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Case Western Reserve University

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The University
Case Western Reserve University (http://case.edu) is one of the nation's leading independent research universities, with programs that encompass the arts and sciences, engineering, the health sciences, law, management, and social work.

Brief History
Although its origins date to 1826, the university in its present form is the result of the 1967 federation of Case Institute of Technology and Western Reserve University. The two institutions had shared adjacent campuses since the late nineteenth century and were involved in cooperative efforts for many years. Western Reserve College was founded in 1826 in Hudson, Ohio, a town 26 miles southeast of Cleveland. The college took its name from that of the region, which at the time of the American Revolution, was known as the Western Reserve of Connecticut. In 1882, renamed Western Reserve University and boasting a medical school in addition to its undergraduate programs, the institution moved to the Cleveland site that later became known as University Circle. There it joined the Case School of Applied Science, founded in 1880 through the bequest of Leonard Case Jr., a leading benefactor and Cleveland civic leader. The name Case Institute of Technology was adopted in 1947 to reflect the institution's growing stature in the sciences and engineering.

University Mission
Case Western Reserve University improves people's lives through preeminent research, education and creative endeavor.

We realize this goal through:
• Scholarship that capitalizes on the power of collaboration.
• Learning that is active, creative and continuous.
• Promotion of an inclusive culture of global citizenship.

University Vision
We aspire to be recognized internationally as an institution that imagines and influences the future.

Toward that end, we will:
• Support advancement of select academic fields as well as new areas of interdisciplinary excellence.
• Provide students with the knowledge, skills and experiences necessary to become leaders in a world of rapid change and increasing interdependence.
• Nurture a community of scholars who are cooperative, collegial and committed to mentoring and inclusion.
• Build on our relationships with world-class health care, cultural, educational, and scientific institutions in University Circle and across greater Cleveland.

Accreditation
Case Western Reserve University is accredited at the institutional level by the Higher Learning Commission (http://www.ncahlc.org) and is a member of the North Central Association. In addition, many of Case's individual programs are accredited by nationally recognized professional associations, including:
• AASCB International - Association to Advance Collegiate Schools of Business (accountancy and business)
• Computing Accreditation Commission of ABET, www.abet.org (http://bulletin.case.edu/http://www.abet.org), (BS degree program in computer science)
• Engineering Accreditation Commission of ABET, www.abet.org (http://bulletin.case.edu/http://www.abet.org), (all BS degree programs in engineering, not including the engineering undesignated degree program)
• Accreditation Council for Cooperative Education (cooperative education programs)
• American Bar Association (law)
• American Board of Genetic Counseling (genetic counseling)
• American Chemical Society (chemistry)
• American College of Nurse-Midwives (nurse midwifery)
• American Dental Association (dentistry)
• American Medical Association and Association of American Medical Colleges, Liaison Committee on Medical Education (medicine)
• American Psychological Association (clinical psychology)
• American Speech-Language-Hearing Association (speech pathology)
• Commission on Accreditation for Dietetics Education, American Dietetic Association (didactic program in dietetics, dietetic internship)
• Commission on Accreditation of Allied Health Education Programs (anesthesiologist assistant)
• Commission on Collegiate Nursing Education (Doctor of Nursing Practice program)
• Council on Accreditation of Nurse Anesthesia Educational Programs
• Council on Education for Public Health (public health)
• Council on Social Work Education (applied social sciences)
• National Association of Schools of Music (music)
• National League for Nursing (nursing)
• Ohio Department of Education, Division of Teacher Education and Licensure (art education and music education)
• Teacher Education Accreditation Council (art education and music education)

The university is chartered as an educational institution under the laws of the State of Ohio and holds a Certificate of Authorization from the Ohio Board of Regents (http://regents.ohio.gov).

For further information, contact the university's Center for Institutional Research (http://www.cwru.edu/president/cir/cirhome.html).

Philosophy Statement on Educational Outcome Assessment
Case Western Reserve University commits to a comprehensive educational outcome assessment program, wherein we measure how our students have changed, what knowledge has been learned, and what competencies have been developed. Our educational outcome assessment programs will not only provide information on how well we are achieving our objectives, but also identify what types of programs and experiences have the most powerful impacts. The ultimate goal is to incorporate continuous evaluation into the educational culture for the improvement of programs and for enhancing the distinctiveness of our university.
Education outcome assessments will be based on the core vision and mission of each school and the university as a whole. The faculty, empowered by adequate resources and support to carry out assessment activities, accepts that educational outcome assessment is a part of academic duties. Outcome assessment is embraced as a means that can lead to improvements in teaching and learning, plus provide evidence of teaching effectiveness for institutional purposes.

Cleveland

From a settlement that began centuries ago on the banks of the Cuyahoga River, Cleveland has grown into a metropolis of close to 3 million people. The heritage of this Great Lakes port includes industrial achievement as well as cultural and scientific advances. The Cleveland area is headquarters for many of the nation's major corporations. The city is also a major banking center; the Fourth District Federal Reserve Bank, one of 12 in the nation, is located here.

Health care is another thriving Cleveland industry. Dozens of hospitals and medical centers are concentrated in the area. University Hospitals, the Cleveland Clinic, the MetroHealth Medical Center, and others have attained international recognition for outstanding patient care and contributions to medical research.

Greater Cleveland is dotted with shopping malls, theaters, and opportunities for sports and amusement. The latter include Lake Erie, the 17,000-acre Metropark system; professional baseball, football, and basketball teams; and facilities for softball, skiing, hiking, cycling, picnics, and other activities. More than 60 ethnic groups live in Cleveland; seasonal festivals continue traditions brought to the region from throughout the world.

University Circle

Case Western Reserve University is located in University Circle (http://www.universitycircle.org), a 550-acre concentration of more than 40 cultural, medical, educational, religious, and social service institutions located at the eastern edge of the city. In addition to Case Western Reserve University, which is the largest institution in University Circle, the community includes Severance Hall, home of the world-famous Cleveland Orchestra; the Cleveland Museum of Art, housing one of the nation's finest collections; the Cleveland Institute of Music; the Cleveland Institute of Art; University Hospitals; the Western Reserve Historical Society; the Cleveland Botanical Garden; the Cleveland Museum of Natural History; and many others. All are within walking distance of the university.

University Circle attracts visitors worldwide and from throughout the region to its concerts, theater performances, athletic events, art shows, public lectures, exhibits, and restaurants. Housing, shopping, and recreational facilities are all located in the area.

University Archives

University Archives (http://www.case.edu/its/archives) manages university records and publications to ensure the preservation of a reliable institutional memory. The office, which manages a collection of over 12,000 linear feet (approximately 25 million pages) and over 40 gigabytes that document the university’s life from 1826 to 2009, offers the following services:

- Research and reference services to help discover the who, what, where, when, how and why of Case Western Reserve University history and development
- Duplication services (digital, xerographic, and fax copies) of most documents
- Records services to assist in managing active records and guidance in transferring records to the University Archives
- Digitization of select, high-demand materials for ease of access and use

University Libraries and Resources

All Case Western Reserve University’s libraries support the university’s undergraduate, graduate and professional programs. Combined, their collections contain nearly 3 million volumes. The libraries maintain individual websites to facilitate communication of their unique services to the university community. Collections of electronic databases and electronic journals are shared and available for all university faculty, staff, and students through the campus network or authorized remote access. The libraries are an integrated system that comprises the Kelvin Smith Library and its branches, the Cleveland Health Sciences Library, the School of Law Library and the Harris Library at the Mandel School of Applied Social Sciences.

Kelvin Smith Library (KSL) serves as the knowledge and creativity commons on campus, and is open to all members of the university community, with collections and services that support the faculty, staff, undergraduate, and graduate students of the College of Arts and Sciences (http://www.case.edu/artsci), the Case School of Engineering (http://engineering.case.edu), the Weatherhead School of Management (http://weatherhead.case.edu), and the general administration of the university. Collections and research services begin with the main collection of nearly 2 million volumes on 30 miles of compact shelving that maximizes space in the building for researchers to work in a variety of styles, collaboratively or individually. Branches include collections, staff, and services:

- The Astronomy and Kulas Music Libraries are branches of KSL and are housed within their respective departments. KSL has access to more than 56,000 unique serials and periodicals and has a large retrospective collection housed in the Retrospective Research Collections Center (RRCC) located in Cedar Avenue Service building.
- The RRCC offers daily retrieval service to KSL for materials that can be borrowed, and also has a reading room and staff to assist with the collections housed at the Center.

Kelvin Smith Library and branch collections (http://library.case.edu/ksl/collections.html) are featured on the KSL homepage and in addition to books and journals expand learning and scholarship with other items such as audiovisual materials, government documents, special collections, datasets, digital collections, and Digital Case (http://library.case.edu/digitalcase) as a repository of campus intellectual output and special collections of the university. Personalized services help advance academics with The Center for Statistics and Geospatial Data (http://library.case.edu/ksl/collections/csgd), and the Freedman Digital Library, Language Learning and Multimedia Services Center (http://library.case.edu/ksl/freedmancenter), with new ways to locate and present research, and explore new technologies. KSL provides staff and services in support of teaching and research, including expert reference assistance in-person, online, and onsite in academic departments. ILLiad (http://library.case.edu/ksl/services/ill/libraryservices/ill) interlibrary loan services & electronic article delivery, Course Reserves & Electronic Reserves (http://library.case.edu/ksl/services/libraryservices/reserves) bring research to the desktop for researchers on or off campus. During fall and spring academic semesters, individuals with current Case ID cards can take advantage of KSL spaces and collections with its 24 hours - 7 days a week service. New initiatives in 2011 opened the Cramelot
The Mandel School of Applied Social Sciences (MSASS) has the distinction of being one of the few schools of social work that maintains a professional library for the use of its students, staff, faculty, and alumni as well as for the general university community. The Mandel School’s Lillian F. and Milford J. Harris Library contains over 40,000 volumes and subscriptions to 250 periodicals and about 900 video and audio items to support Mandel School academic programs, and is located on the 2nd and 3rd floors of the MSASS building. The library also has a variety of electronic media and other materials, which are available for classroom use by faculty. The Harris Library (http://msass.cwru.edu/harrislibrary) reference staff assist researchers in the library and via phone and email, and a computing lab (http://msass.cwru.edu/harrislibrary/General/Lab) and Help Desk also support MSASS students. The library’s website provides information resources (http://msass.cwru.edu/harrislibrary/Alumni/alumncrdclic.htm) information for social work students, faculty, practitioners, and other human service workers in Greater Cleveland.

The Cleveland Health Sciences Library has two facilities with collections that are open to all university students, faculty and staff. The Health Center Library (HCL) collections and services support the Schools of Dental Medicine (http://dental.case.edu), Medicine (http://casemed.case.edu), Nursing (http://fpb.case.edu), as well as the departments of Biology (http://www.case.edu/artsci/biol) and Nutrition (http://www.case.edu/med/nutrition), and celebrates its 40th anniversary in 2011. Allen Memorial Medical Library has a collection of clinical books and journals and a growing historical collection in the Dittrick Medical History Center and Museum, with a rare book collection, archives, medical artifacts, and a history of medical collection. News is featured on the Dittrick Museum Blog (http://dittrick.blogspot.com). Information, news, and highlights about collections, library spaces and services of HCL are featured on the CHSL (http://www.case.edu/chsl/library) homepage, with direct links to featured collections and resources like JAMA and Archives Journals, PubMed, MEDLINE, Springer Protocols, Reference assistance, and ILLiad interlibrary loan services.

The Judge Ben C. Green Law Library is located in the School of Law and has more than 300,000 volumes including complete collections of statutory and case law, law reviews, the National Reporter System, state reports, administrative reports and current law services. There is also an extensive British collection and special collections in taxation, labor law and foreign investments. The law library’s website provides core links to legal information resources, government agencies and legislative history resources. Posts on the facebook (http://www.facebook.com/caselawlibrary) page and Just In Case (http://blog.case.edu/law-library), the library blog, bring information about events, law library content, and new collection news to the campus community.

The Case Catalog is the university’s comprehensive online access portal with all the libraries’ collections and resources. The Case Catalog (http://bulletin.case.edu/http://catalog.case.edu) also includes collections of the Robinson Library (http://www.cim.library/about) at the Cleveland Institute of Music, (http://www.cim.library/about) the Gund Library (http://www.cia.library) at the Cleveland Institute of Art, and the Aaron Garber Library (http://www.siegelcollege.edu/aaron-garber-library/about-us.html) at the Siegal College of Judaic Studies. The Case Catalog (http://bulletin.case.edu/http://catalog.case.edu) is accessible through any web browser and also provides quick links to the individual library websites (http://library.case.edu/loc/libraries.html). For authenticated individuals, the Case Catalog (http://bulletin.case.edu/http://catalog.case.edu) offers quick links to the Research Database List (http://library.case.edu/databases/rdb), the electronic journal portal (http://lu4ld3lr5v.search.serialssolutions.com), and OhioLINK (http://www.ohiolink.edu) consortium materials. It also features research tools and access for Course Reserves and RefWorks citation management, and ILLiad (http://library.case.edu/loc/ill.html) services for each library. Computer workstations are located in each campus library to facilitate use of digital library information resources, and classrooms provide opportunities for learning and library instruction. Network access allows researchers to search the resources of the university’s libraries and the OhioLINK Central Catalog (http://oic1.ohiolink.edu/search) from any port on the campus network, from the Kelvin Smith Library wireless network, or remotely through university-authenticated VPN software.

Case Western Reserve University is a founding member of the OhioLINK consortium, which provides a shared, unified catalog for ninety colleges and universities, including the State Library of Ohio. The Center for Research Libraries also participates in resource sharing from the OhioLINK Central Catalog (http://oic1.ohiolink.edu/search), along with several Ohio public libraries. The OhioLINK Central Catalog (http://oic1.ohiolink.edu/search), at 48+ million items available for online requesting, also provides online access to a rich and robust variety of research materials such as 15,000,000 electronic journal articles in the EJC (http://journals.ohiolink.edu/ejc), 62,000 digital books in the EBC (http://ebooks.ohiolink.edu/ebc-home), 32,000 online theses and dissertations in the ETD Center (http://etd.ohiolink.edu), 3,000 digital media items in the Digital Media Center (http://dmc.ohiolink.edu), and hundreds of online databases in all disciplines. Authorized faculty, students, and staff enjoy automated online borrowing and renewals of book and media materials, as well as onsite borrowing privileges at OhioLINK member (http://www.ohiolink.edu/members-info) libraries. OhioLINK resources supplement local collections and augment online resources by maximizing resources for consortial licensing opportunities, bringing a vast array of online content to the members.

CPL@Case–KSL offers a site collection of Cleveland Public Library materials for all Case students, faculty, and staff with current Case IDs. Best sellers, audio books, foreign language magazines and other public library materials may be borrowed with a Cleveland Public Library (http://www.cpl.org) card. The site collection is designed for students who otherwise are not able to travel to public libraries in the area, with these items borrowed and returned directly to the Kelvin Smith Library (http://bulletin.case.edu/http://library.case.edu). Read more details about privileges for CPL@Case–KSL (http://bulletin.case.edu/CPL@Case–KSL), including how current faculty, staff, and students can get a CPL library card at KSL.

Other libraries in University Circle enrich the academic experience and include the Cleveland Institute of Art, the Cleveland Institute of Music, the Cleveland Museum of Art, the Western Reserve Historical Society, the Cleveland Museum of Natural History, and the Cleveland Botanical Garden Library.

The university is a member of the Association of Research Libraries (ARL), which comprises 126 North American research libraries.
Information Technology Services

The Information Technology Services (ITS) division provides solutions that support education, research and the day-to-day functions at Case Western Reserve University. We are committed to the stewardship of the university’s information technology resources and to fostering an environment in which integrity, communication, collaboration and support are paramount in everything we do.

New to CWRU: Welcome to Case Western Reserve University!

The Information Technology Services division provides solutions and support to the university which uphold and strengthen the interaction between challenge, discovery, scholarship, learning, teaching, working and technology. We proudly provide a wide range of products and services that you will surely utilize each day you are at Case Western Reserve.

We’ve constructed guides for technology immersion based upon your role at the university. These step-by-step books will help take you through how to get set up and where to seek the many resources available to you as a member of the CWRU community. We hope that this resource will help you maximize your technology-based experiences.

Service Desk

The Service Desk provides 24/7/365 free and unlimited technology service and support to all students, faculty and staff of the university community.

- Phone: 216.368.HELP (4357) : speak real time with a IT expert or schedule deskside or dormside assistance
- Email: help@case.edu
- In Person Walk-In locations: 11424 Bellflower & Sears Library
- Online Request or Chat: help.case.edu

eStore: Your key to great discounts on computers, mobile phones and more!

Case Western Reserve University maintains strategic partnerships with many premier technology manufacturers which allow the university to offer our students, faculty and staff cutting-edge technology products and services at highly advantageous discounts. Products available at the eStore include computers, backup services, high speed internet, cellular phones, and other accessories.

Software Center: Free software on popular titles and operating systems

Case Western Reserve faculty, staff and students are eligible to download over 40 software packages from the Software Center, generally at no charge, which the university has purchased and made available through site licenses with software manufacturer. Packages and tools include:

- Microsoft Office
- Symantec Endpoint Protection
- Adobe Creative Suite
- Adobe Acrobat Professional
- Operating System upgrades
- Mathematical and statistical packages and tools and programming languages

Learn how to use all of this great software through our partnership with Lynda.com. CWRU students, faculty and staff have unlimited free access to Lynda.com, a leading video-based IT training provider offers over 3275 training courses including Google Apps, Adobe CS5 Creative Suite, Microsoft Office, web development, audio/video production, computer programing, Apple Mobile Devices, and much more. Each training topic is delivered in hours of videos broken down into easy to manage 5 - 15 minute segments. These video based tutorials are taught by industry experts and available 24/7 for convenient, self-paced learning. Access Lynda.com using your CWRU Network ID and password through our special portal at help.case.edu/lynda

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Case School of Engineering

Engineering seeks to create new processes, products, methods, materials, or systems that impact and are beneficial to our society. To enable its graduates to lead the advancement of technology, the Case School of Engineering (http://engineering.case.edu) offers thirteen degree programs at the undergraduate level (twelve engineering degrees, plus the BS in computer science). At the post-graduate level, the School of Engineering offers Master of Science programs and the Doctor of Philosophy for advanced, research-based study in engineering. Case School of Engineering offers two specialized degrees at the master’s level: a Master of Engineering specifically for practicing engineers, and an integrated Master of Engineering and Management jointly administered with the Weatherhead School of Management. The School of Engineering offers a Graduate Certificate program which provides an introductory graduate level understanding of the field of Wireless Health. The Case School of Engineering also offers two dual-degrees at the graduate level jointly administered with the School of Medicine: a Doctor of Medicine/Master of Science and a Doctor of Medicine/Doctor of Philosophy. The faculty and students participate in a variety of research activities offered through the departments and the interdisciplinary research centers of the University.

At the core of its vision, the Case School of Engineering seeks to set the standards for excellence, innovation, and distinction in engineering education and research prominence.

Statement of Educational Philosophy

The Case School of Engineering prepares and challenges its students to take positions of leadership in the professions of engineering and computer science. Recognizing the increasing role of technology in virtually every facet of our society, it is vital that engineering students have access to progressive and cutting-edge programs stressing five areas of excellence:

- Mastery of fundamentals
- Creativity
- Societal awareness
- Leadership skills
- Professionalism

Emphasizing these core values helps ensure that tomorrow’s graduates are valued and contributing members of our global society and that they will carry out the tradition of engineering leadership established by our alumni.

The undergraduate program aims to create life-long learners by emphasizing engineering fundamentals based on mathematics, physical, and natural sciences. Curricular programs are infused with engineering innovation, professionalism (including engineering ethics and the role of engineering in society), professional communications, and multidisciplinary experiences to encourage and develop leadership skills. To encourage societal awareness, students are exposed to and have the opportunity for in-depth study in the humanities, social sciences, and business aspects of engineering. Undergraduate students are encouraged to develop as professionals. Opportunities include the Cooperative Education Program, on-campus research activities, and participation in the student chapters of professional societies. Graduates are prepared to enter the workforce and be strong contributors as practicing engineers, or continue for advanced study in engineering.

At the graduate level, the Case School of Engineering combines advanced classroom study with a rigorous independent research experience leading to significant results appropriate for publication in archival journals and/or presentation at leading technical conferences. Scientific integrity, engineering ethics, and communication skills are emphasized throughout the program.

Brief History

The Case School of Engineering was established on July 1, 1992, by an action of the Board of Trustees of Case Western Reserve University as a professional school dedicated to serving society and meeting the needs of industry, government and academia through programs of teaching and research.

The Case School of Engineering continues the tradition of rigorous programs based on fundamental principles of mathematics, science and engineering that have been the hallmark of its two predecessors, the Case School of Applied Science (1880) and the Case Institute of Technology (1947). The formation of the Case School of Engineering is a re-commitment to the obligations of the gift of Leonard Case, Jr., to serve the citizens of Northern Ohio. The School of Engineering has been a leader in many educational programs, being the first engineering school to offer undergraduate programs in computer engineering, biomedical engineering, polymer engineering, and systems and control engineering.

Accreditation

The following Bachelor of Science programs are accredited by the Engineering Accreditation Commission of ABET, www.abet.org (http://bulletin.case.edu/schoolofengineering/http://www.abet.org):

- Aerospace Engineering
- Biomedical Engineering
- Chemical Engineering
- Civil Engineering
- Computer Engineering
- Electrical Engineering
- Engineering Physics
- Materials Science and Engineering
- Mechanical Engineering
- Polymer Science and Engineering
- Systems and Control Engineering

The following Bachelor of Science program is accredited by the Computing Accreditation Commission of ABET, www.abet.org (http://bulletin.case.edu/schoolofengineering/http://www.abet.org):

- Computer Science

Case School of Engineering’s Case Co-op Program is accredited by the Accreditation Council for Cooperative Education (http://www.co-opacccreditration.org) (ACCE).

Bachelor of Science | Master of Science | Master of Engineering | Doctorate

Engineering Degrees Granted

Bachelor of Science in Engineering with the following major field designations:

- Aerospace Engineering
- Biomedical Engineering
• Chemical Engineering
• Civil Engineering
• Computer Engineering
• Electrical Engineering
• Engineering Physics
• Materials Science and Engineering
• Mechanical Engineering
• Polymer Science and Engineering
• Systems and Control Engineering

Bachelor of Science in Engineering (Undesignated) (p. 21) (for programs that emphasize interdisciplinary areas or for programs that include some emphasis on non-technical fields)

Bachelor of Science in Computer Science (p. 60)

Bachelor of Science in Engineering/Master of Science
• Aerospace Engineering
• Biomedical Engineering
• Chemical Engineering
• Civil Engineering
• Computer Engineering
• Computing and Information Science
• Electrical Engineering
• Engineering Physics
• Materials Science and Engineering
• Mechanical Engineering
• Polymer Science and Engineering
• Systems and Control Engineering

Bachelor of Science in Engineering/Master of Engineering

Master of Science with the following major field designations:
• Aerospace Engineering
• Biomedical Engineering
• Chemical Engineering
• Civil Engineering
• Computer Engineering
• Computing and Information Science
• Electrical Engineering
• Macromolecular Science and Engineering
• Materials Science and Engineering
• Mechanical Engineering
• Systems and Control Engineering

Bachelor of Science in Engineering

In addition to the major department requirements, each engineering undergraduate degree program includes the Engineering Core, which provides a foundation in mathematics and sciences as well as aspects of engineering fundamentals for programs in engineering. The Engineering Core also is designed to develop communication skills and to provide a body of work in the humanities and social sciences. Requirements of the Engineering Core can be found in the Undergraduate Studies section of this bulletin.

Details of the specific curricular requirements for the undergraduate majors are described in the respective departmental descriptions. Details of the requirements of the undesignated engineering undergraduate degree are described under the Engineering Undesignated description.

Undergraduate Core Courses (ENGR)

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENGR 131</td>
<td>Elementary Computer Programming</td>
<td>3</td>
</tr>
<tr>
<td>ENGR 145</td>
<td>Chemistry of Materials</td>
<td>4</td>
</tr>
<tr>
<td>ENGR 200</td>
<td>Statics and Strength of Materials</td>
<td>3</td>
</tr>
<tr>
<td>ENGR 210</td>
<td>Introduction to Circuits and Instrumentation</td>
<td>4</td>
</tr>
<tr>
<td>ENGR 225</td>
<td>Thermodynamics, Fluid Dynamics, Heat and Mass Transfer</td>
<td>4</td>
</tr>
<tr>
<td>ENGR 398</td>
<td>Professional Communication for Engineers</td>
<td>1</td>
</tr>
</tbody>
</table>

Master of Science

Recognizing the different needs and objectives of resident and non-resident graduate students pursuing the master’s degree, two different plans are offered. In both plans, transfer of credit from another university is limited to six hours of graduate-level courses, taken in excess of the requirements for an undergraduate degree, approved by the student’s advisor, the department chair, and the dean of graduate studies.

All Master of Science degree programs require the submission of a Planned Program of Study via the Student Information System where it will be routed for appropriate approvals. Students must submit an approved program of study by the end of the second semester. A revised program of study must be submitted via the Student Information System when any change in the original plan occurs.

Master’s Thesis Plan (Plan A)

Minimum requirements for the degree of Master of Science in a major field under this plan are:

1. Completion of 18 hours of graduate course work. The courses must be approved by the department offering the degree.
2. Completion of nine hours of thesis work culminating in a thesis examination given by at least three professors, plus approval by the chair of the department offering the degree. A student with research
experience equivalent to a thesis may petition the Graduate Committee of the Case School of Engineering for substitution of nine hours of course work for the thesis requirement. In this case, the thesis examination above is replaced by a similar examination covering the submitted research work and publications.

At least 18 hours of total course work, in addition to 9 hours of thesis research, must be at the 400 level or higher.

**Master’s Comprehensive Plan (Plan B)**

Students may pursue either a project or non-project track under this option. Minimum requirements for the degree of Master of Science in a major field under this plan are one of the following:

**Project track**
Completion of 27 hours of graduate course work including three to six hours of Special Problems. Special Problems course work must consist of an engineering project approved by the chair of the department offering the degree, and may be carried out at the student’s place of employment with nominal supervision by a faculty advisor or in the school’s laboratories under direct supervision. The project must culminate in a written report and examination by at least three professors plus approval by the chair of the department offering the degree. The Special Problems course may be waived for students who have had industrial design or research experience and who submit sufficient evidence of this experience in the form of a publication or internal report. For these students, a minimum of 27 hours of course work and the final oral examination covering the submitted publications or reports as well as related course material will be required for the master’s degree. At least 18 hours of course work including up to 6 hours of Special Problems must be at the 400 level or higher.

**Non-project track**
Students who register for 27 hours, not including Special Problems course work, must pass satisfactorily a comprehensive examination to be administered by the department or curricular program committee. The examination may be written or oral, or both. A student must be registered during the semester in which any part of the comprehensive examination is taken. If not registered for other courses, the student will be required to register for one semester hour of EXAM 600 Master’s Comprehensive Exam, before taking the examination.

**Distance Education**
Through Distance Education, the Case School of Engineering offers graduate courses and degree programs for engineering professionals and students that cannot attend classes on campus. The program makes it convenient for students to overcome the logistical and financial barriers imposed by commuting to campus, and allows students working full time or located a distance from the Cleveland area to pursue a course only (comprehensive option) Master of Science degree (http://engineering.case.edu/current-students/academic-programs/ ms) or a practice oriented Master of Engineering degree (http://engineering.case.edu/meng/). The courses are delivered asynchronously so that distance learning students can view course lectures at their convenience, and can interact with the professor and students in the class through email, phone, video, and the course tools available in Blackboard. The distance learning courses and degree programs are identical to those given on-campus, and student performance assessments are the same regardless of the delivery mechanism. All distance courses are part of our standard curricula, and are offered on a regular time schedule to allow distance students to complete degree requirements over a predictable and reasonable time period.

For more details on the distance learning programs please visit http://engineering.case.edu/current-students/distance-learning and http://engineering.case.edu/meng/.

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**Doctor of Medicine/Master of Science**

Medicine is undergoing a transformation based on the rapid advances in science and technology that are combining to produce more accurate diagnoses, more effective treatments with fewer side effects, and improved ability to prevent disease. The goal of the MD/MS in Engineering is to prepare medical graduates to be leaders in the development and clinical deployment of this technology and to partner with others in technology based translational research teams. For further information, see the MD/MS Program in the Biomedical Engineering graduate section of this bulletin (p. 27). Interested students should apply through the biomedical engineering department.

**Master of Engineering**

The Master of Engineering Program is a graduate degree program that targets currently employed engineers. The objective of this program is to provide engineers in industry with technical as well as business, management, and teamwork skills. The program differs from a traditional Master of Science degree in engineering by combining core courses that focus on the engineering-business environment and technical elective courses that concentrate on contemporary industrial practice rather than on research.

The Master of Engineering Program prepares students to enhance their role as corporate leaders and provides an environment in which practicing engineering professionals can address the increasingly wide range of technical, management, financial and interpersonal skills demanded by an ever-expanding and diverse global industry base.

The Master of Engineering Program requires 30 credit hours of course work that include 18 credit hours of core courses and 12 credit hours of technical electives that are chosen from focus areas (see below). It is possible to complete the Master of Engineering degree program within a two-year (six semester), part-time, program of study, although most students choose to complete the program over a seven-nine semester period. The core courses are aimed at equipping participants with knowledge on how engineering is practiced in contemporary industry, and the technical elective courses provide depth in a chosen specialty area. All courses are held in the late afternoon or evening hours and many are provided in a distance-learning format to minimize disruption at the workplace and home. Because the program makes extensive use of computers, participants need to have access to computer facilities.

**Curriculum**

The program consists of a set of six core courses and a four course technical elective sequence (a total of 30 credit hours are required). The core courses provide a common base of study and experience with problems, issues, and challenges in the engineering business environment. The technical course sequence provides an opportunity to update disciplinary engineering skills and to broaden interdisciplinary skills. Up to six transfer credits may be approved for graduate-level courses taken at Case Western Reserve or another accredited university.

**Core Courses**

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>EPO 400A</td>
<td>Engineering Professionalism: Team Leadership in Effective Groups</td>
<td>1</td>
</tr>
<tr>
<td>EPO 400B</td>
<td>Engineering Professionalism: Presentation Skills for Effective Leaders</td>
<td>1</td>
</tr>
</tbody>
</table>
Ten Core Courses

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>IIME 400</td>
<td>Professional Development</td>
<td>3</td>
</tr>
<tr>
<td>IIME 405</td>
<td>Project Management</td>
<td>3</td>
</tr>
<tr>
<td>IIME 410</td>
<td>Accounting, Finance, and Engineering Economics</td>
<td>3</td>
</tr>
<tr>
<td>IIME 415</td>
<td>Materials and Manufacturing Processes</td>
<td>3</td>
</tr>
<tr>
<td>IIME 430A</td>
<td>Product and Process Design, Development, and Delivery</td>
<td>3</td>
</tr>
<tr>
<td>IIME 430B</td>
<td>Product and Process Design, Development, and Delivery</td>
<td>3</td>
</tr>
<tr>
<td>IIME 420</td>
<td>Information Technology and Systems</td>
<td>3</td>
</tr>
<tr>
<td>IIME 425</td>
<td>People Issues and Change in Organizations</td>
<td>3</td>
</tr>
<tr>
<td>IIME 450A</td>
<td>Engineering Entrepreneurship I</td>
<td>3</td>
</tr>
<tr>
<td>IIME 450B</td>
<td>Engineering Entrepreneurship II</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td><strong>Total Units</strong></td>
<td><strong>30</strong></td>
</tr>
</tbody>
</table>

### Technical Electives

Four courses are chosen from the technical concentration areas below. For detailed course offerings in these areas, please refer to the Master of Engineering (http://www.engineering.case.edu/meng) program information on the Case School of Engineering website.

- Biomedical Engineering
- Chemical Engineering
- Computer Engineering
- Infrastructure Engineering
- Macromolecular Science and Engineering
- Materials Processing and Synthesis
- Mechanical Engineering
- Robotics and Control
- Software Engineering
- Signal Processing and Communications

### Master of Engineering and Management

The Master of Engineering and Management program is designed to meet the needs of students seeking to excel in engineering careers in industry. The MEM degree requires only one calendar year of additional study and may be entered following a student’s Junior or Senior year. The program prepares engineers to work in different business environments. A rigorous curriculum prepares graduates to build synergy between the technical possibilities of engineering and the profit-loss responsibilities of management. This program evolved after years of research and interviews with over 110 professionals and twenty-eight corporations in the U.S.

#### The Program

The program includes 42 credit hours of graded course work. The ten-course core sequence makes up 30 of these hours. Students choose an area of concentration, either technology entrepreneurship or biomedical entrepreneurship, for the remaining 12 credits. The Program prepares participants to function as technical leaders with a unique blend of broadened engineering and management skills, which can have a strategic impact on the organization’s bottom line. Graduates are uniquely positioned for rapid advancement in technology-based organizations.

#### Ten Core Courses

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>EPOM 400C</td>
<td>Engineering Professional Development</td>
<td>1</td>
</tr>
<tr>
<td>EPOM 401</td>
<td>Introduction to Business for Engineers</td>
<td>3</td>
</tr>
<tr>
<td>EPOM 403</td>
<td>Product and Process Design and Implementation</td>
<td>3</td>
</tr>
<tr>
<td>EPOM 405</td>
<td>Applied Engineering Statistics</td>
<td>3</td>
</tr>
<tr>
<td>EPOM 407</td>
<td>Engineering Economics and Financial Analysis</td>
<td>3</td>
</tr>
<tr>
<td>EPOM 409</td>
<td>Master of Engineering Capstone Project</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td><strong>Total Units</strong></td>
<td><strong>18</strong></td>
</tr>
</tbody>
</table>

### Technology Entrepreneurship Concentration

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>IIME 435</td>
<td>Enterprise Resource Planning in the Supply Chain</td>
<td>3</td>
</tr>
<tr>
<td>IIME 440</td>
<td>Six Sigma and Quality Management</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td><strong>Two electives: graduate level management and/or engineering, may include:</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>IIME 472</td>
<td>1.5</td>
</tr>
<tr>
<td></td>
<td>IIME 470</td>
<td>1.5</td>
</tr>
<tr>
<td></td>
<td><strong>Total Units</strong></td>
<td><strong>12</strong></td>
</tr>
</tbody>
</table>

### Biomedical Entrepreneurship Concentration

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>IIME 445</td>
<td>Engineering Statistics for Biosciences</td>
<td>3</td>
</tr>
<tr>
<td>IIME 446</td>
<td>Models of Health Care Systems</td>
<td>1.5</td>
</tr>
<tr>
<td>IIME 447</td>
<td>Regulatory Affairs for the Biosciences</td>
<td>1.5</td>
</tr>
<tr>
<td></td>
<td><strong>Two of the following courses:</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>EBME 403</td>
<td>1.5</td>
</tr>
<tr>
<td></td>
<td>EBME 406</td>
<td>1.5</td>
</tr>
<tr>
<td></td>
<td>EBME 407</td>
<td>1.5</td>
</tr>
<tr>
<td></td>
<td>EBME 408</td>
<td>1.5</td>
</tr>
<tr>
<td></td>
<td>EBME 410</td>
<td>1.5</td>
</tr>
<tr>
<td></td>
<td>EBME 416</td>
<td>1.5</td>
</tr>
<tr>
<td></td>
<td>EBME 417</td>
<td>1.5</td>
</tr>
<tr>
<td></td>
<td>EBME 418</td>
<td>1.5</td>
</tr>
<tr>
<td></td>
<td>EBME 431</td>
<td>1.5</td>
</tr>
<tr>
<td></td>
<td>EBME 461</td>
<td>1.5</td>
</tr>
<tr>
<td></td>
<td>EBME 507</td>
<td>1.5</td>
</tr>
<tr>
<td></td>
<td><strong>Total Units</strong></td>
<td><strong>12</strong></td>
</tr>
</tbody>
</table>

### Doctor of Philosophy

The student’s PhD program should be designed to prepare him or her for a lifetime of creative activity in research and in professional engineering practice. This may be coupled with a teaching career. The mastery of a significant field of knowledge required to accomplish this purpose is demonstrated by an original contribution to knowledge embodied in a thesis and by satisfactory completion of a comprehensive course program which is intensive in a specific area of study and includes work in other areas related to, but not identical with, the major field. The necessity for breadth as well as depth in the student’s education cannot be overemphasized. To this end, any engineering department may add additional requirements or constraints to ensure depth and breadth appropriate to its field.

No student may be admitted to candidacy for the PhD degree before approval of his or her Planned Program of Study via the Student Information System. After this approval has been obtained, it is the responsibility of the student’s department to notify the dean of graduate studies of his or her admission to candidacy after the student has fulfilled any additional department requirements. Minimal requirements in addition to the university requirements are:

1. The minimum course requirement beyond the BS level is 36 credit hours of courses taken for credit, at least 18 hours of which must be taken at Case Western Reserve University. The following courses taken for credit will be acceptable for a PhD program of study:
   i. All 400-, 500-, and 600-level courses
   ii. Those 300-level courses approved by the student’s department up to a maximum of three beyond the BS or a maximum of one beyond the MS
   iii. Approved graduate-level courses taken at other institutions

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>EBME 403</td>
<td>Biomedical Instrumentation</td>
<td>3</td>
</tr>
<tr>
<td>EBME 406</td>
<td>Polymers in Medicine</td>
<td>3</td>
</tr>
<tr>
<td>EBME 407</td>
<td>Neural Interfacing</td>
<td>3</td>
</tr>
<tr>
<td>EBME 408</td>
<td>Engineering Tissues/Materials - Learning from Nature’s Paradigms</td>
<td>3</td>
</tr>
<tr>
<td>EBME 410</td>
<td>Medical Imaging Fundamentals</td>
<td>3</td>
</tr>
<tr>
<td>EBME 416</td>
<td>Biomaterials for Drug Delivery</td>
<td>3</td>
</tr>
<tr>
<td>EBME 417</td>
<td>Excitable Cells: Molecular Mechanisms</td>
<td>3</td>
</tr>
<tr>
<td>EBME 418</td>
<td>Electronics for Biomedical Engineering</td>
<td>3</td>
</tr>
<tr>
<td>EBME 431</td>
<td>Physics of Imaging</td>
<td>3</td>
</tr>
<tr>
<td>EBME 461</td>
<td>Biomedical Image Processing and Analysis</td>
<td>3</td>
</tr>
<tr>
<td>EBME 507</td>
<td>Motor System Neuroprostheses</td>
<td>3</td>
</tr>
</tbody>
</table>
2. A minimum depth in basic science equivalent to six semester hours (for credit) is required. This requirement is to be satisfied by courses that have been previously approved by the faculty of the department in which the student is enrolled.

3. The requirement for breadth is normally satisfied by a minimum of 12 semester hours of courses (for credit) outside the student’s major area of concentration as defined by the student’s department and does not include courses taken to fulfill the basic science requirement.

4. A minimum of three teaching experiences as defined by the student’s department. All programs of study must include departmental 400T, 500T, and 600T courses to reflect this requirement. All students fulfilling teaching duties must complete UNIV 400A or UNIV 400B.

5. The minimum requirement for research is satisfied by at least eighteen hours of thesis (701) credits.

6. A cumulative quality-point average of 3.0 or above in all courses taken for credit as a graduate student at Case Western Reserve University (excluding grades in thesis research and grades of R) is required for the award of the doctoral degree.

Qualifying Examination
The student must pass a qualifying examination relevant to his or her area of study as designated by the curricular department with which he or she is affiliated. For students who obtain the MS degree from Case Western Reserve University, the qualifying examination should be taken preferably before the end of the student’s fourth semester of graduate study but no later than the end of the fifth semester at the university. For students entering with the master’s degree, the examination should be taken no later than the end of the third semester at the university.

Planned Program of Study
Each student is required to submit a Planned Program of Study, detailing his or her course work, thesis schedule, and qualifying examination schedule and indicating that all the minimum requirements of the university and the faculty of the Case School of Engineering are satisfied. This Planned Program of Study must be submitted via the Student Information System for approval before registering for the last 18 credits hours of the program.

If the student is pursuing the PhD degree without acquiring the MS degree, a petition to waive the requirement of the MS degree should be approved by the departmental advisor and the chair and submitted to the dean of graduate studies. All required courses taken at the university beyond the BS degree should be shown on the Planned Program of Study with the grade if completed. If the requirements are to be fulfilled in ways other than the standard described above, a memorandum requesting approval should be submitted to the dean of graduate studies.

The Planned Program of Study must be submitted within one semester after passing the qualifying examination.

Doctor of Medicine/Doctor of Philosophy
Students with outstanding qualifications may apply to the MD/PhD program. Students interested in obtaining a combined MD/PhD, with an emphasis on basic research in biomedical engineering or mechanical engineering, are strongly encouraged to explore the Medical Scientist Training Program (MSTP), administered by the School of Medicine. For further information, please see the Medical Scientist Training Program (MSTP) in the School of Medicine section of this bulletin. Interested students should apply through the MSTP office in the Medical School.

Graduate Cooperative Education (Co-op)
Graduate Cooperative Education (Co-op) is a formalized academic program that enables students to enhance their classroom studies with career-based experiences in industry. It is a learning experience designed to integrate classroom theory with practical experience and professional development.

Course
ENGR 400C. Graduate Cooperative Education. 0 Units.
An academic opportunity designed for graduate students to enhance their classroom, laboratory, and research learning through participation and experience in various organizational/industrial environments where theory is applied to practice. Graduate Cooperative Education experiences may be integrated with the student’s thesis or research project areas, or be solely for the purpose of gaining professional experience related to the student's major field of study. Registration in this course will serve to maintain full-time student status for the period of time that the student is on a co-op assignment.

Graduate Certificate
Wireless Health
Educational Objectives:
The Graduate Certificate in Wireless Health provides an integrated foundation for understanding the fundamentals and applications of converging wireless, sensor and medical technologies in health care. The program integrates fundamental material across the spectrum of disciplines underlying the field of wireless health through three coordinated 3-credit courses:

- Introduction to Wireless Health;
- The Human Body; and
- Biomedical Sensing Instrumentation

These courses prepare students to gain a systems-level overview (Introduction to Wireless Health), as well as introductory graduate level understanding of scientific (The Human Body) and engineering (Biomedical Sensing Instrumentation) disciplines underpinning the field of wireless health.

For more details, please refer to the Wireless Health (http://engineering.case.edu/wireless_health) information on the Case School of Engineering website.

Interdisciplinary Research Centers
Advanced Platform Technology | Case Metal Casting Laboratories | Center for Advanced Polymer Processing | Center for Biomaterials | Center for In Situ Cell and Tissue Imaging | CLIPS | Center for Mechanical Characterization of Materials | MIMS | Cleveland Functional Electrical Simulation Center | EDC | GLEI | Institute for Advanced Materials | MFL | NCSE | Neural Engineering Center | Nitinol Commercialization Accelerator | S-DLE | SCSAM | ThinkTank | WERC

Interdisciplinary research centers act as intensive incubators for students and faculty doing research and studying applications in specialized areas. Thirteen research centers and research programs at the Case School of Engineering have been organized to pursue cutting-edge research in collaboration with industrial and government partners. The transfer of technology to industry is emphasized in all the centers.
The educational programs of these centers encompass the training of graduate students in advanced methods and strategies, thus preparing them to become important contributors to industry after graduation; the involvement of undergraduates in research; the presentation of seminars that are open to interested members of the community; and outreach to public schools to keep teachers abreast of scientific advances and to kindle the interest of students in seeking careers in engineering.

Advanced Platform Technology (APT) Center (http://www.aptcenter.research.va.gov)

Louis Stokes Cleveland Department of Veterans Affairs Medical Center
10701 East Boulevard, Mail Stop 151 AW/APT
Cleveland, Ohio 44106
Phone: 216.707.6421 Fax: 216.707.6420
Ronald J. Triolo, Executive Director
ronald.triolo@case.edu

The Advanced Platform Technology (APT) Center brings together top faculty and researchers from Case Western Reserve University and the Department of Veterans Affairs to capture the most recent developments in the fields of microelectronics, material science, microsystems and mechanics, and focus them on the practical medical needs of individuals disabled by sensorimotor dysfunction, cognitive deficits or limb loss. The APT Center creates novel, cross-cutting technologies for the diagnosis, treatment or study of high priority clinical conditions within a structured framework that facilitates regulatory compliance, outsourcing by contract manufacturers, and dissemination within the rehabilitation community. Scientific technical development and clinical translation concentrates on prosthetics and orthotics, health monitoring and maintenance, neural interfaces and emerging enabling technologies. Center projects to date have concentrated primarily on developing new materials and microsystems for interfacing with the nervous system, repairing orthopaedic trauma and accelerating wound healing, replacing or restoring natural limb, sensory and organ system function, and both monitoring and promoting neurological, genito-urinary and vascular health. The APT Center was established as a VA Center of Excellence in 2005 in partnership with Case Western Reserve University and is based at the Louis Stokes Cleveland Department of Veterans Affairs Medical Center (LSCDVAMC). The Center is able to provide or facilitate access to the following resources:

1. Neural modeling and analysis of interface designs
2. Polymer and bioactive material development
3. Microelectromechanical (MEMS) systems design and fabrication
4. Rapid prototyping, mechanical testing and dynamic simulation
5. Pre-clinical in vitro and in vivo verification of device performance
6. Circuit and software design and fabrication
7. System validation and design control documentation
8. Professional engineering support and project management
9. Administrative support for intellectual property protection and regulatory affairs

Center for Advanced Polymer Processing (CAPP) (http://bulletin.case.edu/schoolofengineering/mailto:joao.maia@case.edu)

Kent Hale Smith Building, 3rd floor
Phone: 216.368.6372 Fax 216.543.4202
Joao Maia, Director
joao.maia@case.edu

CAPP is a state-of-the-art center for advanced polymer blending and compounding and reactive extrusion at CWRU able to perform basic research and applied research and development in support of the Ohio and US plastics industry. The main tools of CAPP are:

- State-of-the-art sensors that allow multiple rheological, physical, chemical and morphological quantities to be measured along the screw axis of twin-screw extruders;
- Advanced multi-scale computational simulation capabilities to build physical-chemical-structural models of polymer systems under flow in realistic polymer transformation processes;
- Integration of on-line sensors and multi-scale softwares to develop new advanced and functional multiphase complex materials or optimize the performance of existing ones.
Center for Biomaterials (http://www.case.edu/affil/CCB/ccbhome.htm?nw_view=1342450698&)

202 Wickenden Building (7207)
www.case.edu/affil/CCB/ccbhome.htm
Phone: 216.368.3005 Fax: 216.368.4969
Roger E. Marchant, Director
roger.marchant@case.edu

Anirban Sen Gupta, Associate Director
Phone: 216.368.4564
anirban.sengupta@case.edu

The Center for Biomaterials carries out research and development projects to investigate new biomaterials, tissue engineered materials, and targeted drug delivery systems for use in cardiovascular applications and implants. The Center for Biomaterials also provides researchers access to shared use facilities, which includes high resolution microscopy such as AFM, molecular spectroscopies, surface analysis, and polymer and peptide synthesis capabilities. The chemical and mechanical interface between the biomaterial and the host tissue are the focus of major study, with the goal being to improve biologic function and biocompatibility in the response of the human body to implants. Current projects include investigation of thrombosis (blood clotting) and infection mechanisms due to cardiovascular prosthesis, biomimetic design of novel biomaterials for cardiovascular and neural implants; and cardiovascular and neural tissue engineering based on biomimetic designs. Studies at the cell and molecular level assist our understanding of the underlying mechanisms so that novel biomedical materials may be designed, prepared, and characterized.

Center for In Situ Cell and Tissue Imaging (http://mechbio.case.edu/contact.html)

307 Wickenden Building (7207)
Phone: 216.368.5884 Fax 216.368.4969
Melissa Knothe Tate, Director
melissa.tate@case.edu

The Center for In Situ Cell and Tissue Imaging (CISCTI) is designed to offer state of the art and cutting edge imaging capabilities to the biomedical community at Case Western Reserve University. The center showcases a custom-configured instrument based on the Leica TCS SP2 AOBS Spectral confocal microscope system (Leica Microsystems, Mannheim, Germany). The tunable acousto-optical beam splitter (AOBS) provides selection and examination of any portion of the visible and near-IR emission wavelengths set for a given dye or chosen for unique research applications; it allows for spectroscopy at length scales from tissue to cellular to subcellular. The microscope is configured with software for fluorescence recovery after photobleaching (FRAP), which provide diffusion rates of fluorescence-marked macromolecules. The upright design of the microscope allows not only examination of slides and cell cultures, but also thicker, opaque objects. The removable stage allows use of large objects, with the confocal scanning feature still functional, because it is built into the motorized nosepiece and not into a motorized stage as in other confocal microscopes. For example, the system allows for live animal and/or cell imaging concomitant fluorescent spectroscopy, patch clamping, fluorescence recovery after photobleaching (FRAP), tracking of molecular transport (e.g., drug delivery), and digital video documentation. In order to assist in preparation of specimens for imaging, a state of the art histology core lab (part of CISCTI) is set up to carry out fixation, embedding, and sectioning of soft and hard tissues. Through an Ohio Board of Regents BRTT grant (Clinical Tissue Engineering Center, CTEC), the CISCTI has recently acquired a stereolithography rapid prototyping system (3D Systems Viper si2).

Center for Layered Polymeric Systems (CLiPS) (http://www.stc-clips.org)

NSF Science and Technology Center
420 Kent Hale Smith Building (7202)
Phone: 216.368.4203 Fax: 216.368.6329 Eric Baer, Director
eric.baer@case.edu

Exploration of multilayered polymeric systems at the micro- and nanolayer levels reveals unique properties and capabilities that are different, and often not predicted, from systems involving the same materials on a larger scale. Technology refined within CLiPS allows the production of films and membranes composed of hundreds or thousands of layers. These extremely thin layers promote interactions approaching the molecular level between the materials used in the process.

CLiPS research activities are organized into four platforms to exploit the microlayer and nanolayer structures: (1) Rheology and New Processing focuses on integrating rheology into the multilayering process, and will explore combinations of rheologically dissimilar materials to create new polymer-based structures; (2) advanced Membranes and Transport Phenomena that exploit the layered hierarchy to achieve unique transport properties; (3) novel Optic and Electronic Systems based on the advanced layered materials, and (4) new Science and Technology Initiatives that probe a fundamental understanding and explore new opportunities for the layered structures.

CLiPS was established in 2006 with funding by the National Science Foundation as a Science and Technology Center. It is the first NSF STC ever to be established at Case Western Reserve University. CLiPS is a national center involving close partnership with the University of Texas, Fisk University, the University of Southern Mississippi, and the Naval Research Laboratory, and an important educational partnership with the Cleveland Metropolitan School District.

CLiPS researchers and educators work together to accomplish the Center’s mission of advancing the nation’s science and technology agenda through development of new materials and materials systems and for educating a diverse American workforce through interdisciplinary education programs.

Center for Mechanical Characterization of Materials (http://dmseg5.case.edu/Groups/Lewandowski/facilities.html)

White Building (7205)
Phone: 216.368.4234
John J. Lewandowski, Director
john.lewandowski@case.edu

The Center for Mechanical Characterization of Materials (CMCM) was established in 1987 to provide mechanical characterization (e.g., mechanical testing, deformation processing, etc.) expertise to the CWRU campus, medical, industrial, legal, outside university, and government laboratory communities. The Center, housed in the Charles M. White Metallurgy building, currently maintains equipment valued in excess of $4.5M and has been accessed by the local, national, and international communities. The CWRU campus community can access the facility via the use of a valid CWRU university account number that will be charged at an internal rate for machine time, including set up and any technician time involved. Long term testing can be provided at pro-rated charges in consultation with the Center Directors. Arrangements can be made...
to train users on the equipment and reserve time for equipment use by contacting the Center Co-director. Outside (i.e. non-CWRU) users can access the facility via a number of different mechanisms by contacting the Center Director.

In general, the Center is capable of mechanically evaluating and deformation processing materials that range in size scale from the micrometer range up through bulk quantities. This unique facility enables mechanical characterization at loading rates as low as one micrometer/hour (i.e. rate of fingernail growth!) up through impact (e.g. 3-4 meters/sec) at temperatures ranging from -196°C (i.e. liquid nitrogen) up to 1400°C. Hot microhardness testing up to 1000°C is available. Monotonic as well as cyclic fatigue testing is possible in addition to evaluations of mechanical behavior and processing with superimposed pressures up to 2 GPa. Novel high-rate and multiple-deformation sequence forging simulations are possible with the use of a multi-actuator forging simulator, in addition to sheet metal forming experimentation with independent control of forming rate and blank hold down force. Hot extrusion is also possible at temperatures up to 900°C on 0.5” diameter billets. Materials systems that have been investigated span the range of organic and inorganic materials, including metals, ceramics, polymers, composites, electronic materials, and biomedical materials systems. Descriptions of specific equipment and capabilities are provided with the website link.

Center for Modeling Integrated Metabolic Systems (MIMS) (http://casemed.case.edu/mims)

410 Wickenden (7207)

http://casemed.case.edu/mims Phone: 216.368.4066 Fax: 216.368.4969
Gerald M. Saidel, Director
gerald.saidel@case.edu

The primary aim of the MIMS Center is to develop mechanistic, mathematical models to simulate cellular metabolism in various tissues and organs (i.e., skeletal muscle, heart, brain, and adipose tissue) and to integrate these components in whole-body models. These biologically and physiologically based computational models incorporate cellular metabolic reactions and transport processes of a large number of chemical species. Model parameters quantitatively characterize metabolic pathways and regulatory mechanisms under normal and abnormal conditions including obesity and hypoxia as well as in disease states including type-2 diabetes, cystic fibrosis, and chronic kidney disease. The large-scale, complex mathematical models are solved numerically using sophisticated computational algorithms to simulate and analyze experimental responses to physiological and metabolic changes. Model parameters are optimally estimated by minimizing differences between model simulated outputs and experimental data using large-scale, nonlinear optimization algorithms. Experimentally validated models are used to predict the effects of altering metabolic processes with disease states, pharmacological agents, diet, and physical training.

Cleveland Functional Electrical Stimulation Center (http://fescenter.org)

11000 Cedar Avenue, Suite 230
www.FEScenter.org (http://bulletin.case.edu/schoolofengineering/http://www.FEScenter.org) Phone: 216.231.3257 Fax: 216.231.3258
Robert J. Kirsch, Director
info@FEScenter.org (http://bulletin.case.edu/schoolofengineering/emailto://info@FEScenter.org)

Functional electrical stimulation (FES) is the application of electrical currents to either generate or suppress activity in the nervous system. FES can produce and control the movement of otherwise paralyzed limbs, for standing and hand grasp; activate visceral bodily functions, such as micturition; create perceptions such as skin sensibility; arrest undesired activity, such as pain or spasm; and facilitate natural recovery and accelerate motor relearning. FES is particularly powerful and clinically relevant, since many people with neurological disabilities retain the capacity for neural conduction, and are thus amenable to this intervention.

The Center focuses its activities in four major areas:

- Fundamental studies to discover new knowledge
- Enabling technologies for clinical application or the discovery of knowledge
- Clinical research that applies this knowledge and technology to individuals with neurological dysfunction
- Transfer of knowledge and technology to the clinical community and to industry.

The FES Center was established as a VA RR&D Center of Excellence in 1991 and is based at the Louis Stokes Cleveland VAMC (CVAMC). The Center is a consortium with three institutional partners: CVAMC, Case Western Reserve University (CWRU), and the MetroHealth Medical Center (MHMC). The Center accomplishes its mission by integrating and facilitating the efforts of scientists, engineers, and clinicians through common goals and directions in the major clinical areas, and by providing mechanisms to accomplish these goals across the institutional partners.

Electronics Design Center (EDC) (http://engineering.case.edu/edc)

112 Bingham (7200)

Phone: 216.368.2935 Fax: 216.368.8738
Chung-Chiu Liu, Director
chung-chiu.liu@case.edu

The Electronics Design Center (EDC) is a multi-disciplinary educational and research center focusing on the applications of microfabrication processing to the advancement of chemical and biological micro-systems specializing in application-oriented electrochemical based biosensors. The Center has complete thick film and thin film processing facilities, including screen printing, ink jet printing and sputtering equipment. Other facilities supporting the microfabrication processing are also readily available. The EDC is a resource for industrial and academic researchers, offering access to equipment, laboratories and trained staff.

Great Lakes Energy Institute (GLEI) (http://energy.case.edu)

305 Olin Building (7074)
energy.case.edu
Phone: 216.368.0748
Dianne Anderson, Executive Director
dianne.anderson@case.edu

The Great Lakes Energy Institute at CWRU connects faculty across the university to transition breakthrough research into worldwide impact. Since 2008, GLEI has helped catalyze a four-fold increase in energy research, won awards from many major federal (NSF, DOE, ARPA-E) and state (Ohio Third Frontier) awarders, attracted nearly $10 million in gifts, worked with over 90 different industry partners, and encouraged multidisciplinary proposals from throughout the university. At the heart of these proposals and effort are over 75 engaged faculty, hailing from engineering, arts & sciences, business, and law. And while GLEI’s work supports all types of energy, focus lies in four priority areas:
Grid - CWRU’s energy program is underpinned by research and power systems. Strengths in controls, sensors, and electronics provide a core for smart grid connectivity of energy and storage.

Wind Energy - Wind energy emphasizes offshore deployment and is founded on controls, power management, and grid interface expertise. Much of this work is supported by DOE awards and the State of Ohio.

Solar - Research in next generation photovoltaics (PV) focuses on organics and lifetime and degradation science, stemming from a strong reputation in materials, research, and development.

Storage - Storage research builds on historical strengths in elecrochemistry. Recent research awards include ARPA-E and DOE.

The role of CWRU in energy also touches economic development and education. Through research and investment, university spin-outs are poised to contribute to a new energy economy while working toward a clean and sustainable future. Students undertake key roles in the research and commercialization of the energy technologies underpinning this transition.

Institute for Advanced Materials (http://case.edu/advancedmaterials)

519 Kent Hale Smith Building
Phone 216.368.4242
Stuart Rowan, Director
stuart.rowan@case.edu

The Institute for Advanced Materials is a clearinghouse for Case Western Reserve’s materials research and provides access to the university’s world-class expertise and state-of-the-art facilities. One of Ohio’s Centers of Excellence in Enabling Technologies: Advanced Materials and Sensors, the institute matches industry and governmental partners with campus-based collaborators to explore solutions to real world problems.

Advanced materials—polymers, metals, ceramics, composites, and biomaterials—are cornerstones to many emerging technologies like biocompatible medical implants, energy storage, and environmentally sustainable consumer products. Recognizing that, in Ohio, approximately ten percent of the state’s high tech workforce is engaged in advanced materials and related area industries, the Institute for Advanced Materials at Case Western Reserve aims to leverage and enhance Ohio’s industrial base and manufacturing capabilities, impact the global materials community, educate future materials leaders, and serve as a single, unified resource for advanced materials research.

Approximately 100 faculty, including several members of the National Academies, spanning four schools—Engineering, Arts & Sciences, Medicine and Dental Medicine—work with industrial partners and institutional collaborators to generate $38 million of annual materials research income with support from the National Institute of Health, the National Science Foundation, the US Department of Energy and the Department of Defense among others.

By harnessing the breadth of Case’s research base and creating new collaborative teams, the Institute for Advanced Materials drives the integration of new materials innovations from initial ideas to marketable technologies in energy, sustainability and human health.
Dominique Durand, Director
dominique.durand@case.edu

The research mission of the center is to bring to bear combined tools in physics, mathematics, chemistry, engineering and neuroscience to analyze the mechanisms underlying neuronal function and to solve the clinical problems associated with neuronal dysfunction. Research areas include: Neuromodulation, Neuroprostheses, Quantitative Neurophysiology, Neural Dynamics, Neuro-Mechanical Systems, Neural Regeneration, Neural Interfacing, Neural Imaging and Molecular Sensing, Neuro-Magnetism, and Systems Neuroscience. The education mission of the center is to provide engineers and scientists with an integrated knowledge of engineering and neuroscience capable of solving problems in neuroscience ranging from the molecules to the clinic. The center is also an outlet for technology transfer of new ideas to be commercialized by industrial partners. The center’s goals are accomplished by fostering interdisciplinary research between clinicians, scientists, students and local industry, educational experiences including didactic material, laboratory experience and clinical exposure, and close ties to industrial partners.

Nitinol Commercialization Accelerator (http://dmseg5.case.edu/groups/Lewandowski)
White Building (7205)
Phone: 216.368.4234
John J. Lewandowski, Director
john.lewandowski@case.edu
James D. McGuffin-Cawley, Co-Director
David Schwam, Co-Director

The Ohio Third Frontier Wright Projects Program has funded the Nitinol Commercialization Accelerator (NCA), a collaborative effort between the Cleveland Clinic, CWRU, University of Toledo, NASA Glenn Research Center, and Norman Noble, Inc. in order to develop a better understanding of the metallurgical processing and mechanical characterization of nitinol for use in biomedical and aerospace applications. Biomedical applications range from orthodontia to implantable devices while higher temperature shape memory alloys are of interest for aerospace. The collaboration is designed to create synergy amongst collaborators in the research and development of nitinol products.

The laboratory housed at CWRU’s Material Science and Engineering Department contains processing and characterization (thermal and mechanical) equipment that allows for the manufacture and analysis of nitinol products. Processing equipment includes a vacuum arc casting unit, vacuum heat treatment system, and hot extrusion capabilities. Thermal characterization equipment includes a high temperature Differential Scanning Calorimeter (DSC) while mechanical characterization equipment for testing wire/foil includes a number of flex bending fatigue machines, rotary bending fatigue machines, and tabletop tension testing machines.

The Cleveland Clinic and NASA Glenn Research Center also house equipment associated with the NCA program including: Radiance-Rofin Femtosecond Laser, Techne FB-08 Precision Calibration Bath, MTS Cryo-chamber and Grips, and an Aramis/Optotrak Certus 3D Strain Mapping system.

Solar-Durability and Lifetime Extension (S-DLE) Center (http://csegroups.case.edu/sdle/home)
Labs: White Building, 5th Floor / Sun Farm: CWRU West Quad

The research mission of the center is to bring to bear combined tools in physics, mathematics, chemistry, engineering and neuroscience to analyze the mechanisms underlying neuronal function and to solve the clinical problems associated with neuronal dysfunction. Research areas include: Neuromodulation, Neuroprostheses, Quantitative Neurophysiology, Neural Dynamics, Neuro-Mechanical Systems, Neural Regeneration, Neural Interfacing, Neural Imaging and Molecular Sensing, Neuro-Magnetism, and Systems Neuroscience. The education mission of the center is to provide engineers and scientists with an integrated knowledge of engineering and neuroscience capable of solving problems in neuroscience ranging from the molecules to the clinic. The center is also an outlet for technology transfer of new ideas to be commercialized by industrial partners. The center’s goals are accomplished by fostering interdisciplinary research between clinicians, scientists, students and local industry, educational experiences including didactic material, laboratory experience and clinical exposure, and close ties to industrial partners.

Nitinol Commercialization Accelerator (http://dmseg5.case.edu/groups/Lewandowski)
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John J. Lewandowski, Director
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James D. McGuffin-Cawley, Co-Director
David Schwam, Co-Director

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Solar-Durability and Lifetime Extension (S-DLE) Center (http://csegroups.case.edu/sdle/home)
Labs: White Building, 5th Floor / Sun Farm: CWRU West Quad

Phone: 216.368.3655/216.368.0374
Roger H. French, Director
roger.french@case.edu
Paul Stinson, Program Manager
paul.stinson@case.edu
Daniel Dryden, Research Engineer
daniel.dryden@case.edu

The S-DLE Center was established in 2011 with funding from Ohio Third Frontier, and is dedicated to advancing the field of lifetime and degradation science. Activities in the Center focus on durability and degradation of environmentally exposed, long lived materials and technologies such as photovoltaics (PV), energy efficient lighting, and building envelope applications. The Center develops real-time and accelerated protocols for exposure to solar radiation and related environmental stressors to enable the evaluation of the environmental durability and lifetime of materials, components, and products. Researchers perform post-exposure optical and thermo-mechanical measurements to develop quantitative mechanistic models of degradation processes. The S-DLE Center’s capabilities and equipment include:

- Outdoor solar exposures: SunFarm with 14 dual-axis solar trackers with multi-sun concentrators, and power degradation monitoring
- Solar simulators for 1-1000X solar exposures
- Multi-factor environmental test chambers with temperature, humidity, freeze/thaw, and cycling
- A full suite of optical, interfacial, thermo-mechanical and electrical evaluation tools for materials, components and systems

Swagelok Center for Surface Analysis of Materials (SCSAM) (http://dmseg5.case.edu/groups/ernst/scsam.html)

110 Glennan Building
A. H. Heuer, Director
arthur.heuer@case.edu

The Swagelok Center for Surface Analysis of Materials (SCSAM) is a multi-user analytical facility providing instrumentation for microstructural characterization and surface and near-surface chemical analysis. The Center’s 16 major instruments encompass a wide range of characterization tools, which provide a comprehensive resource for academic researchers who can tailor the analyses to their specific needs.

Current capabilities include four (4) Scanning Electron Microscopes (SEMs) which are equipped for Focused Ion Beam (FIB) micromachining and XEDS, WDS, and EBSP detectors, two (2) Transmission Electron Microscopes (TEMs) equipped with XEDS and EELS detectors, an Atomic Force Microscope (AFM), a UHV Scanning Probe system, a Laser Scanning Confocal Optical Microscope dedicated for materials studies, including Raman microscopy, an automated Nanoindefter, an Ion Beam Accelerator for Rutherford Backscattering (RBS) and PIXE and PIGE, two (2) X-ray diffraction (XRD) systems, along with surface-specific tools for Time-of-Flight, Secondary Ion Mass Spectrometry (ToF-SIMS), Auger
Electron Spectrometry, and X-Ray Photoelectron Spectroscopy (XPS), also known as Electron Spectrometry for Chemical Analysis (ESCA).

SCSAM is administratively housed in the Case School of Engineering (CSE) and is central to much of the research carried out by the seven departments within CSE. However, the facility is extensively used by the Physics, Chemistry, Biology and Earth, Environmental, and Planetary Sciences departments within the College of Arts and Sciences, and by many departments within the Schools of Medicine and Dental Medicine. In addition to CWRU clients, many external institutions utilize SCSAM’s facilities, including NASA Glenn Research Center, the Cleveland Clinic, and numerous Ohio universities. More than 300 users utilize the facility in any given year.

SCSAM’s instruments are housed in a centralized area, allowing users convenient access to state-of-the-art solutions for their analytical needs.

**ThinkTank for Multiscale Computational Modeling of Bio-medical and Bio-inspired Systems** ([https://bme.case.edu/Welcome/SpecialPrograms/SpecialMECHBIO/MechBioThinkTank](https://bme.case.edu/Welcome/SpecialPrograms/SpecialMECHBIO/MechBioThinkTank))

Department of Mechanical & Aerospace Engineering
Glennan Building 418 (7222)
Phone: 216.368.5884 Fax: 216.368.4969
Melissa Knothe Tate, Director
melissa.tate@case.edu

Typically, computational modelers share common approaches to diverse research and development problems. By providing a common space and infrastructure (software licenses and hardware) for computational modelers to work, we hope to promote exchange of modeling experience and expertise and to promote cross-departmental as well as cross institutional collaborations. The ThinkTank provides a home for several international computational collaborations as well.

**Wind Energy Research and Commercialization (WERC) Center** ([http://energy.case.edu/Ohio-WERC](http://energy.case.edu/Ohio-WERC))

307 Olin Building
Great Lakes Energy Institute
Phone: 216.368.1366, Fax: 216.368.3209
David H. Matthiesen, Director
david.matthiesen@case.edu

The WERC Center is a multidisciplinary center for use by students, faculty, and industry providing instrumentation for wind resource characterization and research platforms in operating wind turbines. The WERC Center was established in 2010 with funding from the Ohio Department of Development Third Frontier Wright Project and the Department of Energy. Additional support was provided by the following inaugural industrial partners: Cleveland Electric Laboratories, The Lubrizol Corporation, Parker Hannifin Corporation, Azure Energy LLC., Rockwell Automation, Inc., Swiger Coil Systems LLC., and Wm. Sopko & Sons Co.

The instruments in the WERC Center include:

- A continuous scan ZephIR LiDAR, manufactured by Natural Power. This instrument measures horizontal and vertical wind velocity along with wind direction at 1 Hz frequency at five user set heights up to 200 m.
- Five meteorological measurement systems: 3 on campus; 1 with the off-campus wind turbines; and one at the City of Cleveland’s water intake crib located 3.5 miles offshore in Lake Erie.
- An ice thickness sensor that is deployed at the bottom of Lake Erie each fall and retrieved in the spring.
- A NorthWind 100 wind turbine manufactured by Northern Power Systems in Barre, Vermont, USA. This 100kW community scale wind turbine has a direct drive generator with full power inverters, stall control blades with a 21 m rotor diameter, and a 37 m hub height. This wind turbine is located on campus just east of Van Horn field and began operation in November, 2010.
- A Vestas V-27 wind turbine originally manufactured by Vestas in Denmark. This 225kW medium scale wind turbine has a gearbox drive generator, pitch controlled blades with a 27 m rotor diameter, and a 30 m hub height. In addition it has a 50kW generator for low wind generation. This wind turbine will be located at an industrial site in Euclid, OH about 15 minutes from campus and is scheduled to begin operation in August, 2011.
- A Nordex N-54 wind turbine originally manufactured by Nordex in Germany. This 1.0MW utility scale wind turbine has a gearbox drive generator, stall control blades with a 54 m rotor diameter, and a 70 m hub height. In addition it has a 200kW generator for low wind generation. This wind turbine will be located at an industrial site in Euclid, OH about 15 minutes from campus and is scheduled to begin operation in August, 2011.

**Administration**

Jeffrey L. Duerk, PhD
(Case Western Reserve University)
Dean of the Case School of Engineering and Nord Professor of Engineering

Marc R. Buchner, PhD
(Michigan State University)
Faculty Director of Program Evaluation and Assessment

Laura Bulgarelli, MS
(Georgia Institute of Technology)
Associate Dean of Finance and Administration

Lisa Camp
(Baldwin Wallace College)
Assistant Dean of Strategic Initiatives

Patrick E. Crago, PhD
(Case Western Reserve University)
Associate Dean of Engineering

Daniel Ducoff
(University of California, Berkeley)
Associate Dean of Development and External Affairs

Deborah J. Fatica, MA
(Bowling Green State University)
Assistant Dean of the Division of Education and Student Programs

Kenneth A. Loparo, PhD
(Case Western Reserve University)
Faculty Director of Continuing Education and Nord Professor of Engineering

Ica Manas-Zloczower, DSc
(Technion-Israel Institute of Technology)
Associate Dean of Faculty Development
Clare M. Rimnac, PhD
(Lehigh University)
Associate Dean of Research and Wilbert J. Austin Professor of Engineering
Degree Program in Engineering, Undesignated

Engineering (Undesignated)
The Case School of Engineering offers undesignated degrees at the Undergraduate and Graduate level.

Bachelor of Science in Engineering (Undesignated)
The Engineering (Undesignated) program prepares students who seek a technological background but do not wish to pursue pure engineering careers. For example, some needs in the public sector, such as pollution remediation, transportation, low-cost housing, elective medical care, and crime control could benefit from engineering expertise. To prepare for careers in fields that address such problems, the Engineering (Undesignated) program allows students to acquire some engineering background, and combine it with a minor in such programs as management, history of technology and science, or economics. This is not an ABET accredited program.

A student electing an undesignated degree must submit a clear statement of career goals supported by a proposed course schedule with written justification for the selections. These documents are to be submitted to the office of the associate dean in the Case School of Engineering. The program must be approved by the dean in the Case School of Engineering or designate in consultation with representatives of the major and minor departments. A total of at least 129 semester credits are required for graduation.

Since each student’s program is unique, no typical curriculum can be shown. Every program must fulfill the requirements described below.

1. Engineering Core
2. A minimum of two engineering electives courses selected from two of the following four groups:

**Thermodynamics or Physical Chemistry**
- EMAC 351 Physical Chemistry for Engineers (CHEM 111) 6
- & EMAC 370 and Polymer Chemistry and Industry
- CHEM 301 Introductory Physical Chemistry I 6
- & CHEM 302 and Introductory Physical Chemistry II
- ECHE 363 Thermodynamics of Chemical Systems 3

**Signals, systems or control**
- EECS 304 Control Engineering I with Laboratory 3
- ECHE 367 Process Control 4
- EECS 246 Signals and Systems 4
- or EBME 308 Biomedical Signals and Systems

**Materials science**
- EMSE 201 Introduction to Materials Science and Engineering 3
- EMAC 270 Introduction to Polymer Science and Engineering 3
- EMSE 314 Electrical, Magnetic, and Optical Properties of Materials 3
- EBME 306 Introduction to Biomedical Materials 3
- EECS 321 Semiconductor Electronic Devices 4

**Economics, production systems or decision theory**
- EECS 350 Operations and Systems Design 3
- EECS 352 Engineering Economics and Decision Analysis 3
- OPRE 345 Decision Theory 3

**Major**
The major must contain a minimum of 24 semester credit hours of work in one of the following engineering fields:
- Biomedical Engineering
- Chemical Engineering
- Civil Engineering
- Computer Engineering
- Electrical Engineering
- Engineering Physics
- Materials Science and Engineering
- Polymer Science and Engineering
- Systems and Control Engineering

This work includes a senior projects laboratory (3 credits) and usually a course with a physical measurements laboratory.

**Minor**
The minor program requires a minimum of 15 semester credit hours. Minors are available with approval of the Office of Undergraduate Studies. Minors should be developed with the help of the associate dean in the Case School of Engineering. Minors must be approved by the department offering the minor. Final approval of the minor resides with the Office of Undergraduate Studies.

**Bachelor of Science in Engineering (Undesignated)**

**First Year**

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**Second Year**

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<td>Course</td>
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<tr>
<td>Introduction to Circuits and Instrumentation (ENGR 210)</td>
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<td>Elementary Differential Equations (MATH 224)</td>
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<td>Introduction to Modern Physics (PHYS 221)</td>
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**Third Year**

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<td>Professional Communication for Engineers (ENGL 398N)</td>
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**Fourth Year**

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<td>Humanities or Social Science elective</td>
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<td>Exxx 398 Engineering Senior Project</td>
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<tr>
<td>Humanities or Social Science elective</td>
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**Total Units in Sequence:** 125-127

**Hours required for graduation:** 129

_a_ One of these courses must be a humanities/social science course.

**Master of Science in Engineering (Undesignated)**

A student working toward an undesignated Master of Science degree in engineering must select a department. The student is responsible for submitting a Planned Program of Study via the Student Information System where it will be routed for appropriate approvals. The Planned Program of Study must contain a minimum of 9 semester hours of course work in the department approving the program. A minimum of 18 semester hours of course work for the degree must be at the 400 level or higher. The student must meet all the requirements of the designated Master of Science degree in engineering.
Department of Biomedical Engineering

The Department of Biomedical Engineering was established in 1968 at Case Western Reserve University. As one of the pioneer programs in the world, it has become a strong and well-established program in research and education with many unique features. It was founded on the premise that engineering principles provide an important basis for innovative and unique solutions to biomedical problems. This philosophy has been the guide for the successful development of the program, which has been emulated by many other institutions. Quantitative engineering and analytic methods for biomedical applications remains the cornerstone of the program and distinguishes it from biomedical science programs. In addition to dealing with biomedical problems at the tissue and organ-system level, the department’s educational programs have a growing emphasis on cellular and subcellular mechanisms for understanding of fundamental processes, as well as for systems approaches to solving clinical problems.

Current degree programs include the BS, MS, ME, combined BS/MS, PhD, MD/MS, and MD/PhD in biomedical engineering. In all of the BME programs at Case, the goal is to educate engineers who can apply engineering methods to problems involving living systems. The Case School of Engineering and the School of Medicine are in close proximity on the same campus. The Biomedical Engineering faculty members carry joint appointments in the two schools and participate in the teaching, research, and decision-making committees of both. The department is close to several major medical centers (University Hospitals, Cleveland Clinic, VA Medical Center, and MetroHealth Medical Center). As a result, there is an unusually free flow of academic exchange and collaboration in research and education among the schools and institutions. All of Case Western Reserve’s BME programs take full advantage of faculty cooperation among university departments, which adds significant strength to the programs.

Mission

To educate leaders who will integrate both principles of engineering and medicine to create knowledge and discoveries that advance human health and well-being. Our faculty and students play leading roles ranging from basic science discovery to the creation, clinical evolution, and commercialization of new technologies, devices, and therapies. In short, we are “Engineering Better Health.”

Background

Graduates in biomedical engineering are employed in industry, hospitals, research centers, government, and universities. Biomedical engineers also use their undergraduate training as a basis for careers in business, medicine, law, and other professions.

Research

Several research thrusts are available to accommodate various student backgrounds and interests. Strong research collaborations with clinical and basic science departments of the university and collaborating medical centers bring a broad range of opportunities, expertise, and perspective to student research projects.

Biomaterials/Tissue Engineering/Drug and Gene Delivery

Fabrication and analysis of materials for implantation, including neural, orthopaedic, and cardiovascular tissue engineering, biomimetic materials, liposomal and other structures for controlled, targeted drug delivery, and biocompatible polymer surface modifications. Analysis of synthetic and biologic polymers by AFM, nanoscale structure-function relationships of biomaterials. Applications in the nervous system, the cardiovascular system, the musculoskeletal system, and cancer.

Biomedical Imaging

MRI, PET, SPECT, CT, ultrasound, acoustic elastography, optical coherence tomography, cardiac electrical potential mapping, human visual perception, image-guided intervention, contrast agents. In vivo microscopic and molecular imaging, and small animal imaging.

Biomedical Sensing

Optical sensing, electrochemical and chemical fiber-optic sensors, chemical measurements in cells and tissues, endoscopy.

Neural Engineering and Neural Prostheses

Neuronal mechanisms; neural interfacing for electric and magnetic stimulation and recording; neural dynamics, ion channels, second messengers; neural prostheses for control of limb movement, bladder, bowel, and respiratory function; computational modeling of neural structures.

Transport and Metabolic Systems Engineering

Modeling and analysis of tissue responses to heating (e.g., tumor ablation) and of cellular metabolism related to organ and whole-body function in health (exercise) and disease (cardiac).

Biomechanical Systems

Computational musculoskeletal modeling, bone biomechanics, soft tissue mechanics, control of neuroprostheses for motor function, neuromuscular control systems, human locomotion, cardiac mechanics.

Cardiovascular Systems

Normal cardiac physiology, pathogenesis of cardiac diseases, therapeutic technologies; electrophysiological techniques, imaging technologies, mathematical modeling, gene regulation, molecular biology techniques; cardiac bioelectricity and cardiac biomechanics.

Major I Specialty Electives I BS/MS I Minor

Undergraduate Programs

The Case Western Reserve undergraduate program leading to the Bachelor of Science degree with a major in biomedical engineering was established in 1972. The Bachelor of Science degree program in Biomedical Engineering is accredited by the Engineering Accreditation Commission of ABET, www.abet.org (http://www.abet.org).

Some BS graduates are employed in industry and medical centers. Others continue studies in biomedical engineering and other fields. Students with engineering ability and an interest in medicine may consider the undergraduate biomedical engineering program as an exciting alternative to conventional premedical programs. The undergraduate program has three major components: (1) Engineering Core, (2) BME Core, and (3) BME Track Courses. The Engineering Core provides a fundamental background in mathematics, sciences, and engineering. The BME Core integrates engineering with biomedical science to solve biomedical problems. Hands-on experience in BME is developed through undergraduate laboratory and project courses. In addition, by choosing BME Track Courses, the student can study a specific area in depth. This integrated program is designed to ensure
that BME graduates are competent engineers. Students may select open electives for educational breadth or depth or to meet entrance requirements of medical school or other professional career choices. BME faculty serve as student advisors to guide students in choosing the program of study most appropriate for individual needs and interests.

Educational Objectives
At the undergraduate level, we direct our efforts toward two educational objectives that describe the performance of alumni 3-6 years after graduation.

1. Our graduates will successfully enter and complete post-baccalaureate advanced degree programs, including those in biomedical engineering.
2. Our graduates will obtain jobs in the biomedical arena and advance to positions of greater responsibility.

Student Outcomes
As preparation for achieving the above educational objectives, the BS degree program in Biomedical Engineering is designed so that students attain:

- An ability to apply knowledge of mathematics, science, and engineering appropriate to the biomedical engineering
- An ability to design and conduct experiments, as well as to analyze and interpret data
- An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
- An ability to function on multi-disciplinary teams
- An ability to identify, formulate, and solve engineering problems
- An understanding of professional and ethical responsibility
- An ability to communicate effectively
- The ability to communicate the impact of engineering solutions in a global, economic, environmental, and societal context
- A recognition of the need for, and an ability to engage in life-long learning
- A knowledge of contemporary issues
- An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

Biomedical Engineering Specialty Electives
BME Courses for these tracks are presented in the tables below; more information can be obtained from the Department of Biomedical Engineering (http://bulletin.case.edu/schoolofengineering/biomedicalengineering) or directly from the Biomedical Engineering Laboratory. These tracks provide the student with a solid background in a well-defined area of biomedical engineering. To meet specific educational needs, students may choose alternatives from among the suggested electives or design unique specialties subject to departmental guidelines and faculty approval.

Biomedical Devices and Instrumentation Track

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
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</thead>
<tbody>
<tr>
<td>EBME 370</td>
<td>Principles of Biomedical Engineering Design</td>
<td>2</td>
</tr>
<tr>
<td>EBME 380</td>
<td>Biomedical Engineering Design Experience</td>
<td>3</td>
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<td>Plus one of the following two sequences:</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>EBME 318 &amp; EBME 319</td>
<td>Biomedical Engineering Laboratory I and Biomedical Engineering Laboratory II</td>
<td></td>
</tr>
<tr>
<td>EBME 328 &amp; EBME 329</td>
<td>Biomedical Engineering R&amp;D Training I and Biomedical Engineering R&amp;D Training II</td>
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<tr>
<td>One of the following statistics courses:</td>
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<tr>
<td>STAT 312</td>
<td>Basic Statistics for Engineering and Science</td>
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<tr>
<td>STAT 313</td>
<td>Statistics for Experimenters</td>
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<tr>
<td>STAT 332</td>
<td>Statistics for Signal Processing</td>
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<tr>
<td>STAT 333</td>
<td>Uncertainty in Engineering and Science</td>
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<tr>
<td>Plus 7 Specialty Track specialization courses</td>
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<td>Total Units</td>
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</table>

Bachelor of Science in Engineering

Major in Biomedical Engineering

Majors in Biomedical Engineering choose a specialization sequence, with sequence-specific courses. More information can be obtained from the Department of Biomedical Engineering (http://bulletin.case.edu/schoolofengineering/biomedicalengineering) or directly from the Biomedical Engineering Laboratory.

Required Courses

Major Courses

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<thead>
<tr>
<th>Course</th>
<th>Title</th>
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<tr>
<td>EBME 201</td>
<td>Physiology-Biophysics I</td>
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<td>EBME 202</td>
<td>Physiology-Biophysics II</td>
<td>3</td>
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<tr>
<td>EBME 306</td>
<td>Introduction to Biomedical Materials</td>
<td>3</td>
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<tr>
<td>EBME 308</td>
<td>Biomedical Signals and Systems</td>
<td>4</td>
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<tr>
<td>EBME 309</td>
<td>Modeling of Biomedical Systems</td>
<td>4</td>
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<tr>
<td>&amp; EBME 359</td>
<td>and Biomedical Computer Simulation Laboratory</td>
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<tr>
<td>EBME 310</td>
<td>Principles of Biomedical Instrumentation</td>
<td>4</td>
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<tr>
<td>&amp; EBME 360</td>
<td>and Biomedical Instrumentation Laboratory</td>
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</table>
Biomechanics Track

EMAE 181  Dynamics  3
ECIV 310  Strength of Materials  3
EMAE 290  Computer-Aided Manufacturing  3

Biomaterials Track

EBME 327  Bioelectric Engineering  3
EBME 320  Medical Imaging Fundamentals  3
EBME 398  Senior Project Laboratory I  3

*To receive a minor in EECS, two (2) of the Tech Electives must be from EECS

Biomedical Computing and Analysis Track

EECS 302  Discrete Mathematics  3
EECS 233  Introduction to Data Structures  4
MATH 201  Introduction to Linear Algebra  3
EECS 324  Simulation Techniques in Engineering  3
EECS 105  Introduction to Biomedical Engineering (or Open Elective)  3

To receive a minor in Systems Engineering, students must choose EECS 304, EECS 346, and EECS 352 for tech. electives and either EECS 350 of EECS 391 for an open tech. elective.

EECS 304  Control Engineering I with Laboratory  3
EECS 346  Engineering Optimization  3
EECS 300  Dynamics of Biological Systems: A Quantitative Introduction to Biology  3
EECS 350  Operations and Systems Design  3
EECS 352  Engineering Economics and Decision Analysis  3
EECS 359  Bioinformatics in Practice  3
EECS 391  Introduction to Artificial Intelligence  3
EECS 398  Senior Project Laboratory I  3

To receive a minor in Computer Science, students must choose EECS 338 and EECS 340 for two of the tech. electives.

EECS 281  Logic Design and Computer Organization  3
EECS 293  Software Craftsmanship  3
EECS 313  Signal Processing  3
EECS 338  Introduction to Operating Systems  3
EECS 340  Algorithms and Data Structures  3
EECS 341  Introduction to Database Systems  3
EECS 343  Theoretical Computer Science  3

Case Western Reserve University  25
Co-op and Internship Programs

Opportunities are available for students to alternate studies and work in industry as a co-op student, which is integrated in a five-year program. Alternatively, students may obtain employment as summer interns.

Bachelor of Science in Engineering

Suggested Program of Study: Major in Biomedical Engineering

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<tr>
<th>First Year</th>
<th>Units</th>
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<td>Introduction to Biomedical Engineering (EBME 105)</td>
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<td>Principles of Chemistry for Engineers (CHEM 111)</td>
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<td>Calculus for Science and Engineering I (MATH 121)</td>
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<td>Elementary Computer Programming (ENGR 131/EECS 132)</td>
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<td>SAGES First Seminar (FSxx)</td>
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<td>PHED (2 half semester courses)</td>
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<td>Chemistry of Materials (ENGR 145)</td>
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<td>Calculus for Science and Engineering II (MATH 122)</td>
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<td>General Physics I - Mechanics (PHYS 121)</td>
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<td>USxx University Seminar</td>
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<td>Physiology-Biophysics I (EBME 201)</td>
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<td>Calculus for Science and Engineering III (MATH 223)</td>
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<td>General Physics II - Electricity and Magnetism (PHYS 122)</td>
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<td>Science elective</td>
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<td>USxx University Seminar</td>
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<tr>
<td>Physiology-Biophysics II (EBME 202)</td>
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<tr>
<td>Elementary Differential Equations (MATH 224)</td>
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<tr>
<td>Introduction to Circuits and Instrumentation (ENGR 210)</td>
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<td>SAGES Breadth Requirement (Arts and Humanities or Social Science Course)</td>
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<thead>
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<th>Third Year</th>
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<tr>
<td>Introduction to Biomedical Materials (EBME 306)</td>
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<tr>
<td>Biomedical Engineering Laboratory I (EBME 318)</td>
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<td>or Biomedical Engineering R&amp;D Training I (EBME 328)</td>
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<tr>
<td>Professional Communication for Engineers (ENGL 398)</td>
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<tr>
<td>&amp; Professional Communication for Engineers (ENGR 398)</td>
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<tr>
<td>Biomedical Signals and Systems (EBME 308)</td>
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<tr>
<td>Thermodynamics, Fluid Dynamics, Heat and Mass Transfer (ENGR 225)</td>
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<tr>
<td>Biomedical Engineering Laboratory II (EBME 319)</td>
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<td>or Biomedical Engineering R&amp;D Training II (EBME 329)</td>
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<tr>
<td>Principles of Biomedical Instrumentation (EBME 310)</td>
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<td>Biomedical Instrumentation Laboratory (EBME 360)</td>
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<tr>
<td>Statics and Strength of Materials (ENGR 200)</td>
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<td>Modeling of Biomedical Systems (EBME 309)</td>
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<td>&amp; Biomedical Computer Simulation Laboratory (EBME 359)</td>
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<td>BME Track Course</td>
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<td>BME Track Course</td>
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<td>Principles of Biomedical Engineering Design (EBME 370)</td>
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<tr>
<td>BME Track Course</td>
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<tr>
<td>BME Track Course</td>
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<td>Statistics</td>
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<td>H/SS</td>
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<td>Open Elective</td>
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<td>BME Track Course</td>
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<td>BME Track Course</td>
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<tr>
<td>Biomedical Engineering Design Experience (EBME 380)</td>
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<td>BME Track Course</td>
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<tr>
<td>BME Track Course</td>
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</tr>
<tr>
<td>Year Total:</td>
<td>17 18</td>
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</tbody>
</table>

Total Units in Sequence: 133

a  This is a typical program. Track courses are designed with courses in a desired order that might vary from the one here. Programs must be planned with a faculty advisor in the Department of Biomedical Engineering.
b  This optional course is limited to freshmen. This can be replaced by an open elective.
c  University Seminars (6 semester hours, minimum of 2 seminars selected from different thematic groups and different thematic group from that of FSCC 100 First Seminar).
d  Courses are chosen depending on the BME track courses as listed below.
e  Students take at least one math or science course approved by BME department.
f  SAGES BME Departmental Seminar, ENGL 398 Professional Communication for Engineers and ENGR 398 Professional Communication for Engineers must be taken together.
g  STAT 312 Basic Statistics for Engineering and Science, STAT 333 Uncertainty in Engineering and Science, or STAT 332 Statistics for Signal Processing fulfill the statistics requirement. Check with sequence advisor to determine the most appropriate class.
h  Students interested in Biomedical Computing and Analysis are required to take EECS 132.
i  Humanities/Social Science course
BS/MS Program

Undergraduates with a strong academic record may apply in their junior year for admission to the integrated BS/MS program. A senior research project that begins in the summer after the junior year is designed to expand into an MS thesis. Also, the student begins to take graduate courses in the senior year. With continuous progress in research during three summers and the academic years, this program can lead to both the BS and MS in five years.

Minor in Biomedical Engineering

A minor in biomedical engineering is offered to students who have taken the Engineering Core requirements. The minor consists of an approved set of five EBME courses.

Required Courses

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>EBME 201</td>
<td>Physiology-Biophysics I</td>
<td>3</td>
</tr>
<tr>
<td>EBME 202</td>
<td>Physiology-Biophysics II</td>
<td>3</td>
</tr>
</tbody>
</table>

Two of the following:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
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<tbody>
<tr>
<td>EBME 306</td>
<td>Introduction to Biomedical Materials</td>
<td>3</td>
</tr>
<tr>
<td>EBME 309</td>
<td>Modeling of Biomedical Systems</td>
<td>3</td>
</tr>
<tr>
<td>EBME 310</td>
<td>Principles of Biomedical Instrumentation</td>
<td>3</td>
</tr>
</tbody>
</table>

One of the following:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
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</thead>
<tbody>
<tr>
<td>EBME 303</td>
<td>Structure of Biological Materials</td>
<td>3</td>
</tr>
<tr>
<td>EBME 307</td>
<td>Biomechanical Prosthetic Systems</td>
<td>3</td>
</tr>
<tr>
<td>EBME 320</td>
<td>Medical Imaging Fundamentals</td>
<td>3</td>
</tr>
<tr>
<td>EBME 322</td>
<td>Applications of Biomedical Imaging</td>
<td>3</td>
</tr>
<tr>
<td>EBME 350</td>
<td>Quantitative Molecular Bioengineering</td>
<td>3</td>
</tr>
</tbody>
</table>

Total Units 15

Graduate Programs

The objective of the graduate program in biomedical engineering is to educate biomedical engineers for careers in industry, academia, health care, and government and to advance research in biomedical engineering. The department provides a learning environment that encourages students to apply biomedical engineering methods to advance basic scientific discovery; integrate knowledge across the spectrum from basic cellular and molecular biology through tissue, organ, and whole-body physiology and pathophysiology; and to exploit this knowledge to design diagnostic and therapeutic technologies that improve human health. The unique and rich medical, science, and engineering environment at Case enables research projects ranging from basic science through engineering design and clinical application.

Numerous fellowships and research assistantships are available to support graduate students in their studies.

Graduate Certificate

A Graduate Certificate in Wireless Health is a new offering in the Department of Biomedical Engineering. For more details, please refer to the Wireless Health (http://engineering.case.edu/wireless_health) information on the Case School of Engineering website.

Master of Engineering

The MS program in biomedical engineering provides breadth in biomedical engineering and biomedical sciences with depth in an engineering specialty. In addition, students are expected to develop the ability to work independently on a biomedical research or design project. The MS requires a minimum of 27 credit hours. With an MS research thesis (Plan A), a minimum of 18 credits hours is needed in regular course work and 9 hours of thesis research (EBME 651 Thesis M.S.).

With an MS project (Plan B), a minimum of 24 credits hours is needed in regular course work, and three hours of project research (EBME 601 Research Projects); or this can be accomplished in 27 credit hours of coursework with a comprehensive final exam for the degree.

Master of Engineering and Management - Biomedical Entrepreneurship

Biomedical engineering students may apply for the Biomedical Entrepreneurship concentration in the Master of Engineering (MEM) program. The MEM is a degree offered by The Institute for Management and Engineering (TIME), a joint program between the Case School of Engineering and the Weatherhead School of Management. The objective of this program is to provide biomedical engineers with the business and management context required to enable them to drive innovation within biomedical companies while serving in a technical capacity.

Students can enter the program as undergraduates. The program does not interfere with undergraduate degree requirements. The curriculum includes courses integrating engineering and management, as well as industrial internships. By making use of summers for both course work and internships, the MEM degree is completed in one additional year beyond the BS, i.e., for a total of five years for the BS and MEM degrees. Students should apply through TIME.

MD/MS Program

Medicine is undergoing a transformation based on the rapid advances in science and technology that are combining to produce more accurate diagnoses, more effective treatments with fewer side effects, and improved ability to prevent disease. The goal of the MD/MS in Engineering is to prepare medical graduates to be leaders in the development and clinical deployment of this technology and to partner with others in technology based translational research teams. Current Case medical students in either the University Program (UP) or the Cleveland Clinic Lerner College of Medicine (CCLCM) may apply to the MD/MS in Engineering program.

Students must complete the normal requirements in their particular MD program. Portions of the medical school curriculum earn graded credit toward the MD/MS degree. Specifically, six credit hours of the medical school curriculum can be applied to the MS component of the joint degree.

The balance of 12 credit hours (4 courses) must be graduate level engineering concentration courses that provide rigor and depth in a field of engineering relevant to the area of research.

A required thesis (9 credit hours of EBME 651 Thesis M.S.) serves a key integration role for the joint degree, with both medical and engineering components. The thesis also fulfills the research requirement of the UP or CCLCM programs.

Students should apply through the BME department admissions office.

PhD Program in Biomedical Engineering

For those students with primary interest in research, the PhD in biomedical engineering provides additional depth and breadth in engineering and the biomedical sciences. Under faculty guidance, students are expected to undertake original research motivated by a biomedical problem. Research possibilities include the development of new theory, devices, or methods for diagnostic or therapeutic applications, as well as for measurement and evaluation of basic biological mechanisms.

The PhD program requires a minimum of 36 credit hours of courses beyond the BS degree. There are 12 credit hours of required core
the clinical needs of veterans and others with motor and sensory deficits and limb loss.

The Coulter-Case Translation and Innovation Partnership (CCTRP) is a department-based collaboration with the Wallace H. Coulter Foundation. The program fosters collaborations between clinicians and the Case Western Reserve University biomedical engineering faculty on translational research projects with the potential to impact patient care often through the creation of new biomedical products and new product concepts.

The department faculty and students have access to the facilities and major laboratories of the Case School of Engineering and School of Medicine. Faculty have numerous collaborations at University Hospitals, MetroHealth Medical Center, Louis Stokes Cleveland VA Medical Center, and the Cleveland Clinic. These provide extensive research resources in a clinical environment for both undergraduate and graduate students.

Primary Appointments

Robert F. Kirsch, PhD
(Northwestern University)
Professor and Interim Chair, Functional Electrical Stimulation Center

A. Bolu Ajiboye, PhD
(Northwestern University)
Assistant Professor
Development and control of brain-computer-interface (BCI) technologies for restoring function to individuals with nervous system injuries

Eben Alsberg, PhD
(University of Michigan)
Associate Professor
Biomimetic tissue engineering; innovative biomaterials and drug delivery vehicles for functional tissue regeneration and cancer therapy; control of stem cell fate decision; precise temporal and spatial presentation of signals to regulate cell behavior; mechanotransduction and the influence of mechanics on cell behavior and tissue formation; and cell-cell interactions

James P. Basilion, PhD
(The University of Texas)
Associate Professor (joint with Radiology)
High resolution imaging of endogenous gene expression; definition of "molecular signatures" for imaging and treatment of cancer and other diseases; generating and utilizing genomic data to define informative targets; strategies for applying non-invasive imaging to drug development; and novel molecular imaging probes and paradigms

Jeffrey Capadona, PhD
(Georgia Institute of Technology)
Assistant Professor
Advanced materials for neural interfacing; biomimetic and bio-inspired materials; host-implant integration; anti-inflammatory materials; and novel biomaterials for surface modification of cortical prostheses

Patrick E. Crago, PhD
(Case Western Reserve University)
Professor and Associate Dean of Engineering
Control of neuroprostheses for restoration of motor function; neuromechanics; and modeling of neuromusculoskeletal systems
Erin Lavik, ScD
(Massachusetts Institute of Technology)

Professor (joint with Mechanical and Aerospace Engineering)

healing, health, and disease states; novel materials and implants; multi-scale orthopaedic mechanobiology in cellular biomechanics, molecular transport and fluid flow through tissue; cellular, tissue, and organ levels; cellular and biofluid mechanics: study of development, growth, adaptation and repair of biological systems at the methods to uncover the biophysical mechanisms underlying processes of experimental mechanobiology: applying computational and experimental

Dominique M. Durand, PhD
(University of Toronto, Canada)

Efstathios (Stathis) Karathanasis, PhD
(Arizona State University)

Assistant Professor

manufacturing of multifunctional agents that facilitate diagnosing; treating and monitoring of therapies in a patient-specific manner

J. Lawrence Katz, PhD
(Polytechnic Institute of Brooklyn)

Professor Emeritus

Structure-property; relationships in bone; osteophilic biomaterials; ultrasonic studies of tissue anisotropy; and scanning acoustic microscopy

Melissa Knothe Tate, PhD
(Swiss Federal Institute of Technology ETH, Zurich, Switzerland)

Professor (Joint with Mechanical and Aerospace Engineering)

stem cell mechanisms and mechanobiology; multi-scale computational and experimental mechanobiology: applying computational and experimental methods to uncover the biophysical mechanisms underlying processes of development, growth, adaptation and repair of biological systems at the cellular, tissue, and organ levels; cellular and biofluid mechanics: study of cellular biomechanics, molecular transport and fluid flow through tissue; engineering and development of mechano-active, bio-inspired, and/or novel materials and implants; multi-scale orthopaedic mechanobiology in healing, health, and disease states

Erin Lavik, ScD
(Massachusetts Institute of Technology)

Elmer Lincoln Lindseth Associate Professor in Biomedical Engineering

Biomaterials; synthesis of new degradable polymers; tissue engineering; spinal cord repair; retinal regeneration; and drug delivery for optic nerve preservation and repair

Zheng-Rong Lu, PhD
(Lanzhou Institute of Chemical Physics, Chinese Academy of Sciences)

M. Frank and Margaret Domiter Rudy Professor of Biomedical Engineering

Drug delivery and molecular imaging; novel targeted imaging agents for molecular imaging; novel MRI contrast agents; image-guided therapy and drug delivery; polymeric drug delivery systems; multi-functional delivery systems for nucleic acids

Roger Marchant, PhD
(Case Western Reserve University)

Professor; Director, Center for Biomaterials

Self-assembling biomimetic materials; vascular tissue engineering; novel biomaterials for surface modification of cardiovascular devices and hydrogels for tissue engineering; targeted liposome drug delivery; bacterial adhesion; and cell and protein interactions with biomaterials using atomic force microscopy

J. Thomas Mortimer, PhD
(Case Western Reserve University)

Professor Emeritus

Neural control and prostheses; electrical activation of neural tissue; and membrane properties and electrodes

P. Hunter Peckham, PhD
(Case Western Reserve University)

Donnell Institute Professor; Distinguished University Professor; Rehabilitation engineering in spinal cord injury; neural prostheses; and functional electrical stimulation and technology transfer

Andrew M. Rollins, PhD
(Case Western Reserve University)

Associate Professor

Biomedical optics; real-time in-vivo microstructural, functional, and molecular imaging using optical coherence tomography; diagnosis and guided therapy for cancer, cardiovascular, and ophthalmic disease

Gerald M. Saidel, PhD
(The Johns Hopkins University)

Professor; Director, Center for Modeling Integrated Metabolic Systems

Mass and heat transport and metabolism in cells, tissues, and organ systems; mathematical modeling and simulation of dynamic and spatially distributed systems; optimal nonlinear parameter estimation and design of experiments

Nicole Seiberlich, PhD
(Lanzhou Institute of Chemical Physics, Chinese Academy of Sciences)

Drug delivery and molecular imaging; novel targeted imaging agents for drug delivery; polymeric drug delivery systems; multi-functional delivery systems for nucleic acids

M. Frank and Margaret Domiter Rudy Professor of Biomedical Engineering

Advanced signal processing and data acquisition techniques for rapid Magnetic Resonance Imaging (MRI).

Anirban Sen Gupta, PhD
(The University of Akron)

Assistant Professor

Targeted drug delivery; targeted molecular imaging; image-guided therapy; platelet substitutes; novel polymeric biomaterials for tissue engineering scaffolds

Nicole F. Steinmetz, PhD
(John Innes Centre in Norwich, UK)

Assistant Professor

Efstathios (Stathis) Karathanasis, PhD
(Arizona State University)

Assistant Professor

Fabricating multifunctional agents that facilitate diagnosing; treating and monitoring of therapies in a patient-specific manner

J. Lawrence Katz, PhD
(Polytechnic Institute of Brooklyn)

Professor Emeritus

Structure-property; relationships in bone; osteophilic biomaterials; ultrasonic studies of tissue anisotropy; and scanning acoustic microscopy

Melissa Knothe Tate, PhD
(Swiss Federal Institute of Technology ETH, Zurich, Switzerland)

Professor (Joint with Mechanical and Aerospace Engineering)

stem cell mechanisms and mechanobiology; multi-scale computational and experimental mechanobiology: applying computational and experimental methods to uncover the biophysical mechanisms underlying processes of development, growth, adaptation and repair of biological systems at the cellular, tissue, and organ levels; cellular and biofluid mechanics: study of cellular biomechanics, molecular transport and fluid flow through tissue; engineering and development of mechano-active, bio-inspired, and/or novel materials and implants; multi-scale orthopaedic mechanobiology in healing, health, and disease states

Erin Lavik, ScD
(Massachusetts Institute of Technology)
Engineering of viral nanoparticles as smart devices for applications in medicine: tissue-specific imaging, drug-delivery, and tissue engineering

Dustin J. Tyler, PhD
(Case Western Reserve University)
Associate Professor

Neuromimetic neuroprostheses; laryngeal neuroprostheses; clinical implementation of nerve electrodes; cortical neuroprostheses; minimally invasive implantation techniques; and modeling of neural stimulation and neuroprostheses

Horst A. von Recum, PhD
(University of Utah)
Associate Professor

Affinity-based delivery of small molecule drugs and biomolecules for applications in device infection, HIV, orthopedics, cardiovascular, ophthalmology and cancer; directed differentiation of stem cells for tissue engineering applications, such as endothelial cells, cardiomyocytes, motor neurons and T-cells

David L. Wilson, PhD
(Rice University)
Robert J. Herbold Professor

Biomedical image processing; digital processing and quantitative image quality of X-ray fluoroscopy images; interventional MRI

Xin Yu, ScD
(Harvard-MIT)
Associate Professor

Magnetic resonance imaging and spectroscopy; applications of MRI and MRS to cardiovascular research

Research Appointments

Musa L. Audu, PhD
(Case Western Reserve University)
Research Associate Professor

Human musculoskeletal modeling and development of control systems for rehabilitation of individuals with balance disorders

Niloy Bhadra, MD, PhD
(Case Western Reserve University)
Research Assistant Professor

Experimental and computational studies of high frequency waveforms for reversible conduction block of peripheral nerves; design, testing and implementation of neuroprosthetic systems for the upper limb

Michael Jenkins, PhD
(Case Western Reserve University)
Research Assistant Professor

Biomedical optics; development of optical pacing and optical imaging technologies for investigating cardiac development and diseases

Nicola Lai, PhD
(University of Pisa, Pisa/Cagliari, Italy)
Research Assistant Professor

Systems biology investigation of muscle exercise metabolism in diabetes; systems integrated physiology; mass transport and metabolism in cell, tissue and organ systems; mathematical modeling and analysis of dynamic and distributed systems

Junmin Zhu, PhD
(Peking University)
Research Assistant Professor

Biomimetic engineering of nanomaterials; design and synthesis of extracellular matrix (ECM)-mimetic scaffolds for bioengineering vascular grafts and networks; engineering of multifunctional nanosystems for targeting tumor angiogenesis

Secondary Appointments

Ozan Akkus, PhD
(Case Western Reserve)  
Associate Professor

Development of novel biomaterials that sill substitute bone and soft tissues, bioinspired from the synthesis of bone such that ductile biocompatible polymer matrices are subjected to mineralization. Tendon replacement strategy involve alignment of collagen monomers by a novel electrochemical method to obtain strong bundles.

Jay Alberts, PhD
(Arizona State University)

Assistant Professor of Biomedical Engineering (Cleveland Clinic)

Neural basis of upper extremity motor function and deep brain stimulation in Parkinson’s disease

James M. Anderson, MD (Case Western Reserve University), PhD
(Oregon State University)

Professor, Pathology, University Hospitals-Case Medical Center

Blood and tissue/material interactions as they relate to implantable devices and biomaterials

Harinara Baskaran, PhD
(Pennsylvania State University)

Assistant Professor, Chemical Engineering

Design and build microvascular flow analogs that can be used to overcome nutrient limitations in tissue-engineered products

Jonathan Baskin, MD
(New York University)

Assistant Professor, Chief, Otolaryngology-Head & Neck Surgery, University Hospitals-Case Medical Center, VA Medical Center

Bioengineering of bone substitutes using nanotechnology

Arnold Caplan, PhD
(Johns Hopkins University)

Professor, Biology

Develop and refine the technology necessary to isolate one of these rare stem cells, the mesenchymal stem cell (MSC)

Ronald L. Cechner, Clinical PhD (Anesthesiology)
(Case Western Reserve University)

Assistant Professor, Anesthesiology and Associate Professor, Biomedical Engineering and Pathology, Technical Director, Anesthesia Simulation Laboratory, University Hospitals-Case Medical Center

Simulator in medical education

John Chae, MD
(New Jersey Medical School)

Professor, Physical Medicine and Rehabilitation, MetroHealth Medical Center

Stroke rehabilitation, neuromuscular electrical stimulation to restore upper and lower extremity function after stroke

Hillel J. Chiel, PhD
(Massachusetts Institute of Technology)

Professor, Biology

Biomechanical and neural basis of feeding behavior in the marine mollusk Aplysia californica; neuromechanical system modeling; analysis of neural network dynamics

Guy Chisolm, PhD
(University of Virginia)
Professor, Cell Biology, Cleveland Clinic
Vascular biology; lipoprotein-cell interactions
Margot Damaser, PhD
(University of California)

Associate Professor, Biomedical Engineering, Cleveland Clinic
Biomechanics and neural control of the female pelvic floor and lower urinary tract in normal and dysfunctional cases
David Dean, PhD
(City University of New York)

Associate Professor, Neurological Surgery, Anatomy, Orthodontics,
University Hospitals-Case Medical Center
Computer-Assisted Surgery, skull (bone) tissue engineering, photodynamic therapy of glioma, and automated radiosurgery treatment planning
James Dennis, PhD
(Case Western Reserve University)

Assistant Professor, Orthopaedics, University Hospitals-Case Medical Center
Engineering cartilage for orthopaedic and trachea reconstruction applications; developing reagents, termed “cell paints;” that can be used to direct repair cells to specific organs and tissues
Kathleen Derwin, PhD
(University of Michigan)

Assistant Professor, Molecular Medicine (Biomedical Engineering, Cleveland Clinic)
Tendon mechanobiology and tissue engineering
Isabelle Deschenes, PhD
(Laval University)

Assistant Professor, Cardiology, MetroHealth Medical Center
Molecular mechanisms of cardiac arrhythmias, ion channels structure-function
J. Kevin Donahue, MD
(Washington University)

Associate Professor, Cardiology, MetroHealth Medical Center
Arrhythmia ablation; atrial fibrillation; cardiac arrhythmia; gene therapy; implantable cardioverter defibrillator; myocardial infarction; ventricular tachycardia
Agata Exner, PhD
(Case Western Reserve University)

Associate Professor, Radiology, University Hospitals-Case Medical Center
Development and imaging characterization of drug delivery for cancer chemotherapy; interventional radiology
Elizabeth Fisher, PhD
(Rutgers University)

Associate Professor, Molecular Medicine (Biomedical Engineering, Cleveland Clinic)
Quantitative image analysis for application to multiple sclerosis and neurodegenerative diseases
Christopher Flask, PhD
(Case Western Reserve University)

Assistant Professor, Radiology, University Hospitals-Case Medical Center
Development of Quantitative and Molecular MRI Imaging Methods, MRI Physics
Kiyotaka Fukamachi, MD, PhD
(Kyushu University)

Professor

Research activities entail promoting human health through the development of various surgical treatments for heart failure, encompassing a broad range of options
Linda M. Graham, MD
(University of Michigan)

Professor, Surgery (Vascular Surgery and Biomedical Engineering), Cleveland Clinic
Cell movement and vascular healing, vascular tissue engineering
Roy Greenberg, MD
(University of Cincinnati)

Associate Professor, Surgery (Thoracic and Cardiovascular and Biomedical Engineering, Cleveland Clinic)
Development and assessment of endovascular devices for treating vascular diseases
Mark Griswold, PhD
(University of Wuerzburg, Germany)

Associate Professor, Radiology, University Hospitals-Case Medical Center
Rapid magnetic resonance imaging, image reconstruction and processing and MRI hardware/instrumentation
Vikas Gulani, MD, PhD
(University of Illinois)

Assistant Professor, Radiology, University Hospitals-Case Medical Center
Diffusion tensor imaging and diffusion anisotropy, MRI microscopy, body MRI, and functional MRI
Alex Y. Huang, MD, PhD
(Johns Hopkins University)

Assistant Professor, Pediatrics, Pathology, University Hospitals-Case Medical Center/Rainbow Babies and Children’s Hospital
Study various aspects of anti-tumor immune responses, immune – host – pathogen interaction, T cell-mediated memory immunity, and chemokine - receptor biology
Michael W. Keith, MD
(Ohio State University)

Professor, Orthopaedic Surgery, MetroHealth Medical Center
Restoration of motor function in hands
Kandice Kottke-Marchant, MD, PhD
(Case Western Reserve University)

Professor, Molecular Medicine (Pathology and Laboratory Medicine, Cleveland Clinic)
Thrombosis, hemostasis and vascular disease, hypercoagulable states, bleeding disorders, endothelial cell function, atherosclerosis
Vinod Labhasetwar, PhD
(Nagpur University, India)

Associate Professor, Molecular Medicine (Biomedical Engineering, Cleveland Clinic)
Cancer treatment and detection, delivery of anti-oxidant enzymes in stroke and development of a non-stent approach to inhibition of restenosis
Kenneth R. Laurita, PhD
(Case Western Reserve University)

Associate Professor, Heart and Vascular Research Center, MetroHealth Medical Center
Cellular mechanisms of cardiac arrhythmias using fluorescent imaging of transmembrane potential and intracellular calcium in the intact heart
Zhenghong Lee, PhD
(Case Western Reserve University)
Associate Professor, Radiology, Nuclear Medicine, University Hospitals-
Case Medical Center
Quantitative PET and SPECT imaging, multimodal image registration, 3D
visualization, molecular imaging and small animal imaging systems

R. John Leigh, MD
(University of Newcastle-Upon-Tyne, U.K.)
Professor, Neurology, VA Medical Center
Normal and abnormal motor control of the eye

Kenneth Loparo, PhD
(Case Western Reserve University)
Nord Professor of Engineering, Electrical Engineering & Computer
Science
Stability and control of nonlinear and stochastic systems; systems biology

Cameron McIntyre, PhD
(Case Western Reserve University)
Assistant Professor, Molecular Medicine (Biomedical Engineering,
Cleveland Clinic)
Theoretical modeling of the interaction between electric fields and the
nervous system; deep brain stimulation

Mehran Mehregany, PhD
(Massachusetts Institute of Technology)
Professor, Electrical Engineering & Computer Science
Micro/Nano-Electro-Mechanical Systems; silicon carbide semiconductor
technology and microsystems; wireless health

Pedram Mohseni, PhD
(University of Michigan)
Assistant Professor, Electrical Engineering & Computer Science
Biomicrosystems; biomedical microtelemetry; biological-electronic
interfaces; microelectronics for neurotechnology; and wireless integrated
sensing/actuating systems

George F. Muschler, MD
(Northwestern University)
Professor, Molecular Medicine (Orthopaedic Surgery and Biomedical
Engineering, Cleveland Clinic)
Bone biology, skeletal reconstruction, aging and osteoporosis

Raymond F. Muzic Jr., PhD
(Case Western Reserve University)
Associate Professor, Radiology, Biomedical Engineering, Oncology,
Division of General Medical Sciences, University Hospitals-Case Medical
Center
Quantitative analysis of biomedical imaging data, physiologic modeling,
optimal experiment design, assessment of new radiopharmaceuticals,
imaging response to therapy, and in vivo quantification of receptor
concentration

Marc Penn, MD, PhD
(Case Western Reserve University)
Assistant Professor, Molecular Medicine (Cardiology and Cell Biology,
Cleveland Clinic)
Myocardial ischemia, vascular biology, cardiac critical care

Clare Rimnac, PhD
(Lehigh University)
Professor, Mechanical and Aerospace Engineering
Orthopaedic implant performance and design, mechanical behavior of
hard tissues

Stuart Rowan, PhD
(University of Glasgow, UK)
Kent Hale Smith Professor, Macromolecular Science & Engineering

Investigation and utilization of Supramolecular Chemistry (the chemistry
of the non-covalent bond) in polymer chemistry

Mark S. Rzeszotarski, PhD
(Case Western Reserve University)
Professor, Radiology, MetroHealth Medical Center
Radiological imaging; computed tomography, medical education

Dawn Taylor, PhD
(Arizona State University)
Assistant Professor, Molecular Medicine (Neurosciences, Cleveland
Clinic)
Restoration of movement and function to paralysis victims through the
application of electrical current to the peripheral nerves

Ronald J. Triolo, PhD
(Drexel University)
Associate Professor, Orthopaedics, University Hospitals-Case Medical
Center, VA Medical Center, MetroHealth Medical Center
Neural prostheses, rehabilitation engineering and restoration of lower
extremity function, biomechanics of human movement quantitative
analysis and control of gait, standing balance and seated posture

Albert L. Waldo, MD
(State University of New York, Downstate)
Professor, Medicine/Cardiology, University Hospitals-Case Medical
Center
Cardiac electrophysiology and cardiac excitation mapping

Michael Weiss, MD, PhD, MBA
(Harvard Medical School, Case Western Reserve University)
Professor
Protein engineering: design of more stable proteins for use in novel
devices and design of less stable proteins for use in artificial operons in
 genetic model organisms. The use of multi-dimensional MR spectroscopy
to interrogate the outcomes of such protein engineering efforts.

Barry Wessels, PhD
(University of Notre Dame)
Professor, Biomedical Engineering and Radiation Oncology; Director,
Division of Medical Physics and Dosimetry, University Hospitals-Case Medical
Center
Radiolabeled antibody therapy (Dosimetry and clinical trials), image-
guided radiotherapy, intensity modulated radiation therapy, image fusion
of CT, MR, SPECT and PET for adaptive radiation therapy treatment
planning

Xiong Yu, PhD, P.E.
(Purdue University School of Civil Engineering)
Associate Professor
Materials and sensors innovations with emphasis on interdisciplinary
innovation to improve intelligent and durability

Guang Hui Yue, PhD
(University of Iowa)
Associate Professor, Molecular Medicine, (Biomedical Engineering,
Cleveland Clinic)
Neural control of movement

Maciej Zborowski, PhD
(Polish Academy of Science)
Associate Professor, Molecular Medicine (Biomedical Engineering,
Cleveland Clinic)
Membrane separation of blood proteins

Assem G. Ziady, PhD
(Case Western Reserve University)
Assistant Professor, Pediatrics, University Hospitals-Case Medical Center
Proteomics, DNA nanoparticles, mass spectrometry, cystic fibrosis, inflammation, and redox signaling
Nicholas P. Ziats, PhD
(Case Western Reserve University)

Associate Professor, Pathology, University Hospitals-Case Medical Center
Vascular grafts; vascular cells; blood vessels
Christian Zorman, PhD
(Case Western Reserve University)

Associate Professor, Electrical Engineering & Computer Science
Development of enabling materials for micro- and nanosystems
Nicholas P. Ziats, PhD
(Case Western Reserve University)

Adjunct Appointments

Kath Bogie, D. Phil
(University of Oxford)
Adjunct Assistant Professor, Biomedical Engineering (VA Medical Center)
Wound prevention and treatment in individuals with paralysis and in the biomechanics of wheelchairs and seating for people with limited mobility

Scott Bruder, MD, PhD
(Case Western Reserve University)
Adjunct Professor
Advises MD/PhD students regarding careers in industry.

Richard C. Burgess, MD, PhD
(Case Western Reserve University)
Adjunct Professor of Biomedical Engineering (Neurological Computing, Cleveland Clinic)
Magnetoencephalography; Electrophysiological monitoring; EEG processing; medical informatics

Alan F. Dowling, PhD
(Massachusetts Institute of Technology)
Adjunct Professor (Global Health Associates LLC)
Models of health care systems

Colin Drummond, PhD (Syracuse University), MBA (Case Western Reserve University)
Adjunct Professor
Sensor and information technology systems

William J. Dupps, MD, PhD
(The Ohio State University)
Adjunct Professor (Cleveland Clinic)
Application of engineering tools to the diagnosis and management of biomechanical disorders such as keratoconus and glaucoma

Luis Gonzalez-Reyes, MD (University of Los Andes), PhD (London University)
Adjunct Instructor, Biomedical Engineering
Physiology; biophysics; molecular and cellular physiology

Elizabeth C. Hardin, PhD
(University of Massachusetts)
Adjunct Associate Professor of Biomedical Engineering, (VA Medical Center)
Neural prostheses and gait mechanics; improving gait performance with neural prostheses using strategies developed in conjunction with forward dynamics musculoskeletal models

Thomas Hering, PhD
(Case Western Reserve University)
Adjunct Associate Professor (Orthopaedic Surgery, Washington University)
Cartilage; extracellular matrix biochemistry and molecular biology; transciptional regulation of chondrogenesis

Vincent J. Hetherington, DPM
(Pennsylvania College of Podiatric Medicine)
Adjunct Assistant Professor of Biomedical Engineering (Surgery, Ohio College of Podiatric Medicine)
Biomaterials and biomechanics of foot prostheses

Jill S. Kawalec-Carroll, PhD
(Case Western Reserve University)
Adjunct Assistant Professor, Biomedical Engineering, Research Director, Ohio College of Podiatric Medicine
Biomaterials and biomechanics of foot prostheses

Kevin L. Kilgore, PhD
(Case Western Reserve University)
Adjunct Assistant Professor, Biomedical Engineering, Orthopaedics, (MetroHealth Medical Center)
Functional electrical stimulation; neuroprostheses

William Landis, PhD
(Massachusetts Institute of Technology)
Adjunct Professor of Biomedical Engineering (Microbiology, Immunology and Biochemistry, Northeastern Ohio Universities College of Medicine)
Mineralization of vertebrates, effect of mechanical force on mineralization, calcium transport in mineralization, tissue engineering

Paul Marasco, PhD
(Vanderbilt University)
Adjunct Assistant Professor
Neural Plasticity, Sensory Neurophysiology, Brain Organization, Senory Integration with Prosthetic devices

Aaron S. Nelson, MD
(Medical College of Ohio)
Adjunct Assistant Professor, Medical Director, MIMvista Corporation (Cleveland, OH)
Multimodality and quantitative imaging for neurologic and cardiac disorders, oncology, and radiation oncology

Anand Ramamurthi, PhD
(Oklahoma State University)
Adjunct Associate Professor (Biomedical Engineering, Cleveland Clinic)
Artificial heart valves, tissue engineering, biomaterials, thrombosis

Michael Southworth
(Webster University)
Adjunct Instructor (Southworth and Associates LLC)
Regulatory affairs for biosciences

James Thomas, MD
(University of Otago)
Adjunct Professor (Cardiovascular Medicine, Cleveland Clinic)
Ultrasound, ultrasonography, and digital echocardiography

Antonie Van den Bogert, PhD
(University of Utrecht)
Adjunct Associate Professor (Orchard Kinetics, LLC)
Biomechanics, motion capture, computational modeling

Franciscus Van der Helm, PhD
(Delft University)
Adjunct Professor (Mechanical and Biomechanical Engineering, Delft University)
Courses

EBME 105. Introduction to Biomedical Engineering. 3 Units.
This course is intended to introduce Freshmen to a wide variety of biomedical engineering fields including: biomaterials, tissue engineering, drug delivery systems, biomedical imaging and processing, cardiac measurement and analysis, neural engineering, neuromuscular control, and systems biology. Topics span research, development, and design for diagnostic and therapeutic applications. Prereq: Freshman standing.

EBME 201. Physiology-Biophysics I. 3 Units.
This course (1) teaches cell physiology from an engineering perspective - basics covered include cell structures and functions, genes and protein synthesis, diffusion fundamentals, electrical properties of neural and muscle cells, sensory transduction, and integration of function on the micro and macro scale; (2) teaches how to use engineering tools to model different cell functions and predict, measure, and control cell behavior; (3) introduces mathematical and graphical analysis of specific physiological systems emphasizing applied modeling and simulation. Prereq: Must have declared major or minor in Biomedical Engineering, or requisites not met permission.

EBME 202. Physiology-Biophysics II. 3 Units.
This course is an extension of EBME 201 that will extend the application of system modeling and simulation to complex physiological systems in a clinical environment. The course will cover models of biochemical systems with pathology, muscle, the cardiovascular system, respiratory system, renal and hepatic systems with pathology and clinical applications. Prereq: EBME 201 or consent of instructor.

EBME 300. Dynamics of Biological Systems: A Quantitative Introduction to Biology. 3 Units.
This course will introduce students to dynamic biological phenomena, from the molecular to the population level, and models of these dynamical phenomena. It will describe a biological system, discuss how to model its dynamics, and experimentally evaluate the resulting models. Topics will include molecular dynamics of biological molecules, kinetics of cell metabolism and the cell cycle, biophysics of excitability, scaling laws for biological systems, biomechanics, and population dynamics. Mathematical tools for the analysis of dynamic biological processes will also be presented. Students will manipulate and analyze simulations of biological processes, and learn to formulate and analyze their own models. This course satisfies a laboratory requirement for the biology major. Offered as BIOL 300 and EBME 300.

EBME 303. Structure of Biological Materials. 3 Units.
Structure of proteins, nucleic acids, connective tissue and bone, from molecular to microscopic levels. An introduction to bioengineering biological materials and biomimetic materials, and an understanding of how different instruments may be used for imaging, identification and characterization of biological materials. Offered as: EBME 303 and EMAC 303. Recommended preparation: EBME 201, EMBE 202, and EMAC 270.

EBME 305. Materials for Prosthetics and Orthotics. 3 Units.
A synthesis of skeletal tissue structure and biology, materials engineering, and strength of materials concepts. This course is centered on deepening the concept of biocompatibility and using it to pose and solve biomaterials problems. We cover: fundamental concepts of materials used for load bearing medical applications, wear, corrosion, and failure of implants. Structure and properties of hard tissues and joints are presented using a size hierarchy motif. Tools and analysis paradigms useful in the characterization of biomaterials are covered in the context of orthopedic and dental applications. Prereq: EBME 306.

EBME 306. Introduction to Biomedical Materials. 3 Units.
Biomaterials design and application in different tissue and organ systems. The relationship between the physical and chemical structure of biomaterials, functional properties, and biological response. Recommended preparation: EBME 201 and EBME 202.

EBME 307. Biomechanical Prosthetic Systems. 3 Units.
Introduction to the basic biomechanics of human movement and applications to the design and evaluation of artificial devices intended to restore or improve movement lost due to injury or disease. Measurement techniques in movement biomechanics, including motion analysis, electromyography, and gait analysis. Design and use of upper and lower limb prostheses. Principles of neuroprostheses with applications to paralyzed upper and lower extremities. Recommended preparation: Consent of instructor and senior standing.

EBME 308. Biomedical Signals and Systems. 4 Units.

EBME 309. Modeling of Biomedical Systems. 3 Units.

EBME 310. Principles of Biomedical Instrumentation. 3 Units.

EBME 315. Applied Tissue Engineering. 3 Units.
This course is designed to provide students with understanding and expertise of the basic tools in tissue engineering research. Through lectures the students will be introduced to the array of methods and materials available to tissue engineering researchers, learn how to rationally determine suitable choices for their applications, and receive instruction on how to implement those designs. Much of the course will be spent in the BME Tissue Engineering Laboratory getting hands-on experience (1) on the materials end with materials selection, characterization, and scaffold fabrication; (2) on the cell end with cell culture, tissue characterization and bioreactor design. The class will be assessed by a weekly grading of the students’ lab notebooks, as well as a final exam based on the content learned throughout the semester.
EBME 316. Biomaterials for Drug Delivery. 3 Units.
The teaching objective is to provide students with a basic understanding of the principles of design and engineering of well-defined molecular structures and architectures intended for applications in controlled release and organ-targeted drug delivery. The course will discuss the therapeutic basic of drug delivery based on drug pharmacodynamics and clinical pharmacokinetics. Biomaterials with specialized structural and interfacial properties will be introduced to achieve drug targeting and controlled release. Offered as EBME 316 and EBME 416. Prereq: EBME 306 and PHRM 309.

EBME 317. Excitable Cells: Molecular Mechanisms. 3 Units.
Ion channels are the molecular basis of membrane excitability in all cell types, including neural, heart, and muscle cells. This course presents the structure and the mechanism of function of ion channels at the molecular level. It introduces the basic principles and methods in the ion channel study including the ionic basis of membrane excitability, thermodynamic and kinetic analysis of channel function, voltage clamp and patch clamp techniques, and molecular and structural biology approaches. The course will cover structure of various potassium, calcium, sodium, and chloride channels and their physiological function in neural, cardiac, and muscle cells. Exemplary channels that have been best studied will be discussed to illustrate the current understanding of the molecular mechanisms of channel gating and permeation. Graduate students will present exemplary papers in the journal club style. Recommended preparation: EBME 201 or equivalent. Offered as EBME 317 and EBME 417.

EBME 318. Biomedical Engineering Laboratory I. 1 Unit.
Experiments for measurement, assisting, replacement, or control of various biomedical systems. Students choose a few lab experiences from a large number of offerings relevant to all BME sequences. Experiments are conducted primarily in faculty labs with 3-8 students participating. Recommended preparation: ENGR 210. Prereq: BME Major, EBME 201, EBME 202 and Prereq or Coreq: EBME 308.

EBME 319. Biomedical Engineering Laboratory II. 1 Unit.
Experiments for measurement, assisting, replacement, or control of various biomedical systems. Students choose a few lab experiences from a large number of offerings relevant to all BME sequences. Experiments are conducted primarily in faculty labs with 3-8 students participating. Recommended preparation: EBME 201, EBME 202, and ENGR 210. Prereq or Coreq: EBME 318.

EBME 320. Medical Imaging Fundamentals. 3 Units.
General principles, instrumentation, and biomedical applications of medical imaging. Topics include: x-ray, ultrasound, MRI, nuclear imaging, image reconstruction, and image quality. Recommended preparation: EBME 308, ENGR 210, and EBME 202 or equivalent.

EBME 322. Applications of Biomedical Imaging. 3 Units.
This course will provide an introduction to biomedical imaging and its applications in measurements of physiological function, stem cell biology, and drug delivery. Students will learn about imaging technologies including basic principles of imaging (resolution and contrast), optical microscopy and in vivo imaging, and magnetic resonance imaging. Emerging techniques in cellular and molecular imaging, including targeted imaging agents and reporter gene imaging will be discussed. Biomedical applications will include such topics as tumor characterization in drug assessment, functional brain mapping, targeted drug delivery, functional cardiovascular measurements, and stem cell research will be demonstrated. Prereq: EBME 201, EBME 202, EBME 308, PHYS 121, PHYS 122.

EBME 325. Introduction to Tissue Engineering. 3 Units.
The goal of this course is to present students with a firm understanding of the primary components, design principles, and engineering concepts central to the field of tissue engineering. First, the biological principles of tissue formation during morphogenesis and wound repair will be examined. The cellular processes underlying these events will be presented with an emphasis on microenvironment regulation of cell behavior. Biomimetic approaches to controlling cell function and tissue formation via the development of biomaterial systems will then be investigated. Case studies of regeneration strategies for specific tissues will be presented in order to examine the different tissue-specific engineering strategies that may be employed. Special current topics in tissue engineering will also be covered. Recommended preparation: EBME 306, BIOL 362, and CHEM 223.

EBME 327. Bioelectric Engineering. 3 Units.

EBME 328. Biomedical Engineering R&D Training I. 1 Unit.
This course will provide research and development in the laboratory of a mentoring faculty member. Varied R&D experiences will include activities in biomedical instrumentation, tissue engineering, imaging, drug delivery, and neural engineering. Each student must identify a faculty mentor, and together they will create description of the training experience prior to the first class. Prereq: EBME 201 and EBME 202.

EBME 329. Biomedical Engineering R&D Training II. 1 Unit.
This course will provide research and development training in the laboratory of a mentoring faculty member. Varied R&D experiences will include activities in biomedical instrumentation, tissue engineering, imaging, drug delivery, and neural engineering. Each student must identify a faculty mentor, and together will create a description of the training experience prior to the first class. Recommended preparation EBME 328. Prereq: EBME 201 and EBME 202.

EBME 350. Quantitative Molecular Bioengineering. 3 Units.
The objective of this course is to equip the students with a “molecular toolbox”--a set of quantitative skills that permit rational designs for engineering tissues starting at the molecular level. The course will build on the physical and chemical principles in equilibrium, kinetics, and mass transport. Specific examples in bioengineering systems will be used throughout the course to illustrate the importance of understanding and application of these principles to tissue engineering. Recommended preparation: ENGR 225. Offered as EBME 350 and ECHE 355.

EBME 359. Biomedical Computer Simulation Laboratory. 1 Unit.

EBME 360. Biomedical Instrumentation Laboratory. 1 Unit.
A laboratory which focuses on the basic components of biomedical instrumentation and provides hands-on experience for students in EBME 310, Biomedical Instrumentation. The purpose of the course is to develop design skills and laboratory skills in analysis and circuit development. Coreq: EBME 310.
EBME 370. Principles of Biomedical Engineering Design. 2 Units.
Students learn and implement the design process to produce working prototypes of medical devices with potential commercial value to meet significant clinical needs. Critical examination of contemporary medical problems is used to develop a specific problem statement. The class is divided into teams of 3 to 4 students. Each team integrates their knowledge and skills to design a device to meet their clinical need. Project planning and management, including resource allocation, milestones, and documentation, are required to ensure successful completion of projects within the allotted time and budget. Formal design reviews by a panel of advisors and outside medical device experts are required every four weeks. Every student is required to give oral presentations at each formal review and is responsible for formal documentation of the design process, resulting in an executive summary and complete design history file of the project. The course culminates with a public presentation of the team's device to a panel of experts. This course is expected to provide the student with a real-world, capstone design experience. Recommended preparation: EBME 310

EBME 380. Biomedical Engineering Design Experience. 3 Units.
This course is the culmination of the BME educational experience in which the student will apply acquired skills and knowledge to create a working device or product to meet a medical need. Students will learn how to apply engineering skills to solve problems and physically realize a project design. The course structure includes regular meetings with a faculty project advisor, regular reports of accomplished activity, hands on fabrication of devices, and several lectures from leading engineers from industry and academia that have first-hand experience in applying the principles of design to Biomedical Engineering. Students will also provide periodic oral progress reports and a final oral presentation with a written design report. Prereq: EBME 370.

EBME 396. Special Topics in Undergraduate Biomedical Engineering I. 1 - 18 Unit.
(Credit as arranged.)

EBME 398. Senior Project Laboratory I. 3 Units.
The design process required to produce biomedical devices, research equipment, and clinical tools is developed. Topics include identification of need; requirements specification; project management; working in teams; solutions conceptualization, refinement, and selection; hazard and risk analysis and mitigation; verification; validation; regulatory requirements; and medical device pathways to the market. Through critical examination of contemporary medical research and clinical problems, students, working in teams, will identify a need to develop a specific problem statement, project plan, input requirements, solution concept and risk analysis. Students will provide periodic oral progress reports and a final oral presentation with a written design report. Recommended preparation: EBME 310.

EBME 399. Senior Project Laboratory II. 3 Units.
Continuation of EBME 398. Recommended preparation: EBME 398 and consent of department.

EBME 400T. Graduate Teaching I. 0 Units.
This will provide the Ph.D. candidate with experience in teaching undergraduate or graduate students. The experience is expected to consist of direct student contact, but will be based upon the specific departmental needs and teaching obligations. This teaching experience will be conducted under the supervision of the faculty member who is responsible for the course, but the academic advisor will assess the educational plan to ensure that it provides an educational opportunity for the student. Recommended preparation: UNIV 400, BME Ph.D. student.

EBME 401. Biomedical Instrumentation and Signal Analysis. 4 Units.
Graduate students with various undergraduate backgrounds will learn the fundamental principles of biomedical measurements that integrate instrumentation and signal processing with problem-based hands-on experience. Prereq or Coreq: May not have taken EBME 401 prior to Fall 2011 or EBME 421 after Summer 2011.

EBME 402. Organ/Tissue Physiology and Systems Modeling. 4 Units.
Graduate students with various undergraduate backgrounds will learn the fundamental principles of organ and tissue physiology as well as systems modeling. Prereq or Coreq: May not have taken EBME 402 prior to Fall 2011 or EBME 422 after Summer 2011.

EBME 403. Biomedical Instrumentation. 3 Units.
Analysis and design of biomedical instruments with special emphasis on transducers. Body, system, organ, tissue, cellular, molecular, and nano-level measurements. Applications to clinical problems and biomedical research. Prereq: Graduate standing.

EBME 406. Polymers in Medicine. 3 Units.
This course covers the important fundamentals and applications of polymers in medicine, and consists of three major components: (i) the blood and soft-tissue reactions to polymer implants; (ii) the structure, characterization and modification of biomedical polymers; and (iii) the application of polymers in a broad range of cardiovascular and extravascular devices. The chemical and physical characteristics of biomedical polymers and the properties required to meet the needs of the intended biological function will be presented. Clinical evaluation, including recent advances and current problems associated with different polymer implants. Recommended preparation: EBME 306 or equivalent. Offered as EBME 406 or EMAC 471. Prereq: Graduate standing or Undergraduate with Junior or Senior standing and a cumulative GPA of 3.2 or above.

EBME 407. Neural Interfacing. 3 Units.
Neural interfacing refers to the principles, methods, and devices that bridge the boundary between engineered devices and the nervous system. It includes the methods and mechanisms to get information efficiently and effectively into and out of the nervous system to analyze and control its function. This course examines advanced engineering, neurobiology, neurophysiology, and the interaction between all of them to develop methods of connecting to the nervous system. The course builds on a sound background in Bioelectric Phenomenon to explore fundamental principles of recording and simulation, electrochemistry of electrodes in biological tissue, tissue damage generated by electrical stimulation, materials and material properties, and molecular functionalization of devices for interfacing with the nervous system. Several examples of the state-of-art neural interfaces will be analyzed and discussed. Recommended preparation: EBME 401. Prereq: Graduate standing or Undergraduate with Junior or Senior standing and a cumulative GPA of 3.2 or above.
EBME 408. Engineering Tissues/Materials - Learning from Nature’s Paradigms. 3 Units.
This course aims to provide students with a foundation based on "nature's" design and optimization criteria for engineering tissues and biomaterials. This will be achieved through focused review of the principles of development, wound healing, regeneration, and repair through remodeling, using nature as a paradigm. Principles of transport will be explored quantitatively and in relation to multi-organismal evolution. Cellular engineering principles will be explored, including current state of the art in stem cell physiology and therapeutic applications. Endogenous engineering approaches to surgical tissue reconstruction will be analyzed. An overview of contemporary approaches to tissue and cell engineering will be given, including tissue scaffold design, use of bioreactors in tissue engineering, and molecular surface modifications for integration of engineered tissues in situ. Fundamental engineering principles will be augmented through case studies involving specific applications. Ethical considerations related to clinical non-clinical application of tissue and cell engineering technology will be integrated into each lecture. Prereq: Graduate standing or Undergraduate with Junior or Senior standing and a cumulative GPA of 3.2 or above.

EBME 409. Systems and Signals in Biomedical Engineering. 3 Units.

EBME 410. Medical Imaging Fundamentals. 3 Units.
Physical principles of medical imaging. Imaging devices for x-ray, ultrasound, magnetic resonance, etc. Image quality descriptions. Patient risk. Recommended preparation: EBME 308 and EBME 310 or equivalent. Prereq: Graduate standing or Undergraduate with Junior or Senior standing and a cumulative GPA of 3.2 or above.

EBME 411. Biomaterials for Drug Delivery. 3 Units.
The teaching objective is to provide students with a basic understanding of the principles of design and engineering of well-defined molecular structures and architectures intended for applications in controlled release and organ-targeted drug delivery. The course will discuss the therapeutic basic of drug delivery based on drug pharmacodynamics and clinical pharmacokinetics. Biomaterials with specialized structural and interfacial properties will be introduced to achieve drug targeting and controlled release. Offered as EBME 316 and EBME 416. Prereq: EBME 306 and PHRM 309 or graduate standing.

EBME 417. Excitable Cells: Molecular Mechanisms. 3 Units.
Ion channels are the molecular basis of membrane excitability in all cell types, including neural, heart, and muscle cells. This course presents the structure and the mechanism of function of ion channels at the molecular level. It introduces the basic principles and methods in the ion channel study including the ionic basis of membrane excitability, thermodynamic and kinetic analysis of channel function, voltage clamp and patch clamp techniques, and molecular and structural biology approaches. The course will cover structure of various potassium, calcium, sodium, and chloride channels and their physiological function in neural, cardiac, and muscle cells. Exemplary channels that have been best studied will be discussed to illustrate the current understanding of the molecular mechanisms of channel gating and permeation. Graduate students will present exemplary papers in the journal club style. Recommended preparation: EBME 201 or equivalent. Offered as EBME 317 and EBME 417. Prereq: Graduate standing or Undergraduate with Junior or Senior standing and a cumulative GPA of 3.2 or above.

EBME 418. Electronics for Biomedical Engineering. 3 Units.
Fundamental concepts of analog design with special emphasis on circuits for biomedical applications. Analysis and design of discrete and integrated circuit amplifiers; application circuits of operational amplifiers; noise measurement; communication circuits; specialized biomedical applications such as circuits for low noise amplification, high CMRR biomedical amplifiers, implantable circuits, circuits for electrochemistry and circuits for optical recordings, circuits for recording neural activity, electrical safety and telemetry. A team project will be required for all students. Recommended preparation: EECS 344 or consent of instructor. Prereq: Graduate standing or Undergraduate with Junior or Senior standing and a cumulative GPA of 3.2 or above.

EBME 419. Applied Probability and Stochastic Processes for Biology. 3 Units.
Applications of probability and stochastic processes to biological systems. Mathematical topics will include: introduction to discrete and continuous probability spaces (including numerical generation of pseudo random samples from specified probability distributions), Markov processes in discrete and continuous time with discrete and continuous sample spaces, point processes including homogeneous and inhomogeneous Poisson processes and Markov chains on graphs, and diffusion processes including Brownian motion and the Ornstein-Uhlenbeck process. Biological topics will be determined by the interests of the students and the instructor. Likely topics include: stochastic ion channels, molecular motors and stochastic ratchets, actin and tubulin polymerization, random walk models for neural spike trains, bacterial chemotaxis, signaling and genetic regulatory networks, and stochastic predator-prey dynamics. The emphasis will be on practical simulation and analysis of stochastic phenomena in biological systems. Numerical methods will be developed using both MATLAB and the R statistical package. Student projects will comprise a major part of the course. Offered as BIOL 319, EECS 319, MATH 319, BIOL 419, EBME 419, and PHOL 419.

EBME 420. Biomedical Ultrasound Technologies. 3 Units.
EBME 421. Bioelectric Phenomena. 3 Units.
The goal of this course is to provide working knowledge of the theoretical methods that are used in the fields of electrophysiology and bioelectricity for both neural and cardiac systems. These methods will be applied to describe, from a theoretical and quantitative perspective, the electrical behavior of excitable cells, the methods for recording their activity and the effect of applied electrical and magnetic fields on excitable issues. A team modeling project will be required. Recommended preparation: differential equations, circuits. Prereq: Graduate standing or Undergraduate with Junior or Senior standing and a cumulative GPA of 3.2 or above.

EBME 422. Muscles, Biomechanics, and Control of Movement. 4 Units.
Quantitative and qualitative descriptions of the action of muscles in relation to human movement. Introduction to rigid body dynamics and dynamics of multi-link systems using Newtonian and Lagrangian approaches. Muscle models with application to control of multi-joint movement. Forward and inverse dynamics of multi-joint, muscle driven systems. Dissection, observation and recitation in the anatomy laboratory with supplemental lectures concentrating on kinesiology and muscle function. Recommended preparation: EMAE 181 or equivalent. Offered as EBME 422 and EMAE 402. Prereq: Graduate standing or Undergraduate with Junior or Senior standing and a cumulative GPA of 3.2 or above.

EBME 425. Tissue Engineering and Regenerative Medicine. 3 Units.
This course will provide advanced coverage of tissue engineering with a focus on stem cell-based research and therapies. Course topics of note include stem cell biology and its role in development, modeling of stem cell function, controlling stem cell behavior by engineering materials and their microenvironment, stem cells' trophic character, and state-of-the-art stem cell implementation in tissue engineering and other therapeutic strategies. Offered as EBME 425 and PATH 435. Prereq: EBME 325 or equivalent or graduate standing.

EBME 426. Nanomedicine. 3 Units.

EBME 427. Movement Biomechanics and Rehabilitation. 3 Units.
Introduction to the basic biomechanics of human movement and applications to the design and evaluation of artificial devices intended to restore or improve movement lost due to injury or disease. Measurement techniques in movement biomechanics, including motion analysis, electromyography, and gait analysis. Design and use of upper and lower limb prostheses. Principles of neuroprostheses with applications to paralyzed upper and lower extremities. Term paper required. Recommended preparation: Consent of instructor and graduate standing. Prereq: Graduate standing or Undergraduate with Junior or Senior standing and a cumulative GPA of 3.2 or above.

EBME 431. Physics of Imaging. 3 Units.
Description of physical principles underlying the spin behavior in MR and Fourier imaging in multi-dimensions. Introduction of conventional, fast, and chemical-shift imaging techniques. Spin echo, gradient echo, and variable flip-angle methods. Projection reconstruction and sampling theorems. Bloch equations, T1 and T2 relaxation times, rf penetration, diffusion and perfusion. Flow imaging, MR angiography, and functional brain imaging. Sequence and coil design. Prerequisite may be waived with consent of instructor. Recommended preparation: PHYS 122 or PHYS 124 or EBME 410. Offered as EBME 431 and PHYS 431.

EBME 440. Translational Research for Biomedical Engineers. 3 Units.
Translation of laboratory developments to improve biomedical and clinical research and patient care. Interdisciplinary and team communication. Evaluation of technology and research planning with clinical and engineering perspectives. Discussing clinical situations, shadowing clinicians, attending Grand Rounds and Morbidity-Mortality conferences. Validation study design. Regulatory/oversight organization. Protocol design and informed consent for Institutional Review Board (IRB) approval. NIH requirements for human subject research. Special project reports to produce IRB protocol or NIH-style proposal. Prereq: Graduate standing or Undergraduate with Junior or Senior standing and a cumulative GPA of 3.2 or above.

EBME 447A. Rehabilitation for Scientists and Engineers. 0 Units.
Medical, psychological, and social issues influencing the rehabilitation of people with spinal cord injury, stroke, traumatic brain injury, and limb amputation. Epidemiology, anatomy, pathophysiology and natural history of these disorders, and the consequences of these conditions with respect to impairment, disability, handicap, and quality of life. Students will directly observe the care of patients in each of these diagnostic groups throughout the full continuum of care starting from the acute medical and surgical interventions to acute and subacute rehabilitation, outpatient medical and rehabilitation management and finally to community re-entry.

EBME 447B. Rehabilitation for Scientists and Engineers. 3 Units.
Medical, psychological, and social issues influencing the rehabilitation of people with spinal cord injury, stroke, traumatic brain injury, and limb amputation. Epidemiology, anatomy, pathophysiology and natural history of these disorders, and the consequences of these conditions with respect to impairment, disability, handicap, and quality of life. Students will directly observe the care of patients in each of these diagnostic groups throughout the full continuum of care starting from the acute medical and surgical interventions to chronic and subacute rehabilitation, outpatient medical and rehabilitation management and finally to community re-entry. Coreq: EBME 447A.

EBME 451. Molecular and Cellular Physiology. 3 Units.
This course covers cellular and molecular basics for graduate students with little or no prior biology background. The emphasis of EBME 451 is on the molecular and cellular mechanisms underlying physiological processes. Structure-function relationship will be addressed throughout the course. The primary goal of the course is to develop understanding of the principles of the physiological processes at molecular and cellular level and to promote independent thinking and ability to solve unfamiliar problems. This course is no longer a core course of the Biomedical Engineering graduate curriculum but serves as a fundamentals course to prepare students for the graduate cellular and molecular physiology core. Prereq: Graduate standing.
EBME 452. Tissue and Organ Systems Physiology. 3 Units.
Mechanisms of membrane and capillary-tissue transport, tissue mechanics, electrical propagation, signaling, control and regulation processes. Cardiac vascular, renal, respiratory, gastro-intestinal, neural, sensory, motor, musculoskeletal, and skeletal systems. Basic engineering analysis for quantitative understanding of physiological concepts. Prereq: Graduate standing or Undergraduate with Junior or Senior standing and a cumulative GPA of 3.2 or above.

EBME 460. Advanced Topics in NMR Imaging. 3 Units.
Frontier issues in understanding the practical aspects of NMR imaging. Theoretical descriptions are accompanied by specific examples of pulse sequences, and basic engineering considerations in MRI system design. Emphasis is placed on implications and trade-offs in MRI pulse sequence design from real-world versus theoretical perspectives. Recommended preparation: EBME 431 or PHYS 431. Offered as EBME 460 and PHYS 460. Prereq: Graduate standing or Undergraduate with Junior or Senior standing and a cumulative GPA of 3.2 or above.

EBME 461. Biomedical Image Processing and Analysis. 3 Units.
Principles of image processing and analysis with applications to biomedical images from the nano-scale to 3D whole organ imaging. Topics include image filtering, enhancement, restoration, registration, morphological processing, and segmentation. Recommended preparation: EBME 409 or equivalent. Prereq: Graduate standing or Undergraduate with Junior or Senior standing and a cumulative GPA of 3.2 or above.

EBME 462. Cellular and Molecular Imaging. 3 Units.
Frontier issues in biomedical imaging that address problems at the cellular and molecular levels. Topics include endogenous methods to assess molecular compositions, imaging agents, reporter genes and proteins, and drug delivery, which will be discussed in the context of applications in cancer, cardiology, central nervous system, ophthalmology, musculoskeletal diseases, pulmonary diseases, and metabolic diseases. Emphasis is placed on an interdisciplinary problem-based approach to investigate the application of biomedical imaging to biological and disease areas. Recommended preparation: EBME 410 and EBME 451 or consent of instructor. Prereq: Graduate standing or Undergraduate with Junior or Senior standing and a cumulative GPA of 3.2 or above.

EBME 474. Biotransport Processes. 3 Units.
Biomedical mass transport and chemical reaction processes. Basic mechanisms and mathematical models based on thermodynamics, mass and momentum conservation. Analytical and numerical methods to simulate in vivo processes as well as to develop diagnostic and therapeutic methods. Applications include transport across membranes, transport in blood, tumor processes, bioreactors, cell differentiation, chemotaxis, drug delivery systems, tissue engineering processes. Recommended preparation: EBME 350 and EBME 409 or equivalent. Offered as EBME 474 and ECHE 474. Prereq: EBME 409 and graduate standing or EBME 309 and senior standing.

EBME 478. Computational Neuroscience. 3 Units.
Computer simulations and mathematical analysis of neurons and neural circuits, and the computational properties of nervous systems. Students are taught a range of models for neurons and neural circuits, and are asked to implement and explore the computational and dynamic properties of these models. The course introduces students to dynamical systems theory for the analysis of neurons and neural learning, models of brain systems, and their relationship to artificial and neural networks. Term project required. Students enrolled in MATH 478 will make arrangements with the instructor to attend additional lectures and complete additional assignments addressing mathematical topics related to the course. Recommended preparation: MATH 223 and MATH 224 or BIOL 300 and BIOL 306. Offered as BIOL 378, COGS 378, MATH 378, BIOL 478, EBME 478, EECS 478, MATH 478 and NEUR 478.

EBME 500T. Graduate Teaching II. 0 Units.
This course will provide the Ph.D. candidate with experience in teaching undergraduate or graduate students. The experience is expected to consist of direct student contact, but will be based upon the specific departmental needs and teaching obligations. This teaching experience will be conducted under the supervision of the faculty member who is responsible for the course, but the academic advisor will assess the educational plan to ensure that it provides an educational opportunity for the students. Recommended preparation: EBME 400T, BME Ph.D. student.

EBME 507. Motor System Neuroprostheses. 3 Units.
Fundamentals of neural stimulation and sensing, neurophysiology and pathophysiology of common neurological disorders, general implantation and clinical deployment issues. Specialist discussions in many application areas such as motor prostheses for spinal cord injury and stroke, cochlear implants, bladder control, stimulation for pain management, deep brain stimulation, and brain computer interfacing. Prereq: Graduate standing.

EBME 513. Biomedical Optical Diagnostics. 3 Units.
Engineering design principles of optical instrumentation for medical diagnostics. Elastic and inelastic light scattering theory and biomedical applications. Confocal and multiphoton microscopy. Light propagation and optical tomographic imaging in biological tissues. Design of minimally invasive spectroscopic diagnostics. Recommended preparation: EBME 403 or PHYS 326 or consent. Prereq: Graduate standing.

EBME 519. Parameter Estimation for Biomedical Systems. 3 Units.

EBME 570. Graduate Professional Development for Biomedical Engineers. 1 Unit.
Students will be trained in topics including public speaking, grant writing, notebook management, professionalism, etc. Prereq: Graduate standing.
EBME 600T. Graduate Teaching III. 0 Units.
This course will provide the Ph.D. candidate with experience in teaching undergraduate or graduate students. The experience is expected to consist of direct student contact, but will be based upon the specific departmental needs and teaching obligations. This teaching experience will be conducted under the supervision of the faculty member who is responsible for the course, but the academic advisor will the assess the educational plan to ensure that it provides an educational opportunity for the students. Recommended preparation: EBME 500T, BME Ph.D. student.

EBME 601. Research Projects. 1 - 18 Unit.

EBME 602. Special Topics. 1 - 18 Unit.

EBME 607. Neural Engineering Topics. 1 Unit.
The goal of this class is to explore topics in Neural Engineering not covered in the curriculum. A single topic will be chosen per semester. Four speakers with expertise in the chosen area will be invited to the campus. Each speaker will give a seminar and participate in a 2-hour workshop/journal club on the specific topic. The students will be assigned one or two seminal papers written by the speaker prior to the visit. Students will take turns presenting these papers to the rest of the class. The paper and the topic will then be open for discussion. At the end of the semester, the students will collaborate to write a single review article in a publishable format on the topic of the semester.

EBME 611. BME Departmental Seminar I. 0.5 Units.
Lectures by invited speakers on subjects of current interest in biomedical engineering. Students will be evaluated on reading and preparation of questions for select speakers, as well as weekly participation. Between this course and EBME 612 students must earn a minimum of 1 credit (two semesters) and can take up to 4 credits over eight different semesters.

EBME 612. BME Departmental Seminar II. 0.5 Units.
Lectures by invited speakers on subjects of current interest in biomedical engineering. Students will be evaluated on reading and preparation of questions for select speakers, as well as weekly participation. Between this course and EBME 611 students must earn a minimum of 1 credit (two semesters) and can take up to 4 credits over eight different semesters.

EBME 613. Topic Seminars for NeuroEngineering Students. 0.5 Units.
Lectures by students in the seminar series on subjects of current interest to biomedical engineering students in NeuroEngineering. Students will be evaluated on presentation preparation and performance, as well as weekly participation. Between this course and EBME 614 students must earn a minimum of 1 credit (two semesters) and can take up to 4 credits over eight different semesters. Prereq: Graduate standing.

EBME 614. Topic Seminars for NeuroEngineering Students. 0.5 Units.
Lectures by students in the seminar series on subjects of current interest to biomedical engineering students in NeuroEngineering. Students will be evaluated on presentation preparation and performance, as well as weekly participation. Between this course and EBME 613 students must earn a minimum of 1 credit (two semesters) and can take up to 4 credits over eight different semesters. Prereq: Graduate standing.

EBME 615. Topic Seminars for Imaging Students. 0.5 Units.
Lectures by students in the seminar series on subjects of current interest to biomedical engineering students in Imaging. Students will be evaluated on presentation preparation and performance, as well as weekly participation. Between this course and EBME 616 students must earn a minimum of 1 credit (two semesters) and can take up to 4 credits over eight different semesters. Prereq: Graduate standing.

EBME 616. Topic Seminars for Imaging Students. 0.5 Units.
Lectures by students in the seminar series on subjects of current interest to biomedical engineering students in Imaging. Students will be evaluated on presentation preparation and performance, as well as weekly participation. Between this course and EBME 615 students must earn a minimum of 1 credit (two semesters) and can take up to 4 credits over eight different semesters. Prereq: Graduate standing.

EBME 617. Topic Seminars for Biomaterials Students. 0.5 Units.
Lectures by students in the seminar series on subjects of current interest to biomedical engineering students in Biomaterials. Students will be evaluated on presentation preparation and performance, as well as weekly participation. Between this course and EBME 618 students must earn a minimum of 1 credit (two semesters) and can take up to 4 credits over eight different semesters. Prereq: Graduate standing.

EBME 618. Topic Seminars for Biomaterials Students. 0.5 Units.
Lectures by students in the seminar series on subjects of current interest to biomedical engineering students in Biomaterials. Students will be evaluated on presentation preparation and performance, as well as weekly participation. Between this course and EBME 617 students must earn a minimum of 1 credit (two semesters) and can take up to 4 credits over eight different semesters. Prereq: Graduate standing.

EBME 619. Topic Seminars for Miscellaneous Biomedical Engineering Students. 0.5 Units.
Lectures by students in the seminar series on subjects of current interest to biomedical engineering students in outside of NeuroEngineering, Imaging, and Biomaterials. Students will be evaluated on presentation preparation and performance, as well as weekly participation. Between this course and EBME 620 students must earn a minimum of 1 credit (two semesters) and can take up to 4 credits over eight different semesters. Prereq: Graduate standing.

EBME 620. Topic Seminars for Miscellaneous Biomedical Engineering Students. 0.5 Units.
Lectures by students in the seminar series on subjects of current interest to biomedical engineering students in topics outside of NeuroEngineering, Imaging, and Biomaterials. Students will be evaluated on presentation preparation and performance, as well as weekly participation. Between this course and EBME 619 students must earn a minimum of 1 credit (2 semesters) and can take up to 4 credits over eight different semesters. Prereq: Graduate standing.

EBME 621. BME Research Rotation I. 0 Units.
Opportunity for trainees to participate in BME research under supervision of faculty.

EBME 651. Thesis M.S.. 1 - 18 Unit.
Ph.D. candidates only. Prereq: Predoctoral research consent or advanced to Ph.D. candidacy milestone.
Department of Chemical Engineering

The Department of Chemical Engineering offers Bachelor of Science in Engineering, Master of Science, and Doctor of Philosophy degree programs that provide preparation for work in all areas of chemical engineering. Breadth elective sequences in biochemical engineering, biomedical engineering, computing, electrochemical engineering, electronic materials, environmental engineering, management/entrepreneurship, polymer science, systems and control, or advanced studies provide depth and specialization for undergraduates majoring in chemical engineering. A special biochemical engineering track is available, where students integrate biochemistry, biology, and bioengineering courses into the standard chemical engineering curriculum. Chemical engineering undergraduates are members of the student chapter of the American Institute of Chemical Engineers (AIChE). The AIChE chapter sponsors social events, field trips to local industry, technical presentations by outside speakers, and employment counseling. Information about the AIChE can be obtained through the department, the chapter president or the chapter advisor. There are eleven full-time faculty members, all of whom are pursuing active research programs. The research of the faculty is aimed at advanced and emerging areas of chemical engineering.

Mission

The chemical engineering department seeks to provide the expertise, environment, facilities, and administrative structure that inspire learning and the pursuit of scholarly activities in chemical engineering and related science and engineering disciplines. The Department will provide an educational program and research environment that will permit our graduates to compete in the evolving workplace, to permit students and faculty to advance knowledge at the highest levels of the profession, and to address the technological and personnel needs of industry, governments, and society.

Background

The profession of chemical engineering involves the analysis, design, operation and control of processes that convert matter and energy to more useful forms, encompassing processes at all scales from the molecular to the megascale. Traditionally, chemical engineers are responsible for the production of basic chemicals, plastics, and fibers. However, today’s chemical engineers are also involved in food and fertilizer production, synthesis of electronic materials, waste recycling, and power generation. Chemical engineers also develop new materials (ceramic composites and electronic chips, for example) as well as biochemicals and pharmaceuticals. The breadth of training in engineering and the sciences gives chemical engineers a particularly wide spectrum of career opportunities. Chemical engineers work in the chemical and materials related industries, in government, and are readily accepted by graduate schools in engineering, chemistry, medicine, or law (mainly for patent law).

Research

Research in the department is sponsored by a variety of state and federal agencies, by private industry, and by foundations. Current active research topics include:

Energy Conversion and Storage
- Fuel cells
- Batteries
- Supercapacitors
- Transport/structure properties of polymer electrolytes for fuel cell applications
- Electrocatalysis
- Photovoltaics

Electrochemical Devices
- Electrochemical sensors
- Implantable electrochemical devices
- Electrochemical reactor design
- Electrode processes
- Metallization of semiconductor devices by plating

Biomedical Applications of Chemical Engineering
- Cell/cellular transport processes in inflammation
- Tissue engineering
- Wound healing
- Neurosensing and neural stimulation
- Engineering of surfaces for sensing applications
- Implantable electrochemical devices
- BioMEMS and biosensors
- Dental implants
- Drug delivery

Diamond and Diamond-like Materials
- Chemical vapor deposition of diamond
- Electrochemistry on diamond
- Conductive diamond films

Design and Synthesis of Advanced Materials
- Growth of single-crystal Group III nitrides
- Plasma and plasma processing
- Nanoparticles, nanotubes, nanowires
- Molecular electronics: Electrochemical synthesis of alloys and compounds
- Microvascular constructs
- Functional polymers and composites

Processing and Characterization of Novel Materials
- Nanomaterials and polymer nanocomposites
- Development of responsive additives for particle clusters
- Electronic materials
- Surface and colloidal phenomena
- Surfactant and polymer solutions
- NMR spectroscopy and imaging
- Light scattering/spectroscopy

Advanced Separation Methods
- Enhanced oil recovery
- Ultrasonically assisted sorting and collection of small particles
- Haemodialysis
- Electrochemical and membrane separations
- Nanoporous materials
Simulation and Modeling
- Mathematical modeling of engineering processes
- Molecular simulation, statistical mechanics
- Triboelectric charging
- Light scattering and laser anemometry
- Data acquisition, statistical analyses
- Current distributions/electrochemical systems
- Redox equilibria
- Biomimetics
- Monolayer dynamics
- Stochastic processes
- Electrode structures

Student Outcomes
As preparation for achieving the above educational objectives, the BS degree program in Chemical Engineering is designed so that students attain:
- an ability to apply knowledge of mathematics, science, and engineering
- an ability to design and conduct experiments, as well as to analyze and interpret data
- an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
- an ability to function on multidisciplinary teams
- an ability to identify, formulate, and solve engineering problems
- an understanding of professional and ethical responsibility
- an ability to communicate effectively
- the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
- a recognition of the need for, and an ability to engage in life-long learning
- a knowledge of contemporary issues
- an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

Bachelor of Science in Engineering
Required Courses: Major in Chemical Engineering

<table>
<thead>
<tr>
<th>Major Required Courses</th>
<th>Units</th>
</tr>
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<tbody>
<tr>
<td>ECHE 151</td>
<td>0</td>
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<tr>
<td>ECHE 260</td>
<td>3</td>
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<tr>
<td>ECHE 360</td>
<td>4</td>
</tr>
<tr>
<td>ECHE 361</td>
<td>3</td>
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<tr>
<td>ECHE 362</td>
<td>4</td>
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<td>ECHE 365</td>
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<tr>
<td>ECHE 367</td>
<td>4</td>
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<tr>
<td>ECHE 398</td>
<td>3</td>
</tr>
<tr>
<td>ECHE 399</td>
<td>3</td>
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Related Required Courses
<table>
<thead>
<tr>
<th>Related Required Courses</th>
<th>Units</th>
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<tbody>
<tr>
<td>CHEM 223</td>
<td>3</td>
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<tr>
<td>or CHEM 323</td>
<td>3</td>
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<tr>
<td>CHEM 290</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 306</td>
<td>3</td>
</tr>
<tr>
<td>STAT 313</td>
<td>3</td>
</tr>
</tbody>
</table>

Materials Elective: one of the following courses:
- EMAC 270 Introduction to Polymer Science and Engineering
- EMAC 276 Polymer Properties and Design
- EMSE 201 Introduction to Materials Science and Engineering
- EMSE 314 Electrical, Magnetic, and Optical Properties of Materials

Approved Breadth Elective Sequence 9-11
Total Units 57-59

Concentrations and Breadth Elective Sequences
A distinctive feature of the chemical engineering program is the three-course breadth elective sequence taken during the junior and senior years that permits a student to major in chemical engineering and, at the same time, pursue an interest in a related field. Eleven elective sequences have standing departmental approval: biochemical engineering, biomedical engineering, computing, electrochemical engineering, electronic materials, energy, environmental engineering, management/entrepreneurship, polymer science, undergraduate research and systems and control. There is also an advanced study sequence for students in the combined BS/MS program. Subject to departmental approval, students may alternatively choose to design their own breadth elective sequence.

In addition, two concentrations, one in biochemical engineering and the second in pre-medical studies, are available for students interested in these paths.

Biochemical Engineering Concentration
Biochemical engineering can be defined as the field of application of chemical engineering principles to systems that utilize biomolecules or bio-organisms to bring forth biotransformation. Biochemical engineering applications are versatile, ranging from waste-water treatment to production of therapeutic proteins. For the biochemical engineering concentration, students should take the following six courses and two electives selected from the subsequent lists:
- BIOL 300 Dynamics of Biological Systems: A Quantitative Introduction to Biology
- BIOL 301 Biotechnology Laboratory: Genes and Genetic Engineering
- BIOC 307 General Biochemistry
The Pre-Medical Concentration provides a focused approach to medical school preparation for chemical engineering majors. By using the flexibility provided by science and technical electives in the curriculum, students are able to pursue courses that provide the background needed for medical school. Students take the following courses to meet the course requirements of most medical schools.

**A student enrolled in this concentration satisfies the material and science electives requirements as well as the breadth elective sequence requirements of the program. Further, the student does not have to take CHEM 290 Chemical Laboratory Methods for Engineers.**

### Approved Breadth Elective Sequences

#### Biochemical Engineering (Advisor: Dr. Qutubuddin)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOC 307</td>
<td>General Biochemistry (Fall)</td>
<td>4</td>
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<tr>
<td>BIOL 343</td>
<td>Microbiology (Spring)</td>
<td>3</td>
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<tr>
<td>ECHE 340</td>
<td>Biochemical Engineering (Spring)</td>
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Total Units: 10

#### Biomedical Engineering (Advisor: Dr. Baskaran)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Units</th>
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<tbody>
<tr>
<td>EBME 201</td>
<td>Physiology-Biophysics I (Fall)</td>
<td>3</td>
</tr>
<tr>
<td>EBME 202</td>
<td>Physiology-Biophysics II (Spring)</td>
<td>3</td>
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<tr>
<td>One additional course selected from:</td>
<td></td>
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</tr>
<tr>
<td>EBME 309</td>
<td>Modeling of Biomedical Systems (Spring)</td>
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</tr>
<tr>
<td>ECHE 355</td>
<td>Quantitative Molecular Bioengineering (Spring)</td>
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</table>

Total Units: 9

#### Computing (Advisor: Dr. Lacks)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
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<tbody>
<tr>
<td>EECS 281</td>
<td>Logic Design and Computer Organization</td>
<td>4</td>
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<tr>
<td>EECS 346</td>
<td>Engineering Optimization (Spring)</td>
<td>3</td>
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<tr>
<td>One additional EECS course at 200 level or above</td>
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</table>

Total Units: 10-11

#### Electrochemical Engineering (Advisor: Dr. Landau)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Units</th>
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<tbody>
<tr>
<td>ECHE 381</td>
<td>Electrochemical Engineering (Spring)</td>
<td>3</td>
</tr>
<tr>
<td>ECHE 383</td>
<td>Chemical Engineering Applied to Microfabrication and Devices (Fall)</td>
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</table>

One additional course selected from: 3

### Electronic Materials (Advisor: Dr. Liu)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Units</th>
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<tbody>
<tr>
<td>EHE 383</td>
<td>Chemical Engineering Applied to Microfabrication and Devices (Fall)</td>
<td>3</td>
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<tr>
<td>EECS 309</td>
<td>Electromagnetic Fields I (Fall)</td>
<td>3</td>
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<tr>
<td>One additional course selected from:</td>
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<tr>
<td>EMSE 314</td>
<td>Electrical, Magnetic, and Optical Properties of Materials (Fall)</td>
<td>3</td>
</tr>
<tr>
<td>EECS 321</td>
<td>Semiconductor Electronic Devices (Spring)</td>
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</table>

Total Units: 9

### Energy (Advisor: Dr. Savinell)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Units</th>
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</thead>
<tbody>
<tr>
<td>EHE 381</td>
<td>Electrochemical Engineering (Fall)</td>
<td>3</td>
</tr>
<tr>
<td>Plus two courses selected from the following:</td>
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<td>6-7</td>
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<tr>
<td>EECS 312</td>
<td>Introduction to Electric Power Systems</td>
<td>3</td>
</tr>
<tr>
<td>EECS 374</td>
<td>Advanced Control and Energy Systems</td>
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</tbody>
</table>

Approved energy course in Engineering, Physics, Chemistry, Management, or Law

Total Units: 9-10

### Environmental Engineering (Advisor: Dr. Feke)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Units</th>
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<tbody>
<tr>
<td>ECIV 368</td>
<td>Environmental Engineering (Spring)</td>
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<tr>
<td>Two additional courses selected from the following:</td>
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<tr>
<td>ECIV 351</td>
<td>Engineering Hydraulics and Hydrology</td>
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</tr>
<tr>
<td>ECIV 361</td>
<td>Water Resources Engineering (Fall)</td>
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</tr>
<tr>
<td>ECIV 362</td>
<td>Solid and Hazardous Waste Management (Spring)</td>
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</tr>
<tr>
<td>ESTD 398</td>
<td>Seminar in Environmental Studies (Fall)</td>
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<tr>
<td>EEPS 303</td>
<td>Environmental Law</td>
<td></td>
</tr>
<tr>
<td>EEPS 321</td>
<td>Hydrogeology</td>
<td></td>
</tr>
<tr>
<td>EECS 342</td>
<td>Introduction to Global Issues (Fall)</td>
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Total Units: 9

### Management/Entrepreneurship (Advisor: Dr. Savinell)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Units</th>
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<tbody>
<tr>
<td>BAF 355</td>
<td>Corporate Finance (Fall)</td>
<td>3</td>
</tr>
<tr>
<td>ACCT 203</td>
<td>Survey of Accounting</td>
<td>3</td>
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<tr>
<td>One additional course selected from the following:</td>
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<tr>
<td>ENTP 311</td>
<td>Entrepreneurship and Wealth Creation (Spring)</td>
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</tr>
<tr>
<td>ENTP 310</td>
<td>Entrepreneurial Finance - Undergraduate (Fall)</td>
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</table>

Total Units: 9

### Polymer Science (Advisor: Dr. Mann)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Units</th>
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<tbody>
<tr>
<td>EMAC 270</td>
<td>Introduction to Polymer Science and Engineering (Fall)</td>
<td>3</td>
</tr>
<tr>
<td>Plus any two courses selected from:</td>
<td></td>
<td>6</td>
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<tr>
<td>EMAC 276</td>
<td>Polymer Properties and Design (Fall)</td>
<td></td>
</tr>
<tr>
<td>EMAC 376</td>
<td>Polymer Engineering (Spring)</td>
<td></td>
</tr>
<tr>
<td>EMAC 377</td>
<td>Polymer Processing (Spring)</td>
<td></td>
</tr>
<tr>
<td>EMAC 378</td>
<td>Polymer Engineer Design Product (Spring)</td>
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<tr>
<td>EMAC 303</td>
<td>Structure of Biological Materials</td>
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</tr>
</tbody>
</table>

Total Units: 9

### Research (Advisor: Dr. Martin)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Units</th>
</tr>
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<tbody>
<tr>
<td>EHE 396</td>
<td>Research and Innovation (Fall)</td>
<td>3</td>
</tr>
<tr>
<td>EHE 350</td>
<td>Undergraduate Research Project I (Fall)</td>
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<td>One additional course selected from the following:</td>
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<tr>
<td>EHE 351</td>
<td>Undergraduate Research Project II</td>
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Research elective

Total Units: 9
Systems and Control (Advisor: Dr. Lacks)

<table>
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<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tbody>
<tr>
<td>EECS 346</td>
<td>Engineering Optimization (Spring)</td>
<td>3</td>
</tr>
<tr>
<td>EECS 281</td>
<td>Logic Design and Computer Organization (Fall)</td>
<td>4</td>
</tr>
<tr>
<td>EECS 304</td>
<td>Control Engineering I with Laboratory (Spring)</td>
<td>3</td>
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</table>

Total Units: 10

BS/MS Advanced Study Sequence (Advisor: Dr. Qutubuddin)

Three courses selected from the following:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tbody>
<tr>
<td>ECHE 460</td>
<td>Thermodynamics of Chemical Systems (Fall)</td>
<td>3</td>
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<tr>
<td>ECHE 461</td>
<td>Transport Phenomena (Spring)</td>
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<tr>
<td>ECHE 462</td>
<td>Chemical Reaction Engineering (Spring)</td>
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</tr>
<tr>
<td>ECHE 475</td>
<td>Chemical Engineering Analysis (Fall)</td>
<td></td>
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</tbody>
</table>

Total Units: 9

Courses in these sequences may satisfy the materials elective requirement but do not reduce the total credit hours requirement for the degree.

Students should take a 300-level undergraduate or introductory graduate course that would be relevant to their research project and is approved by the department.

Bachelor of Science in Engineering

Suggested Program of Study: Major in Chemical Engineering

First Year

<table>
<thead>
<tr>
<th>Units</th>
<th>Fall</th>
<th>Spring</th>
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<tbody>
<tr>
<td>General Physics I - Mechanics (PHYS 121)</td>
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<tr>
<td>Principles of Chemistry for Engineers (CHEM 111)</td>
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<tr>
<td>Calculus for Science and Engineering I (MATH 121)</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>FSxx SAGES First Seminar</td>
<td>4</td>
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<tr>
<td>Introduction to Chemical Engineering at Case (ECHE 151)</td>
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<tr>
<td>PHED (2 half semester courses)</td>
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Second Year

<table>
<thead>
<tr>
<th>Units</th>
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<th>Spring</th>
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<tbody>
<tr>
<td>General Physics II - Electricity and Magnetism (PHYS 122)</td>
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<tr>
<td>Chemistry of Materials (ENGR 145)</td>
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<tr>
<td>Calculus for Science and Engineering II (MATH 122)</td>
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<tr>
<td>Elementary Computer Programming (ENGR 131)</td>
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<td>USxx SAGES University Seminar</td>
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<tr>
<td>PHED (2 half semester courses)</td>
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Year Total: 16 18

Second Year

<table>
<thead>
<tr>
<th>Units</th>
<th>Fall</th>
<th>Spring</th>
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<tbody>
<tr>
<td>Introductory Organic Chemistry I (CHEM 223)</td>
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<tr>
<td>or Organic Chemistry I (CHEM 323)</td>
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<tr>
<td>Calculus for Science and Engineering III (MATH 223)</td>
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<tr>
<td>or Calculus III (MATH 227)</td>
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<tr>
<td>Thermodynamics, Fluid Dynamics, Heat and Mass Transfer (ENGR 225)</td>
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<tr>
<td>Introduction to Chemical Systems (ECHE 260)</td>
<td>3</td>
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<tr>
<td>USxx 2xx SAGES University Seminar</td>
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Year Total: 16 18

Third Year

<table>
<thead>
<tr>
<th>Units</th>
<th>Fall</th>
<th>Spring</th>
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</thead>
<tbody>
<tr>
<td>Transport Phenomena for Chemical Systems (ECHE 360)</td>
<td>4</td>
<td></td>
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<tr>
<td>Process Control (ECHE 367)</td>
<td>4</td>
<td></td>
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<tr>
<td>Introduction to Circuits and Instrumentation (ENGR 210)</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Chemical Laboratory Methods for Engineers (CHEM 290)</td>
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<tr>
<td>Breadth elective I</td>
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<tr>
<td>Separation Processes (ECHE 361)</td>
<td>3</td>
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<tr>
<td>Measurements Laboratory (ECHE 365)</td>
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<tr>
<td>Professional Communication for Engineers (ENGR 398)</td>
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<td>Professional Communication for Engineers (ENG 398)</td>
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<td>Chemical Reaction Processes (ECHE 364)</td>
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<tr>
<td>Humanities/Social Science elective II</td>
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Year Total: 18 15

Fourth Year

<table>
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<tr>
<th>Units</th>
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<tbody>
<tr>
<td>Process Analysis and Design (ECHE 398)</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Chemical Engineering Laboratory (ECHE 362)</td>
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<tr>
<td>Materials elective</td>
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</tr>
<tr>
<td>Breadth Elective Sequence II</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Humanities/Social Science elective III</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Chemical Engineering Design Project (ECHE 399)</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Statics and Strength of Materials (ENGR 200)</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Physical Chemistry II (CHEM 336)</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Breadth elective sequence III</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Humanities/Social Science elective IV</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

Year Total: 16 15

Total Units in Sequence: 129

Hours required for graduation: 129-131 (depending on breadth elective sequence)

Higher number (advanced or honors) courses are available to students by invitation only.

Must take one course from each thematic group: FSSY or USY—Thinking about the symbolic world, FSNA or USNA—Thinking about the natural world and FSSO or USSO—Thinking about the social world. Specific seminar topics will change periodically.

A three-course (9 credit hours minimum) breadth sequence (approved by the Chemical Engineering faculty). Pre-approved sequences include: biochemistry engineering, biomedical engineering, computing, electrochemical engineering, electronic materials processing, energy, environmental engineering, management, polymer science, systems and control, and advanced study (BS/MS).

SAGES Departmental Seminar.

Science elective, chosen from:

- PHYS 221 Introduction to Modern Physics
- CHEM 224 Introductory Organic Chemistry II/CHEM 324 Organic Chemistry II
- CHEM 311 Inorganic Chemistry I
- BIOL 300 Dynamics of Biological Systems: A Quantitative Introduction to Biology
One Materials elective is required. Suggested courses include:
- EMSE 201 Introduction to Materials Science and Engineering
- EMAC 270 Introduction to Polymer Science and Engineering
- EMAC 276 Polymer Properties and Design
- EMSE 314 Electrical, Magnetic, and Optical Properties of Materials

SAGES Capstone Course

Five-Year Combined BS/MS Program
This program offers outstanding undergraduate students the opportunity to obtain an MS degree, with a thesis, in one additional year of study beyond the BS degree. (Normally, it takes two years beyond the BS to earn an MS degree.) In this program, an undergraduate student can take up to nine hours of graduate credit that simultaneously satisfies undergraduate degree requirements. Typically, students in this program start their research leading to the MS thesis in the fall semester of the senior year. The BS degree is awarded at the completion of the senior year. Application for admission to the five-year BS/MS program is made after completion of five semesters of coursework. Minimum requirements are a 3.2 grade point average and the recommendation of the department.

Five-and-a-Half Year Cooperative BS/MS Program
The cooperative bachelor's/master's program enables outstanding students who are enrolled in the cooperative education program to earn an MS in one semester beyond the BS degree. Students complete six credits of a graduate project (ECHE 660) during the second co-op period and follow an Advanced Study elective sequence. The courses ECHE 460, ECHE 461, and an agreed-upon mathematics course are used to satisfy both graduate and undergraduate requirements. Typically, students in this program start their research leading to the MS thesis in the fall semester of the senior year. The BS degree is awarded at the completion of the senior year. Application for admission to the five-year BS/MS program is made after completion of five semesters of coursework. Minimum requirements are a 3.2 grade point average and the recommendation of the department.

Minor in Chemical Engineering
The minor in chemical engineering is for students majoring in other disciplines. A minimum of 17 hours in chemical engineering courses are required for the minor. The required courses are:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENGR 225</td>
<td>Thermodynamics, Fluid Dynamics, Heat and Mass Transfer</td>
<td>4</td>
</tr>
<tr>
<td>ECHE 260</td>
<td>Introduction to Chemical Systems</td>
<td>3</td>
</tr>
<tr>
<td>ECHE 360</td>
<td>Transport Phenomena for Chemical Systems</td>
<td>4</td>
</tr>
<tr>
<td>Plus two courses selected from the following:</td>
<td>6-7</td>
<td></td>
</tr>
<tr>
<td>ECHE 361</td>
<td>Separation Processes</td>
<td></td>
</tr>
<tr>
<td>ECHE 363</td>
<td>Thermodynamics of Chemical Systems</td>
<td></td>
</tr>
<tr>
<td>ECHE 364</td>
<td>Chemical Reaction Processes</td>
<td></td>
</tr>
<tr>
<td>ECHE 365</td>
<td>Measurements Laboratory</td>
<td></td>
</tr>
<tr>
<td>ECHE 367</td>
<td>Process Control</td>
<td></td>
</tr>
</tbody>
</table>

Total Units 17-18

Graduate Programs
Master of Science Program
Each MS candidate must complete a minimum of 27 hours of graduate-level credits. These credits can be distributed in one of two ways.

Plan A

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECHE 401</td>
<td>Chemical Engineering Communications</td>
<td>1</td>
</tr>
<tr>
<td>Six graduate-level courses</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>MS thesis research</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>Total Units</td>
<td>28</td>
<td></td>
</tr>
</tbody>
</table>

Plan B
Part-time students, and those in the 5-1/2-year BS/MS cooperative program, may opt for Plan B, which requires completion of 24 credit hours (eight courses) of approved graduate course work and a 3 credit hour project replacing the MS thesis. In special cases, a student may be permitted to complete a 6 credit project. In this case only seven courses will be required.

All MS students are required to include the following courses in their program:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECHE 460</td>
<td>Thermodynamics of Chemical Systems</td>
<td>3</td>
</tr>
<tr>
<td>ECHE 461</td>
<td>Transport Phenomena</td>
<td>3</td>
</tr>
<tr>
<td>ECHE 462</td>
<td>Chemical Reaction Engineering</td>
<td>3</td>
</tr>
<tr>
<td>ECHE 475</td>
<td>Chemical Engineering Analysis</td>
<td>3</td>
</tr>
<tr>
<td>*</td>
<td>or an equivalent graduate-level math course</td>
<td></td>
</tr>
</tbody>
</table>

The other courses should be technical graduate-level courses selected after consultation with the advisor. In special circumstances, e.g., students have taken a similar or complementary course at another university, one of the required courses may be waived from the program of study. Full-time MS students are expected to do some teaching or mentoring as part of their education. Also, at various points during their thesis research, students will be required to present seminars and reports on their progress.

Master of Engineering Program
The Department of Chemical Engineering also participates in the practice-oriented Master of Engineering program offered by the Case School of Engineering. The Department of Chemical Engineering participates in the Chemical and Materials Processing and Synthesis sequence.

Doctor of Philosophy Program
The degree of Doctor of Philosophy is awarded in recognition of deep and detailed knowledge of chemical engineering and a comprehensive understanding of related subjects together with a demonstration of the ability to perform independent research, to suggest new areas for research, and to communicate results in an acceptable manner. For students entering the PhD program with a BS degree, a total of 12 courses (36 credit hours) is required. Course requirements for students entering with MS degrees are adjusted to account for work done at other universities, but a minimum of 6 courses (18 credit hours) must be taken at CWRU. The course requirements for students entering with a BS degree are as follows:
Core Courses
All programs of study must include:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECHE 460</td>
<td>Thermodynamics of Chemical Systems</td>
<td>3</td>
</tr>
<tr>
<td>ECHE 461</td>
<td>Transport Phenomena</td>
<td>3</td>
</tr>
<tr>
<td>ECHE 462</td>
<td>Chemical Reaction Engineering</td>
<td>3</td>
</tr>
<tr>
<td>ECHE 475</td>
<td>Chemical Engineering Analysis</td>
<td>3</td>
</tr>
<tr>
<td>Total Units</td>
<td></td>
<td>12</td>
</tr>
</tbody>
</table>

A minimum of six additional graduate courses (in chemical engineering or other departments) must be taken. At least one of these electives must be in a Basic Science (i.e., Chemistry, Physics, Biology, Biochemistry, Mathematics, or Statistics). All PhD programs of study must include two mathematics or statistics courses, one of which must be ECHE 475 (listed above as a "core" course). With department approval, a 300-level lecture course can be used to replace an elective course.

Professional Development Courses
The balance of the PhD course work (two courses in addition to the TA assignment) is met through the professional development courses. All PhD students are required to assist in three teaching experiences as part of their degree requirements. Students enroll in the following courses for these teaching experiences.

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECHE 401</td>
<td>Chemical Engineering Communications</td>
<td>1</td>
</tr>
<tr>
<td>ECHE 402</td>
<td>Chemical Engineering Communications II</td>
<td>2</td>
</tr>
<tr>
<td>ECHE 470</td>
<td>Graduate Research Colloquium *</td>
<td>3</td>
</tr>
<tr>
<td>ECHE 400T</td>
<td>Graduate Teaching I</td>
<td>0</td>
</tr>
<tr>
<td>ECHE 500T</td>
<td>Graduate Teaching II</td>
<td>0</td>
</tr>
<tr>
<td>ECHE 600T</td>
<td>Graduate Teaching III</td>
<td>0</td>
</tr>
<tr>
<td>Total Units</td>
<td></td>
<td>6</td>
</tr>
</tbody>
</table>

* Six semesters of ECHE 470 Graduate Research Colloquium are required.

Comments on PhD Guidelines
The department anticipates that from time to time, special cases will arise which are exceptions to the above guidelines, e.g., a student may have taken a graduate-level course at another school. In these cases, the student must submit a statement with the Planned Program of Study justifying the departure from the guidelines. It should be noted that the above guidelines are a minimum requirement. All programs are chosen with the approval of the student’s faculty advisor.

Other Requirements for the PhD Degree
Students who wish to enter the PhD program must pass a First Proposition oral examination (with an accompanying written report) that tests a student’s ability to think creatively, grasp new research concepts, and discuss such concepts critically and comprehensively. The First Proposition serves as the qualifying examination for the PhD degree. A Second Proposition focusing on the students own research topic is required by the end of the second year in the program. All PhD students must satisfy the residency requirements of the university and the Case School of Engineering. In addition, at various points in the course of the dissertation research, students will be required to prepare reports and seminars on their work, and defend their dissertation. The Chemical Engineering Graduate Student Handbook contains a more detailed description of the department’s PhD requirements and a time schedule for their completion.

Facilities
The department is housed in the Albert W. Smith Building and portions of the Bingham Building on the Case Quadrangle. Professor Smith was chair of industrial chemistry at Case from 1911 to 1927. Under his leadership a separate course of study in chemical engineering was introduced at Case in 1913. Professor Smith was also a close associate of Herbert Dow, the Case alumnus who founded Dow Chemical in 1890 with the help and support of Professor Smith. The Albert W. Smith Chemical Engineering Building contains one technology enhanced classroom; the undergraduate Unit Operations Laboratory; an undergraduate reading room, named after Prof. Robert V. Edwards; and the normal complement of offices and research laboratories. The lobby of the A.W. Smith Building, renovated by contributions from the James family, often serves as a formal and informal gathering place for students and faculty. The department has exceptionally strong facilities for electrochemical and energy research, for microfabrication, and for chemical vapor deposition and thin film synthesis. In addition, a full range of biochemical, analytical and materials characterization instrumentation is available in the Case School of Engineering. Analytical instrumentation is available within the Department of Chemical Engineering, the Department of Chemistry, and the Materials Research Laboratory.

Faculty
Uziel Landau, PhD  
(University of California, Berkeley)  
Professor and Chair  
Electrochemical engineering, modeling of electrochemical systems, electrodeposition, batteries, fuel cells, electrolyzers, corrosion  
John C. Angus, PhD  
(University of Michigan)  
Professor Emeritus  
Chemical vapor deposition of diamond, electrochemistry of diamond, gallium nitride synthesis  
Harihara Baskaran, PhD  
(The Pennsylvania State University)  
Associate Professor  
Transport phenomena in biology and medicine  
Donald L. Feke, PhD  
(Princeton University)  
Professor and Vice Provost for Undergraduate Education  
Transport phenomena, dispersive mixing, particle science and processing  
Daniel Lacks, PhD  
(Harvard University)  
C. Benson Branch Professor of Chemical Engineering  
Molecular simulation, statistical mechanics  
Chung-Chiu Liu, PhD  
(Case Institute of Technology)  
Wallace R. Persons Professor of Sensor Technology and Control  
Electrochemical sensors, electrochemical synthesis, electrochemistry related to electronic materials  
J. Adin Mann Jr., PhD  
(Iowa State University)  
Professor  
Surface phenomena, interfacial dynamics, colloid science, light scattering, biomemetics, molecular electronics, Casimir force (effects)  
Heidi B. Martin, PhD  
(Case Western Reserve University)
Developing skills in quantitative formulation and solution of word problems. Prereq: CHEM 111, ENGR 145 and MATH 122. Material and energy balances. Conservation principles and the elementary laws of physical chemistry applied to chemical processes.

**ECHE 250. Honors Research I. 1 - 3 Unit.**
A special program which affords a limited number of students the opportunity to conduct research under the guidance of one of the faculty. At the end of the first semester of the sophomore year, students who have a strong interest in research are encouraged to discuss research possibilities with the faculty. Assignments are made based on mutual interest. Subject to the availability of funds, the faculty employs students through the summers of their sophomore and junior years, as members of their research teams.

**ECHE 251. Honors Research II. 1 - 3 Unit.**
(See ECHE 250.) Recommended preparation: ECHE 250.

**ECHE 252. Introduction to Chemical Systems. 3 Units.**
Material and energy balances. Conservation principles and the elementary laws of physical chemistry applied to chemical processes. Developing skills in quantitative formulation and solution of word problems. Prereq: CHEM 111, ENGR 145 and MATH 122.

**ECHE 360. Transport Phenomena for Chemical Systems. 4 Units.**
Fundamentals of fluid flow, heat and mass transport from the microscopic and macroscopic perspectives. Applications to chemical systems, including steady and transient operations, convective and molecular (conduction and diffusion) effects, and interfacial transport. Design of unit operations (e.g., heat exchangers). Heat and mass transfer analogies. Vector/tensor analysis and dimensional analysis used throughout. Prereq: ENGR 225 and MATH 223.

**ECHE 361. Separation Processes. 3 Units.**
Analysis and design of separation processes involving distillation, extraction, absorption, adsorption, and membrane processes. Design problems and the physical and chemical processes involved in separation. Equilibrium stage, degrees of freedom in design, graphical and analytical design techniques, efficiency and capacity of separation processes. Prereq: ECHE 260 and ECHE 363.

**ECHE 362. Chemical Engineering Laboratory. 4 Units.**
Experiments in the operation of separation and reaction equipment, including design of experiments, technical analysis, and economic analysis. Experiments cover distillation, liquid-liquid extraction, heat transfer, fluidized beds, control, membrane separations, and chemical and electrochemical reactors. Prereq: ECHE 260, ECHE 360, ECHE 361, ECHE 363 and ECHE 364.

**ECHE 362D. Chemical Engineering Laboratory in Denmark. 4 Units.**
Chemical Engineering Laboratory in Denmark. A version of ECHE 362 taught during the summer at DTU in Lyngby. Prereq: ECHE 260 and ECHE 360 and ECHE 361 and ECHE 363 and ECHE 364.
ECHE 363. Thermodynamics of Chemical Systems. 3 Units.
First law, second law, phase equilibria, phase rule, chemical reaction equilibria, and applications to engineering problems.
Thermodynamic properties of real substances, with emphasis on solutions. Thermodynamic analysis of processes including chemical reactions. Prereq: ECHE 260 and Prereq or Coreq: ENGR 225.

ECHE 364. Chemical Reaction Processes. 3 Units.

ECHE 365. Measurements Laboratory. 3 Units.
Laboratory introduction to the measurement process in engineering. Matching measurements to approximate and exact physical models is stressed. Extraction of physical parameters and estimation of the errors in the parameter estimates is an important part of the course. Example projects cover steady and unsteady state heat transfer, momentum transfer, and the first law of thermodynamics. Recommended preparation: ECHE 360. Prereq: ECHE 260, ECHE 363 and ENGR 225.

ECHE 366. Process Control. 4 Units.
Theoretical and practical aspects of feedback control of chemical processes. The course involves extensive use of computer software with some exams taken using the computer. Short laboratories and Labview training are integrated into the course. Topics include: analysis of linear dynamical systems using Laplace transforms, derivation of unsteady state mathematical models of simple chemical processes, dynamic simulation of linear and nonlinear models, design of PID controllers by model inverse methods, tuning of controller to accommodate process model uncertainty, two degrees of freedom controllers, feed-forward and cascade control. The Labview training covers programming basics, interfacing to a data acquisition system, and incorporating control algorithms. Prereq: ECHE 260 and MATH 224.

ECHE 367. Fluid Mechanics for Chemical Systems. 3 Units.
This course introduces the physical and mathematical concepts associated with the motion of material and the transfer of momentum. These concepts will be applied to the analysis of engineering systems to obtain both exact solutions and practical estimates. Both analytical and numerical solutions will be utilized.

ECHE 368. Heat and Mass Transfer for Chemical Systems. 3 Units.
This course introduces the physical and mathematical concepts associated with the transfer of heat and mass. These will be applied to the analysis of engineering situations to obtain both exact solutions and practical estimates. Analytical and numerical solutions will be utilized.

ECHE 369. Chemical Engineering Design Project. 3 Units.
This is a course that uses the small teams approach to solve chemical process design problems. Numerous exercises involving process design are used to integrate material taught in previous and concurrent courses. This includes application of computer based design tools, economics, scheduling, decision making with uncertainty, and proposal and report preparation. This work leads to one comprehensive process design project done by the class, which includes a written and oral report. Prereq: ECHE 365, ECHE 367, ECHE 398.

ECHE 370. Process Analysis and Design. 3 Units.

ECHE 371. Special Topics in Chemical Engineering. 3 Units.
Special topics within an area of chemical engineering.

ECHE 372. Chemical Engineering Applied to Microfabrication and Devices. 3 Units.
Silicon based microfabrication and micromachining require many chemical engineering technologies. Microfabricated devices such as sensors are also directly related to chemical engineering. The applications of chemical engineering principles to microfabrication and micromachining are introduced. Oxidation processing, chemical vapor deposition, etching and patterning techniques, electroplating and other technologies are discussed. Graduate students will submit an additional final project on some technical aspect of microfabrication technology or devices. Recommended preparation: ECHE 363 and ECHE 371. Offered as ECHE 383 and ECHE 483.

ECHE 373. Research and Innovation. 3 Units.
This course is an opportunity for undergraduate students to experience research--how to approach a research problem, design experiments and analyze data. This will be accomplished through (a) hands-on laboratory experiences with important research techniques, (b) assignment of open-ended projects on research topics, and (c) discussion of specific interdisciplinary research being pursued at Case. It is meant to be a mechanism for students to become involved in a research project; the final assignment is to submit a proposal for this project. Example interdisciplinary research areas to be included are Fuel Cells and Batteries, Sensors, Biomaterials, and Micro and Nano-fabricated Devices.

ECHE 374. Process Analysis and Design. 3 Units.

ECHE 375. Chemical Engineering Design Project. 3 Units.
This is a course that uses the small teams approach to solve chemical process design problems. Numerous exercises involving process design are used to integrate material taught in previous and concurrent courses. This includes application of computer based design tools, economics, scheduling, decision making with uncertainty, and proposal and report preparation. This work leads to one comprehensive process design project done by the class, which includes a written and oral report. Prereq: ECHE 365, ECHE 367, ECHE 398.

ECHE 376. Graduate Teaching 1. 0 Units.
All Ph.D. students are required to take this course. The experience includes elements from the following tasks: development of teaching or lecture materials, teaching recitation groups, providing laboratory assistance, tutoring, exam/quiz/homework preparation and grading, mentoring students. Recommended preparation: Entering Ph.D. student in Chemical Engineering.
ECHE 401. Chemical Engineering Communications. 1 Unit.
Introductory course in communication for Chemical Engineering graduate students: preparation of first proposal for thesis, preparation of technical reports and scientific papers, literature sources, reviewing proposals, and manuscripts for professional journals, and making effective technical presentations.

ECHE 402. Chemical Engineering Communications II. 2 Units.
This course is a continuation of ECHE 401 and is designed to develop skills in writing proposals for funding research projects. The federal requirements are reviewed for submitting proposals to the major granting agents including NSF, NIH and DoD. We will study strategies for developing fundable projects. Each student will submit a research proposal for a thesis project and do an oral presentation of the project.

ECHE 460. Thermodynamics of Chemical Systems. 3 Units.
Phase equilibria, phase rule, chemical reaction equilibria in homogeneous and heterogeneous systems, ideal and non-ideal behavior of fluids and solutions, thermodynamic analysis of closed and open chemical systems with applications. Recommended preparation: ECHE 363.

ECHE 461. Transport Phenomena. 3 Units.

ECHE 462. Chemical Reaction Engineering. 3 Units.

ECHE 464. Surfaces and Adsorption. 3 Units.
Thermodynamics of interfaces, nature of interactions across phase boundaries, capillary wetting properties of adsorbed films, friction and lubrication, flotation, detergency, the surface of solids, relation of bulk to surface properties of materials, non-catalytic surface reactions. Recommended preparation: CHEM 335 or equivalent.

ECHE 466. Colloid Science. 3 Units.

ECHE 469. Chemical Engineering Seminar. 0 Units.
Distinguished outside speakers present current research in various topics of chemical engineering science. Graduate students also present technical papers based on thesis research.

ECHE 470. Graduate Research Colloquium. 0.5 Units.
Outside speakers present lectures on their current research. Various topics in the areas of chemical engineering science, basic and applied chemistry, bioengineering, material science, and applied mathematics are covered in the lectures. Graduate students also present technical papers based on their own research. Students are graded on the submission of one-page summary reports on any two lectures.

ECHE 474. Biotransport Processes. 3 Units.
Biomedical mass transport and chemical reaction processes. Basic mechanisms and mathematical models based on thermodynamics, mass and momentum conservation. Analytical and numerical methods to simulate in vivo processes as well as to develop diagnostic and therapeutic methods. Applications include transport across membranes, transport in blood, tumor processes, bioreactors, cell differentiation, chemotaxis, drug delivery systems, tissue engineering processes. Recommended preparation: EBME 350 and EBME 409 or equivalent. Offered as EBME 474 and ECHE 474.

ECHE 475. Chemical Engineering Analysis. 3 Units.

ECHE 477. Data Acquisition and LabVIEW Bootcamp. 1 Unit.
This course will introduce and implement basic data acquisition concepts and LabVIEW virtual instrumentation programming, providing hands-on experience with hardware and software. It is intended to help those with little or no data acquisition experience to get started on setting up data acquisition for their application. No prior experience with LabVIEW is required. Consult with the instructor for additional details.

ECHE 480. Electrochemical Engineering. 3 Units.
Engineering aspects of electrochemical processes including current and potential distribution, mass transport and fluid mechanical effects. Examples from industrial processes including electroplating, industrial electrolysis, corrosion, and batteries. Recommended preparation: ECHE 260 or permission of instructor. Offered as ECHE 381 and ECHE 480.

ECHE 483. Chemical Engineering Applied to Microfabrication and Devices. 3 Units.
Silicon based microfabrication and micromachining require many chemical engineering technologies. Microfabricated devices such as sensors are also directly related to chemical engineering. The applications of chemical engineering principles to microfabrication and micromachining are introduced. Oxidation processing, chemical vapor deposition, etching and patterning techniques, electroplating and other technologies are discussed. Graduate students will submit an additional final project on some technical aspect of microfabrication technology or devices. Recommended preparation: ECHE 363 and ECHE 371. Offered as ECHE 383 and ECHE 483.

ECHE 500T. Graduate Teaching II. 0 Units.
All Ph.D. students are required to take this course. The experience will include elements from the following tasks: development of teaching or lecture materials, teaching recitation groups, providing laboratory assistance, tutoring, exam/quiz/homework preparation and grading, mentoring students. Recommended preparation: Ph.D. student in Chemical Engineering.
ECHE 580. Special Topics. 3 Units.
Special topics in chemical engineering. Prereq: Consent of instructor.

ECHE 590. Topics in Materials Engineering. 3 Units.
Seminar course focusing on topics related to materials engineering. Typical subjects include processing and properties of electronic and nanomaterials, composites and dispersions; mixing of particles and agglomerates; electrodeposition of alloys; molecular level simulations. Students will be assigned readings from book chapters, classical articles and state of the art publications. A discussion leader (pre-assigned) will be responsible for introducing the papers and leading a critical discussion. Active student participation in the discussions is expected.

ECHE 591. Carbon Nanoscience and Nanotechnology. 3 Units.
This course presents the fundamental aspects of nanoscience and nanotechnology with an emphasis on carbon nanomaterials and nanodevices. This proposed course intends to provide students with the fundamental aspects of nanoscience and nanotechnology. Nanotechnology draws on the strengths of all the basic sciences and is the engineering at the molecular level, which has the potential to lead to novel scientific discoveries as well as new industrial technologies. This course will give students insight into a new, exciting and rapidly developing field. The course has a good balance between basic knowledge and depth with a focus on some key application areas, which will enable students to work in a variety of scientific professions. Offered as ECHE 591 and EMAC 492.

ECHE 600T. Graduate Teaching III. 0 Units.
All Ph.D. students are required to take this course. The experience will include elements from the following tasks: development of teaching or lecture materials, teaching recitation groups, providing laboratory assistance, tutoring, exam/quiz/homework preparation and grading, mentoring students. Recommended preparation: Ph.D. student in Chemical Engineering.

ECHE 601. Independent Study. 1 - 18 Unit.

ECHE 651. Thesis M.S.. 1 - 18 Unit.

ECHE 660. Special Problems. 1 - 18 Unit.
Research course taken by Plan B M.S. students.

ECHE 701. Dissertation Ph.D.. 1 - 18 Unit.
Prereq: Predoctoral research consent or advanced to Ph.D. candidacy milestone.
Department of Civil Engineering

The Department of Civil Engineering offers programs of study in environmental, geotechnical, and structural engineering, construction engineering and management, and engineering mechanics.

Civil engineers plan, design, and construct facilities for meeting the needs of modern society. Civil engineers also help to reduce the environmental impact of these designs to help make modern society more sustainable. Examples of such facilities are transportation systems, schools and office buildings, bridges, dams, land reclamation projects, water treatment and distribution systems, commercial buildings, and industrial plants. Civil engineers can choose from a broad spectrum of opportunities in industry and consulting practice as well as research and development in firms in which civil engineers often participate as owners or partners. Employment can be found among a wide variety of industrial, governmental, construction, and private consulting organizations. There is a large demand for civil engineers nationally. The program at Case Western Reserve University is built around small classes, good faculty-student relationships and advising, and a program flexible enough to meet students’ personal career aims.

The Department of Civil Engineering of the Case School of Engineering offers an accredited Bachelor of Science degree in Civil Engineering with courses in almost all the traditional civil engineering subjects. The graduate program offers the Master of Science and Doctor of Philosophy degrees in structures, engineering mechanics, geotechnical and environmental engineering. A cooperative education program involving participating engineering firms is available for both undergraduate and graduate students.

An active research program gives the students opportunities to participate in projects related to design, analysis, and testing. Projects are in areas such as computational mechanics, probabilistic design, bridges, dynamics and wind engineering, response of concrete and steel structures, fracture mechanics, static and dynamic behavior of soils, earthquake engineering, subsurface and ex situ remediation, contaminated sediments, infrastructure materials and infrastructure systems optimization.

Mission Statement and Objectives

The Department of Civil Engineering developed its own mission statement and educational objectives that are consistent with those of the Engineering School. This process involved the entire Civil Engineering faculty and the Civil Engineering Development Committee. It was conducted during regular faculty meetings and special meetings called for this purpose. It is an ongoing process.

Mission Statement:

Our mission is to prepare students for leadership roles in civil and environmental engineering. The department will provide facilities and research expertise to advance the state of the civil engineering profession within the mission of the Case School of Engineering. Students will be taught to address problems building on solid technical foundations while taking advantage of advanced technologies. Our graduates will adhere to high technical and ethical standards, in service to the public. Graduates will be prepared for the pursuit of advanced learning in civil engineering and related fields, as well as for the practice of civil and environmental engineering at the highest professional levels.

Research

Research under way in Civil Engineering includes work in analytical, design and experimental areas and is sponsored by industry, state, and federal government sources. Major areas of research interest are:

- Random vibration
- Engineering materials
- Behavior of reinforced and prestressed concrete
- Wind engineering
- Earthquake analysis and design of structures
- Finite element methods
- Nondestructive Testing of Structures
- Passive and active control of the vibration of structures
- Transient response of nonlinear structures
- Blast loading of structures
- Modeling of micro electromechanical systems
- Fracture mechanics
- Modeling of concrete, of geomaterials and of asphalt concrete
- High and low-cycle fatigue
- Geotechnical/Pavement Materials
- Static behavior of anisotropic clays and sands
- Soil liquefaction
- Bifurcation and shear banding in soils
- Centrifuge modeling of static and dynamic soil behavior
- Dynamic soil structure interaction
- Non-destructive testing evaluation of soils and pavement materials
- Measurement of dynamic soil properties
- Design of Structures for High-Speed Vehicles
- Stability of tailings dams
- Environmental Engineering
- Environmentally conscious manufacturing
- Remediation of “old” metal-contaminated soils
- Brownfields/structural remediation
- Environmental modeling/software development
- Environmental decision analysis
- Geoenvironmental engineering
- Environmental fluid mechanics
- Sediment remediation
- In-situ remediation of non-aqueous phase liquids
- Environmental chemistry
- Bioremediation
- Sustainable engineering
- Structural health monitoring
- Transportation safety
- Infrastructure engineering
- Non-destructive Testing
- Sensor technology
- Smart materials
- Energy structures and geotechnology
- Urban hydraulics
- Soil contamination standards
Undergraduate Programs

The faculty of the Civil Engineering Department believe very strongly that undergraduate education should prepare students to be productive engineers upon receiving the degree. For this reason, particular emphasis in undergraduate teaching is placed on the application of engineering principles to the solution of problems. After completing a broad civil engineering core program undergraduate students must choose an elective sequence in one of the areas of civil engineering of particular interest, such as structural, geotechnical or environmental engineering; construction management or engineering mechanics.

In order to provide undergraduates with experience in industry, the department attempts to arrange summer jobs for the three summers between their semesters at Case Western Reserve University. By working for organizations in all areas of design and construction, students can gain an invaluable knowledge of the way the industry functions. This experience lets them gain more from their education and makes them more attractive to prospective employers upon graduation.

A cooperative education program is also available, which allows the student to spend time working full-time in an engineering capacity with a contractor, consulting engineer, architect, or materials supplier during the course of his or her education. This learning experience is designed to intergrate classroom theory with practical experience and professional development.

The Bachelor of Science degree program in Civil Engineering is accredited by the Engineering Accreditation Commission of ABET, www.abet.org (http://bulletin.case.edu/schoolofengineering/civilengineering/http://www.abet.org).

The curriculum has been designed so that the student chooses a sequence of four (4) or more approved elective courses. The sequence is intended to give students the chance to pursue in some depth a particular area related to their careers as civil engineers. Samples of courses from which elective sequences could be chosen follow the civil engineering curriculum in this bulletin. In addition, the students are required to do a senior project in their area of interest.

Students enrolled in other majors may elect to pursue a minor in civil engineering or in environmental engineering. Department approval and a minimum of 15 credit hours are required.

Most classes in the Civil Engineering Department have enrollment of less than 25 so the students have opportunities to develop close relationships with the faculty. Students also have opportunities to gain practical experience as well as earn a supplemental income by assisting faculty members on consulting work during vacation periods.

Educational Objectives

1. Graduates of the ECIV Program will enter the profession of Civil Engineering and advance to positions of greater responsibility and leadership, in line with ASCE Professional Grade Descriptions.
2. Graduates of the ECIV Program will enter and successfully progress in, or complete, advanced degree programs within their fields of choice.
3. Graduates of the ECIV Program will progress toward or complete professional registration and licensure.

Student Outcomes

As preparation for achieving the above educational objectives, the BS degree program in Civil Engineering is designed so that students attain:

- an ability to apply knowledge of mathematics (including differential equations) and science (including calculus-based physics and general chemistry) and one additional area of science.
- an ability to design and conduct experiments, as well as to analyze and interpret data in more than one area of civil engineering.
- an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
- an ability to function on multi-disciplinary teams.
- an ability to identify, formulate, and solve engineering problems.
- an understanding of professional and ethical responsibility and the role of civil engineers in providing for the safety and well-being of the general public.
- an ability to communicate effectively in written and oral form.
- the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.
- a recognition of the need for, and an ability to engage in life-long learning.
- a knowledge of contemporary issues.
- an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice and the design of functional civil engineering facilities.
- proficiency in probability and statistics, as applied to civil engineering design and planning issues.
- an understanding of professional practice issues, including the role of civil engineering design and management professionals in the construction process, public policy and leadership.
- an ability to develop an understanding of the importance of professional licensure and the ethical use of a professional license.

Bachelor of Science in Engineering

Required Courses: Major in Civil Engineering

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECIV 160</td>
<td>Surveying and Computer Graphics</td>
<td>3</td>
</tr>
<tr>
<td>ECIV 211</td>
<td>Civil Engineering Materials</td>
<td>3</td>
</tr>
<tr>
<td>ECIV 310</td>
<td>Strength of Materials</td>
<td>3</td>
</tr>
<tr>
<td>ECIV 320</td>
<td>Structural Analysis I</td>
<td>3</td>
</tr>
<tr>
<td>ECIV 322</td>
<td>Structural Design I</td>
<td>3</td>
</tr>
<tr>
<td>ECIV 330</td>
<td>Soil Mechanics</td>
<td>4</td>
</tr>
<tr>
<td>ECIV 340</td>
<td>Construction Management</td>
<td>3</td>
</tr>
<tr>
<td>ECIV 351</td>
<td>Engineering Hydraulics and Hydrology</td>
<td>3</td>
</tr>
<tr>
<td>ECIV 360</td>
<td>Civil Engineering Systems</td>
<td>3</td>
</tr>
<tr>
<td>ECIV 368</td>
<td>Environmental Engineering</td>
<td>3</td>
</tr>
<tr>
<td>ECIV 398</td>
<td>Civil Engineering Senior Project</td>
<td>3</td>
</tr>
</tbody>
</table>

Related Required Courses

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>EMAE 181</td>
<td>Dynamics</td>
<td>3</td>
</tr>
<tr>
<td>EMAE 250</td>
<td>Computers in Mechanical Engineering</td>
<td>3</td>
</tr>
</tbody>
</table>

Four or five of the following technical elective sequences, two of which must be from civil engineering:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECIV 321</td>
<td>Structural Analysis II</td>
<td></td>
</tr>
<tr>
<td>ECIV 323</td>
<td>Structural Design II</td>
<td></td>
</tr>
<tr>
<td>ECIV 411</td>
<td>Elasticity, Theory and Applications</td>
<td></td>
</tr>
<tr>
<td>ECIV 420</td>
<td>Finite Element Analysis</td>
<td></td>
</tr>
<tr>
<td>ECIV 421</td>
<td>Advanced Reinforced Concrete Design</td>
<td></td>
</tr>
<tr>
<td>ECIV 422</td>
<td>Advanced Structural Steel Design</td>
<td></td>
</tr>
<tr>
<td>ECIV 423</td>
<td>Prestressed Concrete Design</td>
<td></td>
</tr>
</tbody>
</table>

Structural Engineering
Computer use is an integral part of the Civil Engineering curriculum. From required courses in computer programming and numerical analysis to subsequent use and development of civil engineering programs, the student fully utilizes the computer as a planning, analysis, design, and managerial tool.

All sequences are constructed to provide a balance of marketable skills and theoretical bases for further growth. With departmental approval other sequences can be developed to meet students’ needs.

Bachelor of Science in Engineering
Suggested Program of Study: Major in Civil Engineering

First Year

<table>
<thead>
<tr>
<th>Units</th>
<th>Fall</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open elective</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Principles of Chemistry for Engineers (CHEM 111)</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Elementary Computer Programming (ENGR 131)</td>
<td>3</td>
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<tr>
<td>FSXX SAGES First Seminar</td>
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<tr>
<td>Calculus for Science and Engineering I (MATH 121)</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>PHED (two half semester classes)</td>
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</table>

Total Units: 18

Second Year

<table>
<thead>
<tr>
<th>Units</th>
<th>Fall</th>
<th>Spring</th>
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<tbody>
<tr>
<td>SAGES University Seminar II</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Surveying and Computer Graphics (ECIV 160)</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Computers in Mechanical Engineering (EMAE 250)</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Statics and Strength of Materials (ENGR 200)</td>
<td>3</td>
<td></td>
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<tr>
<td>Calculus for Science and Engineering III (MATH 223)</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>General Physics II - Electricity and Magnetism (PHYS 122)</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Humanities or Social Science</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Strength of Materials (ECIV 310)</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Dynamics (EMAE 181)</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Introduction to Circuits and Instrumentation (ENGR 210)</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Elementary Differential Equations (MATH 224)</td>
<td>3</td>
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</table>

Year Total: 19

Third Year

<table>
<thead>
<tr>
<th>Units</th>
<th>Fall</th>
<th>Spring</th>
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</thead>
<tbody>
<tr>
<td>Humanities or Social Science</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Civil Engineering Materials (ECIV 211)</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Structural Analysis I (ECIV 320)</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Thermodynamics, Fluid Dynamics, Heat and Mass Transfer (ENGR 225)</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Professional Communication for Engineers (ENGR 398)</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>&amp; Professional Communication for Engineers (ENGL 398)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Structural Design I (ECIV 322)</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Soil Mechanics (ECIV 330)</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Engineering Hydraulics and Hydrology (ECIV 351)</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Environmental Engineering (ECIV 368)</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Approved elective</td>
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</table>

Year Total: 19

Fourth Year

<table>
<thead>
<tr>
<th>Units</th>
<th>Fall</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Humanities or Social Science</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Construction Management (ECIV 340)</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Civil Engineering Senior Project (ECIV 398)</td>
<td>3</td>
<td></td>
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<tr>
<td>Approved elective</td>
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<td></td>
</tr>
<tr>
<td>Approved elective</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Humanities or Social Science</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Civil Engineering Systems (ECIV 360)</td>
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<td></td>
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<tr>
<td>Approved Natural Science Elective</td>
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<td></td>
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<tr>
<td>Approved elective</td>
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<td></td>
</tr>
<tr>
<td>Open elective</td>
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</tbody>
</table>

Year Total: 15

Total Units in Sequence: 130

Minor in Civil Engineering

Students enrolled in other majors may elect to pursue a minor in Civil Engineering. A minimum of 15 credit hours is required, as follows:

<table>
<thead>
<tr>
<th>Units</th>
<th>Fall</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENGR 200</td>
<td>Statics and Strength of Materials</td>
<td>3</td>
</tr>
<tr>
<td>12 credit hours from one of the following areas:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Solid Mechanics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ECIV 310</td>
<td>Strength of Materials</td>
<td></td>
</tr>
</tbody>
</table>
ECIV 411  Elasticity, Theory and Applications
ECIV 420  Finite Element Analysis

**Structural & Geotechnical Engineering**

ECIV 211  Civil Engineering Materials
ECIV 320  Structural Analysis I
ECIV 321  Structural Analysis II
ECIV 322  Structural Design I
ECIV 323  Structural Design II
ECIV 330  Soil Mechanics
ECIV 430  Foundation Engineering
ECIV 433  Soil Dynamics

**Construction Engineering and Management**

ECIV 340  Construction Management
ECIV 341  Construction Scheduling and Estimating
ACCT 203  Survey of Accounting
BIFI 355  Corporate Finance
COGS 303  SAGES Departmental Seminar: Current Controversies in Cognitive Science (acct 203)

* Approval of the department is required.

**Minor in Environmental Engineering**

Select a minimum of 15 credit hours from the following list of courses (approval of the department is required):

ENGR 225  Thermodynamics, Fluid Dynamics, Heat and Mass Transfer  4
EEPS 321  Hydrogeology  3
ECIV 351  Engineering Hydraulics and Hydrology  3
ECIV 361  Water Resources Engineering  3
ECIV 362  Solid and Hazardous Waste Management  3
ECIV 368  Environmental Engineering  3
ECIV 460  Environmental Remediation  3

**Graduate Programs**

The graduate programs in structural engineering, geotechnical engineering, engineering mechanics and environmental engineering prepare students for careers in industry, professional practice, research and teaching. Experience has shown that job opportunities are excellent for students who receive advanced degrees in civil engineering from Case Western Reserve University. Recent advanced degree recipients have found positions in universities, consulting firms, state and federal agencies, aerospace firms, and the energy industry.

Each student’s program of course work and research is tailored to his or her interests, in close consultation with the faculty advisor. For students working toward the Master of Science degree plans may include a research oriented thesis, a practice oriented project or only courses plus a comprehensive exam. For students working toward the Doctor of Philosophy degree a research dissertation is required.

The department also encourages undergraduate students to make use of the university’s BS/MS program to pursue advanced studies in Civil Engineering. Undergraduates should apply for the BS/MS program in their junior year so they are able to select senior electives that will also satisfy MS degree requirements. Up to 9 hours of senior electives may be counted in both the BS and MS program thus allowing the student to complete the MS degree in the fifth year of study. Fifth year tuition scholarships may also be available. For more information students should discuss the BS/MS program with their Academic Advisor and/or the department BS/MS program coordinator.

**Facilities**

**Vanderhoof-Schuette Structural Laboratory**

The Vanderhoof-Schuette Structural Laboratory and Educational facility features a 2400 ft² cellular strong floor and a 28 ft. high, L-shaped cellular strong wall. The strong wall includes a vertical cell for testing tall specimens with loads up to 1000kips. A 15-ton crane, a scissors lift, and a forklift truck are available for positioning specimens. A 95 gpm hydraulic pump powers servo-hydraulic actuators for applying static or dynamic forces. The laboratory has a variety of instrumentation and data acquisition equipment. A 6 ft x 6 ft uni-axial shaking table is available for seismic testing of small physical models.

**Strength of Materials Laboratory**

This laboratory is equipped with two MTS servo-hydraulic test systems. One of the MTS systems is capable of applying simultaneous axial and torsional loads. Capabilities include fracture toughness evaluation of various materials, crack growth kinetics under different loading histories and other micromechanics studies. An environmental chamber is available.

**Bingham Concrete Laboratory**

A concrete laboratory is available for undergraduate instruction. It includes screening equipment, a concrete mixer, air-entrainment equipment, a humidity-controlled room for curing concrete, and facilities for prestressing concrete. A 300k MTS servo-hydraulic machine is available for testing concrete and masonry specimens.

**Environmental Engineering Laboratory**

This laboratory is one in a suite of laboratories that support environmental engineering teaching and research. The facilities include a teaching laboratory, an advanced instrumentation laboratory, a remediation research laboratory and an electronic classroom/software laboratory. The Environmental Engineering laboratory is equipped for conventional Standard Methods analysis of water, wastewater, soil, solid waste and air samples (pH meters, furnaces, ovens, incubators, hoods, etc.) and for aerobic microbiology work. The lab also offers generous bench top space for student teams to explore laboratory procedures and provides direct access to research, instrumentation, and computational facilities.

**Environmental Instrumentation Laboratory**

This laboratory is equipped for state-of-the-art analysis of environmental contaminants. The room supports a computer controlled Dionex DX-500 IC/HPLC system, a computer controlled Varian SPECTRAA 200/SIPS 10 (flame & furnace) AA system, and a computer controlled Hewlett Packard 6890 GC/MS analysis system for organic and inorganic pollutant analysis. Where appropriate, machines have been equipped with autosamplers to improve productivity.

**Remediation Research Laboratory**

This laboratory is designed to support physical research on the applied science and design of remediation engineering. The laboratory provides a modeling floor for the assembly of laboratory-scale remediation schemes, and provides immediate access to instrumentation and computational facilities for data analysis.

**Soil Mechanics Laboratory**

This laboratory has a full array of both instructional and research units; notable are automated triaxial units for generalized extension and compression tests, units permitting simultaneous application of hydrostatic, axial, and torsional static and dynamic stresses, a cubical
device for true triaxial testing, units by means of which one-dimensional consolidation in the triaxial cell can be automatically achieved, and various pore pressure force and deformation measuring devices. Tests are monitored and evaluated by data acquisition-computer systems. Also available is a longitudinal and torsional resonant column device and a large size oedometer equipped with bender elements. The laboratory has a SP2000 high speed camera to study dynamic phenomena. A 20 g-tons fully automated centrifuge with a servo-hydraulic earthquake shaker is in operation. The laboratory has a full set of equipment for TDR tests.

**Haptic Research Laboratory**
The haptic interface laboratory hosts two state-of-the-art driving simulators. It provides holistic driving simulations for advanced research, education and training in the area of transportation safety, human perception and human-machine interface.

**Neff Civil Engineering Undergraduate Computer Laboratory**
This laboratory provides Civil Engineering students with access to all the computer resources needed for both course work and research. The laboratory is supplemented by other facilities provided by the university. All of the computers in the Neff lab can act as independent workstations or provide access via a fiber optic link to other campus computers.

**Civil Engineering Study Lounge**
This study area is designed to supplement the computer laboratories with a more quiet workplace for individual or group study.

**ASCE Lounge**
Provides a student controlled venue for hosting American Society of Civil Engineers (ASCE) student chapter activities.

**Miller Library**
The Miller Library named in honor of Graig J. Miller, a former Civil Engineering Faculty member, acts as both a library and as the Department’s premier meeting space.

**Vose Room**
The department also shares use of the Vose Room equipment for meetings and video conferencing.

**Faculty**
Xiangwu (David) Zeng, PhD, PE
(Cambridge University)
*Chair and Frank H. Neff Professor*
Geotechnical earthquake engineering; centrifuge modeling; foundation vibration
Dario A. Gasparini, PhD
(Massachusetts Institute of Technology)
*Professor*
Structures; wind and earthquake engineering; applied random processes; history of engineering
Arthur A. Huckelbridge, DEng, PE
(University of California Berkeley)
*Professor*
Structures, design and dynamics: earthquake engineering, bridge engineering
Aaron A. Jennings, PhD, PE
(University of Massachusetts)
*Professor*
Environmental and geoenvironmental engineering; groundwater contamination; hazardous waste management; uncertainty analysis for environmental models
Brian Metrovich, PhD
(Lehigh University)
*Associate Professor*
Structural engineering, fatigue and fracture mechanics, steel structures, atomistic modeling of failure phenomena, structural health monitoring, and nondestructive evaluation
Michael Pollino, PhD, PE
(University at Buffalo)
*Assistant Professor*
Structural engineering; seismic analysis and design, rehabilitation of structures and civil infrastructure, large scale experimental testing of structural systems and sub-assemblages, structural dynamics, steel structures
Adel S. Saada, PhD, PE
(Princeton University)
*Professor*
Mechanics of materials; static and dynamic mechanical behavior of soils; foundation engineering
Xiong (Bill) Yu, PhD, PE
(Purdue University)
*Associate Professor*
Geotechnical engineering; infrastructure; construction material testing; information technology
Banu Sizirici Yildiz, PhD
(Florida International University)
*Assistant Professor*
Sustainable engineering systems, waste management and concentrate management

**Emeritus Faculty**
J. Ludwig Figueroa, PhD
(University of Illinois)
*Professor Emeritus*

**Adjunct Faculty**
Terrance Cybulski, Adjunct Lecturer
Philip DeSantis, Adjunct Professor
Dan Ghiocel, Adjunct Professor
Kenneth L. Klika, Adjunct Professor
Mark D. Rokoff, Adjunct Assistant Professor
John Stevenson, Adjunct Professor
Lance Wanamaker, Adjunct Lecturer
Katie Wheaton, Adjunct Lecturer
Bart Zalewski, Adjunct Lecturer
Erwin V. Zaretsky, Adjunct Professor

**Staff**
Nancy A. Longo, Department Assistant
Courses

ECIV 160. Surveying and Computer Graphics. 3 Units.
Principles and practice of surveying; error analysis, topographic mapping, introduction to photogrammetry and GIS; principles of graphics; computer-aided-drafting. Laboratory.

ECIV 211. Civil Engineering Materials. 3 Units.

ECIV 300. Undergraduate Research. 3 Units.
Research conducted under the supervision of a sponsoring Civil Engineering faculty member. Research can be done on an independent topic or as part of an established ongoing research activity. The student will prepare a written report on the results of the research. Course may fulfill one technical elective requirement.

ECIV 310. Strength of Materials. 3 Units.

ECIV 320. Structural Analysis I. 3 Units.

ECIV 321. Structural Analysis II. 3 Units.

ECIV 322. Structural Design I. 3 Units.

ECIV 323. Structural Design II. 3 Units.
Continuation of ECIV 322. Collapse limit state analysis/design, torsion of concrete members, reinforcing steel details, compression reinforced flexural members, two-way slabs, slender columns, torsion of steel members, lateral and local buckling of steel members, plate girders, intro to prestressed concrete design and timber design. Recommended preparation: ECIV 320 and ECIV 322.

ECIV 330. Soil Mechanics. 4 Units.
The physical, chemical, and mechanical properties of soils. Soil classification, capillarity, permeability, and flow nets. One dimensional consolidation, stress and settlement analysis. Shear strength, stability of cuts, and design of embankments, retaining walls and footings. Standard laboratory tests performed for the determination of the physical and mechanical properties of soils. Laboratory. Recommended preparation: ECIV 310.

ECIV 340. Construction Management. 3 Units.
Selected topics in construction management including specifications writing, contract documents, estimating, materials and labor, bidding procedures and scheduling techniques. The course is augmented by guest lecturers from local industries.

ECIV 341. Construction Scheduling and Estimating. 3 Units.
The focus is on scheduling, and estimating and bidding for public and private projects. This includes highways as well as industrial and building construction. The use of computers with the latest software in estimating materials, labor, equipment, overhead and profit is emphasized. Recommended preparation: ECIV 340 and consent of instructor.

ECIV 351. Engineering Hydraulics and Hydrology. 3 Units.
Application of fluid statics and dynamics to Civil Engineering Design. Hydraulic machinery, pipe network analysis, thrust, hammer, open channel flow, sewer system design, culverts, flow gauging, retention detention basin design. Applied hydrology, hydrograph analysis and hydraulic routing will also be introduced. Recommended preparation: Concurrent enrollment in ENGR 225.

ECIV 360. Civil Engineering Systems. 3 Units.
Introduction to probability, random variables, and non-deterministic modeling. Decision-making in civil engineering. Engineering economics. Introduction to optimization and linear programming. Reliability analysis.

ECIV 361. Water Resources Engineering. 3 Units.
Water doctrine, probabilistic analysis of hydrologic data, common and rare event analysis, flood forecasting and control, reservoir design, hydrologic routing, synthetic streamflow generation, hydroelectric power, water resource quality, water resources planning. Recommended preparation: ECIV 351.

ECIV 362. Solid and Hazardous Waste Management. 3 Units.

ECIV 368. Environmental Engineering. 3 Units.
Principle and practice of environmental engineering. Water and waste water engineering unit operations and processes including related topics from industrial waste disposal, air pollution and environmental health.

ECIV 396. Civil Engineering Special Topics I. 1 - 3 Unit.
Special topics in civil engineering in which a regular course is not available. Conferences and report.

ECIV 397. Civil Engineering Topics II. 3 Units.
Special topics in civil engineering in which a regular course is not available. Conferences and report.
ECIV 398. Civil Engineering Senior Project. 3 Units.
A project emphasizing research and/or design must be completed by all civil engineers. Requirements include periodic reporting of progress, plus a final oral presentation and written report.

ECIV 400T. Graduate Teaching I. 0 Units.
This series of three courses will provide Ph.D. students with practical experience in teaching at the University level and will expose them to effective teaching methods. Each course assignment will be organized in coordination with the student's dissertation advisor and the department chairperson. Assignments will successively require more contact with students, with duties approaching the teaching requirements of a faculty member in the Ph.D. student's area of study. Prereq: Ph.D. students in Civil Engineering.

ECIV 411. Elasticity, Theory and Applications. 3 Units.

ECIV 420. Finite Element Analysis. 3 Units.
Development and application of finite element methods with emphasis on solid mechanics. Development of truss, beam, shell, and solid elements will be considered. Formulation of isoparametric elements. Meshing and modeling techniques discussed using commercial finite element software. Recommended preparation: ECIV 310 or permission of instructor.

ECIV 421. Advanced Reinforced Concrete Design. 3 Units.
Properties of plain and reinforced concrete, ultimate strength of reinforced concrete structural elements, flexural and shear design of beams, bond and cracking, torsion, moment redistribution, limit analysis, yield line analysis of slabs, direct design and equivalent frame method, columns, fracture mechanics concepts. Recommended preparation: ECIV 322 and consent of instructor.

ECIV 422. Advanced Structural Steel Design. 3 Units.
Selected topics in structural steel design including plastic design, torsion, lateral buckling, torsional-flexural buckling, frame stability, plate girders, and connections, including critical review of current design specifications relating to these topics. Recommended preparation: ECIV 322.

ECIV 423. Prestressed Concrete Design. 3 Units.
Design of prestressed concrete structures, mechanical behavior of concrete suitable for prestressing and prestressing steels, load balancing, partial prestressing, prestressing losses, continuous beams, prestressed slab design, columns. Recommended preparation: ECIV 323 or ECIV 421 and consent of instructor.

ECIV 424. Structural Dynamics. 3 Units.
Modeling of structures as single and multidegree of freedom dynamic systems. The eigenvalue problem, damping, and the behavior of dynamic systems. Deterministic models of dynamic loads such as wind and earthquakes. Analytical methods, including modal, response spectrum, time history, and frequency domain analyses. Recommended preparation: ECIV 321 and consent of instructor.

ECIV 425. Structural Design for Dynamic Loads. 3 Units.
Structural design problems in which dynamic excitations are of importance. Earthquake, wind, blast, traffic, and machinery excitations. Human sensitivity to vibration, mechanical behavior of structural elements under dynamic excitation, earthquake response and earthquake-resistant design, wind loading, damping in structures, hysteretic energy dissipation, and ductility requirements. Recommended preparation: ECIV 424.

ECIV 426. Structural Reliability. 3 Units.

ECIV 430. Foundation Engineering. 3 Units.

ECIV 431. Special Topics in Geotechnical Engineering. 3 Units.

ECIV 432. Mechanical Behavior of Soils. 3 Units.
Soil statics and stresses in a half-space-tridimensional consolidation and sand drain theory; stress-strain relations and representations with rheological models. Critical state and various failure theories and their experimental justification for cohesive and noncohesive soils. Laboratory measurement of rheological properties, pore water pressures, and strength under combined stresses. Laboratory. Recommended preparation: ECIV 330.

ECIV 433. Soil Dynamics. 3 Units.

ECIV 437. Pavement Analysis and Design. 3 Units.
ECIV 450. Environmental Engineering Chemistry. 3 Units.
Fundamentals of inorganic, organic, and physical chemistry with emphasis on the types of problems encountered in the environmental engineering field. Equilibria among liquid, gaseous, and solid phases; kinetics to the extent that time permits. A strong mathematical approach is taken in solving the equilibrium and kinetic problems presented. Equilibrium speciation software for solution of more complex problems. Topics that will be covered in the course include chemical equilibrium, acid/base reactions, mathematical problem solving approach, graphical approaches, titration curves, solubility of gases and solids, buffering systems, numerical solution of equilibrium problems, thermodynamics, oxidation-reduction reactions, principles of quantitative chemistry and analytical techniques, introduction to the use of analytical instrumentation, and chemical kinetics. Prereq: ECIV 368 or requisites not met permission.

ECIV 451. Infrastructure Engineering Practice. 3 Units.
Case studies presenting significant accomplishments in infrastructure engineering presented by distinguished practicing engineers. Case studies will examine the historical development of our infrastructure, assessing cultural value of our built environment, alternate infrastructure models, public empowerment, sustainability, stewardship, financing, legal issues, and concepts for future development of infrastructure systems. Students will write environmental and cultural assessments of specific infrastructure projects.

ECIV 452. Infrastructure Aging and Assessment Technologies. 4 Units.
Mechanical, thermal, and electrochemical processes that cause degradation of our built infrastructure. Reinforced concrete carbonation and freezing and thawing; fatigue, brittle fracture, and corrosion of steel; weathering of masonry; degradation of asphalt pavements; deterioration of underground systems; aging of polymer-based construction products such as sealants and coatings. Assessment technologies, including non-destructive testing and mathematical modeling. Laboratory and field experiences.

ECIV 453. Infrastructure Rehabilitation Design. 4 Units.
Rehabilitation materials and systems; mechanical, electrochemical, thermal, environmental, and aesthetic criteria for decision-making; design principles; specifications and control of construction processes; rehabilitation case studies. Application to structures, pipelines, pavements, and drainage systems.

ECIV 454. Modeling Infrastructure Systems. 4 Units.
Examination of the properties that distinguish infrastructure performance models from more traditional engineering analysis models. Infrastructure software implementation strategies. Application of existing models to problems such as water distribution systems, mass transport, pavement management, and brownfield redevelopment. Development of new models to address infrastructure performance and sustainability.

ECIV 455. Infrastructure Engineering Decision Making. 3 Units.
Aspects of decision theory applied to infrastructure systems. Review of probability and statistics, engineering economics, cost-benefit analysis, impact of social, historical, environmental and government policies on decisions. Emergency management and security considerations. Methods of project financing; asset management and asset optimization.

ECIV 456. Intelligent Infrastructure Systems. 3 Units.
Topics on smart infrastructure systems; smart materials fabrication, embedded sensing technology for infrastructure condition monitoring, the system models for infrastructural condition diagnosing and adaptive controlling, and spatial-temporal integrated infrastructure management system.

ECIV 460. Environmental Remediation. 3 Units.
Evolution of proactive environmental engineering to recover contaminated air, water, and soil environments. Lake and river remediation, contaminated sediments, indoor air quality, chemical spills, underground storage tanks, contaminated soils, solid and hazardous waste sites, superfund remediation. Recommended preparation: ECIV 368 or consent of instructor.

ECIV 500T. Graduate Teaching II. 0 Units.
This series of three courses will provide Ph.D. students with practical experience in teaching at the University level and will expose them to effective teaching methods. Each course assignment will be organized in coordination with the student’s dissertation advisor and the department chairperson. Assignments will successively require more contact with students, with duties approaching the teaching requirements of a faculty member in the Ph.D. student’s area of study. Prereq: Ph.D. student in Civil Engineering.

ECIV 560. Environmental Engineering Modeling. 3 Units.

ECIV 561. Groundwater Analysis. 3 Units.
Principles of mass transport through porous media, formulation of saturated and unsaturated flow equations in alternative coordinate systems, analytical and numerical solutions of flow equations, application of existing groundwater software, analysis of solute transport problems.

ECIV 585. Fracture Mechanics. 3 Units.
Crack tip fields, stress intensity factors, singular solutions, energy changes with crack growth, cohesive zone models, fracture toughness, small scale yielding, experimental techniques, fracture criteria, J-integral, R-curve, fatigue cracks, fracture of composites, dynamic fracture. Recommended preparation: ECIV 405, ECIV 411 and consent of instructor.

ECIV 587. Advanced Mechanics Seminar. 3 Units.
Advanced topics in mechanics of solids. Thermodynamics with internal variables; thermoelasticity; plasticity; gradient theories; finite theories of plasticity; damage mechanics; endochronic plasticity; non-linear fracture mechanics; probabilistic mechanics. Recommended preparation: ECIV 406, ECIV 420, ECIV 505 or consent of instructor.
ECIV 600T. Graduate Teaching III. 0 Units.
This series of three courses will provide Ph.D. students with practical experience in teaching at the University level and will expose them to effective teaching methods. Each course assignment will be organized in coordination with student’s dissertation advisor and the department chairperson. Assignments will successively require more contact with students, with duties approaching the teaching requirements of a faculty member in the Ph.D. student’s area of study. Prereq: Ph.D. students in Civil Engineering.

ECIV 601. Independent Study. 1 - 18 Unit.
Plan B.

ECIV 611. Civil Engineering Graduate Seminar. 0 Units.
Distinguished outside speakers present current research in various topics of Civil Engineering. Graduate students also present technical papers based on thesis research.

ECIV 650. Infrastructure Project. 1 - 6 Unit.
Project based experience in the application of infrastructure engineering principles to a complex infrastructure system.

ECIV 651. Thesis M.S.. 1 - 18 Unit.
Plan A.

ECIV 660. Special Topics. 1 - 18 Unit.
Topics of special interest to students and faculty. Topics can be those covered in a regular course when the student cannot wait for the course to be offered.

Prereq: Predoctoral research consent or advanced to Ph.D. candidacy milestone.
Department of Electrical Engineering and Computer Science

Electrical Engineering and Computer Science (EECS) spans a spectrum of topics from (i) materials, devices, circuits, and processors through (ii) control, signal processing, and systems analysis to (iii) software, computation, computer systems, and networking. The EECS Department at Case Western Reserve supports four synergistic degree programs: Electrical Engineering, Computer Science, Computer Engineering, and Systems & Control Engineering. Each degree program leads to the Bachelor of Science degree at the undergraduate level. The department also offers a Bachelor of Arts in Computer Science for those students who wish to combine a technical degree with a broad education in the liberal arts. At the graduate level, the department offers the Master of Science and Doctor of Philosophy degrees in Electrical Engineering, Computer Engineering, Systems & Control Engineering, and Computing & Information Sciences (i.e., computer science). We offer minors in Electrical Engineering, Computer Science (BS and BA), Computer Engineering, Systems & Control Engineering, and also in Computer Gaming, Artificial Intelligence (AI), and Electronics. For supplemental information to this bulletin as well as the latest updates, please visit the EECS Department web site at http://eecs.case.edu.

EECS is at the heart of modern technology. EECS disciplines are responsible for the devices and microprocessors powering our computers and embedded into everyday devices, from cell phones and tablets to automobiles and airplanes. Healthcare is increasingly building on EECS technologies: micro/nano systems, electronics/instrumentation, implantable systems, wireless medical devices, surgical robots, imaging, medical informatics, bioinformatics, system biology, and data mining and visualization. The future of energy will be profoundly impacted by EECS technologies, from smart appliances connected to the Internet, smart buildings that incorporate distributed sensing and control, to the envisioned smart grid that must be controlled, stabilized, and kept secure over an immense network. EECS drives job creation and starting salaries in our fields are consistently ranked in the top of all college majors. Our graduates work in cutting-edge companies—from giants to start-ups, in a variety of technology sectors, including computer and internet, healthcare and medical devices, manufacturing and automation, automotive and aerospace, defense, finance, energy, and consulting.

Department Structure

EECS at Case Western Reserve is organized internally into two informal divisions: (i) Computer Science (CS); and (ii) Electrical, Computer, and Systems Engineering (ECSE). The chair of EECS is Professor Michael Branicky.

Educational Philosophy

The EECS department is dedicated to developing high-quality graduates who will take positions of leadership as their careers advance. We recognize that the increasing role of technology in virtually every facet of our society, life, and culture makes it vital that our students have access to progressive and cutting-edge higher education programs. The program values for all of the degree programs in the department are:

- mastery of fundamentals
- creativity
- social awareness

- leadership skills
- professionalism

Stressing excellence in these core values helps to ensure that our graduates are valued and contributing members of our global society and that they will carry on the tradition of engineering leadership established by our alumni.

Our goal is to graduate students who have fundamental technical knowledge of their profession and the requisite technical breadth and communications skills to become leaders in creating the new techniques and technologies which will advance their fields. To achieve this goal, the department offers a wide range of technical specialties consistent with the breadth of electrical engineering and computer science, including recent developments in the field. Because of the rapid pace of advancement in these fields, our degree programs emphasize a broad and foundational science and technology background that equips students for future developments. Our programs include a wide range of electives and our students are encouraged to develop individualized programs which can combine many aspects of electrical engineering and computer science.

Research

The research thrusts of the Electrical Engineering and Computer Science department include:

1. Micro/Nano Systems
2. Electronics and Instrumentation
3. Robotics and Haptics
4. Embedded Systems, including VLSI, FPGA
6. Bioinformatics and Systems Biology
7. Machine Learning and Data Mining
8. Computer Networks and Distributed Systems
9. Secure and Reliable Software
10. Energy Systems, including Wind and Power Grid Management/Control
11. Gaming, Simulation, Optimization
12. Medical Informatics and Wireless Health

EECS participates in a number of groundbreaking collaborative research and educational programs, including the Microelectromechanical Systems Research Program, the Center for Computational Genomics, graduate program in Systems Biology and Bioinformatics, the Clinical & Translational Science Collaborative, the Great Lakes Energy Institute, and the VA Center for Advanced Platform Technology.

Electrical Engineering | Systems and Control Engineering | Computer Engineering | Computer Science | Suggested Programs of Study

Undergraduate Programs

The EECS department engineering offers accredited programs leading to BS degrees in:

1. Electrical Engineering
2. Systems and Control Engineering
3. Computer Engineering
4. Computer Science

These programs provide students with a strong background in the fundamentals of mathematics, science, and engineering. Students
can use their technical and open electives to pursue concentrations in
bioelectrical engineering, complex systems, automation and control,
digital systems design, embedded systems, micro/nano systems, robotics
and intelligent systems, signal processing and communications, and
software engineering. In addition to an excellent technical education,
all students in the department are exposed to societal issues, ethics,
professionalism, and have the opportunity to develop leadership and
creativity skills.

The Bachelor of Science degree programs in Computer Engineering,
Electrical Engineering, and Systems and Control Engineering are
accredited by the Engineering Accreditation Commission of ABET,

The Bachelor of Science degree program in Computer Science is
accredited by the Computing Accreditation Commission of ABET,

**Electrical Engineering**

The Bachelor of Science program in electrical engineering provides
our students with a broad foundation in electrical engineering through
combined classroom and laboratory work, and prepares our students for
entering the profession of electrical engineering, as well as for further
study at the graduate level.

The educational mission of the electrical engineering program is to
graduate students who have fundamental technical knowledge of their
profession and the requisite technical breadth and communications skills
to become leaders in creating the new techniques and technologies that
will advance the general field of electrical engineering.

**Educational Objectives**

1. Graduates will be successful professionals obtaining positions
   appropriate to their background, interests, and education.
2. Graduates will engage in life-long learning.
3. Graduates employed within engineering fields will demonstrate
techical competence such as identifying, formulating, analyzing,
and creating engineering solutions using appropriate current
engineering techniques, skills, and tools.
4. Graduates will be able to (i) effectively communicate technical
   information, (ii) function effectively on teams, and (iii) develop and
   apply electrical engineering solutions within a global, societal, and
   environmental context.

**Student Outcomes**

As preparation for achieving the above educational objectives, the BS
degree program in Electrical Engineering is designed so that students attain:

- an ability to apply knowledge of mathematics, science, and
  engineering
- an ability to design and conduct experiments, as well as to analyze
  and interpret data
- an ability to design a system, component, or process to meet desired
  needs within realistic constraints such as economic, environmental,
  social, political, ethical, health and safety, manufacturability, and
  sustainability
- an ability to function on multi-disciplinary teams
- an ability to identify, formulate, and solve engineering problems
- an understanding of professional and ethical responsibility
- an ability to communicate effectively
- the broad education necessary to understand the impact of
  engineering solutions in a global, economic, environmental, and
  societal context
- a recognition of the need for, and an ability to engage in life-long
  learning
- a knowledge of contemporary issues
- an ability to use the techniques, skills, and modern engineering tools
  necessary for engineering practice.

Core courses provide our students with a strong background in signals
and systems, computers, electronics (both analog and digital), and
semiconductor devices. Students are required to develop depth in at
least one of the following technical areas: electromagnetics, signals and
systems, solid state, computer hardware, computer software, control, and
circuits. Each electrical engineering student must complete the following
requirements.

**Major in Electrical Engineering**

**Major Requirements**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
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</thead>
<tbody>
<tr>
<td>EECS 245</td>
<td>Electronic Circuits</td>
<td>4</td>
</tr>
<tr>
<td>EECS 246</td>
<td>Signals and Systems</td>
<td>4</td>
</tr>
<tr>
<td>EECS 281</td>
<td>Logic Design and Computer Organization</td>
<td>4</td>
</tr>
<tr>
<td>EECS 309</td>
<td>Electromagnetic Fields I</td>
<td>3</td>
</tr>
<tr>
<td>EECS 321</td>
<td>Semiconductor Electronic Devices</td>
<td>4</td>
</tr>
<tr>
<td>EECS 398</td>
<td>Engineering Projects I</td>
<td>4</td>
</tr>
<tr>
<td>EECS 399</td>
<td>Engineering Projects II</td>
<td>3</td>
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**Area I: Signals & Systems**

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>EECS 246</td>
<td>Signals and Systems</td>
<td>4</td>
</tr>
<tr>
<td>EECS 313</td>
<td>Signal Processing</td>
<td>3</td>
</tr>
<tr>
<td>EECS 351</td>
<td>Communications and Signal Analysis</td>
<td>3</td>
</tr>
<tr>
<td>EECS 354</td>
<td>Digital Communications</td>
<td>3</td>
</tr>
<tr>
<td>EECS 381</td>
<td>Hybrid Systems</td>
<td>3</td>
</tr>
</tbody>
</table>

**Breadth Requirement**

<table>
<thead>
<tr>
<th>Course</th>
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<th>Units</th>
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</thead>
<tbody>
<tr>
<td>ENGR 131</td>
<td>Elementary Computer Programming</td>
<td>3</td>
</tr>
<tr>
<td>ENGR 210</td>
<td>Introduction to Circuits and Instrumentation</td>
<td>4</td>
</tr>
<tr>
<td>EECS 281</td>
<td>Logic Design and Computer Organization</td>
<td>4</td>
</tr>
<tr>
<td>EECS 245</td>
<td>Electronic Circuits</td>
<td>4</td>
</tr>
<tr>
<td>EECS 246</td>
<td>Signals and Systems</td>
<td>4</td>
</tr>
<tr>
<td>EECS 309</td>
<td>Electromagnetic Fields I</td>
<td>3</td>
</tr>
<tr>
<td>STAT 332</td>
<td>Statistics for Signal Processing</td>
<td>3</td>
</tr>
<tr>
<td>EECS 321</td>
<td>Semiconductor Electronic Devices</td>
<td>4</td>
</tr>
<tr>
<td>EECS 398</td>
<td>Engineering Projects I</td>
<td>4</td>
</tr>
<tr>
<td>EECS 399</td>
<td>Engineering Projects II</td>
<td>3</td>
</tr>
</tbody>
</table>

**Total Units** 36

**Depth Requirement**

Each student must show a depth of competence in one technical area by
taking at least three courses from one of the following seven areas. This
depth requirement may be met using a combination of the above core
courses and a selection of open and technical electives.

**Area I: Signals & Systems**

<table>
<thead>
<tr>
<th>Course</th>
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<td>Digital Communications</td>
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</tr>
<tr>
<td>EECS 381</td>
<td>Hybrid Systems</td>
<td>3</td>
</tr>
</tbody>
</table>
Area II: Computer Software
EECS 233 Introduction to Data Structures 4
EECS 337 Compiler Design 4
EECS 338 Introduction to Operating Systems 4
EECS 393 Software Engineering 3

Area III: Solid State
EECS 321 Semiconductor Electronic Devices 4
EMSE 314 Electrical, Magnetic, and Optical Properties of Materials 3
EECS 322 Integrated Circuits and Electronic Devices 3
EECS 415 Integrated Circuit Technology I 3

Area IV: Control
EECS 304 Control Engineering I with Laboratory 3
EECS 346 Engineering Optimization 3
EECS 381 Hybrid Systems 3
EECS 483 Data Acquisition and Control 3

Area V: Circuits
EECS 245 Electronic Circuits 4
EBME 310 Principles of Biomedical Instrumentation 3
EECS 344 Electronic Analysis and Design 3
EBME 418 Electronics for Biomedical Engineering 3
EECS 426 MOS Integrated Circuit Design 3

Area VI: Computer Hardware
EECS 281 Logic Design and Computer Organization 4
EECS 301 Digital Logic Laboratory 2
EECS 314 Computer Architecture 3
EECS 315 Digital Systems Design 4
EECS 316 Computer Design 3
EECS 318 VLSI/CAD 4

Statistics Requirement
STAT 332 Statistics for Signal Processing * 3
One of the following: 3
EECS 313 Signal Processing
EECS 351 Communications and Signal Analysis
EECS 354 Digital Communications
Another class approved by advisor

* STAT 333 Uncertainty in Engineering and Science may be substituted with approval of advisor

Design Requirement
EECS 398 Engineering Projects I 4
EECS 399 Engineering Projects II 3

Cooperative Education Program in Electrical Engineering
There are many excellent Cooperative Education (CO-OP) opportunities for electrical engineering majors. A CO-OP student does two CO-OP assignments in industry or government. The length of each assignment is a semester plus a summer which is enough time for a student to complete a significant engineering project. The CO-OP program takes five years to complete because the student is typically gone from campus for two semesters.

BS/MS Program in Electrical Engineering
The department encourages highly motivated and qualified students to apply for admission to the five-year BS/MS Program in the junior year. This integrated program, which permits substitution of MS thesis work for the senior design project, provides a high level of fundamental training and in-depth advanced training in the student's selected specialty. It also offers the opportunity to complete both the Bachelor of Science in Engineering and Master of Science degrees within five years.

Minor in Electrical Engineering
Students enrolled in degree programs in other engineering departments can have a minor specialization by completing the following courses:
EECS 245 Electronic Circuits 4
EECS 246 Signals and Systems 4
EECS 281 Logic Design and Computer Organization 4
EECS 309 Electromagnetic Fields I 3
Approved technical elective 3
Total Units 18

Minor in Electronics
The department also offers a minor in electronics for students in the College of Arts and Sciences. This program requires the completion of 31 credit hours, of which 10 credit hours may be used to satisfy portions of the students’ skills and distribution requirements. The following courses are required for the electronics minor:
MATH 125 Math and Calculus Applications for Life, Managerial, and Social Sci I 4
MATH 126 Math and Calculus Applications for Life, Managerial, and Social Sci II 4
PHYS 115 Introductory Physics I 4
PHYS 116 Introductory Physics II 4
ENGR 131 Elementary Computer Programming 3
ENGR 210 Introduction to Circuits and Instrumentation 4
EECS 246 Signals and Systems 4
EECS 281 Logic Design and Computer Organization 4
Total Units 31

Systems and Control Engineering
The Bachelor of Science program in systems and control engineering provides our students with the basic concepts, analytical tools, and engineering methods which are needed in analyzing and designing complex technological and non-technological systems. Problems relating to modeling, decision-making, control, and optimization are studied. Some examples of systems problems which are studied include: modeling and analysis of complex energy, environmental, and biological systems; computer control of industrial plants; developing world models for studying environmental policies; and optimal planning and management in large-scale systems. In each case, the relationship and interaction among the various components of a given system must
be modeled. This information is used to determine the best way of coordinating and regulating these individual contributions to achieve the overall goal of the system.

Major in Systems and Control Engineering

The mission of the Systems and Control Engineering program is to provide internationally recognized excellence for graduate and undergraduate education and research in systems analysis, design, and control. These theoretical and applied areas require cross-disciplinary tools and methods for their solution.

Educational Objectives

1. Graduates will understand multidisciplinary phenomena using systems methodology as demonstrated by their ability to deal with technical, social, political and economic issues.
2. Graduates will use systems understanding, critical thinking and problem solving skills to analyze and design engineering systems or processes that respond to technical and societal needs as demonstrated by their measured professional accomplishments in industry, government and research.
3. Graduates will facilitate multidisciplinary projects that bring together practitioners of various engineering fields in an effective, professional, and ethical manner as demonstrated by their teamwork, leadership, communication, and management skills.

Student Outcomes

As preparation for achieving the above educational objectives, the BS degree program in Systems and Control Engineering is designed so that students attain:

- an ability to apply knowledge of mathematics, science, and engineering
- an ability to design and conduct experiments, as well as to analyze and interpret data
- an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
- an ability to function on multi-disciplinary teams
- an ability to identify, formulate, and solve engineering problems
- an understanding of professional and ethical responsibility
- an ability to communicate effectively
- the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
- a recognition of the need for, and an ability to engage in life-long learning
- a knowledge of contemporary issues
- an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

There are four elective sequences available within the BS program in systems and control engineering curriculum that represent the breadth of the discipline:

Area: 1 Dynamic Systems, Control and Signal Processing

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 201</td>
<td>Introduction to Linear Algebra</td>
<td>3</td>
</tr>
<tr>
<td>EECS 351</td>
<td>Communications and Signal Analysis</td>
<td>3</td>
</tr>
<tr>
<td>EECS 381</td>
<td>Hybrid Systems</td>
<td>3</td>
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</tbody>
</table>

Area: 2 Systems Biology and Complex Systems Analysis

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 201</td>
<td>Introduction to Linear Algebra</td>
<td>3</td>
</tr>
<tr>
<td>EECS 381</td>
<td>Hybrid Systems</td>
<td>3</td>
</tr>
<tr>
<td>EECS 391</td>
<td>Introduction to Artificial Intelligence</td>
<td>3</td>
</tr>
<tr>
<td>EECS 396</td>
<td>Independent Projects</td>
<td>1</td>
</tr>
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<td></td>
<td>6</td>
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<tr>
<td>EECS 408</td>
<td>Introduction to Linear Systems</td>
<td>3</td>
</tr>
<tr>
<td>EECS 416</td>
<td>Convex Optimization for Engineering</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 325</td>
<td>Cell Biology</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 250</td>
<td>Introduction to Cell and Molecular Biology Systems</td>
<td>3</td>
</tr>
</tbody>
</table>

Area: 3 Manufacturing, Robotics and Operational Systems

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>EECS 350/450</td>
<td>Operations and Systems Design</td>
<td>3</td>
</tr>
<tr>
<td>EECS 360/460</td>
<td>Manufacturing and Automated Systems</td>
<td>3</td>
</tr>
<tr>
<td>EECS 489</td>
<td>Robotics I</td>
<td>3</td>
</tr>
<tr>
<td>OPMT 450</td>
<td>Project Management</td>
<td>3</td>
</tr>
<tr>
<td>OPMT 420</td>
<td>Six Sigma and Quality Management</td>
<td>3</td>
</tr>
<tr>
<td>OPMT 476</td>
<td>Strategic Sourcing</td>
<td>3</td>
</tr>
<tr>
<td>OPMT 477</td>
<td>Enterprise Resource Planning in the Supply Chain</td>
<td>3</td>
</tr>
</tbody>
</table>

Area: 4 Information Systems

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>EECS 233</td>
<td>Introduction to Data Structures</td>
<td>4</td>
</tr>
<tr>
<td>EECS 325</td>
<td>Computer Networks I</td>
<td>3</td>
</tr>
<tr>
<td>EECS 381</td>
<td>Hybrid Systems</td>
<td>3</td>
</tr>
<tr>
<td>EECS 391</td>
<td>Introduction to Artificial Intelligence</td>
<td>3</td>
</tr>
<tr>
<td>EECS 484</td>
<td>Computational Intelligence I: Basic Principles</td>
<td>3</td>
</tr>
<tr>
<td>EECS 491</td>
<td>Artificial Intelligence</td>
<td>3</td>
</tr>
</tbody>
</table>

Cooperative Education Program in Systems and Control Engineering

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BS/MS Program in Systems and Control Engineering

The department encourages highly motivated and qualified students to apply for admission to the five-year BS/MS Program in the junior year. This integrated program, which permits substitution of MS thesis work for the senior design project, provides a high level of fundamental training and in-depth advanced training in the student’s selected specialty. It also offers the opportunity to complete both the Bachelor of Science in Engineering and Master of Science degrees within five years.

Minor in Systems and Control Engineering

A total of five courses (15 credit hours) are required to obtain a minor in systems and control engineering. At least 9 credit hours must be selected from:

- EECS 401 Digital Signal Processing
- EECS 408 Introduction to Linear Systems
- EECS 416 Convex Optimization for Engineering
- EECS 452 Random Signals
- EECS 483 Data Acquisition and Control
- EECS 489 Robotics I
Educational Objectives

1. Graduates will be successful professionals obtaining positions appropriate to their background, interests, and education.
2. Graduates will engage in life-long learning.
3. Graduates employed within engineering fields will demonstrate technical competence such as identifying, formulating, analyzing, and creating engineering solutions using appropriate current engineering techniques, skills, and tools.
4. Graduates will be able to (i) effectively communicate technical information, (ii) function effectively on teams, and (iii) develop and apply computer engineering solutions within a global, societal, and environmental context.

Student Outcomes

As preparation for achieving the above educational objectives, the BS degree program in Computer Engineering is designed so that students attain:

- an ability to apply knowledge of mathematics, science, and engineering
- an ability to design and conduct experiments, as well as to analyze and interpret data
- an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
- an ability to function on multi-disciplinary teams
- an ability to identify, formulate, and solve engineering problems
- an understanding of professional and ethical responsibility
- an ability to communicate effectively
- the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
- a recognition of the need for, and an ability to engage in life-long learning
- a knowledge of contemporary issues
- an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Computer Engineering

The Bachelor of Science program in Computer Engineering is designed to give a student a strong background in the fundamentals of computer engineering through combined classroom and laboratory work. A graduate of this program will be able to use these fundamentals to analyze and evaluate computer systems, both hardware and software. A computer engineering graduate would also be able to design and implement a computer system for general purpose or embedded computing incorporating state-of-the-art solutions to a variety of computing problems. This includes systems which have both hardware and software component, whose design requires a well-defined interface between the two, and the evaluation of the associated trade-offs.

The educational mission of the computer engineering program is to graduate students who have fundamental technical knowledge of their profession along with requisite technical breadth and communications skills to become leaders in creating the new techniques and technologies which will advance the general field of computer engineering. Core courses provide our students with a strong background in digital systems design, computer organization, hardware architecture, and digital electronics.

Educational Objectives

1. Graduates will be successful professionals obtaining positions appropriate to their background, interests, and education.
2. Graduates will engage in life-long learning.
3. Graduates employed within engineering fields will demonstrate technical competence such as identifying, formulating, analyzing, and creating engineering solutions using appropriate current engineering techniques, skills, and tools.
4. Graduates will be able to (i) effectively communicate technical information, (ii) function effectively on teams, and (iii) develop and apply computer engineering solutions within a global, societal, and environmental context.

Student Outcomes

As preparation for achieving the above educational objectives, the BS degree program in Computer Engineering is designed so that students attain:

- an ability to apply knowledge of mathematics, science, and engineering
- an ability to design and conduct experiments, as well as to analyze and interpret data
- an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
- an ability to function on multi-disciplinary teams
- an ability to identify, formulate, and solve engineering problems
- an understanding of professional and ethical responsibility
- an ability to communicate effectively
- the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
- a recognition of the need for, and an ability to engage in life-long learning
- a knowledge of contemporary issues
- an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Major in Computer Engineering

Major Requirements

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>EECS 132</td>
<td>Introduction to Programming in Java</td>
<td>3</td>
</tr>
<tr>
<td>ENGR 210</td>
<td>Introduction to Circuits and Instrumentation</td>
<td>4</td>
</tr>
<tr>
<td>EECS 233</td>
<td>Introduction to Data Structures</td>
<td>4</td>
</tr>
<tr>
<td>EECS 281</td>
<td>Logic Design and Computer Organization</td>
<td>4</td>
</tr>
<tr>
<td>EECS 301</td>
<td>Digital Logic Laboratory</td>
<td>2</td>
</tr>
<tr>
<td>EECS 302</td>
<td>Discrete Mathematics</td>
<td>3</td>
</tr>
<tr>
<td>EECS 314</td>
<td>Computer Architecture</td>
<td>3</td>
</tr>
<tr>
<td>EECS 315</td>
<td>Digital Systems Design</td>
<td>4</td>
</tr>
<tr>
<td>EECS 337</td>
<td>Compiler Design</td>
<td>4</td>
</tr>
<tr>
<td>EECS 318</td>
<td>VLSI/CAD</td>
<td>4</td>
</tr>
<tr>
<td>EECS 338</td>
<td>Introduction to Operating Systems</td>
<td>4</td>
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</tbody>
</table>

Statistics Requirement

One Statistics elective may be chosen from:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>MATH 380</td>
<td>Introduction to Probability</td>
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</tr>
<tr>
<td>STAT 312</td>
<td>Basic Statistics for Engineering and Science</td>
<td>3</td>
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<td>STAT 313</td>
<td>Statistics for Experimenters</td>
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<tr>
<td>STAT 332</td>
<td>Statistics for Signal Processing</td>
<td>3</td>
</tr>
<tr>
<td>STAT 333</td>
<td>Uncertainty in Engineering and Science</td>
<td>3</td>
</tr>
</tbody>
</table>

Design Requirement

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>EECS 398</td>
<td>Engineering Projects I</td>
<td>4</td>
</tr>
</tbody>
</table>

In consultation with a faculty advisor, a student completes the program by selecting technical and open elective courses that provide in-depth training in principles and practice of computer engineering. With the approval of the advisor a student may emphasize a specialty of his/her choice by selecting elective courses from other programs or departments.

Many courses have integral or associated laboratories in which students gain “hands-on” experience with computer engineering principles and instrumentation. Students have ready access to the teaching laboratory facilities and are encouraged to use them during nonscheduled hours in addition to the regularly scheduled laboratory sessions. Opportunities also exist for undergraduate student participation in the wide spectrum of research projects being conducted in the department.
Cooperative Education Program in Computer Engineering

There are many excellent Cooperative Education (CO-OP) opportunities for computer engineering majors. A CO-OP student does two CO-OP assignments in industry or government. The length of each assignment is a semester plus a summer which is enough time for the student to complete a significant computing project. The CO-OP program takes five years to complete because the student is typically gone from campus for two semesters.

BS/MS Program in Computer Engineering

Highly motivated and qualified students are encouraged to apply to the BS/MS Program which will allow them to get both degrees in five years. The BS can be in Computer Engineering or a related discipline, such as mathematics or electrical engineering. Integrating graduate study in computer engineering with the undergraduate program allows a student to satisfy all requirements for both degrees in five years.

Minor in Computer Engineering

The department also offers a minor in computer engineering. The minor has a required two course sequence followed by a two course sequence in either hardware or software aspects of computer engineering. The following two courses are required for any minor in computer engineering:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>EECS 281</td>
<td>Logic Design and Computer Organization</td>
<td>4</td>
</tr>
<tr>
<td>EECS 233</td>
<td>Introduction to Data Structures</td>
<td>4</td>
</tr>
</tbody>
</table>

Students should note that EECS 132 Introduction to Programming in Java is a prerequisite for EECS 233 Introduction to Data Structures.

The two-course hardware sequence is:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>EECS 314</td>
<td>Computer Architecture</td>
<td>3</td>
</tr>
<tr>
<td>EECS 315</td>
<td>Digital Systems Design</td>
<td>4</td>
</tr>
</tbody>
</table>

The corresponding two-course software sequence is:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>EECS 337</td>
<td>Compiler Design</td>
<td>4</td>
</tr>
<tr>
<td>EECS 338</td>
<td>Introduction to Operating Systems</td>
<td>4</td>
</tr>
</tbody>
</table>

In addition to these two standard sequences, a student may design his/her own depth area with the approval of the minor advisor. A student cannot have a major and a minor, or two minors, in both Computer Engineering and Computer Science because of the significant overlap between these subjects.

Computer Science

Bachelor of Science in Computer Science

The Bachelor of Science program in Computer Science is designed to give a student a strong background in the fundamentals of mathematics and computer science. A graduate of this program should be able to use these fundamentals to analyze and evaluate software systems and the underlying abstractions upon which they are based. A graduate should also be able to design and implement software systems which are state-of-the-art solutions to a variety of computing problems; this includes problems which are sufficiently complex to require the evaluation of design alternatives and engineering trade-offs. In addition to these program specific objectives, all students in the Case School of Engineering are exposed to societal issues, professionalism, and are provided opportunities to develop leadership skills.

Our mission is to graduate students who have fundamental technical knowledge of their profession and the requisite technical breadth and communications skills to become leaders in creating the new techniques and technologies which will advance the field of computer science.

Educational Objectives

1. To educate and train students in the fundamentals of computer science and mathematics, in order to analyze and solve computing problems, as demonstrated by their professional accomplishments in industry, government and graduate programs and measured within three to five years after graduation.
2. To educate students with an understanding of real-world computing needs, as demonstrated by their ability to address technical issues involving computing problems encountered in industry, government and graduate programs and measured within three to five years after graduation.
3. To train students to work effectively, professionally and ethically in computing-related professions, as demonstrated by their communications, teamwork and leadership skills in industry, government and graduate programs and measured within three to five years after graduation.

Student Outcomes

As preparation for achieving the above educational objectives, the BS degree program in Computer Science is designed so that students attain:

- An ability to apply knowledge of computing and mathematics appropriate to the discipline
- An ability to analyze a problem, and identify and define the computing requirements appropriate to its solution
- An ability to design, implement, and evaluate a computer-based system, process, component, or program to meet desired needs
- An ability to function effectively on teams to accomplish a common goal
- An understanding of professional, ethical, and social responsibilities
- An ability to communicate effectively
- An ability to analyze the impact of computing on individuals, organizations, and society, including ethical, legal, security, and global policy issues
- Recognition of the need for and an ability to engage in continuing professional development
- An ability to use current techniques, skills, and tools necessary for computing practice
- An ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer-based systems in a way that demonstrates comprehension of the tradeoffs involved in design choices
- An ability to apply design and development principles in the construction of software systems of varying complexity

Bachelor of Arts in Computer Science

The Bachelor of Arts program in Computer Science is a combination of a liberal arts program and a computing major. It is a professional program in the sense that graduates can be employed as computer professionals, but it is less technical than the Bachelor of Science program in Computer Science. This degree is particularly suitable for students with a wide range of interests. For example, students can major in another discipline in addition to computer science and routinely complete all of the requirements for the double major in a 4 year period. This is possible because over a third of the courses in the program are open electives. Furthermore, if a student is majoring in computer science and a second technical field such as mathematics or physics many of
the technical electives will be accepted for both majors. Another example of the utility of this program is that it routinely allows students to major in computer science and take all of the pre-med courses in a four-year period.

Cooperative Education Program in Computer Science

There are many excellent Cooperative Education (CO-OP) opportunities for computer science majors. A CO-OP student does two CO-OP assignments in industry or government. The length of each assignment is a semester plus a summer which is enough time for the student to complete a significant computing project. The CO-OP program takes five years to complete because the student is typically gone from campus for two semesters.

BS/MS Program in Computer Science

Students with a grade point average of 3.2 or higher are encouraged to apply to the BS/MS Program which will allow them to get both degrees in five years. The BS can be in Computer Science or a related discipline, such as mathematics or electrical engineering. Integrating graduate study in computer science with the undergraduate program allows a student to satisfy all requirements for both degrees in five years.

Minor in Computer Science (BS or BSE)

For students pursuing a BS or BSE degree, the following three courses are required for a minor in computer science:

- EECS 233  Introduction to Data Structures  4
- EECS 338  Introduction to Operating Systems  4
- EECS 340  Algorithms and Data Structures  3

A student must take an additional 4 credit hours of computing courses with the exclusion of EECS 132 Introduction to Programming in Java and ENGR 131 Elementary Computer Programming. EECS 302 Discrete Mathematics may be used in place of three of these credit hours since it is a prerequisite for EECS 340 Algorithms and Data Structures. Students should note that EECS 132 Introduction to Programming in Java is a prerequisite for EECS 233 Introduction to Data Structures.

Minor in Computer Science (BA)

For students pursuing BA degrees, the following courses are required for a minor in computer science:

- EECS 132  Introduction to Programming in Java  3
- EECS 233  Introduction to Data Structures  4
- MATH 125  Math and Calculus Applications for Life, Managerial, and Social Sci  4

Two additional computing courses are also required for this minor.

Bachelor of Science in Engineering

Suggested Program of Study: Major in Electrical Engineering

<table>
<thead>
<tr>
<th>First Year</th>
<th>Units</th>
<th>Fall</th>
<th>Spring</th>
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<tbody>
<tr>
<td>SAGES First Year Seminar</td>
<td>4</td>
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<tr>
<td>Principles of Chemistry for Engineers (CHEM 111)</td>
<td>4</td>
<td></td>
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<tr>
<td>Calculus for Science and Engineering I (MATH 121)</td>
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<td></td>
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</tr>
<tr>
<td>Elementary Computer Programming (ENGR 131)</td>
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<tr>
<td>Open elective</td>
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</tr>
<tr>
<td>PHED (2 half semester courses)</td>
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<tr>
<td>SAGES University Seminar</td>
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Second Year | Units | Fall | Spring |
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<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>General Physics I - Mechanics (PHYS 121)</td>
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<td>Calculus for Science and Engineering II (MATH 122)</td>
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<td>Logic Design and Computer Organization (EECS 281)</td>
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Third Year | Units | Fall | Spring |
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<tbody>
<tr>
<td>HM/SS elective</td>
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<td>3</td>
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<tr>
<td>Statistics for Signal Processing (STAT 332)</td>
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<td>Statics and Strength of Materials (ENGR 200)</td>
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<td>Signals and Systems (EECS 246)</td>
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<td>Semiconductor Electronic Devices (EECS 321)</td>
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Fourth Year | Units | Fall | Spring |
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<th></th>
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</thead>
<tbody>
<tr>
<td>HM/SS elective</td>
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</tr>
<tr>
<td>Engineering Projects I (EECS 398)</td>
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<tr>
<td>Open elective</td>
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<tr>
<td>Professional Communication for Engineers (ENGR 398)</td>
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<tr>
<td>Professional Communication for Engineers (ENGR 398)</td>
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<td>Approved technical elective</td>
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<td>Year Total:</td>
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</table>

Total Units in Sequence: 128

Hours Required for Graduation: 128
### Bachelor of Science in Engineering Suggested Program of Study: Major in Systems and Control Engineering

#### First Year

<table>
<thead>
<tr>
<th>Course</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>SAGES First Year Seminar</td>
<td>4</td>
</tr>
<tr>
<td>Principles of Chemistry for Engineers (CHEM 111)</td>
<td>4</td>
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<tr>
<td>Calculus for Science and Engineering I (MATH 121)</td>
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<td>Elementary Computer Programming (ENGR 131)</td>
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<tr>
<td>PHED (2 half semester courses)</td>
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</tr>
<tr>
<td>SAGES University Seminar</td>
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<tr>
<td>General Physics I - Mechanics (PHYS 121)</td>
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<td>Calculus for Science and Engineering II (MATH 122)</td>
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<td>Chemistry of Materials (ENGR 145)</td>
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#### Second Year

<table>
<thead>
<tr>
<th>Course</th>
<th>Units</th>
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</thead>
<tbody>
<tr>
<td>General Physics II - Electricity and Magnetism (PHYS 122)</td>
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<tr>
<td>Calculus for Science and Engineering III (MATH 223)</td>
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</tr>
<tr>
<td>Introduction to Circuits and Instrumentation (ENGR 210)</td>
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</table>

#### Third Year

<table>
<thead>
<tr>
<th>Course</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>HM/SS elective</td>
<td>3</td>
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<tr>
<td>Signals and Systems (EECS 246)</td>
<td>4</td>
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<tr>
<td>Simulation Techniques in Engineering (EECS 324)</td>
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<td>Introduction to Global Issues (EECS 342)</td>
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<td>Control Engineering I with Laboratory (EECS 304)</td>
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<td>Engineering Optimization (EECS 346)</td>
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#### Fourth Year

<table>
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<th>Course</th>
<th>Units</th>
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<tr>
<td>HM/SS elective</td>
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<td>Professional Communication for Engineers (ENGL 398)</td>
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<td>Engineering Economics and Decision Analysis (EECS 352)</td>
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<td>Engineering Projects I (EECS 398)</td>
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<tr>
<td>Engineering Projects II (EECS 399)</td>
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<tr>
<td><strong>Year Total:</strong></td>
<td><strong>15</strong></td>
</tr>
</tbody>
</table>

#### Total Units in Sequence: 128

#### Hours Required for Graduation: 128

b. Selected students may be invited to take PHYS 123 Physics and Frontiers I - Mechanics and PHYS 124 Physics and Frontiers II - Electricity and Magnetism in place of PHYS 121 General Physics I - Mechanics and PHYS 122 General Physics II - Electricity and Magnetism.


d. CO-OP students may obtain design credit for one semester of Engineering Projects if their co-op assignment included significant design responsibility; however, the student is still responsible for such course obligations as reports, presentations, and ethics assignments. Design credit and fulfillment of remaining course responsibilities are arranged through the course instructor.
Signal Processing or Communication Systems technical elective to be taken in any semester after EECS 246 Signals and Systems. This elective should be chosen from EECS 313 Signal Processing, EECS 351 Communications and Signal Analysis, or EECS 354 Digital Communications.

Technical electives from an approved list.

Bachelor of Science in Engineering

Suggested Program of Study: Major in Computer Engineering

First Year

<table>
<thead>
<tr>
<th>Units</th>
<th>Fall</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>SAGES First Year Seminar</td>
<td>4</td>
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<td>Principles of Chemistry for Engineers (CHEM 111)</td>
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<td>Introduction to Programming in Java (EECS 132)</td>
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Second Year

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<td>Introduction to Data Structures (EECS 233)</td>
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Third Year

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<tr>
<td>HM/SS elective</td>
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<tr>
<td>Discrete Mathematics (EECS 302)</td>
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<tr>
<td>Thermodynamics, Fluid Dynamics, Heat and Mass Transfer (ENGR 225)</td>
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<td>Professional Communication for Engineers (ENGR 396)</td>
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<td>Digital Logic Laboratory (EECS 301)</td>
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<td>Computer Architecture (EECS 314)</td>
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<td>Digital Systems Design (EECS 315)</td>
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<tr>
<td>Introduction to Operating Systems (EECS 338) (or Technical elective)</td>
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Fourth Year

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Bachelor of Science

Suggested Program of Study: Major in Computer Science

First Year

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<tr>
<td>SAGES First Year Seminar</td>
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<tr>
<td>Principles of Chemistry for Engineers (CHEM 111)</td>
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<tr>
<td>Calculus for Science and Engineering I (MATH 121)</td>
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<tr>
<td>Introduction to Programming in Java (EECS 132)</td>
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<td>SAGES University Seminar</td>
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<tr>
<td>General Physics I - Mechanics (PHYS 121)</td>
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<tr>
<td>Calculus for Science and Engineering II (MATH 122)</td>
<td>4</td>
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</tr>
<tr>
<td>Chemistry of Materials (ENGR 145)</td>
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<td>PHED (2 half semester courses)</td>
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<td>Year Total:</td>
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Second Year

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<tr>
<td>SAGES University Seminar</td>
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<tr>
<td>General Physics II - Electricity and Magnetism (PHYS 122)</td>
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<td>SAGES University Seminar</td>
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<td>Chemistry of Materials (ENGR 145)</td>
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<tr>
<td>Year Total:</td>
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</tbody>
</table>

Total Units in Sequence: 129

Hours Required for Graduation: 129

Technical electives are more generally defined as any course related to the principles and practice of computer engineering. This includes all EECS courses at the 200 level and above, and can include courses from other programs. All non-EECS technical electives must be approved by the student’s advisor.

The student must take either EECS 318 VLSI/CAD (Fall Semester) or EECS 338 Introduction to Operating Systems (Spring Semester), and a three credit hour technical elective.

Chosen from: MATH 380 Introduction to Probability, STAT 312 Basic Statistics for Engineering and Science, STAT 313 Statistics for Experimenters, STAT 332 Statistics for Signal Processing, STAT 333 Uncertainty in Engineering and Science

May be taken in the Fall semester if the student would like to take EECS 399 Engineering Projects II in the Spring semester.
Introduction to Data Structures (EECS 233) 4
HM/SS elective 3
Technical elective a 3
Year Total: 17 16

### Third Year

<table>
<thead>
<tr>
<th>Units</th>
<th>Fall</th>
<th>Spring</th>
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<tbody>
<tr>
<td>Compiler Design (EECS 337)</td>
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<tr>
<td>Algorithms and Data Structures (EECS 340)</td>
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<td>HM/SS elective</td>
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Year Total: 16 16

### Fourth Year

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<tr>
<th>Units</th>
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<tbody>
<tr>
<td>Software Engineering (EECS 393)</td>
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<td>Computer Networks I (EECS 325)</td>
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<td>Discrete Mathematics (EECS 343)</td>
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<td>Year Total:</td>
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**Total Units in Sequence:** 129

**Hours Required for Graduation:** 129

a. Chosen from the list of approved CS technical electives. All other technical electives must be approved by the student’s advisor.

b. ENGR 210 Introduction to Circuits and Instrumentation is recommended because it provides flexibility in choice of major and advanced EECS courses.


**Bachelor of Arts**

**Suggested Program of Study: Computer Science**

<table>
<thead>
<tr>
<th>First Year</th>
<th>Units</th>
<th>Fall</th>
<th>Spring</th>
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<tbody>
<tr>
<td>SAGES First Year Seminar</td>
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<tr>
<td>Math and Calculus Applications for Life, Managerial, and Social Sci I (MATH 125)</td>
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<tr>
<td>Introduction to Programming in Java (EECS 132)</td>
<td>3</td>
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<td>HM/SS elective</td>
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Open elective 3
PHED (2 half semester courses) 0
SAGES University Seminar 3
Math and Calculus Applications for Life, Managerial, and Social Sci II (MATH 126) 4
HM/SS elective 3
Open elective 3
Open elective 3
PHED (2 half semester courses) 0
Year Total: 17 16

### Second Year

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<tr>
<td>Discrete Mathematics (EECS 302)</td>
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<td>Introduction to Data Structures (EECS 233)</td>
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<td>HM/SS elective</td>
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### Third Year

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<td>Computer Architecture (EECS 314)</td>
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<td>Introduction to Operating Systems (EECS 338)</td>
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<td>Introduction to Database Systems (EECS 341)</td>
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<td>Theoretical Computer Science (EECS 343)</td>
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<td>Senior Project in Computer Science (EECS 395)</td>
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**Total Units in Sequence:** 122

**Hours Required for Graduation:** 121
Graduate Programs

The EECS department offers graduate study leading to the Master of Science and Doctor of Philosophy degrees in (a) Electrical Engineering; (b) Computer Engineering; (c) Systems & Control Engineering; (d) Computing & Information Sciences (i.e., computer science). These graduate programs provide a balance of breadth and depth appropriate for each degree and support the department’s research thrust areas by emphasizing:

Electrical Engineering
Research in microelectromechanical systems (MEMS), micro/nano sensors, solid-state and photonic devices, wireless implantable biosensors, CMOS and mixed-signal integrated circuit design, robotics, surgical robotics and simulation, and haptics.

Systems and Control Engineering
Research in non-linear control, optimization, simulation, signal processing, systems biology, smart grid, and wind energy.

Computer Engineering
Research in VLSI design, programmable logic, computer architectures, embedded systems, design for testability, reconfigurable processors, and hardware security.

Computer Science
Research in bioinformatics, databases, software engineering, data mining, machine learning, pervasive networks, distributed systems, computational biology, and medical Informatics.

Incoming students are encouraged to apply for departmental teaching assistantships. In addition, training and research funds are used to provide assistantships that support the academic preparation and thesis research of graduate students. A limited number of fellowships providing partial support may also be available for students enrolled in the BS/MS program.

The department believes that the success of its graduates at all levels is due to emphasis on project and problem-oriented course material coupled with the broad-based curricular requirements.

MS students may select either Plan A which requires a research thesis or Plan B which does not require a thesis. Doctoral dissertations in all programs must be original contributions to the existing body of knowledge in engineering and science.

Academic requirements for graduate degrees in engineering are as specified by the Case School of Engineering in this bulletin (p. 9). A more detailed set of rules and regulations for each degree program contained here is available from the department, and may also be found on the department Web page (http://engineering.case.edu/eecs).

Graduate Certificate
A Graduate Certificate in Wireless Health is a new offering in the Department of Electrical Engineering and Computer Science. For more details, please refer to the Wireless Health (http://engineering.case.edu/wireless_health) information on the Case School of Engineering website.

Facilities

Computer Facilities

The department computer facilities incorporate both Unix (primarily Solaris) and Microsoft Windows-based operating systems on high end computing workstations for education and research. A number of file, printing, database, and authentication servers support these workstations, as well as the administrative functions of the department. Labs are primarily located in the Olin and Glennan buildings, but include Nord Hall, and are networked via the Case network.

The Case network is a state-of-the-art, high-speed fiber optic campus-wide computer network that interconnects laboratories, faculty and student offices, classrooms, and student residence halls. It is one of the largest fiber-to-desktop networks anywhere in the world. Every desktop has a 1 Gbps (gigabit per second) connection to a fault-tolerant 10 Gbps backbone. To complement the wired network, over 1,200 wireless access points (WAPs) are also deployed allowing anyone with a laptop or wireless enabled PDA to access resources from practically anywhere on campus.

Off campus users, through the use of virtual private network (VPN) servers, can use their broadband connections to access many on campus resources, as well as software, as if they were physically connected to the Case network. The department and the university participate in the Internet2 and National Lambda Rail projects, which provides high-speed, inter-university network infrastructure allowing for enhanced collaboration between institutions. The Internet2 infrastructure allows students, faculty and staff alike the ability to enjoy extremely high performance connections to other Internet2 member institutions.

Aside from services provided through a commodity Internet connection, Case network users can take advantage of numerous online databases such as EUCLIDplus, the University Libraries’ circulation and public access catalog, as well as Lexus-Nexis™ and various CD-ROM based dictionaries, thesauri, encyclopedias, and research databases. Many regional and national institutional library catalogs are accessible over the network, as well.

EECS faculty are active users of the Microfabrication Laboratory and participants in the Advanced Platform Technology Center described under Interdisciplinary Research Centers.

Additional Department Facilities

Sally & Larry Sears Undergraduate Design Laboratory

This laboratory supports all departmental courses in circuits and includes a state-of-the-art lecture hall, a modernistic glass-walled lab, an electronics “store”, and a student lounge and meeting area. Specialized lab space is available for senior projects and sponsored undergraduate programs. The lab is open to all undergraduates, and components are provided free of charge, so students can “play and tinker” with electronics and foster innovation and creativity. The laboratory provides access to PCs, oscilloscopes, signal generators, logic analyzers, and specialized equipment such as RF analyzers and generators. In addition, the lab includes full-time staff dedicated to the education, guidance and mentoring of undergraduates in the “art and practice” of hands-on engineering.

This is the central educational resource for students taking analog, digital, and mixed-signal courses in electronics, and has been supported by various corporations in addition to alumnus Larry Sears, a successful
engineer and entrepreneur. Basic workstations consist of Windows-based computers equipped with LabView software, as well as Agilent 546xx oscilloscopes, 33120A Waveform Generators, 34401A Digital Multimeters, and E3631A power supplies. Advanced workstations are similarly configured, but with a wider variety of high-performance test equipment.

**Jennings Computer Center Lab**

Supported by an endowment from the Jennings Foundation, this lab provides our students with the educational resources necessary for their classwork and exploration of the art of computing. This lab has both PCs and Sun Unix workstations, and includes two high-speed laser printers.

**EECS Undergraduate Computer Lab**

This laboratory (recently renovated with major funding provided by Rockwell Automation) on the 8th floor of the Olin building is accompanied by a suite of instructor/TA offices, and supports the freshman computing classes: ENGR 131 Elementary Computer Programming and EECS 132 Introduction to Programming in Java. Thirty student Macintosh workstations with underlying UNIX operating systems are available for hands-on instruction, and support the study of introductory programming at the university.

**Nord Computer Laboratory**

This is a general-purpose computer facility that is open 24 hours a day, to all students. The lab contains 50 PCs running Windows and four Apple Macintosh computers. Facilities for color printing, faxing, copying and scanning are provided. Special software includes PRO/Engineer, ChemCAD and Visual Studio. Blank CDs, floppy disks, transparencies and other supplies are available for purchase. Visit the website (http://www.scl.cwru.edu) for more information.

**Virtual Worlds (Gaming and Simulation) Laboratory**

The Virtual Worlds Gaming and Simulation Lab forms the basis for experiential work in existing game related courses such as Artificial Intelligence, Graphics, and Simulation and for new gaming/simulation courses. Multi-disciplinary senior projects also use the lab facilities. In addition, a large number of significant cross-disciplinary immersive learning opportunities are available with the Cleveland Institute of Art, the CWRU Music department, and the CWRU School of Medicine.

The Virtual Worlds laboratory includes a PC room, a Console room, an Immersion room, an Audio room, a Medical Simulation room, and a Virtual Reality room containing:

- 24 networked high-performance Alienware gaming quality PCs
- Virtual reality components including three head mounted displays, three data gloves, a four sensor magnetic tracker, two inertial trackers, and three haptic interfaces
- Game consoles, e.g. PS2, Xbox, Gamecube, Nintendo DS, PSP
- Large screen 2-D and 3-D projection displays
- Audio and music synthesis and production equipment

**Database and Bioinformatics Research Laboratory**

Primarily funded by equipment grants from the National Science Foundation and Microsoft Research, this laboratory provides PCs running Windows and Linux supporting research in database systems and bioinformatics.

**Networks Laboratory**

Supported through donations from both Cisco Systems and Microsoft Research, the networks lab has 15 stations complete with a PC, a Cisco switch and router, IP telephony equipment, as well as network patches back to a central rack where devices at one workstation may be routed to other equipment in the lab. A “library” of related equipment is also available.

**Intelligent Networks & Systems Architecting (INSA) Research Laboratory**

The Intelligent Networks & Systems Architecting (INSA) Research Laboratory is a state-of-the-art research facility dedicated to intelligent computer networks, systems engineering, design, and architectural. It includes optimization, simulation, artificial intelligent, visualization, and emulation. This lab has been partially supported by NASA’s Space Exploration programs for Human and Robotic Technology (H&RT). The INSA Lab is equipped with 10 high-performance workstations and 2 servers in a mixed Windows and Linux environment, with over 40 installed network interface cards providing connectivity to its wired and wireless research networks. It includes software packages such as GINO and LINDO, Arena simulation, ns2 and OPNET, as well as the STK satellite toolkit, artificial neural network, systems architecting and modeling, and statistical analysis and data management packages such as SPSS. The INSA Lab is also used for research in heterogeneous, sensor web, and mobile ad-hoc networks with space and battlefield applications.

**VLSI Design Laboratory**

This lab has been supported by the Semiconductor Research Corporation, NSF, NASA, Synopsys and Sun Microsystems. This laboratory has a number of advanced UNIX workstations that run commercial CAD software tools for VLSI design and is currently used to develop design and testing techniques for embedded system-on-chip.

**Embedded Systems Laboratory**

The Embedded Systems Laboratory is equipped with several Sun Blade Workstations running Solaris and Intel PCs running Linux. This lab has been recently equipped with advanced FPGA Virtex II prototype boards from Xilinx, including about 100 Xilinx Virtex II FPGAs and Xilinx CAD tools for development work. A grant-in-aid from Synopsys has provided the Synopsys commercial CAD tools for software development and simulation. This Lab is also equipped with NIOS FPGA boards from Altera, including software tools.

**Mixed-Signal Integrated Circuit Laboratory**

This research laboratory includes a cluster of Windows workstations and a UNIX server with integrated circuit design software (Cadence Custom IC Bundle), as well as a variety of equipment used in the characterization of mixed-signal (analog and digital) integrated circuits, which are typically fabricated using the MOSIS foundry service. Test equipment includes an IC probe station, surface-mount soldering equipment, logic and network/spectrum analyzers, an assortment of digital oscilloscopes with sample rates up to 1 GHz, and a variety of function generators, multi-meters, and power supplies.

**Microelectromechanical Systems (MEMS) Research Laboratory**

The MEMS Research Laboratory is equipped for microfabrication processes that do not require a clean room environment. These include chemical-mechanical polishing (two systems), bulk silicon etching, aqueous chemical release of free standing micromechanical components,
and supercritical point drying. In addition to the fabrication capabilities, the lab is also well equipped for testing and evaluation of MEMS components as it houses wafer-scale probe stations, a vacuum probe station, a multipurpose vacuum chamber, and an interferometric load-deflection station. Two large (8 x 2 ft2) vibration isolated air tables are available for custom testing setups. The laboratory has a wide variety of electronic testing instruments, including a complete IV-CV testing setup.

BioMicroSystems Laboratory

This research laboratory focuses on developing wireless integrated circuits and microsystems for a variety of applications in biomedical and neural engineering. The laboratory contains several PC computers, software packages for design, simulation, and layout of high-performance, low-noise, analog/mixed-signal/RF circuits and systems, and testing/measurement equipment such as dc power supply, arbitrary function generator, multichannel mixed-signal oscilloscope, data acquisition hardware, spectrum analyzer, potentiotstat, and current source meter. Visit the website (http://www.mohsenilab-cwru.org) for more information.

Emerging Materials Development and Evaluation Laboratory

The EMDE Laboratory is equipped with tooling useful in characterizing materials for MEMS applications. The laboratory contains a PC-based apparatus for load-deflection and burst testing of micromachined membranes, a custom-built test chamber for evaluation and reliability testing of MEMS-based pressure transducers and other membrane-based devices, a probe station for electrical characterization of micro-devices, a fume hood configured for wet chemical etching of Si, polymers, and a wide variety of metals, tools for electroplating, an optical reflectometer, and a supercritical-point dryer for release of surface micromachined devices. The lab also has a PC with layout and finite element modeling software for device design, fabrication process design and analysis of testing data.

Laboratory for Nanoscale Devices and Integrated Systems

This research lab explores new engineering and physics at the nanoscale, and by applying such knowledge, develops new devices and tools for emerging technological applications in the new frontiers of information, biomedical, and life sciences. A primary current theme of the research is on developing nanoscale electromechanical systems (NEMS), based on exploration and understandings of mesoscopic devices fundamentals and new characteristics of various nanoscale structures and functional systems. The lab has been developing NEMS with new functions and high performance, in combination with some of the latest advances in advanced materials, integrated circuits, and others, through crossdisciplinary explorations and collaboration. The lab is dedicated to the development of various NEMS transducers, biosensors, high-frequency nanodevices, and high-precision instruments. For more information, contact Dr. Philip Feng (http://bulletin.case.edu/schoolofengineering/elecengcompsci/malitto/philip.feng@case.edu).

Some of the recent research highlights include: the first very-high-frequency silicon nanowire resonators and sensors, the first ultra-high-frequency self-sustaining oscillators (aka NEMS clocks), the first low-voltage (~1V), high-speed nanowire NEMS switches, and the first NEMS mass sensors for weighing single-biomolecules and for probing the noise arising from adsorbed atoms walking on the surface of a vibrating NEMS.

Control and Energy Systems Center (CESC)

The Control and Energy Systems Center (CESC) looks for new transformational research and engineering breakthroughs to build a better world, improving our industry, economy, energy, environment, water resources and society, all with sustainability and within an international collaboration framework. With an interdisciplinary and concurrent engineering approach, the CESC focuses on bridging the gap between fundamental and applied research in advanced control and systems engineering, with special emphasis in energy innovation, wind energy, power systems, water treatment plants, sustainability, spacecraft, environmental and industrial applications. Fundamental research foci are to gain knowledge and understanding on multi-input-multi-output physical worlds, nonlinear plants, distributed parameter systems, plants with non-minimum phase, time delay and/or uncertainty, etc., and to develop new methodologies to design quantitative robust controllers to improve the efficiency and reliability of such systems. Applied research aims to develop advanced solutions with industrial partners, for practical control engineering problems in energy systems, multi-megawatt wind turbines, renewable energy plants, power system dynamics and control, grid integration, energy storage, power electronics, wastewater treatment plants, desalination systems, formation flying spacecraft, satellites with flexible appendages, heating systems, robotics, parallel kinematics, telescope control, etc. The Center was established in 2009 with the support of the Milton and Tamar Maltz Family Foundation and the Cleveland Foundation.

Process Control Laboratory

This laboratory contains process control pilot plants and computerized hardware for data acquisition and process control that is used for demonstrations, teaching, and research. This laboratory also has access to steam and compressed air for use in the pilot processes that include systems for flow and temperature control, level and temperature control, pH control, and pressure control plants.

Dynamics and Control Laboratory

This laboratory contains data acquisition and control devices, PLCs, electromechanical systems, and mechanical, pneumatic, and electrical laboratory experiments for demonstrations, teaching, and research. Particular systems include: AC/DC servo systems, multi-degree-of-freedom robotic systems, rectilinear and torsional multi-degree-of-freedom vibration systems, inverted pendulum, magnetic levitation system, and a PLC-controlled low-voltage AC smart grid demonstration system that includes conventional and renewable (wind and solar) generation, battery and compressed air energy storage, residential, commercial and industry loads, a capacitor bank for real-time power factor correction, and advanced sensing and controls implemented through an interconnected system of intelligent software agents.

Electrical, Computer, and Systems Engineering Division

Michael S. Branicky, ScD, PE
(Massachusetts Institute of Technology)
Professor and Chair of EECS

Systems and control, hybrid systems, cyber-physical systems, distributed control over networks, learning; applications to robotics, manufacturing, and biology

Swarup Bhunia, PhD
(Purdue University)
Associate Professor
Low power and robust nanoelectronics, adaptive nanocomputing, hardware security and protection, implantable electronics

Marc Buchner, PhD
(Michigan State University)
Associate Professor
Computer gaming and simulation, virtual reality, software-defined radio, wavelets, joint time-frequency analysis

M. Cenk Cavusoglu, PhD
(University of California, Berkeley)
Associate Professor
Robotics, systems and control theory, and human-machine interfaces; with emphasis on medical robotics, haptics, virtual environments, surgical simulation, and bio-system modeling and simulation

Vira Chankong, PhD
(Case Western Reserve University)
Associate Professor
Large-scale optimization; logic-based optimization; multi-objective optimization; optimization applications in radiation therapy treatment planning, medical imaging, manufacturing and production systems, and engineering design problems

Philip Feng, PhD
(California Institute of Technology)
Assistant Professor
Nanoelectromechanical systems (NEMS), energy-efficient devices, advanced materials & devices engineering, bio/chemical sensors & biomedical Microsystems, RF/microwave devices & circuits, low-noise measurement & precision instruments

Mario Garcia-Sanz, DrEng
(University of Navarra, Spain)
Milton and Tamar Maltz Professor in Energy Innovation
Robust and nonlinear control, quantitative feedback theory, multivariable control, dynamic systems, systems modeling and identification; energy innovation, wind energy, spacecraft, electrical, mechanical, environmental and industrial applications

Steven L. Garverick, PhD
(Massachusetts Institute of Technology)
Professor
Mixed-signal integrated circuit design, microelectromechanical system integration, sensor/actuator interfacing, data conversion, wireless communication, analog neural network circuits, medical instrumentation

Wei Lin, PhD
(Washington University)
Professor
Nonlinear control, dynamic systems and homogeneous systems theory, H-infinity and robust control, adaptive control, system parameter estimation and fault detection, nonlinear control applications to under-actuated mechanical systems, biologically-inspired systems and systems biology

Kenneth A. Loparo, PhD
(Case Western Reserve University)
Nord Professor of Engineering
Stability and control of nonlinear and stochastic systems; fault detection, diagnosis, and prognosis; recent applications work in advanced control and failure detection of rotating machines, signal processing for the monitoring and diagnostics of physiological systems, and modeling, analysis, and control of power and energy storage systems including the smart grid and micro-grids

Behnam Malakooti, PhD, PE
(Purdue University)
Professor
Design and multi-objective optimization, manufacturing/production/operations systems, intelligent systems and networks, artificial neural networks, biological systems, intelligent decision making

Mehran Mehregany, PhD
(Massachusetts Institute of Technology)
Goodrich Professor of Engineering Innovation
Research and development at the intersections of micro/nano-electro-mechanical systems, semiconductor silicon carbide and integrated circuits

Francis "Frank" L. Merat, PhD, PE
(Case Western Reserve University)
Associate Professor
Computer and robot vision, digital image processing, sensors, titanium capacitors and power electronics; RF and wireless systems; optical sensors; engineering education

Pedram Mohseni, PhD
(University of Michigan)
Associate Professor
Biomedical microsystems, bioelectronics, wireless neural interfaces, CMOS interface circuits for MEMS, low-power wireless sensing/actuating microsystems

Wyatt S. Newman, PhD, PE
(Massachusetts Institute of Technology)
Professor
Mechatronics, high-speed robot design, force- and vision-based machine control, artificial reflexes for autonomous machines, rapid prototyping, agile manufacturing, mobile robotic platforms

C. A. Papachristou, PhD
(Johns Hopkins University)
Professor
VLSI design and CAD, computer architecture and parallel processing, design automation, embedded system design

Daniel Saab, PhD
(University of Illinois at Urbana-Champaign)
Associate Professor
Computer architecture, VLSI system design and test, CAD design automation

Sree N. Sreenath, PhD
(University of Maryland)
Professor
Systems biology complexity research (modeling, structural issues, and simulation); cell signaling, population behavior, and large-scale behavior; global issues and sustainable development

Xinmiao Zhang, PhD
(University of Minnesota)
Timothy E. and Allison L. Schroeder Associate Professor
VLSI architecture design for communications, digital signal processing, cryptosystems and medical instruments

Hongping Zhao, PhD
(Lehigh University)
Assistant Professor
Applied physics of semiconductor optoelectronics materials and devices, physics of semiconductor nanostructures, and semiconductors for light emitting diodes, lasers, and energy applications; emphasis on III-Nitride semiconductors
Christian A. Zorman, PhD  
(Case Western Reserve University)  
Associate Professor  
Materials and processing techniques for MEMS and NEMS, wide bandgap semiconductors, development of materials and fabrication techniques for polymer-based MEMS and bioMEMS

Case School of Engineering

Christian A. Zorman, PhD  
(Case Western Reserve University)  
Associate Professor  
Materials and processing techniques for MEMS and NEMS, wide bandgap semiconductors, development of materials and fabrication techniques for polymer-based MEMS and bioMEMS

Computer Science Division

Michael S. Branicky, ScD, PE  
(Massachusetts Institute of Technology)  
Professor and Chair of EECS  
Systems and control, hybrid systems, cyber-physical systems, distributed control over networks, learning; applications to robotics, manufacturing, and biology

Harold S. Connamacher, PhD  
(University of Toronto)  
Assistant Professor  
Constraint satisfaction problems, graph theory, random structures, and algorithms

Chris Fietkiewicz, PhD  
(Case Western Reserve University)  
Assistant Professor  
Applied and theoretical neuroscience, neuronal modeling, signal processing and signal analysis, electrophysiology, applications to epilepsy and respiratory control

Mehmet Koyuturk, PhD  
(Purdue University)  
T. & D. Schroeder Associate Professor of Computer Science and Engineering  
Bioinformatics and computational biology, computational modeling and algorithm development for systems biology, integration, mining and analysis of biological data, algorithms for distributed systems

Michael Lewicki, PhD  
(California Institute of Technology)  
Associate Professor  
Computational perception and scene analysis, visual representation and processing, auditory representation and analysis

Jing Li, PhD  
(University of California, Riverside)  
Associate Professor  
Computational biology and bioinformatics, statistical genomics and functional genomics, systems biology, algorithms

Vincenzo Liberatore, PhD  
(Rutgers University)  
Associate Professor  
Distributed systems, Internet computing, randomized algorithms

Gultekin Ozsoyoglu, PhD  
(University of Alberta, Canada)  
Professor  
Graph databases and data mining problems in metabolic networks, metabolomics, and systems biology, bioinformatics, web data mining

Z. Meral Ozsoyoglu, PhD  
(University of Alberta, Canada)  
Andrew R. Jennings Professor of Computing  
Database systems, database query languages and optimization, data models, index structures, bioinformatics, medical informatics

H. Andy Podgurski, PhD  
(University of Massachusetts, Amherst)  
Professor  
Software engineering methodology and tools, especially use of data mining, machine learning, and program analysis techniques in software testing, fault detection and localization, reliable engineering and software security, electronic medical records, privacy

Michael Rabinovich, PhD  
(University of Washington)  
Professor  
Computer networks, Internet performance evaluation, databases, utility computing

Soumya Ray, PhD  
(University of Wisconsin, Madison)  
Assistant Professor  
Artificial intelligence, machine learning, reinforcement learning, automated planning, applications to interdisciplinary problems including medicine and bioinformatics

GQ (Guo-Qiang) Zhang, PhD  
(Cambridge University, England)  
Professor  
Programming languages, theory of computation, logic and topology in computer science, knowledge representation, information technology, clinical and medical informatics, semantic web

Xiang Zhang, PhD  
(University of North Carolina at Chapel Hill)  
Assistant Professor  
Computational genetics, bioinformatics, data mining, machine learning, databases

Research Faculty

Mehdi Bageri-Hamaneh, PhD  
(Case Western Reserve University)  
Research Assistant Professor  
Simulation and modeling of biological systems, biomedical signal processing, electroencephalogram (EEG) source imaging

Evren Gurkan-Cavusoglu, PhD  
(Middle East Technical University)  
Research Assistant Professor  
Systems and control theory, systems biology, computational biology, biological system modeling, signal processing applied to biological systems, signal processing

Farhad Kaffashi, PhD  
(Case Western Reserve University)  
Research Assistant Professor  
Haptic devices, including low-power design and effects on perception; applications to robotic surgery and telesurgery; secure teleoperation

Joseph A. Potkay, PhD  
(University of Michigan)  
Research Assistant Professor  
Medical microsystems, MEMS, microfluidics; microfabricated artificial organs, biocompatible sensor/actuator systems; energy harvesting and implantable power generators
Active Emeritus Faculty

George W. Ernst, PhD
(Carnegie Institute of Technology)
Emeritus Professor
Learning problem solving strategies, artificial intelligence, expert systems, program verification

Dov Hazony, PhD
(University of California, Los Angeles)
Emeritus Professor
Network synthesis, ultrasonics, communications

Wen H. Ko, PhD
(Case Institute of Technology)
Emeritus Professor
Solid state electronics, micro and nano sensors, biomedical instrumentation, implant telemetry

Mihajlo D. Mesarovic, PhD
(University of Belgrade)
Emeritus Professor
Complex systems theory, global issues and sustainable development, systems biology

Lee J. White, PhD
(University of Michigan)
Emeritus Professor
Software testing: regression testing, GUI testing, specification-based testing, testing of object-oriented software

Adjunct Faculty Appointments

Michael Adams, PhD
(Case Western Reserve University)
Adjunct Assistant Professor

Mark A. Allman
(Case Western Reserve University)
Adjunct Instructor

Aaron Fleischman, PhD
(Case Western Reserve University)
Adjunct Assistant Professor

Reza Jamesebi, PhD
(Case Western Reserve University)
Adjunct Assistant Professor

Suparerk Janjarasjitt, PhD
(Case Western Reserve University)
Adjunct Assistant Professor

Stephen M. Phillips, PhD, PE
(Arizona State University)
Adjunct Professor

Srinivas Raghavan, PhD
(Ohio State University)
Adjunct Professor

Gideon Samid, PhD
(Israel Institute of Technology)
Adjunct Assistant Professor

Shivakumar Sastry
(Case Western Reserve University)
Adjunct Associate Professor

William L. Schultz, PhD, PE
(Case Western Reserve University)
Adjunct Associate Professor

Marvin S. Schwartz, PhD
(Case Western Reserve University)
Adjunct Professor

Larry Sears
(Case Western Reserve University)
Adjunct Instructor

Amit Sinha, PhD
(Case Western Reserve University)
Adjunct Assistant Professor

Norman Tien, PhD
(University of California, San Diego)
Adjunct Professor

Peter J. Tsivitse, PhD
(Case Western Reserve University)
Adjunct Professor

Stephen D. Umans, PhD
(Massachusetts Institute of Technology)
Adjunct Professor

Olaf Wolkenhauer, PhD
(UMIST, Manchester)
Adjunct Professor

Qing-rong Jackie Wu, PhD
(Mayo Graduate School)
Adjunct Associate Professor

Secondary Faculty Appointments

Alexis R. Abramson, PhD
(University of California, Berkeley)
Associate Professor, Mechanical and Aerospace Engineering

Mark Griswold, PhD
(University of Würzburg, Germany)
Associate Professor, Radiology

Joseph F. Koonce, PhD
(University of Wisconsin, Madison)
Professor, Biology

Thomas LaFramboise, PhD
(University of Illinois)
Associate Professor, Genetics

Roger D. Quinn, PhD
(Virginia Polytechnic Institute and State University)
Professor, Mechanical and Aerospace Engineering

Satya S. Sahoo, PhD
(Wright State University)
Assistant Professor, Center for Clinical Investigations

Nicole Sieberlich, PhD
(University of Wurzburg, Germany)
Assistant Professor, Biomedical Engineering

Matthew J. Sobel, PhD
(Stanford University)
Professor, Operations
Courses

EECS 132. Introduction to Programming in Java. 3 Units.
Introduction to computer programming and problem solving with the Java language. Computers, operating systems, and Java applications; software development; conditional statements; loops; methods; arrays; classes and objects; object-oriented design; unit testing; strings and text I/O; inheritance and polymorphism; GUI components; application testing; abstract classes and interfaces; exception handling; files and streams; GUI event handling; generics; collections; threads; comparison of Java to C, C++, and C#.

EECS 233. Introduction to Data Structures. 4 Units.
The programming language Java; pointers, files, and recursion. Representation and manipulation of data: one way and circular linked lists, doubly linked lists; the available space list. Different representations of stacks and queues. Representation of binary trees, trees and graphs. Hashing; searching and sorting. Prereq: EECS 132.

EECS 245. Electronic Circuits. 4 Units.

EECS 246. Signals and Systems. 4 Units.

EECS 251. Numerical Methods. 3 Units.
Introduction to basic concepts and algorithms used in the numerical solution of common problems including solving non-linear equations, solving systems of linear equations, interpolation, fitting curves to data, integration and solving ordinary differential equations. Computational error and the efficiency of various numerical methods are discussed in some detail. Most homework requires the implementation of numerical methods on a computer. Prereq: MATH 122 and either ENGR 131 or EECS 132.

EECS 281. Logic Design and Computer Organization. 4 Units.
Fundamentals of digital systems in terms of both computer organization and logic level design. Organization of digital computers; information representation; boolean algebra; analysis and synthesis of combinational and sequential circuits; datapaths and register transfers; instruction sets and assembly language; input/output and communication; memory. Prereq: ENGR 131 or EECS 132.

EECS 290. Introduction to Computer Game Design and Implementation. 3 Units.
This class begins with an examination of the history of video games and of game design. Games will be examined in a systems context to understand gaming and game design fundamentals. Various topics relating directly to the implementation of computer games will be introduced including graphics, animation, artificial intelligence, user interfaces, the simulation of motion, sound generation, and networking. Extensive study of past and current computer games will be used to illustrate course concepts. Individual and group projects will be used throughout the semester to motivate, illustrate and demonstrate the course concepts and ideas. Group game development and implementation projects will culminate in classroom presentation and evaluation. Prereq: EECS 132.

EECS 293. Software Craftsmanship. 4 Units.
A course to improve programming skills, software quality, and the software development process. Software design; Version control; Control issues and routines; Pseudo-code programming process and developer testing; Defensive programming; Classes; Debugging; Self-documenting code; Refactoring. Prereq: EECS 233.

EECS 296. Independent Projects. 1 - 3 Unit.

EECS 297. Special Topics. 1 - 3 Unit.
Special topics in Computer Engineering, Computer Science, Electrical Engineering, and Systems and Control Engineering. Prereq: Limited to freshmen and sophomores.

EECS 301. Digital Logic Laboratory. 2 Units.
This course is an introductory experimental laboratory for digital networks. The course introduces students to the process of design, analysis, synthesis and implementation of digital networks. The course covers the design of combinational circuits, sequential networks, registers, counters, synchronous/asynchronous Finite State Machines, register based design, and arithmetic computational blocks. Recommended preparation: EECS 281.

EECS 302. Discrete Mathematics. 3 Units.
A general introduction to basic mathematical terminology and the techniques of abstract mathematics in the context of discrete mathematics. Topics introduced are mathematical reasoning, Boolean connectives, deduction, mathematical induction, sets, functions and relations, algorithms, graphs, combinatorial reasoning. Offered as EECS 302 and MATH 304. Prereq: MATH 122 or MATH 124 or MATH 126.

EECS 304. Control Engineering I with Laboratory. 3 Units.
Analysis and design techniques for control applications. Linearization of nonlinear systems. Design specifications. Classical design methods: root locus, bode, nyquist, PID, lead, lag, lead-lag controller design. State space modeling, solution, controllability, observability and stability. Modeling and control demonstrations and experiments single-input/ single-output and multivariable systems. Control system analysis/design/ implementation software. Prereq: EECS 246 or equivalent.
EECS 305. Control Engineering I Laboratory. 1 Unit.
A laboratory course based on the material in EECS 304. Modeling, simulation, and analysis using MATLAB. Physical experiments involving control of mechanical systems, process control systems, and design of PID controllers. Coreq: EECS 304.

EECS 309. Electromagnetic Fields I. 3 Units.
Maxwell’s integral and differential equations, boundary conditions, constitutive relations, energy conservation and Pointing vector, wave equation, plane waves, propagating waves and transmission lines, characteristic impedance, reflection coefficient and standing wave ratio, in-depth analysis of coaxial and strip lines, electro- and magnetooptics, simple boundary value problems, correspondence between fields and circuit concepts, energy and forces. Prereq: PHYS 122. Prereq or Coreq: MATH 224.

EECS 312. Introduction to Electric Power Systems. 3 Units.
This course is intended to be an introduction to three-phase electric power systems. Modeling of system components including generators, transformers, loads, transmission lines. The per-unit system. One-line diagrams and equivalent circuits. Real and reactive power. Phasor diagrams. Voltage and frequency regulation. Load-flow analysis. Short-circuit calculations. Fault analysis using the techniques of symmetrical component analysis.

EECS 313. Signal Processing. 3 Units.

EECS 314. Computer Architecture. 3 Units.
This course provides students the opportunity to study and evaluate a modern computer architecture design. The course covers topics in fundamentals of computer design, performance, cost, instruction set design, processor implementation, control unit, pipelining, communication and network, memory hierarchy, computer arithmetic, input-output, and an introduction to RISC and super-scalar processors. Recommended preparation: EECS 281.

EECS 315. Digital Systems Design. 4 Units.
This course gives students the ability to design modern digital circuits. The course covers topics in logic level analysis and synthesis, digital electronics: transistors, CMOS logic gates, CMOS lay-out, design metrics space, power, delay, Programmable logic (partitioning, routing), state machine analysis and synthesis, register transfer level block design, datapath, controllers, ASM charts, microsequencers, emulation and rapid prototyping, and switch/logic-level simulation. Recommended preparation: EECS 281.

EECS 316. Computer Design. 3 Units.
Methodologies for systematic design of digital systems with emphasis on programmable logic implementations and prototyping. Laboratory which uses modern design techniques based on hardware description languages such as VHDL, CAD tools, and Field Programmable Gate Arrays (FPGAs). Recommended preparation: EECS 281; EECS 315 or consent of instructor.

EECS 318. VLSI/CAD. 4 Units.
With Very Large Scale Integration (VLSI) technology there is an increased need for Computer-Aided Design (CAD) techniques and tools to help in the design of large digital systems that deliver both performance and functionality. Such high performance tools are of great importance in the VLSI design process, both to perform functional, logical, and behavioral modeling and verification to aid the testing process. This course discusses the fundamentals in behavioral languages, both VHDL and Verilog, with hands-on experience. Recommended preparation: EECS 281, EECS 315.

EECS 319. Applied Probability and Stochastic Processes for Biology. 3 Units.
Applications of probability and stochastic processes to biological systems. Mathematical topics will include: introduction to discrete and continuous probability spaces (including numerical generation of pseudo random samples from specified probability distributions), Markov processes in discrete and continuous time with discrete and continuous space examples, point processes including homogeneous and inhomogeneous Poisson processes and Markov chains on graphs, and diffusion processes including Brownian motion and the Ornstein-Uhlenbeck process. Biological topics will be determined by the interests of the students and the instructor. Likely topics include: stochastic ion channels, molecular motors and stochastic ratchets, actin and tubulin polymerization, random walk models for neural spike trains, bacterial chemotaxis, signaling and genetic regulatory networks, and stochastic predator-prey dynamics. The emphasis will be on practical simulation and analysis of stochastic phenomena in biological systems. Numerical methods will be developed using both MATLAB and the R statistical package. Student projects will comprise a major part of the course. Offered as BIOL 319, EECS 319, MATH 319, BIOL 419, EBME 419, and PHOL 419. Prereq: MATH 224 or MATH 223 and BIOL 300 or BIOL 306 and MATH 201 or MATH 307 or consent of instructor.

EECS 321. Semiconductor Electronic Devices. 4 Units.
Energy bands and charge carriers in semiconductors and their experimental verifications. Excess carriers in semiconductors. Principles of operation of semiconductor devices that rely on the electrical properties of semiconductor surfaces and junctions. Development of equivalent circuit models and performance limitations of these devices. Devices covered include: junctions, bipolar transistors, Schottky junctions, MOS capacitors, junction gate and MOS field effect transistors, optical devices such as photodetectors, light-emitting diodes, solar cells and lasers. Prereq: PHYS 122. Prereq or Coreq: MATH 224.

EECS 322. Integrated Circuits and Electronic Devices. 3 Units.
Technology of monolithic integrated circuits and devices, including crystal growth and doping, photolithography, vacuum technology, metalization, wet etching, thin film basics, oxidation, diffusion, ion implantation, epitaxy, chemical vapor deposition, plasma processing, and micromachining. Basics of semiconductor devices including junction diodes, bipolar junction transistors, and field effect transistors. Prereq: PHYS 122. Prereq or Coreq: MATH 224.
EECS 324. Simulation Techniques in Engineering. 3 Units.
Principles and techniques of continuous-time and discrete-event simulation which are powerful tools for analyzing a wide variety of complex engineering, systems biology and business problems. EXCEL, MATLAB/SIMULINK, and ARENA are used as the main computational and programming instruments to demonstrate the basic steps in dynamic systems modeling, discrete-event systems modeling as well as typical results of stochastic/Monte Carlo simulations, continuous/discrete-time simulations, and discrete-event simulations respectively. Design and evaluation of simulation experiments will also be covered. Recommended preparation: STAT 312, STAT 332, or STAT 333. Prereq: MATH 224.

EECS 325. Computer Networks I. 3 Units.

EECS 326. Instrumentation Electronics. 3 Units.
A second course in instrumentation with emphasis on sensor interface electronics. General concepts in measurement systems, including accuracy, precision, sensitivity, linearity, and resolution. The physics and modeling of resistive, reactive, self-generating, and direct-digital sensors. Signal conditioning for same, including bridge circuits, coherent detectors, and a variety of amplifier topologies: differential, instrumentation, charge, and transimpedance. Noise and drift in amplifiers and resistors. Practical issues of interference, including grounding, shielding, supply/return, and isolation amplifiers. Prereq: ENGR 210 and (EECS 246, EBME 308 or EMAE 350).

EECS 337. Compiler Design. 4 Units.
Design and implementation of compilers and other language processors. Scanners and lexical analysis; regular expressions and finite automatata; scanner generators; parsers and syntax analysis; context free grammars; parser generators; semantic analysis; intermediate code generation; runtime environments; code generation; machine independent optimizations; data flow and dependence analysis. There will be a significant programming project involving the use of compiler tools and software development tools and techniques. Recommended preparation: EECS 233 and EECS 281.

EECS 338. Introduction to Operating Systems. 4 Units.
CPU scheduling, memory management, concurrent processes, semaphores, monitors, deadlocks, secondary storage management, file systems, protection, UNIX operating system, fork, exec, wait, UNIX System V IPCs, sockets, remote procedure calls, threads. Must be proficient in "C" programming language. Recommended preparation: EECS 337.

EECS 339. Web Data Mining. 3 Units.

EECS 340. Algorithms and Data Structures. 3 Units.
Efficient sorting algorithms, external sorting methods, internal and external searching, efficient string processing algorithms, geometric and graph algorithms. Recommended preparation: EECS 233 and MATH 304.

EECS 341. Introduction to Database Systems. 3 Units.
Relational model, ER model, relational algebra and calculus, SQL, OBE, security, views, files and physical database structures, query processing and query optimization, normalization theory, concurrency control, object relational systems, multimedia databases, Oracle SQL server, Microsoft SQL server. Recommended preparation: EECS 233. Prereq: EECS 302.

EECS 342. Introduction to Global Issues. 3 Units.
This systems course is based on the paradigm of the world as a complex system. Global issues such as population, world trade and financial markets, resources (energy, water, land), global climate change, and others are considered with particular emphasis put on their mutual interdependence. A reasoning support computer system which contains extensive data and a family of models is used for future assessment. Students are engaged in individual, custom-tailored, projects of creating conditions for a desirable or sustainable future based on data and scientific knowledge available. Students at CWRU will interact with students from fifteen universities that have been strategically selected in order to give global coverage to UNESCO'S Global-problematique Education Network Initiative (GENie) in joint, participatory scenario analysis via the internet.

EECS 343. Theoretical Computer Science. 3 Units.
Introduction to mathematical logic, different classes of automata and their correspondence to different classes of formal languages, recursive functions and computability, assertions and program verification, denotational semantics. MATH/EECS 343 and MATH 410 cannot both be taken for credit. Offered as EECS 343 and MATH 343.

EECS 344. Electronic Analysis and Design. 3 Units.
The design and analysis of real-world circuits. Topics include: junction diodes, non-ideal op-amp models, characteristics and models for large and small signal operation of bipolar junction transistors (BJTs) and field effect transistors (FETs), selection of operating point and biasing for BJT and FET amplifiers. Hybrid-pi model and other advanced circuit models, cascaded amplifiers, negative feedback, differential amplifiers, oscillators, tuned circuits, and phase-locked loops. Computers will be extensively used to model circuits. Selected experiments and/or laboratory projects. Prereq: EECS 245.

EECS 345. Programming Language Concepts. 3 Units.
This course studies important concepts underlying the design, definition, implementation and use of modern programming languages including syntax, semantics, names/scopes, types, expression, assignment, subprograms, data abstraction, and inheritance. Imperative, object-oriented, concurrent, functional, and logic programming paradigms are discussed. Illustrative examples are drawn from a variety of popular languages, such as C++, Java, Ada, Lisp, and Prolog. Recommended preparation: EECS 233, EECS 337.
EECS 346. Engineering Optimization. 3 Units.
Optimization techniques including linear programming and extensions; transportation and assignment problems; network flow optimization; quadratic, integer, and separable programming; geometric programming; and dynamic programming. Nonlinear optimization topics: optimality criteria, gradient and other practical unconstrained and constrained methods. Computer applications using engineering and business case studies. Recommended preparation: MATH 201.

EECS 350. Operations and Systems Design. 3 Units.
Introduction to design, modeling, and optimization of operations and scheduling systems with applications to computer science and engineering problems. Topics include, forecasting and time series, strategic, tactical, and operational planning, life cycle analysis, learning curves, resources allocation, materials requirement and capacity planning, sequencing, scheduling, inventory control, project management and planning. Tools for analysis include: multi-objective optimization, queuing models, simulation, and artificial intelligence.

EECS 351. Communications and Signal Analysis. 3 Units.
Fourier transform analysis and sampling of signals. AM, FM and SSB modulation and other modulation methods such as pulse code, delta, pulse position, PSK and FSK. Detection, multiplexing, performance evaluation in terms of signal-to-noise ratio and bandwidth requirements. Prereq: EECS 246 or requisites not met permission.

EECS 352. Engineering Economics and Decision Analysis. 3 Units.

EECS 354. Digital Communications. 3 Units.

EECS 359. Bioinformatics in Practice. 3 Units.
This course covers basic computational methods of organizing and analyzing biological data, targeting senior and junior level students from both mathematical/computational sciences and life sciences. The aim of the course is to provide the students with basic skills to be able to understand molecular biology data and associated abstractions (sequences, structure, gene expression, molecular network data), access to available resources (public databases, computational tools on the web). Implement basic computational methods for biological data analysis, and use understanding of these methods to solve other problems that arise in biological data analysis. Topics covered include DNA and protein sequence databases, pairwise sequence alignment and sequence search (dynamic programming, BLAST), multiple sequence alignment (HMMs, CLUSTAL-W), sequence clustering, motif finding, pattern matching, phylogenetic analysis (tree reconstruction, neighbor joining, maximum parsimony, maximum likelihood), gene finding, functional annotation, biological ontologies, analysis of gene expression data, and network biology (protein protein interactions, topology, modularity).

EECS 360. Manufacturing and Automated Systems. 3 Units.
Formulation, modeling, planning, and control of manufacturing and automated systems with applications to computer science and engineering problems. Topics include, design of products and processes, location/spatial problems, transportation and assignment, product and process layout, group technology and clustering, cellular and network flow layouts, computer control systems, reliability and maintenance, and statistical quality control. Tools and analysis include: multi-objective optimization, artificial intelligence, and heuristics for combinatorial problems. Offered as EECS 360 and EECS 460.

EECS 365. Complex Systems Biology. 3 Units.
Complex Systems Biology is an interdisciplinary course based on systems science, engineering, biology, and medicine. The objective is to provide students with an understanding of the current state of systems biology and major challenges ahead. The biological phenomena across the level of complexity will be considered from molecular to organisms and ecology to provide universality of the systems concepts for understanding the functions and behavior of biological systems. Case studies are used and a course project is required to be completed. Prereq: Junior Standing.

EECS 366. Computer Graphics. 3 Units.

EECS 371. Applied Circuit Design. 4 Units.
This course will consist of lectures and lab projects designed to provide students with an opportunity to consolidate their theoretical knowledge of electronics and to acquaint them with the art and practice of circuit and product design. The lectures will cover electrical and electronic circuits and many electronic and electrical devices and applications. Examples include mixed-signal circuits, power electronics, magnetic and piezo components, gas discharge devices, sensors, motors and generators, and power systems. In addition, there will be discussion of professional topics such as regulatory agencies, manufacturing, testing, reliability, and product cost. Weekly labs will be true "design" opportunities representing real-world applications. A specification or functional description will be provided, and the students will design the circuit, select all components, construct a breadboard, and test. The objective will be functional, pragmatic, cost-effective designs. Prereq: EECS 245.

EECS 374. Advanced Control and Energy Systems. 3 Units.
This course introduces applied quantitative robust and nonlinear control engineering techniques to regulate automatically renewable energy systems in general and wind turbines in particular. The course also studies the fundamentals for dynamic multidisciplinary modeling and analysis of large multi-megawatt wind turbines (mechanics, aerodynamics, electrical systems, control concepts, etc.). The course combines lecture sessions and lab hours. The 400-level includes an experimental lab competition, where the object is to design, implement, and experimentally validate a control strategy to regulate a real system in the laboratory (helicopter control competition or similar); it will also include additional project design reports. Offered as EECS 374 and EECS 474. Prereq: EECS 304.
EECS 376. Mobile Robotics. 4 Units.
Design of software systems for mobile robot control, including: motion control; sensory processing; localization and mapping; mobile-robot planning and navigation; and implementation of goal-directed behaviors. The course has a heavy lab component involving a sequence of design challenges and competitions performed in teams. Prereq: ENGR 131 or EECS 233.

EECS 381. Hybrid Systems. 3 Units.
Today, the most interesting computer code and microprocessor designs are "embedded" and hence interact with the physical world, producing a mixture of digital and analog domains. The class studies an array of tools for understanding and designing these "hybrid systems." Topics include: basics of language and finite state automata theory, discrete-event dynamic systems, Petri nets, timed and hybrid automata, and hybrid dynamical systems. Simulation, verification, and control concepts and languages for these models. Prereq: MATH 224 and (EECS 246 or EECS 302 or MATH 304).

EECS 390. Advanced Game Development Project. 3 Units.
This game development project course will bring together an interdisciplinary group of advanced undergraduate students in the fields of Electrical Engineering and Computer Science, Art, Music, and English to focus on the design and development of a complete, fully-functioning computer game (as an interdisciplinary team). The student teams are given complete liberty to design their own fully functional games from their original concept to a playable finished product, i.e., from the initial idea through to the wrapped box. The student teams will experience the entire game development cycle as they execute their projects. Responsibilities include creating a game idea, writing a story, developing the artwork, designing characters, implementing music and sound effects, programming and testing the game, and documenting the entire project. Recommended preparation: Junior or Senior standing and consent of instructor.

EECS 391. Introduction to Artificial Intelligence. 3 Units.
This course is an introduction to artificial intelligence. We will study the concepts that underlie intelligent systems. Topics covered include problem solving with search, constraint satisfaction, adversarial games, knowledge representation and reasoning using propositional and first order logic, reasoning under uncertainty, introduction to machine learning, automated planning, reinforcement learning and natural language processing. Recommended: basic knowledge of probability and statistics. Prereq: ENGR 131 or EECS 132.

EECS 393. Software Engineering. 3 Units.
Topics: Introduction to software engineering; software lifecycle models; development team organization and project management; requirements analysis and specification techniques; software design techniques; programming practices; software validation techniques; software maintenance practices; software engineering ethics. Undergraduates work in teams to complete a significant software development project. Graduate students are required to complete a research project. Recommended preparation for EECS 493: EECS 337. Offered as EECS 393 and EECS 493. Prereq: EECS 337.

EECS 394. Introduction to Information Theory. 3 Units.
This course is intended as an introduction to information and coding theory with emphasis on the mathematical aspects. It is suitable for advanced undergraduate and graduate students in mathematics, applied mathematics, statistics, physics, computer science and electrical engineering. Course content: Information measures-entropy, relative entropy, mutual information, and their properties. Typical sets and sequences, asymptotic equipartition property, data compression. Channel coding and capacity: channel coding theorem. Differential entropy, Gaussian channel, Shannon-Nyquist theorem. Information theory inequalities (400 level). Additional topics, which may include compressed sensing and elements of quantum information theory. Recommended Preparation: MATH 201 or MATH 307. Offered as MATH 394, EECS 394, MATH 494 and EECS 494. Prereq: MATH 223 and MATH 380 or requisites not met permission.

EECS 395. Senior Project in Computer Science. 4 Units.
Capstone course for computer science seniors. Material from previous and concurrent courses used to solve computer programming problems and to develop software systems. Professional engineering topics such as project management, engineering design, communications, and professional ethics. Requirements include periodic reporting of progress, plus a final oral presentation and written report. Scheduled formal project presentations during last week of classes. Prereq: Senior standing.

EECS 396. Independent Projects. 1 - 6 Unit.

EECS 397. Special Topics. 1 - 6 Unit.
Special topics in Computer Engineering, Computer Science, Electrical Engineering, and Systems and Control Engineering. Prereq: Limited to juniors and seniors.

EECS 398. Engineering Projects I. 4 Units.
Capstone course for electrical, computer and systems and control engineering seniors. Material from previous and concurrent courses used to solve engineering design problems. Professional engineering topics such as project management, engineering design, communications, and professional ethics. Requirements include periodic reporting of progress, plus a final oral presentation and written report. Scheduled formal project presentations during last week of classes. Prereq: Senior Standing. Prereq or Coreq: ENGR 398 and ENGL 398.

EECS 399. Engineering Projects II. 3 Units.
Continuation of EECS 398. Material from previous and concurrent courses applied to engineering design and research. Requirements include periodic reporting of progress, plus a final oral presentation and written report. Prereq: Senior Standing.
EECS 400T. Graduate Teaching I. 0 Units.
This course will provide the Ph.D. candidate with experience in teaching undergraduate or graduate students. The experience is expected to involve direct student contact but will be based upon the specific departmental needs and teaching obligations. This teaching experience will be conducted under the supervision of the faculty member who is responsible for the course, but the academic advisor will assess the educational plan to ensure that it provides an educational experience for the student. Students in this course may be expected to perform one or more of the following teaching related activities: grading homeworks, quizzes, and exams, having office hours for students, tutoring students. Recommended preparation: Ph.D. student in EECS department.

EECS 401. Digital Signal Processing. 3 Units.

EECS 405. Data Structures and File Management. 3 Units.
Fundamental concepts: sequential allocation, linked allocation, lists, trees, graphs, internal sorting, external sorting, sequential, binary, interpolation search, hashing file, indexed files, multiple level index structures, btrees, hashed files. Multiple attribute retrieval; inverted files, multi lists, multiple-key hashing, hd trees. Introduction to data bases. Data models. Recommended preparation: EECS 233 and MATH 304.

EECS 408. Introduction to Linear Systems. 3 Units.

EECS 409. Discrete Event Systems. 3 Units.
A broad range of system behavior can be described using a discrete event framework. These systems are playing an increasingly important role in modeling, analyzing, and designing manufacturing systems. Simulation, automata, and queuing theory have been the primary tools for studying the behavior of these logically complex systems; however, new methods and techniques as well as new modeling frameworks have been developed to represent and to explore discrete event system behavior. The class will begin by studying simulation, the theory of languages, and finite state automata, and queuing theory approaches and then progress to examining selected additional frameworks for modeling and analyzing these systems including Petrinets, perturbation analysis, and Min-Max algebras.

EECS 412. Electromagnetic Fields III. 3 Units.

EECS 413. Nonlinear Systems I. 3 Units.
This course will provide an introduction to techniques used for the analysis of nonlinear dynamic systems. Topics will include existence and uniqueness of solutions, phase plane analysis of two dimensional systems including Poincare-Bendixson, describing functions for single-input single-output systems, averaging methods, bifurcation theory, stability, and an introduction to the study of complicated dynamics and chaos. Recommended preparation: Concurrent enrollment in EECS 408.

EECS 415. Integrated Circuit Technology I. 3 Units.

EECS 416. Convex Optimization for Engineering. 3 Units.
This course will focus on the development of a working knowledge and skills to recognize, formulate, and solve convex optimization problems that are so prevalent in engineering. Applications in control systems; parameter and state estimation; signal processing; communications and networks; circuit design; data modeling and analysis; data mining including clustering and classification; and combinatorial and global optimization will be highlighted. New reliable and efficient methods, particular those based on interior-point methods and other special methods to solve convex optimization problems will be emphasized. Implementation issues will also be underscored. Recommended preparation: MATH 201 or equivalent.

EECS 417. Introduction to Stochastic Control. 3 Units.
Analysis and design of controllers for discrete-time stochastic systems. Review of probability theory and stochastic properties, input-output analysis of linear stochastic systems, spectral factorization and Weiner filtering, minimum variance control, state-space models of stochastic systems, optimal control and dynamic programming, statistical estimation and filtering, the Kalman-Bucy theory, the linear quadratic Gaussian problem, and the separation theorem. Recommended preparation: EECS 408.

EECS 419. Computer System Architecture. 3 Units.
Interaction between computer systems hardware and software. Pipeline techniques - instruction pipelines - arithmetic pipelines. Instruction level parallelism. Cache mechanism. I/O structures. Examples taken from existing computer systems.

EECS 421. Optimization of Dynamic Systems. 3 Units.
EECS 422. Solid State Electronics II. 3 Units.

EECS 423. Distributed Systems. 3 Units.
Introduction to distributed systems; system models; network architecture and protocols; interprocess communication; client-server model; group communication; TCP sockets; remote procedure calls; distributed objects and remote invocation; distributed file systems; file service architecture; name services; directory and discovery services; distributed synchronization and coordination; transactions and concurrency control; security; cryptography; replication; distributed multimedia systems. Recommended preparation: EECS 338.

EECS 424. Introduction to Nanotechnology. 3 Units.
An exploration of emerging nanotechnology research. Lectures and class discussion on 1) nanostructures: superlattices, nanowires, nanotubes, quantum dots, nanoparticles, nanocomposites, proteins, bacteria, DNA; 2) nanoscale physical phenomena: mechanical, electrical, chemical, thermal, biological, optical, magnetic; 3) nanofabrication: bottom up and top down methods; 4) characterization: microscopy, property measurement techniques; 5) devices/applications: electronics, sensors, actuators, biomedical, energy conversion. Topics will cover interdisciplinary aspects of the field. Offered as EECS 424 and EMAE 424.

EECS 425. Computer Networks I. 3 Units.

EECS 426. MOS Integrated Circuit Design. 3 Units.

EECS 428. Computer Communications Networks II. 3 Units.
Introduction to topics and methodology in computer networks and middleware research. Traffic characterization, stochastic models, and self-similarity. Congestion control (Tahoe, Reno, Sack). Active Queue Management (RED, FQ) and explicit QoS. The Web: overview and components, HTTP, its interaction with TCP, caching. Overlay networks and CDN. Expected work includes a course-long project on network simulation, a final project, a paper presentation, midterm, and final test. Recommended preparation: EECS 425 or permission of instructor.

EECS 433. Database Systems. 3 Units.

EECS 434. Microfabricated Silicon Electromechanical Systems. 3 Units.

EECS 435. Data Mining. 3 Units.
Data Mining is the process of discovering interesting knowledge from large amounts of data stored either in databases, data warehouses, or other information repositories. Topics to be covered include: Data Warehouse and OLAP technology for data mining, Data Preprocessing, Data Mining Primitives, Languages, and System Architectures, Mining Association Rules from Large Databases, Classification and Prediction, Cluster Analysis, Mining Complex Types of Data, and Applications and Trends in Data Mining. Recommended preparation: EECS 341 or equivalent.

EECS 437. Advanced Topics in Data Mining and Bioinformatics. 3 Units.
This course will cover a large number of active data mining and bioinformatics research areas, which include but not limited to: text mining, sequence analysis, network/graph mining, microarray analysis, and mining mobile objects. Students are expected to understand various methods and approaches employed in these research areas and have critical thinking on the advantages and disadvantages of these approaches. In addition, students need to complete a course-long project which exhibits the independent research capability in these data mining and bioinformatics areas. Recommended preparation: EECS 340, EECS 435.

EECS 438. Biomedical Microdevices. 3 Units.
Recent advances in large scale molecular biology have created the technological need for miniaturized instrumentation that can interact with macromolecules, cells, and tissue with high throughput and in many cases massively parallel formats. This course covers several applications of microfabricated devices to current problems in biology and medicine. The course material includes applications of miniaturization technologies for medical diagnostics and macromolecule assays, drug discovery, cellular activity monitoring and growth, and tissue engineering.

EECS 439. Web Data Mining. 3 Units.
Web crawling technology, web search and information extraction, unsupervised and semi-supervised learning techniques and their application to web data extraction, social network analysis, various pagerank algorithms, link analysis, web resource discovery, web, resource description framework (RDF), XML. Web Ontology Language (OWL). Recommended preparation: EECS 338, EECS 341.
EECS 440. Machine Learning. 3 Units.
Machine learning is a subfield of Artificial Intelligence that is concerned with the design and analysis of algorithms that "learn" and improve with experience. While the broad aim behind research in this area is to build systems that can simulate or even improve on certain aspects of human intelligence, algorithms developed in this area have become very useful in analyzing and predicting the behavior of complex systems. Machine learning algorithms have been used to guide diagnostic systems in medicine, recommend interesting products to customers in e-commerce, play games at human championship levels, and solve many other very complex problems. This course is focused on algorithms for machine learning: their design, analysis and implementation. We will study different learning settings, including supervised, semi-supervised and unsupervised learning. We will study different ways of representing the learning problem, using propositional, multiple-instance and relational representations. We will study the different algorithms that have been developed for these settings, such as decision trees, neural networks, support vector machines, k-means, harmonic functions and Bayesian methods. We will learn about the theoretical tradeoffs in the design of these algorithms, and how to evaluate their behavior in practice. At the end of the course, you should be able to: --Recognize situations where machine learning algorithms are applicable; --Understand, represent and formulate the learning problem; --Apply the appropriate algorithm(s), or if necessary, design your own, with an understanding of the tradeoffs involved; --Correctly evaluate the behavior of the algorithm when solving the problem. Prereq: EECS 391 or EECS 491 or consent of instructor.

EECS 441. Internet Applications. 3 Units.
This course exposes students to research in building and scaling internet applications. Covered topics include Web services, scalable content delivery, applications of peer-to-peer networks, and performance analysis and measurements of internet application platforms. The course is based on a collection of research papers and protocol specifications. Students are required to read the materials, present a paper in class, prepare short summaries of discussed papers, and do a course project (team projects are encouraged). Prereq: EECS 325 or EECS 425.

EECS 444. Computer Security. 3 Units.
General types of security attacks; approaches to prevention; secret key and public key cryptography; message authentication and hash functions; digital signatures and authentication protocols; information gathering; password cracking; spoofing; session hijacking; denial of service attacks; buffer overruns; viruses, worms, etc., principles of secure software design, threat modeling; access control; least privilege; storing secrets; socket security; RPC security; security testing; secure software installation; operating system security; database security; web security; email security; firewalls; intrusions. Recommended preparation: EECS 337.

EECS 450. Operations and Systems Design. 3 Units.
Introduction to design, modeling, and optimization of operations and scheduling systems with applications to computer science and engineering problems. Topics include, forecasting and times series, strategic, tactical, and operational planning, life cycle analysis, learning curves, resources allocation, materials requirement and capacity planning, sequencing, scheduling, inventory control, project management and planning. Tools for analysis include: multi-objective optimization, queuing models, simulation, and artificial intelligence.

EECS 451. Introduction to Digital Communications. 3 Units.
Analysis and design of modern digital communications systems: introduction to digital communication systems, review of basic analog and digital signal processing for both deterministic and stochastic signals, signal space representation, basis functions, projections and matched filters, pulse shaping, pulse amplitude modulation, quadrature amplitude modulation, deterministic performance and performance in noise, carrier frequency and phase tracking, symbol timing synchronization, source coding and channel coding. Extensive computer-based design exercises using Matlab and Simulink to design and test digital modems and communication systems. Prereq: STAT 332 or equivalent.

EECS 452. Random Signals. 3 Units.

EECS 454. Analysis of Algorithms. 3 Units.
This course presents and analyzes a number of efficient algorithms. Problems are selected from such problem domains as sorting, searching, set manipulation, graph algorithms, matrix operations, polynomial manipulation, and fast Fourier transforms. Through specific examples and general techniques, the course covers the design of efficient algorithms as well as the analysis of the efficiency of particular algorithms. Certain important problems for which no efficient algorithms are known (NP-complete problems) are discussed in order to illustrate the intrinsic difficulty which can sometimes preclude efficient algorithmic solutions. Recommended preparation: EECS 454: MATH 304 and (EECS 340 or EECS 405). Offered as EECS 454 and OPRE 454.

EECS 458. Introduction to Bioinformatics. 3 Units.

EECS 459. Bioinformatics for Systems Biology. 3 Units.
EECS 460. Manufacturing and Automated Systems. 3 Units.
Formulation, modeling, planning, and control of manufacturing and automated systems with applications to computer science and engineering problems. Topics include, design of products and processes, location/spatial problems, transportation and assignment, product and process layout, group technology and clustering, cellular and network flow layouts, computer control systems, reliability and maintenance, and statistical quality control. Tools and analysis include: multi-objective optimization, artificial intelligence, and heuristics for combinatorial problems. Offered as EECS 360 and EECS 460.

EECS 466. Computer Graphics. 3 Units.
Theory and practice of computer graphics: object and environment representation including coordinate transformations image extraction including perspective, hidden surface, and shading algorithms; and interaction. Covers a wide range of graphic display devices and systems with emphasis in interactive shaded graphics. Laboratory. Recommended preparation: EECS 233.

EECS 474. Advanced Control and Energy Systems. 3 Units.
This course introduces applied quantitative robust and nonlinear control engineering techniques to regulate automatically renewable energy systems in general and wind turbines in particular. The course also studies the fundamentals for dynamic multidisciplinary modeling and analysis of large multi-megawatt wind turbines (mechanics, aerodynamics, electrical systems, control concepts, etc.). The course combines lecture sessions and lab hours. The 400-level includes an experimental lab competition, where the object is to design, implement, and experimentally validate a control strategy to regulate a real system in the laboratory (helicopter control competition or similar); it will also include additional project design reports. Offered as EECS 374 and EECS 474. Prereq: EECS 374 and EECS 474. Prereq: EECS 374.

EECS 476. Mobile Robotics. 3 Units.
Design of software systems for mobile robot control, including: motion control; sensory processing; localization and mapping; mobile-robot planning and navigation; and implementation of goal-directed behaviors. The course has a heavy lab component involving a sequence of design challenges and competitions performed in teams.

EECS 478. Computational Neuroscience. 3 Units.
Computer simulations and mathematical analysis of neurons and neural circuits, and the computational properties of nervous systems. Students are taught a range of models for neurons and neural circuits, and are asked to implement and explore the computational and dynamic properties of these models. The course introduces students to dynamical systems theory for the analysis of neurons and neural learning, models of brain systems, and their relationship to artificial and neural networks. Term project required. Students enrolled in MATH 478 will make arrangements with the instructor to attend additional lectures and complete additional assignments addressing mathematical topics related to the course. Recommended preparation: MATH 223 and MATH 224 or BIOL 300 and BIOL 306. Offered as BIOL 378, COGS 378, MATH 378, BIOL 478, EBME 478, EECS 478, MATH 478 and NEUR 478.

EECS 483. Data Acquisition and Control. 3 Units.
Data acquisition (theory and practice), digital control of sampled data systems, stability tests, system simulation digital filter structure, finite word length effects, limit cycles, state-variable feedback and state estimation. Laboratory includes control algorithm programming done in assembly language.

EECS 484. Computational Intelligence I: Basic Principles. 3 Units.
This course is concerned with learning the fundamentals of a number of computational methodologies which are used in adaptive parallel distributed information processing. Such methodologies include neural net computing, evolutionary programming, genetic algorithms, fuzzy set theory, and "artificial life." These computational paradigms complement and supplement the traditional practices of pattern recognition and artificial intelligence. Functionalities covered include self-organization, learning a model or supervised learning, optimization, and memorization.

EECS 485. VLSI Systems. 3 Units.
Basic MOSFET models, inverters, steering logic, the silicon gate, nMOS process, design rules, basic design structures (e.g., NAND and NOR gates, PLA, ROM, RAM), design methodology and tools (spice, N.mpc, Caesar, mkpla), VLSI technology and system architecture. Requires project and student presentation, laboratory.

EECS 486. Research in VLSI Design Automation. 3 Units.
Research topics related to VLSI design automation such as hardware description languages, computer-aided design tools, algorithms and methodologies for VLSI design for a wide range of levels of design abstraction, design validation and test. Requires term project and class presentation.

EECS 488. Embedded Systems Design. 3 Units.
Objective: to introduce and expose the student to methodologies for systematic design of embedded system. The topics include, but are not limited to, system specification, architecture modeling, component partitioning, estimation metrics, hardware software codesign, diagnostics.

EECS 489. Robotics I. 3 Units.

EECS 490. Digital Image Processing. 3 Units.
Digital images are introduced as two-dimensional sampled arrays of data. The course begins with one-to-one operations such as image addition and subtraction and image descriptors such as the histogram. Basic filters such as the gradient and Laplacian in the spatial domain are used to enhance images. The 2-D Fourier transform is introduced and frequency domain operations such as high and low-pass filtering are developed. It is shown how filtering techniques can be used to remove noise and other image degradation. The different methods of representing color images are described and fundamental concepts of color image transformations and color image processing are developed. One or more advanced topics such as wavelets, image compression, and pattern recognition will be covered as time permits. Programming assignments using software such as MATLAB will illustrate the application and implementation of digital image processing.

EECS 491. Artificial Intelligence. 3 Units.
This course covers advanced topics in Artificial Intelligence. Topics include representing knowledge using directed and undirected probabilistic graphical models, associated exact and approximate inference algorithms, statistical relational learning, advanced topics in reinforcement learning and automated planning. Prereq: EECS 391 or consent.
EECS 492. VLSI Digital Signal Processing Systems. 3 Units.
Digital signal processing (DSP) can be found in numerous applications, such as wireless communications, audio/video compression, cable modems, multimedia, global positioning systems and biomedical signal processing. This course fills the gap between DSP algorithms and their efficient VLSI implementations. The design of a digital system is restricted by the requirements of applications, such as speed, area and power consumption. This course introduces methodologies and tools which can be used to design VLSI architectures with different speed-area tradeoffs for DSP algorithms. In addition, the design of efficient VLSI architectures for commonly used DSP blocks is presented in this class. Recommended preparation: EECS 485.

EECS 493. Software Engineering. 3 Units.
Topics: Introduction to software engineering; software lifecycle models; development team organization and project management; requirements analysis and specification techniques; software design techniques; programming practices; software validation techniques; software maintenance practices; software engineering ethics. Undergraduates work in teams to complete a significant software development project. Graduate students are required to complete a research project. Recommended preparation for EECS 493: EECS 337. Offered as EECS 393 and EECS 493.

EECS 494. Introduction to Information Theory. 3 Units.
This course is intended as an introduction to information and coding theory with emphasis on the mathematical aspects. It is suitable for advanced undergraduate and graduate students in mathematics, applied mathematics, statistics, physics, computer science and electrical engineering. Course content: Information measures-entropy, relative entropy, mutual information, and their properties. Typical sets and sequences, asymptotic equipartition property, data compression. Channel coding and capacity: channel coding theorem. Differential entropy, Gaussian channel, Shannon-Nyquist theorem. Information theory inequalities (400 level). Additional topics, which may include compressed sensing and elements of quantum information theory. Recommended Preparation: MATH 201 or MATH 307. Offered as MATH 394, EECS 394, MATH 494 and EECS 494.

EECS 495. Nanometer VLSI Design. 3 Units.
Semiconductor industry has evolved rapidly over the past four decades to meet the increasing demand on computing power by continuous miniaturization of devices. Now we are in the nanometer technology regime with the device dimensions scaled below 100nm. VLSI design using nanometer technologies involves some major challenges. This course will explain all the major challenges associated with nanoscale VLSI design such as dynamic and leakage power, parameter variations, reliability and robustness. The course will present modeling and analysis techniques for timing, power and noise in nanometer era. Finally, the course will cover the circuit/architecture level design solutions for low power, high-performance, testable and robust VLSI system. The techniques will be applicable to design of microprocessor, digital signal processor (DSP) as well as application specific integrated circuits (ASIC). The course includes a project which requires the student to work on a nanometer design issue. Recommended preparation: EECS 426 or EECS 485.

EECS 500. EECS Colloquium. 0 Units.
Seminars on current topics in Electrical Engineering and Computer Science.

EECS 500T. Graduate Teaching II. 0 Units.
This course will provide the Ph.D. candidate with experience in teaching undergraduate or graduate students. The experience is expected to involve direct student contact but will be based upon the specific departmental needs and teaching obligations. This teaching experience will be conducted under the supervision of the faculty member who is responsible for the course, but the academic advisor will assess the educational plan to ensure that it provides an educational experience for the student. Students in this course may be expected to perform one or more of the following teaching related activities: grading homeworks, quizzes, and exams, having office hours for students, running recitation sessions, providing laboratory assistance. Recommended preparation: Ph.D. student in EECS department.

EECS 516. Large Scale Optimization. 3 Units.
Concepts and techniques for dealing with large optimization problems encountered in designing large engineering structure, control of interconnected systems, pattern recognition, and planning and operations of complex systems; partitioning, relaxation, restriction, decomposition, approximation, and other problem simplification devices; specific algorithms; potential use of parallel and symbolic computation; student seminars and projects. Recommended preparation: EECS 416.

EECS 518. Nonlinear Systems: Analysis and Control. 3 Units.

EECS 520. Robust Control. 3 Units.
One of the most important problems in modern control theory is that of controlling the output of a system so as to achieve asymptotic tracking of prescribed signals and/or asymptotic rejection of undesired disturbances. The problem can be solved by the so-called regulator theory and H-infinity control theory. This course presents a self-contained introduction to these two important design methods. The intention of this course is to present ideas and methods on such a level that the beginning graduate student will be able to follow current research. Both linear and nonlinear results will be covered. Recommended preparation: EECS 408.

EECS 523. Advanced Neural Microsystems. 3 Units.
This course will cover the latest advances in neuroengineering with specific attention to integrated Microsystems targeting wired/wireless multichannel interfacing with the nervous system at the cellular level in biological hosts. The aim is to provide students familiar with microfabrication and integrated circuit design with an application-driven, system-level overview of sensors and microelectronics in Microsystems format for neural engineering. Recommended preparation: EECS 426.

EECS 526. Integrated Mixed-Signal Systems. 3 Units.
Mixed-signal (analogue/digital) integrated circuit design. D-to-A and A-to-D conversion, applications in mixed-signal VLSI, low-noise and low-power techniques, and communication sub-circuits. System simulation at the transistor and behavioral levels using SPICE. Class will design a mixed-signal CMOS IC for fabrication by MOSIS. Recommended preparation: EECS 426.
EECS 527. Advanced Sensors: Theory and Techniques. 3 Units.
Sensor technology with a primary focus on semiconductor-based devices. Physical principles of energy conversion devices (sensors) with a review of relevant fundamentals: elasticity theory, fluid mechanics, silicon fabrication and micromachining technology, semiconductor device physics. Classification and terminology of sensors, defining and measuring sensor characteristics and performance, effect of the environment on sensors, predicting and controlling sensor error. Mechanical, acoustic, magnetic, thermal, radiation, chemical and biological sensors will be examined. Sensor packaging and sensor interface circuitry.

EECS 531. Computer Vision. 3 Units.
The goal of computer vision is to create visual systems that recognize objects and recover structures in complex 3D scenes. This course emphasizes both the science behind our understanding of the fundamental problems in vision and the engineering that develops mathematical models and inference algorithms to solve these problems. Specific topics include feature detection, matching, and classification; visual representations and dimensionality reduction; motion detection and optical flow; image segmentation; depth perception, multi-view geometry, and 3D reconstruction; shape and surface perception; visual scene analysis and object recognition.

EECS 589. Robotics II. 3 Units.
Survey of research issues in robotics. Force control, visual servoing, robot autonomy, on-line planning, high-speed control, man/machine interfaces, robot learning, sensory processing for real-time control. Primarily a project-based lab course in which students design real-time software executing on multi-processors to control an industrial robot. Recommended preparation: EECS 489.

EECS 600. Special Topics. 1 - 18 Unit.
Offered as EECS 600 and SYBB 600.

EECS 600T. Graduate Teaching III. 0 Units.
This course will provide Ph.D. candidate with experience in teaching undergraduate or graduate students. The experience is expected to involve direct student contact but will be based upon the specific departmental needs and teaching obligations. This teaching experience will be conducted under the supervision of the faculty member who is responsible for the course, but the academic advisor will assess the educational plan to ensure that it provides an educational experience for the student. Students in this course may be expected to perform one or more of the following teaching related activities running recitation sessions, providing laboratory assistance, developing teaching or lecture materials presenting lectures. Recommended preparation: Ph.D. student in EECS department.

EECS 601. Independent Study. 1 - 18 Unit.

EECS 602. Advanced Projects Laboratory. 1 - 18 Unit.

EECS 620. Special Topics. 1 - 18 Unit.

EECS 621. Special Projects. 1 - 18 Unit.

EECS 649. Project M.S.. 1 - 9 Unit.

EECS 651. Thesis M.S.. 1 - 18 Unit.
Department of Macromolecular Science and Engineering

Macromolecular science and engineering is the study of the synthesis, structure, processing, and properties of polymers. These giant molecules are the basis of synthetic materials including plastics, fibers, rubber, films, paints, membranes, and adhesives. Research is constantly expanding these applications through the development of new high performance polymers, e.g., for engineering composites, electronic, optical, and biomedical uses. In addition, most biological systems are composed of macromolecules—proteins (e.g., silk, wool, tendon), carbohydrates (e.g., cellulose) and nucleic acids (RNA and DNA) are polymers and are studied by the same methods that are applied to synthetic polymers.

Production of polymers and their components is central to the chemical industry, and statistics show that over 75 percent of all chemists and chemical engineers in industry are involved with some aspect of polymers. Despite this, formal education in this area is offered by only a few universities in this country, resulting in a continued strong demand for our graduates upon completion of their BS, MS, or PhD degrees.

Research
The research activities of the department span the entire scope of macromolecular science and polymer technology.

Synthesis
New types of macromolecules are being made in the department’s synthesis laboratories. The emphasis is on creating polymers with novel functional properties such as photoconductivity, selective permeation, and biocompatibility, and in producing new materials which behave like classical polymers without being linked together by covalent bonds.

Physical Characterization
This is the broad area of polymer analysis, which seeks to relate the structure of the polymer at the molecular level to the bulk properties that determine its actual or potential applications. This includes characterization of polymers by infrared, Raman, and NMR and mass spectroscopy, thermal and rheological analysis, determination of structure and morphology by x-ray diffraction, electron microscopy, and atomic force microscopy, permeability and free volume, and investigation of molecular weights and conformation by light scattering.

Mechanical Behavior and Analysis
Polymeric materials are known for their unusual mechanical capabilities, usually exploited as components of structural systems. Analysis includes the study of viscoelastic behavior, yielding and fracture phenomena and a variety of novel irreversible deformation processes.

Processing
A major concern of industry is the efficient and large scale production of polymer materials for commercial applications. Research in this area is focusing on reactive processing, multi-layer processing and polymer mixing, i.e., compounding and blends. The integration of sensors and processing equipment, and methods for examining changes in structure and composition during processing steps are growing areas of inquiry. Both laboratory and simulation research are brought to bear on these critical issues.

Materials Development and Design
Often, newly conceived products require the development of polymeric materials with certain specific properties or design characteristics. Materials can be tailor-made by designing synthesis and processing conditions to yield the best performance under specified conditions. Examples might be the design of photoluminescent and semi-conducting polymers for use in optoelectronic devices, polymers that are stable at high temperatures for fire-retardant construction materials, high temperature polymer electrolytes for use in advanced fuel cells, low density thermal insulating polymer composite materials, advanced polymeric optical devices, and biocompatible polymers for use in prosthetic implants, reconstructive medicine and drug-delivery vehicles.

Biopolymers
Living systems are composed primarily of macromolecules, and research is in progress on several projects of medical relevance. The department has a long-standing interest in the hierarchical structure and properties of the components of connective tissues (e.g., skin, cartilage, and bone). The department is also engaged in the development of new biocompatible polymers for applications in human health.

Undergraduate Programs
In 1970, the department introduced a program leading to the Bachelor of Science in Engineering degree with a major in polymer science, which is designed to prepare the student both for employment in polymer-based industry and for graduate education in polymer science. The Bachelor of Science degree program in Polymer Science and Engineering is accredited by the Engineering Accreditation Commission of ABET, www.abet.org (http://www.abet.org).

The Case School of Engineering is proud that the polymer science and engineering program was the first such undergraduate program in the country to receive accreditation from the Engineering Council for Professional Development. The curriculum combines courses dealing with all aspects of polymer science and engineering with basic courses in chemistry, physics, mathematics, and biology, depending on the needs and interests of the student. The student chooses a sequence of technical electives, in consultation with a faculty advisor, allowing a degree of specialization in one particular area of interest, e.g., biomaterials, chemical engineering, biochemistry, or physics. In addition to required formal laboratory courses, students are encouraged to participate in the research activities of the department, both through part-time employment as student laboratory technicians and through the senior project requirement: a one or two semester project that involves the planning and performance of a research project.

Polymer science undergraduates are also strongly encouraged to seek summer employment in industrial laboratories during at least one of their three years with the department. In addition to the general undergraduate curriculum in macromolecular science, the department offers three specialized programs which lead to the BS with a macromolecular science major. The cooperative program contains all the course work required for full-time resident students plus one or two six-month cooperative sessions in polymer-based industry. The company is selected by the student in consultation with his or her advisor, depending on the available opportunities. The dual-degree program allows students to work simultaneously on two baccalaureate level degrees within the university. It generally takes five years to complete the course requirements for each department for the degree. The BS/MS program leads to the simultaneous completion of requirements for both the master’s and bachelor’s degrees. Students with a minimum GPA of 3.0 may apply for admission to this program in their junior year.
Mission Statement
To educate students who will excel and lead in the development of polymeric materials and the application of structure-property relationships. The department seeks to prepare students for either professional employment or advanced education, primarily in this or related science or engineering disciplines, but also in professional schools of business, law or medicine. Undergraduate students are offered opportunities for significant research experience, capitalizing on the strength of our graduate program.

Educational Objectives
Our program will produce graduates who:

1. Are competent, creative, and highly valued professionals in industry, academia, or government.
2. Are flexible and adaptable in the workplace, possess the capacity to embrace new opportunities of emerging technologies, and embrace leadership and teamwork opportunities, all affording sustainable engineering careers.
3. Continue their professional development by obtaining advanced degrees in Polymer Science and Engineering or other professional fields, as well as medicine, law, management, finance or public policy.
4. Act with global, ethical, societal, ecological, and commercial awareness expected of practicing engineering professionals.

Student Outcomes
As preparation for achieving the above educational objectives, the BS degree in Polymer Science and Engineering is designed so that students attain:

- an ability to apply knowledge of mathematics, science, and engineering
- an ability to design and conduct experiments, as well as to analyze and interpret data
- an ability to design a system, component, or process to meet desired needs
- an ability to function in multi-disciplinary teams
- an ability to identify, formulate, and solve engineering problems
- an understanding of professional and ethical responsibility
- an ability to communicate effectively
- the broad education necessary to understand the impact of engineering solutions in a global and societal context
- a recognition of the need for, and an ability to engage in life-long learning
- a knowledge of contemporary issues
- an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

Bachelor of Science in Engineering
Suggested Program of Study: Major in Polymer Science and Engineering (standard track)

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**Bachelor of Science in Engineering**

**Suggested Program of Study: Major in Polymer Science and Engineering (biomaterials track)**

**First Year**

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**Year Total:** 18 15

**Third Year**

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<td>Structure of Biological Materials (EMAC 303)</td>
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**Year Total:** 18 15

**Fourth Year**

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**Year Total:** 16 15

**Total Units in Sequence:** 129

**Hours required for graduation:** 129

- Engineering Core Courses
- Choice of USNA, USSO, or USSY course focused on thinking about the natural, social, or symbolic “world.”
- Approved Natural Science electives:
  - BIOL 214 Genes, Evolution and Ecology (d);
  - BIOL 215 Cells and Proteins (d);
  - BIOL 307 General Biochemistry (d);
  - BIOL 362 Principles of Developmental Biology
- Suggested for pre-med students
- EMAC 355 Polymer Analysis Laboratory is strongly recommended.
At least 3 of the 4 Technical Electives have to be taken from:
- EBME 315 Applied Tissue Engineering;
- EBME 316 Biomaterials for Drug Delivery;
- EBME 325 Introduction to Tissue Engineering;
- EBME 350 Quantitative Molecular Bioengineering;
- EBME 408 Engineering Tissues/Materials - Learning from Nature's Paradigms;
- EBME 426 Nanomedicine;
- EMAC 471 Polymers in Medicine / EBME 406 Polymers in Medicine;
- a three-credit research sequence of EMAC 125 Freshman Research on Polymers and EMAC 325 Undergraduate Research in Polymer Science
- EMAC 372 Polymer Processing and Testing Laboratory (offered in the spring semester of the fourth year)

Preparation for the polymer science project should commence in the previous semester.

**Minor in Polymer Science and Engineering**

The minor in Polymer Science and Engineering consists of five courses from the list below (special arrangements can be made to include appropriate EMAC graduate courses as well).

Choose any five of the following: 15

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<td>Polymer Properties and Design</td>
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<td>Fundamentals of Non-Newtonian Fluid Mechanics and Polymer Rheology</td>
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Total Units: 15

**Graduate Programs**

Courses leading to the Master of Science (MS) and Doctor of Philosophy (PhD) degrees in macromolecular science are offered within the Case School of Engineering. They are designed to increase the student’s knowledge of macromolecular science and of his or her own basic area of scientific interest, with application to specific polymer research problems. Research programs derive particular benefit from close cooperation with graduate programs in chemistry, physics, materials science, chemical engineering, biological sciences, and other engineering areas. The interdisciplinary academic structure allows the faculty to fit the individual program to the student’s background and career plans. Basic and advanced courses are offered in polymer synthesis, physical chemistry, physics, biopolymers, and applied polymer science and engineering. A laboratory course in polymer characterization instructs students in the use of modern experimental techniques and equipment. Graduate students are also encouraged to take advanced course work in polymer solid state physics, physical chemistry, synthesis, rheology, and polymer processing. The department also offers, in conjunction with the School of Medicine, a six- to seven-year MD/PhD program for students interested in the application of polymers and plastics to medicine, as well as for students interested in a molecular structural basis of medicine, particularly related to connective tissues, biomechanics, aging, pharmaceuticals, and blood behavior. Initiated in 1977, it is the only program of its kind in the nation.

**Master of Science**

**Master’s Thesis (Plan A)**

The minimum requirement to complete a master’s degree under Plan A is 27 hours. Of the 27 hours, at least 18 hours must be coursework, and 9 hours must be EMAC 651 Thesis M.S. (thesis research). At least 18 semester hours of coursework, including thesis, must be at the 400 level or higher.

All Plan A MS students must take 6 credits of departmental fundamentals courses including the lab component. Please note: Once a student begins registration of EMAC 651 Thesis M.S., the student must register for at least one credit hour of this course every semester until graduation. The normal residency period for an MS degree is 2 years.

For completion of master’s degree Plan A, an oral examination (defense) of the master’s thesis is required. The examination is conducted by a committee of three university faculty members. The candidate’s thesis advisor usually serves as the chair of the examining committee. The chair of the department or the curricular program faculty appoints members of the committee. The examining committee must agree unanimously that the candidate has passed the thesis examination.

**Master’s Comprehensive (Plan B)**

The master’s Plan B program is available for individuals who live out-of-state or are working full-time. A research report and oral examination is required before graduation. This option requires 27 total credit hours; categorized by the following:

1. 3-6 cr. hrs. need to be project credit (independent study) which needs to be approved by advisor
2. 21-24 course credits (of which 9 must be based in Macromolecular Science); and
3. 6 core course credits.

Each candidate for the master’s degree under Plan B must satisfactorily pass a comprehensive examination, which is administered by the department or curricular program committee. The examination may be written or oral or both. A student must be registered during the semester in which any part of the comprehensive examination is taken. If not registered for other courses, the student will be required to register for one semester hour of EXAM 600 Master’s Comprehensive Exam, before taking the examination.

Elective and core courses can be taken via Distance Learning (ITN) or by transfer (transfers need to be approved by chair of department and dean of graduate studies; core courses also needs instructors’ approval).

**PhD Programs**

The PhD program consists of 36 hours of coursework, including the departmental core courses and 18 credit hours of PhD thesis (EMAC 701 Dissertation Ph.D.) are required for the PhD degree, in addition to passing the research qualifying exam (oral proposal) and the written qualifying exam.

Of the coursework credit requirements, the core courses are designated as “depth” courses (12 credits). In addition, all students will take a minimum of two breadth courses in basic science and/or other departments in the School of Engineering (for a total of six credits). The remaining breadth requirements (up to 18 credits) are satisfied by course modules taken in Macromolecular Science and Engineering.
Each doctoral student is responsible for becoming sufficiently familiar with the research interests of the department or program faculty to choose in a timely manner a faculty member who will serve as the student’s research advisor. The research advisor is expected to provide mentorship in research conception, methods, performance and ethics, as well as focus on development of the student’s professional communication skills, building professional contacts in the field, and fostering the professional behavior standard of the field and research in general.

The research advisor also assists with the selection of three other faculty to serve as the required additional members of the dissertation advisory committee. This committee must be formed within the second semester following admission. Throughout the development and completion of the dissertation, these members are expected to provide constructive criticism and helpful ideas generated by the research problem from the viewpoint of their particular expertise. Each member will make an assessment of the originality of the dissertation, its value, the contribution it makes and the clarity with which concepts are communicated, especially to a person outside the field.

The doctoral student is expected to arrange meetings and maintain periodic contact with each committee member. A meeting of the full committee for the purpose of assessing the student’s progress should occur at least once a year until the completion of the dissertation.

For students entering the PhD program with a MS degree, 18, instead of 36 credit hours, of coursework is required. Other requirements for a PhD remain the same as described above. Normally students should orient their training around their main area of interest/expertise and in relation to their research program. For those enrolled in the MD/PhD degree program, all 18 course credits for breadth and depth courses must be taken within the Medical School Program.

The core courses designated as depth courses are:

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Students are required to take all four depth courses (12 credits), but on the approval of the instructor, can be excused from one or more of the courses if the relevant course content is not satisfied by a course taken in prior undergraduate or graduate degrees. However, the excused credits must be fulfilled by taking additional breadth courses. NOTE: While EMAC 401 Polymer Foundation Course I: Organic Chemistry and EMAC 402 Polymer Foundation Course II: Physical Chemistry, and EMAC 403 Polymer Foundation Course III: Physics and EMAC 404 Polymer Foundation Course IV: Engineering are offered at the same time in the Fall and Spring semesters, respectively, students can still sign up for both courses, since one is offered in the first half and the other in the second half of the semester.

Two courses in basic science and/or engineering are required. These courses can be taken in other departments of the School of Engineering, or in the departments of Mathematics, Biology, Biochemistry, Chemistry, or Physics as approved by the advisor.

As part of the course requirements, all students are required to register for EMAC 677 Colloquium in Macromolecular Science and Engineering (the Friday departmental seminars) which will be graded with either “Pass” or “No Pass.”

Students who have taken EMAC 370 Polymer Chemistry and Industry and EMAC 376 Polymer Engineering as undergraduates can use these courses to fulfill one or more of the depth requirements in the Department of Macromolecular Science and Engineering for the MS and PhD degree. However, the credits for this course cannot be applied towards the course credit requirements for the graduate degree. Exceptions are possible for the combined BS/MS program.

**Engineering School Requirements**

**Depths:** The foundation courses are deemed to satisfy the depth requirements (12 credits).

**Breadth:** Two courses in basic science and/or other departments in the School of Engineering (for a total of six credits). The remaining breadth requirements (18 credits) are satisfied by course modules taken in Macromolecular Science and Engineering.

**Graduate Rules**

Graduates entering the Department of Macromolecular Science and Engineering are subject to the academic rules of the University, of the School of Engineering, and of the Department. Consult the Graduate Student Handbook (http://gradstudies.case.edu).

A short abstract of important points include:

1. GPA requirements are described below in the Departmental Rules.
2. A student receiving a “U” in a course is automatically placed on probation and must remove him/herself from probation within one year (usually by repeating the course). If a course is repeated, both original and revised grades will count in the grade point average.
3. Some students are admitted on a probationary basis and must achieve a 3.0 GPA after two semesters to remain in good standing (this is a rule of the Engineering School).
4. Students entering the graduate program for a PhD need to fill out the “Planned Program of Study” by the end of their second semester.
5. All students are required to serve as teaching assistants. Responsibilities as a TA include serving as an instructor, lab assistant, recitation leader, grader, or tutor in an undergraduate course. After fulfilling the required teaching assistant program, UNIV 400, students will make sure that three teaching courses (400T, 500T, and 600T) are listed on their Planned Program of Study. Completion of this teaching requirement will be monitored by Graduate Studies and is required in order to graduate.

**Engineering School Rules**

Most of these rules are incorporated in the number and type of courses required by the Department. However, Case School of Engineering PhD students are required to 1) maintain full-time status as a PhD bound student; 2) maintain a grade point average of 3.2 or above; and 3) continue making satisfactory academic progress as certified by their advisor.

**Departmental Rules**

1. Students in the PhD program receiving a GPA below 2.50 in any two consecutive semesters will be asked to terminate their graduate study program.
2. The GPA requirement established by the university at various stages of the graduate program shall exclude MS or PhD thesis credits which will be graded "S" or "U" until a final grade is given at the end of the program. Hence a student must maintain a minimum GPA of 2.75 (for an MS) OR a 3.0 (for a PhD) in coursework. (As mentioned above, Case School of Engineering PhD students must maintain a GPA of 3.2 or above.)
4. Plan A MS students must give a departmental seminar (as part of the student lecture series).

5. Plan B MS degrees are limited to non-fellowship students.

6. Coursework may be transferred from another university, subject to Graduate Committee approval if:
   - the courses duplicate requirements of the department;
   - the courses were in excess of the undergraduate degree requirements; or
   - the courses were taken in a graduate program elsewhere;
   - a grade of B or better was achieved in those courses;
   - a petition is made to and approved by the Graduate Committee of the Department
   - the transferred grades will not count in the GPA at CWRU.

7. Plan B MS degrees are limited to non-fellowship students.

8. The Department reserves the right to withhold financial support to a student if that student takes an undue amount of time in completing his/her MS or PhD requirements (normally no longer than 3 years for MS and 5 years after initial registration of EMAC 701 Dissertation Ph.D.).

9. A PhD student must pass the written Qualifying Exam within 24 months after enrollment with a MS degree into the PhD program. A PhD student must pass the written Qualifying Exam within 24 months after enrollment with a BS degree into the PhD program. A student only has two chances to pass the Qualifying Exam. Students will be asked to answer 4 mandatory questions – one from each of the following five areas:
   - Polymer Synthesis
   - Polymer Physical Chemistry
   - Polymer Physics
   - Applied Polymer Science
   - Seminars (from the previous year)

   Two elective questions will be chosen from a number of questions from all elective courses offered in the Department. NOTE: The Qualifying Exam is given twice per year respectively on the first Friday in the beginning and the first Friday after the end of the Spring semester. For PhD students enrolled in a Spring semester, those with MS must pass the Qualifying Exam at the end of his/her second Spring semester, and those with BS must pass it at the beginning of his/her third Spring semester.

10. It is expected that all students will present the results of their research at the student lecture series.

11. At least three (3) weeks prior to the RQE oral defense, the student will submit to the graduate chairperson a research proposal title with a one-paragraph synopsis of the research problem and approach, along with suggestions for two members (i) and (ii), below) of the three member examining committee. The examining committee will consist of three faculty members: (i) a member (or intended member) of the student’s Thesis Advisory Committee, (ii) an expert in the research proposal area and (iii) a faculty member selected systematically and in a neutral manner by the Graduate Committee. The student’s primary thesis advisor or co-advisors is/are excluded from the examining committee. Upon establishing the examining committee, the student will arrange with the committee for the date, time, and location of the RQE. The student will then distribute the written research proposal to the examining committee five full business days before the defense. It should be no less than 15 and no more than 20 pages of double-spaced text with 1” margins on all sides. No more than 5 pages can be devoted to the proposal introduction or background. Figures, tables, and schemes should not exceed five pages in total. Literature citations are in addition to this page count. The oral presentation will be chaired by a designated chairperson from the examining committee. It should contain only limited background material, focusing primarily on execution of the proposed research. The oral presentation should last 20-30 minutes, with questions from faculty being for clarification only. Following the presentation, the examining committee will ask questions for the student to answer concerning the proposal. On the basis of the written proposal and oral defense (presentation and question responses) the faculty will then confer and tender a decision of pass, conditional pass with major revision, or fail, immediately. The decision will be communicated to the student and graduate chairperson in writing within one business day.

12. All PhD students are required to fulfill their teaching requirement by registering for the three teaching courses, 400T, 500T, and 600T that will be posted to the departmental roster each semester. Completion of the teaching requirement will be monitored by Graduate Studies, and these three teaching courses must appear both on the Program of Study form and the student’s transcript.

13. The Research Qualifying Exam (RQE) is designed to test the student’s knowledge of the chosen field as well as his/her originality and ability to perform high quality, independent research. It consists of a written research proposal and an oral defense. All PhD students who hold an MS degree must pass the RQE within 2 years of enrolling in the PhD program, while students with a BS degree must do so within 2.5 years. Successful passing of the Written Qualifying Exam (not to be confused with the written portion of this RQE) is prerequisite to taking the RQE. Students have two chances to pass the RQE and no student will be allowed to continue on to a PhD degree if he/she has not successfully taken it. A conditional pass with major revision (see below) requires modification to the written or oral portion, at the examination committee discretion, within ten business days and following guidelines by the examination committee. A second exam, if required due to failure of the first exam, must be taken within six months of the first exam with at least one examination committee member remaining the same. Passing the exam constitutes advancement to candidacy and is required for enrolling in EMAC 701 Dissertation Ph.D.

14. The department requires the equivalent of six credit hours of departmental assistance. This requirement takes the form of grading, laboratory assistance and/or general departmental duties and is designed to utilize no more than three hours/week of a student’s time. The departmental service requirement must be completed within the first two semesters of study. However, the departmental service requirement form must be turned in at the end of the each semester until the obligation is met.
19. Vacation Policy. Graduate students in the department who receive fellowship support for 12 months are normally entitled to two weeks vacation plus national holidays. Alternative arrangements may be made with the student’s advisor, giving ample advance notice. In certain situations it is possible to take a leave of absence without financial support.

20. Prior to graduation a student is required to clean out his/her laboratory space including a removal of waste solvents and hazardous material.

21. Failure to comply with all of the above course requirements may result in termination or delay graduation.

Facilities

The Kent Hale Smith Science and Engineering Building houses the Department of Macromolecular Science. The building was built in 1993, and specifically designed to meet the specific needs of polymer research. The facility consists of five floors, plus a basement. The laboratories for chemical synthesis are located principally on the top floor, the molecular and materials characterization laboratories on the middle floors, and the major engineering equipment on the ground floor, while the NMR, MALDI-TOF, and TA-InstrumentsThermal Characterization instrumentation are located in the basement. Modern, computer-interfaced classrooms are installed on the ground floor. Additional instrumentation available includes Small and Wide-Angle X-ray diffractometers; scanning electron microscopy; a complete range of molecular spectroscopic equipment including FTIR, laser Raman, and high resolution solution and solid-state NMR (including imaging), as well as Raman and FTIR microscopes; and dynamic light scattering spectroscopy. There are also facilities for polymer characterization (molecular weight distribution), optical microscopy, solution and bulk rheology, scanning calorimetry, and for testing and evaluating the mechanical properties of materials. A newly built-out processing lab provides the complete suite of Thermo-Fisher batch, single- and twin-screw mixing and extrusion equipment, as well as that manufacturer’s state of the art rheometers. The C. Richard Newpher polymer processing laboratory includes a high temperature Rheometrics RMS-800 dynamic mechanical spectrometer, a Bomem DA-3 FTIR with FT-Raman capabilities, a compression molding machine, a Brabender plasticorder, a high speed Instron testing machine, and a vibrating sample magnetometer. The Charles E. Reed ’34 Laboratory is concerned with the mechanical analysis of polymeric materials. The major testing is done by Instron Universal testing instruments including an Instron model 1123 with numerous accessories such as an environmental chamber for high or low temperature experiments. Additional mechanical testing of fibers, films and injection-molded (Boy model 22-S) are provided by MTS universal testers which are used for both research and undergraduate teaching laboratory classes. The NSF Center for Layered Polymeric Systems (CLiPS) has its central facility within the department, with three cutting-edge multilayer extrusion systems as its centerpiece. CLiPS also operates a Bruckner KARO IV biaxial stretching unit, which allows controlled biaxial stretching of polymer films, and an Atomic Force Microscope which probes the morphological and mechanical properties of materials at the nanoscale. The Molecular Modeling Center provides access to various software packages for the rheological and molecular modeling of polymers.

Faculty

David Schiraldi, PhD
(University of Oregon)

Professor and Chair
Advanced composites based on aerogels and nanofillers, monomer and polymer synthesis, structure-property relationships, polymer degradation, polymerization catalysis, synthetic fibers, barrier packaging materials.

Rigoberto C. Advincula, PhD
(University of Florida)
Professor
Design and synthesis of nanostructured materials, dendrimers, polymer brushes, thin films, and the use of innovative surface characterization techniques. Applications in electro-optical devices, sensors, biomaterials, and smart coatings.

John Blackwell, PhD
(University of Leeds, England)
Leonard Case Jr. Professor
Determination of the solid state structure and morphology of polymers. X-ray analysis of the structure of thermotropic copolyesters, copolyimides, polyurethanes, polysaccharides; supramolecular assemblies, fluoropolymers; molecular modeling of semi-crystalline and liquid crystalline polymers; rheological properties of polysaccharides and glycoproteins.

Liming Dai, PhD
(Australian National University)
Kent Hale Smith Professor
Multifunctional nanomaterials; optoelectronic macromolecules; and biomaterials and bioinspiration.

Hatsuo Ishida, PhD
(Case Western Reserve University)
Professor
Processing of polymers and composite materials; structural analysis of surfaces and interfaces; molecular spectroscopy of synthetic polymers

Alexander M. Jamieson, DPhil
(Oxford University, England)
Professor
Quasielastic laser light scattering; relaxation and transport of macromolecules in solution and bulk; structure-function relationships of biological macromolecules.

LaShanda T. Korley, PhD
(Massachusetts Institute of Technology)
Assistant Professor
Structure-function relationships; toughening mechanisms in segmented copolymers; spatial confinement of self-assembled materials, including biomaterials; hierarchical microstructures.

João Maia, PhD
(University of Wales Aberystwyth, U.K.)
Associate Professor
Emeriti Faculty

Jack L. Koenig, PhD  
(University of Nebraska, Lincoln)  
The Donnell Institute Professor Emeritus  
Polymer structure-property relationships using infrared, Raman, NMR spectroscopy and spectroscopic imaging techniques

Jerome B. Lando, PhD  
(Polytechnic Institute of Brooklyn)  
Professor Emeritus  
Solid state polymerization; X-ray crystallography of polymers; electrical properties of polymers; ultra-thin polymer films

Morton H. Litt, PhD  
(Polytechnic Institute of Brooklyn)  
Professor Emeritus

Kinetics and mechanisms of free radical and ionic polymerization; mechanical properties of polymers; fluorocarbon chemistry; synthesis of novel monomers and polymers; polymer electrical properties; cross-linked liquid crystal polymers

Charles E. Rogers, PhD  
(Syracuse University and State University of New York)  
Professor Emeritus  
Transport and mechanical properties of polymers; synthesis and properties of multicomponent systems; environmental effect on polymers; adhesion, adhesives, and coatings

Secondary Faculty

James M. Anderson, PhD  
(Orange State University, M.D.)  
Professor of Macromolecular Science, Pathology, and Biomedical Engineering  
Biomaterials for delivery of therapeutic proteins; protein-polymer conjugates; drug-delivery; biopolymer catalysts; self-assembling peptides; affinity-based delivery of therapeutics; layered polymeric delivery systems

Gary Wnek, PhD  
(Massachusetts Institute of Technology)  
F. Alex Nason Professor of Materials Science  
Optical materials and elements, optical properties and electronic structure of materials, and electrodynamic van der Waals-London dispersion interactions

Erin Lavik, PhD  
(Massachusetts Institute of Technology)  
Elmer Lincoln Lindseth Associate Professor in Biomedical Engineering  
Development of new approaches to understand and treat injuries and to diseases of the spinal cord, optic nerve, and retina

J. Adin Mann Jr., PhD  
(Iowa State University)  
Professor of Chemical Engineering  
Surface phenomena, interfacial dynamics, light scattering, and stochastic processes of adsorption and molecular rearrangement at interfaces

Roger Marchant, PhD  
(Case Western Reserve University)  
Professor of Biomedical Engineering  
Biopolymers, polymer surface coatings, and properties and characterization of polymer surfaces on implants and sensors

Primary Faculty

Polymer rheology: extensional rheology and rheometry; micro- and nano-rheology; bio-rheology: food rheology and processing; rheology for macromolecular technology: development and optimization of polymer blends and composites; viscoelasticity of micro- and nano-layered polymer films; on- and in-line monitoring of extrusion-based processes; micro-processing; environmental rheology and processing

Ica Manas-Zloczower, DSc  
(Israel Institute of Technology)  
Professor and Associate Dean of Faculty Development  
Structure and micromechanics of fine particle clusters; interfacial engineering strategies for advanced materials processing; dispersive mixing mechanisms and modeling; design and mixing optimization studies for polymer processing equipment through flow simulations

John Pokorski, PhD  
(Northwestern University)  
Assistant Professor  
Biomaterials for delivery of therapeutic proteins; protein-polymer conjugates; drug-delivery; biopolymer catalysts; self-assembling peptides; affinity-based delivery of therapeutics; layered polymeric delivery systems

Stuart Rowan, PhD  
(University of Glasgow, UK)  
Kent Hale Smith Professor  
Organic chemistry, synthesis, supramolecular chemistry, conducting polymers, interlocked macromolecules (polyrotaxanes and polycatenanes), peptide nucleic acids, supramolecular polymerization, reversible ‘dynamic’ chemistry and combinatorial libraries

Gary Wnek, PhD  
(University of Massachusetts, Amherst)  
The Joseph F. Toot, Jr., Professor of Engineering and Faculty Director, The Institute for Management and Engineering (TIME)  
Polymers with unusual electrical or optical properties; biomaterials for tissue engineering and regenerative medicine; electric field-mediated processing (electrospinning of nano- and micro fibers and morphology modulation in polymer blends); polymer-based microfluidic platforms; polymer product design

Lei Zhu, PhD  
(University of Akron)  
Associate Professor  
Nanoscale structure and morphology of crystalline/liquid crystalline polymers and block copolymers; ferroelectric and dielectric polymers for electric energy storage; polymer/inorganic hybrid nanocomposites; biodegradable polymers for diagnostic and drug delivery
Experimental condensed matter physics and liquid crystal physics

Kenneth Singer, PhD
(University of Pennsylvania)
Professor of Physics

Modern optics and condensed matter experiment and nonlinear optics

Philip Taylor, PhD
(Cambridge University, England)
Perkins Professor of Physics

Phase transitions and equations of state for crystalline polymers; piezoelectricity and pyroelectricity

Horst von Recum, PhD
(University of Utah, Salt Lake City)
Assistant Professor of Biomedical Engineering

Novel platforms for the delivery of molecules and cells and the use of novel stimuli-responsive polymers for use in gene and drug delivery

Adjunct Faculty

Scott E. Rickert, PhD
(Case Western Reserve University)
Adjunct Professor

Conducting polymers; microdevices; polymer electrodes; polymer adorption

Alan Riga, PhD
(Case Western Reserve University)
Adjunct Full Professor

Extensive industrial and forensic science experience in laboratory testing and characterization of materials, pharmaceuticals, excipients, proteins, metals, alloys, polymers, biopolymers, elastomers, organic chemicals, monomers, resins, thermostets, and thermoplastics

Christoph Weder, DrScNat
(ETH Zurich Switzerland)
Adjunct Full Professor

Design, synthesis and investigation of structure-property relationships of novel functional polymers: polymers with unusual optic and/or electronic properties; (semi)conducting conjugated polymers; stimuli-responsive polymers; biomimetic materials, polymer nanocomposites, supramolecular chemistry.

Courses

EMAC 125. Freshman Research on Polymers. 1 Unit.
Freshman research in polymer chemistry, engineering, and physics. Students will be placed in active research groups and will participate in real research projects under the supervision of graduate students and faculty mentors.

EMAC 270. Introduction to Polymer Science and Engineering. 3 Units.

EMAC 276. Polymer Properties and Design. 3 Units.
The course reviews chemical and physical structures of a wide range of applications for synthetic and natural polymers, and addresses “Which polymer do we choose for a specific application and why?” We examine the polymer properties, the way that these depend on the chemical and physical structures, and reviews how they are processed. We aim to understand the advantages and disadvantages of the different chemical options and why the actual polymers that are used commercially are the best available in terms of properties, processibility and cost. The requirements include two written assignments and one oral presentation. Recommended preparation: ENGR 145.

EMAC 303. Structure of Biological Materials. 3 Units.
Structure of proteins, nucleic acids, connective tissue and bone, from molecular to microscopic levels. An introduction to bioengineering biological materials and biomimetic materials, and an understanding of how different instruments may be used for imaging, identification and characterization of biological materials. Offered as: EBME 303 and EMAC 303. Recommended preparation: EBME 201, EMBE 202, and EMAC 270.

EMAC 325. Undergraduate Research in Polymer Science. 1 - 3 Unit.
Undergraduate laboratory research in polymer chemistry/physics/engineering. Students will undertake an independent research project, working under the mentoring of both a graduate student and a faculty member. A mid-term written progress report is required. A written report and oral presentation will be made at the end of the semester. Can be taken for 1-3 credits per semester, up to a total of 6 credit hours. Students are expected to spend approximately 5 hours/week in the laboratory per credit registered each semester. Recommended preparation: Sophomore/Junior standing and consent of instructor.

EMAC 351. Physical Chemistry for Engineering. 3 Units.
Principles of physical chemistry and their application to systems involving physical and chemical transformations. The nature of physical chemistry, properties of gases, overview of the laws of thermodynamics, thermochemistry, solutions, phases and chemical equilibrium, kinetics of chemical reaction, solutions of electrolytes and introduction to quantum mechanics, atomic structure and molecular statistics. Recommended preparation: ENGR 225, PHYS 122.

EMAC 355. Polymer Analysis Laboratory. 3 Units.
Experimental techniques in polymer synthesis and characterization. Synthesis by a variety of polymerization mechanisms. Quantitative investigation of polymer structure by spectroscopy, diffraction and microscopy. Molecular weight determination. Physical properties. Recommended preparation: EMAC 270 or MATH 224 or MATH 234.

EMAC 370. Polymer Chemistry and Industry. 3 Units.
The nature of polymer chemistry ranging from the fundamentals of organic chemistry of polymer synthesis to the industrial chemistry of polymer production. Physical chemistry as it pertains to the characterization of polymers will also be discussed. Recommended preparation: EMAC 270, CHEM 223, CHEM 224.

EMAC 372. Polymer Processing and Testing Laboratory. 3 Units.
Basic techniques for the rheological characterization of thermoplastic and thermoset resins; "hands-on" experience with the equipment used in polymer processing methods such as extrusion, injection molding, compression molding; techniques for mechanical characterization and basic principles of statistical quality control. Recommended preparation: EMAC 377.
EMAC 375. Fundamentals of Non-Newtonian Fluid Mechanics and Polymer Rheology. 3 Units.
This course will involve the study of Rheology from the perspectives of rheological property measurement, phenomenological and molecular models, and applicability to polymer processing. In particular, students will be introduced to: 1) General concepts of Rheology and Newtonian Fluid Mechanics, 2) Standard flows and material functions; 3) The role of Rheology as a structural characterization tool, with an emphasis on polymeric systems; 4) Experimental methods in Rheology with quantitative descriptions of associated flows and data analyses; 5) Viscoelasticity and Non-Newtonian Fluid Mechanics, including the application of models, both phenomenological and molecular, to the prediction of rheological behavior and extraction of model parameters from real data sets; and 6) The relevance of rheological behavior of different systems to practical processing schemes, particularly with respect to plastics manufacturing. Offered as EMAC 375 and EMAC 475. Prereq: ENGR 225 or EMAC 404.

EMAC 376. Polymer Engineering. 3 Units.
Mechanical properties of polymer materials as related to polymer structure and composition. Visco-elastic behavior, yielding and fracture behavior including irreversible deformation processes. Recommended preparation: EMAC 276 and ENGR 200. Offered as EMAC 376 and EMAC 476.

EMAC 377. Polymer Processing. 3 Units.
Application of the principles of fluid mechanics, heat transfer and mass transfer to problems in polymer processing; elementary steps in polymer processing (handling of particulate solids, melting, pressurization and pumping, mixing); principles and procedures for extrusion, injection molding, reaction injection molding, secondary shaping. Recommended preparation: ENGR 225.

EMAC 378. Polymer Engineer Design Product. 3 Units.
Uses material taught in previous and concurrent courses in an integrated fashion to solve polymer product design problems. Practicality, external requirements, economics, thermal/mechanical properties, processing and fabrication issues, decision making with uncertainty, and proposal and report preparation are all stressed. Several small exercises and one comprehensive process design project will be carried out by class members. Offered as EMAC 378 and EMAC 478.

EMAC 396. Special Topics. 1 - 18 Unit.
(Credit as arranged.)

EMAC 398. Polymer Science and Engineering Project I. 1 - 3 Units.
(Senior project). Research under the guidance of faculty. Requirements include periodic reporting of progress, plus a final oral presentation and written report. Repeatable up to 3 credit hours. When taken for 3 credits it may be spread over two successive semesters. Recommended preparation: Senior standing.

EMAC 399. Polymer Science and Engineering Project II. 1 - 9 Unit.
(Senior project.) Research under the guidance of staff, culminating in thesis. Recommended preparation: Majors only and senior standing.

EMAC 400T. Graduate Teaching I. 0 Units.
This course will engage the Ph.D. students in teaching experiences that will include non-contact (such as preparation and grading of homeworks and tests) and direct contact (leading recitations and monitoring laboratory works, lectures and office hours) activities. The teaching experience will be conducted under the supervision of the faculty. All Ph.D. students will be expected to perform direct contact teaching during the course sequence. The proposed teaching experiences for EMAC Ph.D. students are outlined below in association with undergraduate classes. The individual assignments will depend on the specialization of the students. The activities include grading, recitation, lab supervision and guest lecturing. Recommended preparation: Ph.D. student in Macromolecular Science.

EMAC 401. Polymer Foundation Course I: Organic Chemistry. 3 Units.
The class is an introduction to the synthesis and organic chemistry of macromolecules. The course introduces the most important polymerization reactions, focusing on their reaction mechanisms and kinetic aspects. Topics include free radical and ionic chain polymerization, condensation (step-growth) polymerization, ring-opening, insertion and controlled addition polymerization. The lecture portion of this course (2 credit hours) is integrated with a laboratory or term paper component (1 credit hour). There is no limit on the number of students for the class as a whole. However, there is a limit of 12 students on the laboratory component (other students will do term papers).

EMAC 402. Polymer Foundation Course II: Physical Chemistry. 3 Units.
This course is an introduction to the physical chemistry of polymers in solution. Topics include: polymer statistics (microstructure, configuration, and chain dimensions), thermodynamics and transport properties of polymers in solution, methods for molecular weight determination, physical chemistry of water-soluble polymers, and characterization of polymer microstructure (IR and NMR). The lecture portion of this course (2 credit hours) is integrated with a laboratory or term paper component (1 credit hour). There is no limit on the number of students for the class as a whole. However, there is a limit of 12 students on the laboratory component (other students will do term papers).

EMAC 403. Polymer Foundation Course III: Physics. 3 Units.
This course is an introduction to the physics of polymers in the bulk amorphous and crystalline states. Topics include: structural and morphological analysis using X-ray diffraction, electron microscopy and atomic force microscopy, characterization of thermal transitions, viscoelastic behavior and rubber elasticity, and dynamic mechanical analysis. The lecture portion of this course (2 credit hours) is integrated with a laboratory or term paper component (1 credit hour). There is no limit on the number of students for the class as a whole. However, there is a limit of 12 students on the laboratory component (other students will do term papers).
EMAC 404. Polymer Foundation Course IV: Engineering. 3 Units.
This class is an introduction to the engineering and technology of polymeric materials. Topics include: additives, blends and composites, natural polymers and fibers, thermoplastics, elastomers, and thermosets, polymer degradation and stability, polymers in the environment, polymer rheology and polymer processing, and polymers for advanced technologies (membrane science, biomedical engineering, applications in electronics, photonic polymers). The lecture portion of this course (2 credit hours) is integrated with a laboratory or term paper component (1 credit hour). There is no limit on the number of students for the class as a whole. However, there is a limit of 12 students on the laboratory component (other students will do term papers).

EMAC 410. Polymers Plus Self - Assembly and Nanomaterials. 2 Units.
The course focuses on the concepts of supramolecular chemistry and self-assembly specifically as it applies to nano-polymeric systems. After dealing with many of the fundamental aspects of supramolecular chemistry the focus of the class deals with how to access/ utilize nanoscale features using such processes, namely the 'bottom-up' approach to nanomaterials/systems. Areas which will be addressed include block copolymers, DNA assemblies, nanotubes and dendrimers. Prereq: EMAC 401 or EMAC 370.

EMAC 412. Polymers Plus Inorganic/Coordination Chemistry. 2 Units.
The course focuses on the concepts of inorganic and coordination chemistry specifically as they apply to polymeric systems. The fundamental aspects of coordination chemistry, including coordinative saturation, kinetics and mechanism will be presented and used as a vehicle to describe coordination polymerizations and supramolecular coordination phenomena. The chemistry and physics of nanoscale inorganic modification of polymers by clays, silsesquioxanes, metal oxides and metal particles will also be discussed. Prereq: EMAC 401 or EMAC 370.

EMAC 413. Polymers Plus Green Chemistry and Engineering. 2 Units.
This course focuses on green chemistry and engineering, particularly as it relates to polymers. Specific topics to be covered in this course will include green chemistry, catalysis, alternative solvents, green processing, renewable materials, and life cycle analysis. Case studies will be utilized to connect lecture topics to real-world examples. Prereq: EMAC 401 and EMAC 404.

EMAC 414. Polymers Plus Advanced Composite and Nanocomposite Materials and Interfaces. 2 Units.
"Advanced Composite and Nanocomposite Materials and Interfaces" will aim at providing advanced concept in composite material structures, importance of interface on the property development, rheological background to be able to manufacture optimized materials, and appropriate processing techniques to choose for a specific product to be manufactured. Specifically, this course will discuss the following items: 1. Basic concept of heterogeneous materials including advantages and problems associated with making multiphase materials. 2. It will review broadly the materials used to make composites and nanocomposites. 3. Unique properties of composites/nanocomposites in rheological, mechanical, and physical properties will be discussed. 4. Various composite processing techniques will be discussed in detail. 5. Surface treatment of the reinforcing materials and interface/interphase structures of composites/nanocomposites will be discussed.

EMAC 415. Polymers Plus Structure and Morphology. 2 Units.
This special topic focuses on polymer structure and morphology and their applications. Topics include solid-state physics of various polymeric materials, ranging from crystalline polymers to liquid crystalline polymers, and block copolymers. First, symmetry operation, space groups, reciprocal spaces are introduced. Examples of the crystalline structures of industrially important polymers and typical polymer crystalline morphology such as lamellar and spherulitic crystals are discussed. Defects in crystalline polymer is also an important issue that determines their physical properties. Second, typical phase structure and transitions of liquid crystals and liquid crystalline polymers are introduced, including both thermotropic and lyotropic liquid crystals. Finally, nanostructure and morphology of block copolymers are discussed. Prereq: EMAC 402 and EMAC 403.

EMAC 416. Polymers Plus Applied Rheology and Processing. 2 Units.
This course focuses on the applications of Rheology to Polymer Engineering in general and processing technologies in particular. It starts with a general review of rheological concepts, including viscoelasticity and continues with the influence of shear rate, temperature, and pressure on the rheological properties. Next, the role of Rheology in support of polymer processing, including effects and defects of rheological origin will be analyzed; here the focus will be on the most common processing techniques - extrusion, injection molding, blow-molding, and thermoforming. Finally, there will be a brief introduction of the role of Rheology in the structural characterization of polymeric materials. Prereq: EMAC 376 or graduate standing.

EMAC 420. Polymers Plus Advanced Physical Chemistry. 2 Units.
The course focuses on the principles of physical chemistry that are most relevant to macromolecular science. Prereq: EMAC 402, EMAC 403.

EMAC 421. Polymer Plus Hierarchical Structures and Properties. 2 Units.
Discuss the hierarchical solid state structure of synthetic and naturally occurring polymeric systems and relate these structures to their properties. Particular emphasis will be on natural systems containing collagen(s) and carbohydrate(s), and on synthetic crystalline, liquid crystalline, and reinforced composite polymeric materials. In order to prepare students for application of these concepts we will determine how mechanical, transport and optical (photonic) behavior can be controlled by structure manipulation. Prereq: EMAC 403 and EMAC 404 or EMAC 474 or EMAC 476.

EMAC 422. Polymers Plus Microscopy. 2 Units.
This course focuses on application of microscopy techniques to the analysis of the microstructure of polymeric materials. Specifically, atomic force microscopy, transmission and scanning electron microscopy, and optical microscopy will be discussed. Practical aspects of these techniques will be applied to a variety of systems, including block copolymers, nanocomposites, LC polymers, and multi-layered films. Prereq: EMAC 403 or EMAC 474.

EMAC 423. Polymers Plus Adhesives, Sealants and Coatings. 2 Units.
EMAC 425. Polymer Plus Energy. 2 Units.

Energy research has become the focus of the twenty-first century. This course is a special topic on polymers in the energy field and related applications. We primarily focus on polymers for solar cells, fuel cells, batteries, double layer electrochemical capacitors, dielectric capacitors, and wind energy. For solar cells, we will introduce conducting polymers and basic types of polymer solar cells. For fuel cells, we will introduce both proton- and hydroxide-exchange fuel cells. Fundamental issues of ion transport, water management, and fuel cell longevity will be introduced. For supercapacitors, we will introduce porous carbon structures and charge storage mechanism. For dielectric capacitors, we will introduce fundamental concepts in electrostatics, different types of polarization, and loss mechanism. For wind energy, we will introduce polymer composites for wind blades and polymer coatings. This course will combine lectures and contemporary literature reviews/essays.

EMAC 444. Polymers Plus Optoelectronics. 2 Units.

The course focuses on the design, synthesis and structure-property relationship of polymers with unusual optic and electronic properties and the application of these advanced materials in emerging technologies. Topics include (1) introduction to the interaction of polymers with electromagnetic radiation, (2) Conjugated Polymers: Chemistry & Physics, (3) Intrinsically Conducting Polymers, (4) Ionically Conducting Polymers, (5) Light Emitting Polymers, (6) Polymer Field Effect Transistors and other Semiconductor Devices, (7) Optoelectronic Polymers in Sensors, (8) Nonlinear Optical Polymers, and (9) Latest Developments. Prereq: EMAC 401 or EMAC 370.

EMAC 450. The Business of Polymers. 2 Units.

This course will link polymer technology to business and management issues that need to be considered for successful technology commercialization. Topics include project management, finance, opportunity assessment, the voice of the customer, and protection of intellectual property. Case studies from both large and small companies will be used to illustrate key concepts. Recommended preparation: EMAC 270, EMAC 276.

EMAC 451. Polymer Product Design. 2 Units.

This course introduces the fundamentals of successful product design and development with specific attention to products based on polymeric materials. Topics covered include the voice of the customer, idea generation and screening, concept selection, prototyping, manufacturing, and launch. The importance of good design beyond simple form and function will be stressed. Each student will complete a product design portfolio that considers all of these issues. Recommended preparation: EMAC 270, EMAC 276, EMAC 450.

EMAC 475. Fundamentals of Non-Newtonian Fluid Mechanics and Polymer Rheology. 3 Units.

This course will involve the study of Rheology from the perspectives of rheological property measurement, phenomenological and molecular models, and applicability to polymer processing. In particular, students will be introduced to: (1) General concepts of Rheology and Newtonian Fluid Mechanics, (2) Standard flows and material functions; (3) The role of Rheology as a structural characterization tool, with an emphasis on polymeric systems; (4) Experimental methods in Rheology with quantitative descriptions of associated flows and data analyses; (5) Viscoelasticity and Non-Newtonian Fluid Mechanics, including the application of models, both phenomenological and molecular, to the prediction of rheological behavior and extraction of model parameters from real data sets; and (6) The relevance of rheological behavior of different systems to practical processing schemes, particularly with respect to plastics manufacturing. Offered as EMAC 375 and EMAC 475. Prereq: ENGR 225 or EMAC 404.

EMAC 477. Elementary Steps in Polymer Processing. 3 Units.

This course is an application of principles of fluid mechanics and heat transfer to problems in polymer processing. In the first part of the course, basic principles of transport phenomena will be reviewed. In the second part, the elementary steps in polymer processing will be described and analyzed with application to a single screw extruder.

EMAC 478. Polymer Engineer Design Product. 3 Units.

Uses material taught in previous and concurrent courses in an integrated fashion to solve polymer product design problems. Practicability, external requirements, economics, thermal/mechanical properties, processing and fabrication issues, decision making with uncertainty, and proposal and report preparation are all stressed. Several small exercises and one comprehensive process design project will be carried out by class members. Offered as EMAC 378 and EMAC 478.

EMAC 490. Polymers Plus Professional Development. 1 Unit.

This course focuses on graduate student professional development. The course involves weekly meetings and oral presentations with attention on the content and style of the presentation materials (PowerPoint, posters, etc.), oral presentation style and project management skills. This course can be taken for the total of 3 credits over three different semesters.

EMAC 491. Polymers Plus Literature Review. 1 Unit.

This course involves weekly presentations of the current polymer literature. It involves at least one presentation by the enrolled student and participation in all literature reviews (at least 10/semester). The course will focus on presentation skills (both oral and written), scientific interpretation, and development of peer-review skills. This course can be taken for a total of 3 credits over three different semesters.

EMAC 492. Carbon Nanoscience and Nanotechnology. 3 Units.

This course presents the fundamental aspects of nanoscience and nanotechnology with an emphasis on carbon nanomaterials and nanodevices. This proposed course intends to provide students with the fundamental aspects of nanoscience and nanotechnology. Nanotechnology draws on the strengths of all the basic sciences and is the engineering at the molecular level, which has the potential to lead to novel scientific discoveries as well as new industrial technologies. This course will give students insight into a new, exciting and rapidly developing field. The course has a good balance between basic knowledge and depth with a focus on some key application areas, which will enable students to work in a variety of scientific professions. Offered as ECHE 591 and EMAC 492.
EMAC 500T. Graduate Teaching II. 0 Units.
This course will engage the Ph.D. students in teaching experiences that will include non-contact (such as preparation and grading of homework and tests) and direct contact (leading recitations and monitoring laboratory works, lectures and office hours) activities. The teaching experience will be conducted under the supervision of the faculty. All Ph.D. students will be expected to perform direct contact teaching during the course sequence. The proposed teaching experiences for EMAC Ph.D. students are outlined below in association with graduate classes. The individual assignments will depend on the specialization of the students. The activities include grading, recitation, lab supervision and guest lecturing. Recommended preparation: Ph.D. student in Macromolecular Science.

EMAC 600T. Graduate Teaching III. 0 Units.
This course will engage the Ph.D. students in teaching experiences that will include non-contact and direct contact activities. The teaching experience will be conducted under the supervision of the faculty. The proposed teaching experiences for EMAC Ph.D. student in this course involve instruction in the operation of major instrumentation and equipment used in the daily research activities. The individual assignments will depend on the specialization of the students. Recommended preparation: Ph.D. student in Macromolecular Science.

EMAC 601. Independent Study. 1 - 18 Unit.
(Credit as arranged.)

EMAC 651. Thesis M.S.. 1 - 18 Unit.
(Credit as arranged.)

EMAC 673. Selected Topics in Polymer Engineering. 2 - 3 Units.
Timely issues in polymer engineering are presented at the advanced graduate level. Content varies, but may include: mechanisms of irreversible deformation: failure, fatigue and fracture of polymers and their composites; processing structure-property relationships; and hierarchical design of polymeric systems. Recommended preparation: EMAC 376 or EMAC 476.

EMAC 677. Colloquium in Macromolecular Science and Engineering. 0 - 1 Units.
Lectures by invited speakers on subjects of current interest in polymer science and engineering. This course can be taken for 3 credits over three different semesters.

EMAC 690. Special Topics in Macromolecular Science. 1 - 18 Unit.

(Credit as arranged.) Prereq: Predoctoral research consent or advanced to Ph.D. candidacy milestone.

EMAC C200. Co-op Seminar II for Macromolecular Science and Engineering. 2 Units.
Professional development activities for students returning from cooperative education assignments. Recommended preparation: COOP 002 and EMAC C100.
Department of Materials Science and Engineering

Materials science and engineering is a discipline that extends from the basic science of materials structure and properties to the design and evaluation of materials in engineering systems. Most engineers—mechanical, civil, chemical, and electrical—work with materials on the job, and many become well acquainted with the properties of the materials they use most often. The role of a materials engineer is to understand why materials behave as they do under various conditions; to recognize the limits of performance that particular materials can attain; and to know what can be done during the manufacture of materials to meet the demands of a given application.

The Department of Materials Science and Engineering at Case Western Reserve University offers programs leading to the Bachelor of Science in Engineering, Master of Science, and Doctor of Philosophy degrees. The department conducts academic and research activities with metals, ceramics, composites, and electronic materials. Increasingly, the demands for new materials, and for improved materials in existing applications, transcend the traditional categories. The technological challenges that materials engineers face will continue to demand a breadth of knowledge across the spectrum of engineering materials.

While an engineering discipline, the field brings basic science tools to bear on the technological challenges related to materials products and their manufacture. Materials science draws on chemistry in its concern for bonding, synthesis, and composition of engineering materials and their chemical interactions with the environment. Physics provides a basis for understanding the mechanical, thermal, optical, magnetic and electrical properties of materials, as well as the tools needed to ascertain the structure and properties of materials. Mathematics is used throughout materials manufacture and analysis.

Undergraduate Programs

The undergraduate curriculum leading to the degree of Bachelor of Science in materials science and engineering consists of the “Engineering Core”—basic courses in mathematics, physics, chemistry, and engineering, with electives in social sciences and humanities—plus materials courses, technical electives, and open electives. A total of 129 credit hours is required. Please see the table for the recommended semester-by-semester listing of courses.

The Bachelor of Science degree program in Materials Science and Engineering is accredited by the Engineering Accreditation Commission of ABET, www.abet.org (http://www.abet.org).

The broad objectives of the undergraduate program at the Department of Materials Science and Engineering are to provide the students a strong background in mathematics, physics and chemistry, a link between the sciences and the practice of materials engineering through the departmental courses during the sophomore, junior, and senior years, and a comprehensive design experience in materials engineering through a combination of graded course work distributed throughout the curriculum in addition to the Senior Project.

The primary means of accomplishing this mission is our undergraduate curriculum and associated activities, through their emphasis on:

• The interrelationships among the processing, structure, properties, and performance of engineering materials

• The mutual reinforcement of education and professional development throughout one’s career.

The undergraduate experience in Materials Science and Engineering at Case Western Reserve is marked by a high degree of hands-on experience and many opportunities for professional development before graduation. Lab courses, senior projects, and plant tours ensure that every student sees the field first-hand in current research and industrial settings.

Educational Objectives

1. Graduates will successfully enter and complete graduate and professional degree programs.
2. Graduates will assume leadership positions in materials science related industries.
3. Graduates will work in an environment that requires problem solving skills.
4. Graduates will be proficient in written, graphical, and oral communications.
5. Graduates will take an active part in professional organizations.

Student Outcomes

As preparation for achieving the above educational objectives, the BS degree program in Materials Science and Engineering is designed so that students attain:

• an ability to apply knowledge of mathematics, science, and engineering
• an ability to design and conduct experiments, as well as to analyze and interpret data
• an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
• an ability to function on multi-disciplinary teams
• an ability to identify, formulate, and solve engineering problems
• an understanding of professional and ethical responsibility
• an ability to communicate effectively
• the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
• a recognition of the need for, and an ability to engage in life-long learning
• a knowledge of contemporary issues
• an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Program Outcomes

• Graduates will understand the interrelationships among processing, structure, and properties of a wide range of engineering materials, and how these factors together control the materials performance.
• Graduates will be able to carry out laboratory experiments, analyze data, and interpret the significance of their results, especially with respect to the processing of engineering materials and characterization of their engineering properties.
• Graduates will be proficient in the oral, written, and electronic communication of their ideas.
• Graduates will be proficient in the use of computer technology and computer-based information systems.
• Graduates will be able to function effectively in groups of peers and independently.
• Graduates will be informed of the impact of engineering on society and of the professional, ethical, safety, and environmental responsibilities that that entails.
• Graduates will regard professional development and education as processes that should continue hand-in-hand throughout their academic and professional careers.

Bachelor of Science in Engineering
Major in Materials Science and Engineering

Major Courses

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
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<tr>
<td>EMSE 102</td>
<td>Materials Seminar</td>
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<tr>
<td>EMSE 201</td>
<td>Introduction to Materials Science and Engineering</td>
<td>3</td>
</tr>
<tr>
<td>EMSE 202</td>
<td>Phase Diagrams and Transformations</td>
<td>3</td>
</tr>
<tr>
<td>EMSE 203</td>
<td>Applied Thermodynamics</td>
<td>3</td>
</tr>
<tr>
<td>EMSE 270</td>
<td>Materials Laboratory I</td>
<td>2</td>
</tr>
<tr>
<td>EMSE 280</td>
<td>Materials Laboratory II</td>
<td>2</td>
</tr>
<tr>
<td>EMSE 290</td>
<td>Materials Laboratory III</td>
<td>2</td>
</tr>
<tr>
<td>EMSE 301</td>
<td>Fundamentals of Materials Processing</td>
<td>3</td>
</tr>
<tr>
<td>EMSE 302</td>
<td>Fundamentals of Materials Processing Laboratory</td>
<td>1</td>
</tr>
<tr>
<td>EMSE 303</td>
<td>Mechanical Behavior of Materials</td>
<td>3</td>
</tr>
<tr>
<td>EMSE 310</td>
<td>Applications of Diffraction Principles</td>
<td>1</td>
</tr>
<tr>
<td>EMSE 312</td>
<td>Diffraction Principles</td>
<td>3</td>
</tr>
<tr>
<td>EMSE 313</td>
<td>Engineering Applications of Materials</td>
<td>3</td>
</tr>
<tr>
<td>EMSE 314</td>
<td>Electrical, Magnetic, and Optical Properties of Materials</td>
<td>3</td>
</tr>
<tr>
<td>EMSE 396</td>
<td>Senior Project in Materials I</td>
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<tr>
<td>EMSE 399</td>
<td>Senior Project in Materials II</td>
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<tr>
<td>PHYS 250</td>
<td>Computational Methods in Physics</td>
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<tr>
<td>or EMAE 250</td>
<td>Computers in Mechanical Engineering</td>
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Technical Electives (9 hours)

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<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
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<tbody>
<tr>
<td>CHEM 301</td>
<td>Introductory Physical Chemistry I</td>
<td></td>
</tr>
<tr>
<td>CHEM 335</td>
<td>Physical Chemistry I</td>
<td></td>
</tr>
</tbody>
</table>

Total Units: 51

Approved Technical Electives

The following courses are approved technical electives in Materials Science and Engineering. A student is encouraged to discuss with their class advisor a sequence of technical elective courses, which takes into account the biannual nature of some offerings. Students may request approval of other elective courses by submitting a written petition justifying their choices to the department’s Undergraduate Studies Committee.

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
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<tr>
<td>ECV 310</td>
<td>Strength of Materials</td>
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<tr>
<td>ECV 420</td>
<td>Finite Element Analysis</td>
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<td>EECS 245</td>
<td>Electronic Circuits</td>
<td>4</td>
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<tr>
<td>EECS 246</td>
<td>Signals and Systems</td>
<td>4</td>
</tr>
<tr>
<td>EECS 309</td>
<td>Electromagnetic Fields I</td>
<td>3</td>
</tr>
<tr>
<td>EECS 321</td>
<td>Semiconductor Electronic Devices</td>
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</tr>
<tr>
<td>EMAC 270</td>
<td>Introduction to Polymer Science and Engineering</td>
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</tr>
<tr>
<td>EMAC 276</td>
<td>Polymer Properties and Design</td>
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</tr>
<tr>
<td>EMSE 307</td>
<td>Foundry Metallurgy</td>
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<tr>
<td>EMSE 325</td>
<td>Undergraduate Research in Materials Science and Engineering</td>
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<tr>
<td>EMSE 335</td>
<td>Strategic Metals and Materials for the 21st Century</td>
<td>3</td>
</tr>
<tr>
<td>EMSE 360</td>
<td>Transport Phenomena in Materials Science</td>
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</tr>
<tr>
<td>EMSE/EMAE 372</td>
<td>Relation of Materials to Design</td>
<td>4</td>
</tr>
<tr>
<td>EMSE 401</td>
<td>Transformations in Materials</td>
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<tr>
<td>EMSE 403</td>
<td>Modern Ceramic Processing</td>
<td>3</td>
</tr>
<tr>
<td>EMSE 404</td>
<td>Diffusion Processes in Solids and Melts</td>
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<td>EMSE 405</td>
<td>Dielectric, Optical and Magnetic Properties of Materials</td>
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<tr>
<td>EMSE 406</td>
<td>Optical Materials, Elements and Technologies</td>
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<td>EMSE 409</td>
<td>Deformation Processing</td>
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<tr>
<td>EMSE 411</td>
<td>Environmental Effects on Materials</td>
<td>3</td>
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<tr>
<td>EMSE 417</td>
<td>Properties of Materials at High Temperatures</td>
<td>3</td>
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<tr>
<td>EMSE 419</td>
<td>Phase Equilibria and Microstructures of Materials</td>
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<tr>
<td>EMSE 421</td>
<td>Fracture of Materials</td>
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<td>EMSE 426</td>
<td>Semiconductor Thin Film Science and Technology</td>
<td>3</td>
</tr>
<tr>
<td>EMSE 427</td>
<td>Dislocations in Solids</td>
<td>3</td>
</tr>
<tr>
<td>EMSE 429</td>
<td>Crystallography and Crystal Chemistry</td>
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<tr>
<td>PHYS 331</td>
<td>Introduction to Quantum Mechanics I</td>
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</tr>
<tr>
<td>PHYS 315</td>
<td>Introduction to Solid State Physics</td>
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<tr>
<td>STAT 312</td>
<td>Basic Statistics for Engineering and Science</td>
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<td>STAT 313</td>
<td>Statistics for Experimenters</td>
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Bachelor of Science in Engineering
Suggested Program of Study: Major in Materials Science and Engineering

First Year

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
<th>Fall</th>
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<tbody>
<tr>
<td>Principles of Chemistry for Engineers</td>
<td>(CHEM 111)</td>
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<tr>
<td>Elementary Computer Programming (ENGR 131)</td>
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<tr>
<td>SAGES First year Seminar</td>
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<tr>
<td>Calculus for Science and Engineering I</td>
<td>(MATH 121)</td>
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<td>PHED 1xx Physical Education Activities</td>
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<td>Open elective or Humanities/Social Science Elective</td>
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<td>Chemistry of Materials (ENGR 145)</td>
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<td>Calculus for Science and Engineering II</td>
<td>(MATH 122)</td>
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<tr>
<td>General Physics I - Mechanics (PHYS 121)</td>
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<td>PHED 1xx Physical Education Activities</td>
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<td>SAGES University Seminar</td>
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Second Year

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<tr>
<td>Introductory Physical Chemistry I</td>
<td>(CHEM 301)</td>
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<td>Materials Seminar (EMSE 102)</td>
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<tr>
<td>Introduction to Materials Science and Engineering</td>
<td>(EMSE 201)</td>
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<td>Calculus for Science and Engineering III</td>
<td>(MATH 223)</td>
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<tr>
<td>General Physics II - Electricity and Magnetism (PHYS 122)</td>
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<tr>
<td>SAGES University Seminar</td>
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<tr>
<td>Computers in Mechanical Engineering (EMAE 250)</td>
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<tr>
<td>Phase Diagrams and Transformations (EMSE 202)</td>
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<td>Materials Laboratory I (EMSE 270)</td>
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<td>Elementary Differential Equations (MATH 224)</td>
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<td>Statics and Strength of Materials (ENGR 200)</td>
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Third Year

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<tr>
<td>Materials Laboratory II (EMSE 280)</td>
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<tr>
<td>Introduction to Circuits and Instrumentation (ENGR 210)</td>
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<td>3</td>
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<tr>
<td>Applied Thermodynamics (EMSE 203)</td>
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<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electrical, Magnetic, and Optical Properties of Materials (EMSE 314)</td>
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<td></td>
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<tr>
<td>Humanities/Social Science elective</td>
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</table>
Materials Laboratory III (EMSE 290) 2
Professional Communication for Engineers (ENGR 396) 3
& Professional Communication for Engineers (ENGL 396) 6
Mechanical Behavior of Materials (EMSE 303) 3
Thermodynamics, Fluid Dynamics, Heat and Mass Transfer (ENGR 225) 4
Open elective or Humanities/Social Science elective 3
Technical elective 3
Year Total: 15 18

Fourth Year

Fall
Spring
Fundamentals of Materials Processing (EMSE 301) 3
Fundamentals of Materials Processing Laboratory (EMSE 302) 1
Applications of Diffraction Principles (EMSE 310) 1
Diffraction Principles (EMSE 312) 3
Senior Project in Materials I (EMSE 398) 1
Humanities/Social Science elective 3
Technical elective 3
Engineering Applications of Materials (EMSE 313) 3
Senior Project in Materials II (EMSE 399) 2
Technical elective 3
Open elective 3
Open elective 3
Year Total: 15 14

Total Units in Sequence: 129

Hours required for graduation: 129

1. Selected students may be invited to take PHYS 123 Physics and Frontiers I - Mechanics & PHYS 124 Physics and Frontiers II - Electricity and Magnetism (General Physics I-II Honors) in place of PHYS 121 General Physics I - Mechanics & PHYS 122 General Physics II - Electricity and Magnetism.
2. The two SAGES University Seminars must be chosen from a different thematic group of USNA (Natural World), USSO (Social World) or USSY (Symbolic World).
3. One of these must be in the humanities or social sciences.
4. Or CHEM 335 Physical Chemistry I. Satisfies the Math, Natural Sciences, or Statistics requirement of the Engineering Core.
5. Or PHYS 250 Computational Methods in Physics.
6. Designed as SAGES Departmental Seminar; ENGR 398 & ENGL 398 must be taken concurrently.

Cooperative Education

The Cooperative Education program at Case Western Reserve began in the Materials Science and Engineering Department and the department’s faculty continues to strongly support student participation. Over the past ten years approximately three-quarters of the department’s undergraduates have participated in and completed at least one cooperative education experience. A wide range of opportunities exist for materials majors including heavy industry, mid-size and small firms, and government and corporate research centers. Many opportunities are local to Northern Ohio, but a wide range of possibilities around the country, and, occasionally, international opportunities arise.

The cooperative education experience is monitored to ensure that students progress in job responsibilities during the course of an assignment. It is common for students to assume positions of responsibility, including employee supervision or decision-making on behalf of the company.

Five-Year Combined BS/MS Program

This program offers outstanding undergraduate students the opportunity to obtain an MS degree, with a thesis, in one additional year of study beyond the BS degree. (Normally, it takes 2 years beyond the BS to earn an MS degree.) In this program, an undergraduate student can take up to 9 credit hours that simultaneously satisfy undergraduate and graduate requirements. Typically, students in this program start their research leading to the MS thesis in the fall semester of the senior year. The department endeavors to support such students through the following summer and academic year at the normal stipend for entering graduate students. The BS degree is awarded at the completion of the senior year.

Application for admission to the five year BS/MS program is made after completion of five semesters of course work. Minimum requirements are a 3.2 grade point average and the recommendation of a faculty member of the department. Interested students should contact Professor Peter Lagerlof.

Minor in Materials Science and Engineering

In addition to the Bachelor of Science degree program in materials science and engineering, the department also offers a minor in materials science and engineering. This sequence is intended primarily for a student majoring in science or engineering, but it is open to any student with a sound background in introductory calculus, chemistry, and physics. This program requires the completion of 5 courses with a minimum of 15 credit hours, of which a maximum of 6 hours can be counted toward the student’s major. All students will be required to take:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>EMSE 201</td>
<td>Introduction to Materials Science and Engineering</td>
<td>3</td>
</tr>
<tr>
<td>Four of the following:</td>
<td></td>
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<tr>
<td>EMSE 202</td>
<td>Phase Diagrams and Transformations</td>
<td></td>
</tr>
<tr>
<td>EMSE 203</td>
<td>Applied Thermodynamics</td>
<td></td>
</tr>
<tr>
<td>EMSE 301</td>
<td>Fundamentals of Materials Processing</td>
<td></td>
</tr>
<tr>
<td>EMSE 303</td>
<td>Mechanical Behavior of Materials</td>
<td></td>
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<tr>
<td>EMSE 307</td>
<td>Foundry Metallurgy</td>
<td></td>
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<tr>
<td>EMSE 313</td>
<td>Engineering Applications of Materials</td>
<td></td>
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<tr>
<td>EMSE 314</td>
<td>Electrical, Magnetic, and Optical Properties of Materials</td>
<td></td>
</tr>
<tr>
<td>EMSE 312</td>
<td>Diffraction Principles</td>
<td></td>
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<tr>
<td>EMSE 335</td>
<td>Strategic Metals and Materials for the 21st Century</td>
<td></td>
</tr>
<tr>
<td>EMSE 360</td>
<td>Transport Phenomena in Materials Science</td>
<td></td>
</tr>
<tr>
<td>EMSE 372</td>
<td>Relation of Materials to Design</td>
<td></td>
</tr>
</tbody>
</table>

Total Units: 15

Substitutions of other 3-credit EMSE courses, or sequences including 1- and 2-credit EMSE courses totaling at least 15 credit hours, will be considered on a case-by-case basis. Prof. De Guire (http://bulletin.case.edu/schoolofengineering/materialsscienceengineering/mailto:mark.degure@case.edu) (510 White, 368.4221) will assist MSE minors with course selection.

Graduate Programs

The department offers programs leading to the Master of Science and Doctor of Philosophy degrees. The theory, properties, and engineering behavior of metals, ceramics, electronic materials, and composite materials is encompassed in the academic courses and research within the department. The primary areas of specialization are in
materials processing, mechanical properties, surface and microstructural characterization, environmental effects, and electronic materials.

**MS Degree Requirements**

The MS degree in materials science and engineering is awarded through either Plan A (master’s thesis) or Plan B (master’s comprehensive). Plan A involves a thesis based on individual research and a final oral thesis defense; this plan is appropriate for full-time graduate students. Plan B involves a major project and a comprehensive oral exam; it is typically pursued by part-time graduate students.

Plan A requires successful completion of 6 courses (18 credit hours) and at least 9 credit hours of EMSE 651 Thesis M.S.. Plan B requires the successful completion of eight courses (24 credit hours) as well as 3 credit hours of EMSE 649 Special Projects. The six courses for Plan A and the 8 courses for Plan B may include a maximum of 2 courses from an engineering or science curriculum outside the department. No more than 2 courses at the 300 level can be included; all other courses must be at a higher level. Transfer of credit from another university is limited to 6 credit hours of graduate level courses (with grade B or better) taken in excess of BS degree requirements at the other university. A Planned Program of Study must be submitted by the end of the first semester for Plan A students, and by the end of 2 courses for Plan B students. A cumulative GPA of 2.75 or higher is required.

Plan A students must prepare a written thesis and successfully defend the thesis in a final oral exam. Plan B students must prepare a written report on his/her special project and satisfactorily pass a comprehensive oral exam. The thesis exam for Plan A and the oral exam for Plan B must be conducted by an examining committee consisting of three faculty members of the department.

**PhD Degree Requirements**

Students entering the graduate program for a PhD will need to submit the Planned Program of Study within the first semester.

Candidates for a PhD degree in materials science and engineering must meet the following requirements to prove their competency for doctoral study and to be accepted into the doctoral program:

1. Submit an approved Planned Program of Study form and a Supplementary Information form specifying the Breadth and Basic Science requirements.
2. Pass a comprehensive written General Exam within 6 months following their being awarded an MS degree (12 months for students with an MS degree from a different science or engineering discipline).
3. Pass a Thesis Proposal Exam (written and oral) during the semester immediately following the successful completion of the written General Exam. These requirements are explained in detail below. At the completion of these requirements, the student must fill out the second part of the PhD Student Permanent Record form.

Upon successful completion of all requirements and research, the PhD candidate must submit a written dissertation as evidence for his/her ability to conduct independent research at an advanced level. The PhD candidate must pass a final oral exam in defense of the dissertation. The Dissertation Committee must consist of at least three faculty members of the department and one non-departmental member. The candidate must provide each committee member with a copy of the completed dissertation at least 10 days before the exam, so that the committee members may have an opportunity to read and discuss it in advance.

The student must provide two (2) unbound copies of the final approved version of the thesis for the university, and two (2) bound copies of the thesis, one for the department and one for the student’s faculty advisor.

**PhD Program of Study (Course Requirements)**

A PhD student must take a minimum of 18 credit hours of EMSE 701 and must continue registration each succeeding regular semester (fall and spring) until the dissertation is complete, unless granted a leave of absence. The time limit for the PhD program is 5 years, starting with the first semester of EMSE 701 Dissertation Ph.D. registration.

The minimum course requirement for a PhD degree is 12 courses (36 credit hours) beyond the BS level, out of which at least six courses (18 credit hours) must be taken at Case Western Reserve University. Of these 12 courses, six courses must satisfy the Breadth Requirement and two courses must satisfy the Basic Science Requirement for the department as outlined below. In the case of a student entering with an MS degree from another discipline, additional courses may be required as decided by the Graduate Studies Committee of the department. A GPA of 3.0 is required for graduate assistants.

**Breadth Requirements**

A broad knowledge of the field of materials science and engineering includes a minimum level of understanding of the following six areas:

- Mechanical Behavior (a)
- Structure (b)
- Physical Properties (c)
- Processing (d)
- Thermodynamics and Kinetics (e)
- Phase Transformations (f)

The Breadth Requirement for the PhD can be fulfilled by taking a total of 6 courses (18 credit hours); these 6 courses must include at least one course from each area a, b, c, and d and 2 courses from areas e and f combined. The department maintains a list of approved courses for each of these areas.

**Basic Science Requirements**

A minimum depth in basic science of two courses (6 credit hours) is required for a PhD degree. This requirement can be fulfilled by taking 2 courses selected from physics, chemistry, mathematics and/or statistics, and/or certain engineering curricula. The department maintains a current list of approved courses for the Basic Science Requirements.

The Planned Program of Study, a list of the courses the student will take to fulfill the PhD requirements, will be discussed and approved at the time of the Thesis Proposal Exam. This form and the associated Supplementary Information form must be approved by the student’s Dissertation Committee (excluding the non-departmental member) and the chair of the department and submitted to the dean of graduate studies within one semester of passing the General Exam.

**PhD General Exam**

The written General Exam is offered twice a year, typically in January and June, provided at least three students are registered to take the exam. The Exam is comprehensive and consists of two parts:

1. Thermodynamics and Kinetics; Materials Processing: covering such topics as phase equilibria, phase transformations, diffusion, defect chemistry, synthesis, fabrication, microstructural development, and thermomechanical processing.
2. Structure; Properties, Performance, and Reliability: covering crystallography and symmetry, analytical techniques (diffraction, imaging, and spectroscopy), line defects, surfaces and interfaces, microstructural analysis, mechanical, thermal, chemical (environmental), and electrical, optical, and magnetic properties, individually and in combination.

The emphasis in both parts of this General Exam will be on inorganic materials: metals, ceramics, semiconductors, and composites.

Each part of the exam will last for three hours; the morning session is devoted to part 1 and the afternoon session covers part 2. Each part of the Exam is divided into two sections:

- Part 1 (morning): Section 1 (Thermodynamics & Kinetics) and Section 2 (Processing)
- Part 2 (afternoon): Section 3 (Structure) and Section 4 (Properties, Performance, & Reliability)

The exam is closed book. Each section of the exam will contain a minimum of 4 questions. Students must answer 5 questions from part 1 and 5 questions from part 2, with at least 2 questions being answered from each section.

In order to pass the written General Exam, the criteria are as follows—six out of ten questions in the exam require a 70% passing grade as well as a 75% average for the whole exam. Students who fail the exam (or the Thesis Proposal Exam described below) may elect to take the exam a second time.

**Thesis Proposal Exam**

The Thesis Proposal Exam tests the more specific knowledge of the PhD candidate concerning the science underlying the proposed research and to his or her intellectual maturity. It is composed of a written and an oral part, both dealing with the candidate’s proposed research project. The written document should be given to each member of the student’s Dissertation Advisory Committee (excluding the non-departmental member) during the semester immediately following the successful completion of the General Exam. It should include a literature search, analysis of the research problem, suggested research procedures, and the general results to be expected. The document should be written by the student and not his/her thesis advisor, and will be examined by the student’s Dissertation Advisory Committee for this purpose.

The oral part of the Thesis Proposal Exam should last approximately two hours and must be given before the student’s Dissertation Advisory Committee within one week of submitting the above written document to the Committee. Both parts of the Thesis Proposal Exam will be graded Pass/Fail.

At the time of this exam, the student will also have his/her Planned Program of Study examined and approved by the Dissertation Advisory Committee.

**Research Areas**

**Deformation and Fracture**

Determination of the relationships between structure and mechanical behavior of traditional and advanced materials: metals, ceramics, intermetallics, composites, and biological materials. State-of-the-art facilities are available for testing over a range of strain rates, test temperatures, stress states, and size scales for both monotonic and cyclic conditions.
simulates modern manufacturing processing. The press can deliver up to five consecutive impacts to a material in less than five seconds with a punch velocity as high as 110 inch/sec. The maximum punch force is 110,000 pounds.

**Mechanical Testing Facility**

The Center for Mechanical Characterization of Materials (CMC) Mechanical Testing Facility permits the determination of mechanical behavior of materials over loading rates ranging from static to impact, with the capability of testing under a variety of stress states under either monotonic or cyclic conditions. A variety of furnaces and environmental chambers are available to enable testing at temperatures ranging from -196 C to 1800 C. The facility is operated under the direction of a faculty member and under the guidance of a full-time engineer. The facility contains one of the few laboratories in the world for high-pressure deformation and processing, enabling experimentation under a variety of stress states and temperatures. The equipment in this state-of-the-art facility includes:

- **High Pressure Deformation Apparatus**: These units enable tension or compression testing to be conducted under conditions of high hydrostatic pressure. Each apparatus consists of a pressure vessel and diagnostics for measurement of load and strain on deforming specimens, as well as instantaneous pressure in the vessel. Pressures up to 1.0 GPa loads up to 10kN, and displacements of up to 25 mm are possible. The oil based apparatus is operated at temperatures up to 300°C room temperature while a gas (i.e. Ar) based apparatus is used at room temperature.
- **Hydrostatic Extrusion Apparatus**: Hydrostatic extrusion (e.g. pressure-to-air, pressure-to-pressure) can be conducted at temperatures up to 300 °C on manually operated equipment interfaced with a computer data acquisition package. Pressures up to 2.0 GPa are possible, with reduction ratios up to 6 to 1, while various diagnostics provide real time monitoring of extrusion pressure and ram displacement.
- **Advanced Forging Simulation Rig**: A multi-actuator: MTS machine based on a 330 kip, four post frame, enables sub-scale forging simulations over industrially relevant strain rates. A 110 kip forging actuator is powered by five nitrogen accumulators enabling loading rates up to 120 inches/sec on large specimens. A 220 kip indexing actuator provides precise deformation sequences for either single, or multiple, deformation sequences. Date acquisition at rates sufficient for analysis is available. Testing with heated dies is possible.
- **Advanced Metal Forming Rig**: A four post frame with separate control of punch actuator speed and blank hold down pressure enables determination of forming limit diagrams. Dynamic control of blank hold down pressure is possible, with maximum punch actuator speeds of 11.8 inches/sec. A variety of die sets are available.

The remainder of the equipment in the Mechanical Testing Facility is summarized below:

- **Servo-hydraulic Machines**: Four MTS Model 810 computer-controlled machines with load capacities of 3 kip, 20 kip, 50 kip, and 50 kip, permit tension, compression, and fatigue studies to be conducted under load-, strain-, or stroke control. Fatigue crack growth may be monitored via a dc potential drop technique as well as via KRAK gages applied to the specimen surfaces. Fatigue studies may be conducted at frequencies up to 30 Hz. In addition, an Instron Model 1331 20 kip Servo-hydraulic machine are available for both quasi-state and cyclic testing.

- **Universal Testing Machines**: Three INSTRON screw-driven machines, including two INSTRON Model 1125 units permit tension, compression and torsion testing.

**Electromechanical Testing Machine**: A computer-controlled INSTRON Model 1361 can be operated under load-, strain-, or stroke control. Stroke rates as slow as 1 micrometer/hour are possible.

- **Fatigue Testing Machines**: Three Sonntag fatigue machines and two R. R. Moore rotating-bending fatigue machines are available for producing fatigue-life (S-N) data. The Sonntag machines may be operated at frequencies up to 60 Hz.

- **Creep Testing Machines**: Three constant load frames with temperature capabilities up to 800 C permit creep testing, while recently modified creep frames permit thermal cycling experiments as well as slow cyclic creep experiments.

- **Impact Testing Machines**: Two Charpy impact machines with capacities ranging from 20 ft-lbs to 240 ft-lbs are available. Accessories include a Dynatup instrumentation package interfaced with an IBM PC, which enables recording of load vs. time traces on bend specimens as well as on tension specimens tested under impact conditions.

- **Instrumented Microhardness Tester**: A Nikon Model QM High-Temperature Microhardness Tester permits indentation studies on specimens tested at temperatures ranging from -196 C to 1600 C under vacuum and inert gas atmospheres. This unit is complemented by a Zwick Model 3212 Microhardness Tester as well as a variety of Rockwell Hardness and Brinell Hardness Testing Machines.

**Environmental Stress Laboratories**

These facilities include equipment for corrosion, oxidation, and adhesion and wear studies. A wide range of environments can be simulated and controlled: a) aqueous corrosion: atmospheric, immersion and high pressure/high temperature in autoclaves and b) oxidation: single and mixed gases over a range of temperatures and pressures. Special items include: electrochemical test equipment, environmental cracking test equipment, vacuum equipment for permeation studies, high sensitivity Cahn electro balances for thermogravitmetric studies and polymer/metal adhesion test fixtures.

**The Swagelok Center for Surface Analysis of Materials (SCSAM)**

The Swagelok Center for Surface Analysis of Materials (SCSAM) is a multi-user analytical facility providing instrumentation for microstructural characterization and surface and near-surface chemical analysis. The center's 16 major instruments encompass a wide range of characterization tools, which provide a comprehensive resource for academic researchers who can tailor the analyses to their specific needs.

Current capabilities include four (4) Scanning Electron Microscopes (SEMs) which are equipped for Focused Ion Beam (FIB) micromachining and XEDS, WDS, and EBSP detectors, two (2) Transmission Electron Microscopes (TEMs) equipped with XEDS and EELS detectors, an Atomic Force Microscope (AFM), a UHV Scanning Probe system, a Laser Scanning Confocal Optical Microscope dedicated for materials studies, including Raman microscopy, an automated Nanodentener, an Ion Beam Accelerator for Rutherford Backscattering (RBS) and PIXE and PIGE, two (2) X-ray diffraction (XRD) systems, along with surface-specific tools for Time-of-Flight, Secondary Ion Mass Spectrometry (ToF-SIMS), Auger Electron Spectrometry, and X-Ray Photoelectron Spectroscopy (XPS), also known as Electron Spectrometry for Chemical Analysis (ESCA).

SCSAM is administratively housed in the Case School of Engineering (CSE) and is central to much of the research carried out by the seven departments within CSE. However, the facility is extensively used by the Physics, Chemistry, Biology and Earth, Environmental, and Planetary Sciences departments within the College of Arts and Sciences, and by
many departments within the Schools of Medicine and Dental Medicine. In addition to CWRU clients, many external institutions utilize SCSAM’s facilities, including NASA Glenn Research Center, the Cleveland Clinic, and numerous Ohio universities. More than 300 users utilize the facility in any given year.

SCSAM’s instruments are housed in a centralized area, allowing users convenient access to state-of-the-art solutions for their analytical needs.

Transmission Electron Microscope Laboratory

Two transmission electron microscopes are available that provide virtually all conventional and advanced microscopy techniques required for state-of-the-art materials research and involve an installed capacity worth $3,000,000. The microscopes available are (i) an FEI Tecnai F30 300kV field-emission gun energy-filtering high-resolution analytical transmission scanning transmission electron microscope with an information resolution limit better than 0.14nm, equipped with an EDAX system with a high-energy resolution Si-Li detector for X-ray energy-dispersive spectroscopy (XEDS), a Gatan GIF2002 imaging energy filter including a 2k by 2k slow-scan CCD camera, and a high-angle annular dark-field detector for scanning transmission electron microscopy (STEM), and (ii) a Philips CM20 200kV analytical transmission electron microscope equipped with a Tracer Northern high-purity Ge X-ray energy-dispersive spectroscopy detector, a Gatan parallel electron energy-loss spectrometer (PEELS), and a STEM unit.

Conventional TEM techniques, such as bright-field and dark-field imaging, electron diffraction, or weak-beam dark-field imaging (WBDF) are used routinely to analyze line defects (dislocations) and planar defects (interfaces, grain boundaries, stacking faults) in crystalline materials. Advanced TEM techniques include (i) high-resolution TEM, which enables assessing the atomic structure of crystal defects such as heterophase interfaces, grain boundaries, or dislocations, (ii) convergent-beam electron diffraction, which can be used, for example, to obtain crystallographic information (space group) and to determine orientation relationships between small (even nanoscopic) crystallites, and (iii) energy-filtering TEM, which includes zero-loss filtering for improved image contrast and resolution in conventional imaging and diffraction as well as electron spectroscopic imaging (ESI), a technique that enables rapid elemental mapping with high spatial resolution based on element-characteristic energy losses of the primary electrons in the specimen. Specimen preparation facilities for transmission electron microscopy consist of two dimple-grinders, two electropolishing units, three ultramicrotomes, and two conventional ion-beam mills, and two state-of-the-art precision ion polishing systems (PIPS, by Gatan).

Scanning Electron Microscopy Laboratory

Scanning electron microscopy (SEM) and spectrochemical analysis provide valuable specimen investigation with great depth of field and realistic three-dimensional imaging at resolutions up to 500,000X. Determination of the topography of nearly any solid surface is possible. Spectrochemical studies are possible with the use of energy dispersive systems capable of detecting elements from boron to uranium. The laboratory houses two instruments. The first is an Hitachi S-4500, a field emission electron microscope with two secondary electron detectors, a backscattered electron detector, and an infrared chamber scope. In addition, it has a Noran energy dispersive x-ray detection system. The microscope is capable of operating at a spatial resolution of less than 1.5 nm at 15 kV. It also performs well at reduced beam energies (1 kV), facilitating the observation of highly insulating materials. The second instrument is a Philips XL-30 ESEM with a large chamber that can be used as a conventional SEM, or in the environmental mode, can be used to examine wet, oily, gassy or non-conducting samples. It has a camera for crystallographic orientation imaging, a deformation stage capable of 1000 lbs force, hot stages capable of temperatures up to 1500 C, and a cooling stage that goes down to -20 C. An attached Noran X-ray system permits qualitative and quantitative EDX spectroscopy, X-ray mapping and line scans.

Surface Science Laboratories

The Center for Surface Analysis of Materials (CSAM) enjoys state-of-the-art characterization of metal, alloy, ceramic, and polymer surfaces. These tools include a PHI 680 Scanning Auger Microprobe (SAM) for elemental analysis of surfaces and mapping, and PHI 3600 Secondary Ion Mass Spectrometry (SIMS), which provides surface sensitivities for species in the part per billion range. A PHI model 5600 instrument provides X-ray Photoelectron Spectroscopy (XPS or ESCA) capability, which produces information concerning chemical states. The latter two instruments are particularly useful for ceramic and polymer surfaces. With specimen heating, cooling, and depth profiling capabilities directly incorporated in these devices, subsurface regions and interfaces in composite structures, as well as at thin film substrate interfaces, can be examined and fully characterized. The ion beam facility for the analysis of materials consists of a NEC SSDH 1.7 MV tandem pelletron accelerator for the production of 3.4 MeV protons, 5.1 MeV alpha particles, and N ions with energies in excess of 7.0 MeV. Sample analysis takes place in a turbo-molecular pumped high vacuum chamber. The chamber is equipped with a computer-controlled 5 axis manipulator and has provisions for maintaining sample temperatures from 77 K to 1000 K. A Si surface barrier detector, NaI(Tl) scintillator, and a liquid nitrogen-cooled Si(Li) detector are used to detect scattered ions, characteristic gamma rays and characteristic X-rays, respectively. This instrumentation can non-destructively provide composition and structure information in the near-surface region of materials using techniques such as Rutherford backscattering spectrometry (RBS), ion channeling, particle-induced X-ray analysis (PIXE), and nuclear reaction analysis (NRA). As with other analytic techniques, sensitivity, sampling depth, and depth resolution are sample dependent. However, sensitivities of 1 atomic percent, accuracies of 5%, and a depth resolution of 20 nm are usually easily achieved.

The typical specimen is a solid, vacuum-compatible material with lateral dimensions between 0.5 cm x 0.5 cm and 5 cm x 5 cm. However, PIXE and NRA can also be performed on non-vacuum compatible specimens such as liquids and irreplaceable artifacts of interest to museum curators and archeologists.

A recently acquired FEI Nova Focused Ion Beam (FIB) system used to machine thin foils suitable for TEM directly out of the surface of a specimen is available. The Nova FIB includes an SEM, a computer interface enabling entirely automated milling and an internal “lift out” system for transferring thin films onto support grids. To investigate the character of surfaces at the nanometer scale the laboratory has a Digital Instruments Dimension 3000 Scanning Probe Microscope which operates as an AFM and contains a Hysitron Nanoindenter.

Electronic Properties Laboratory

Crystal Growth and Analysis Laboratory

The Crystal Growth and Analysis Laboratory is equipped for research studies and characterization of bulk semiconductor and photonic materials. The growth facilities include a high pressure Czochralski system, low pressure Czochralski system, and a Vertical Bridgman system with magnetic field stabilization. The characterization facilities include capabilities for sample preparation, a Hall effect system, Infra-
red microscope, and an Inductively Coupled Plasma-Mass Spectrometer (ICP-MS).

**X-Ray Laboratory**

The X-ray laboratory contains diffraction equipment for study of the structures of ceramics, metals, polymers, minerals, and single crystals of organic and inorganic compounds. A new Scintag diffractometer system includes a theta-theta wide angle goniometer, a 4.0 kW x-ray generator with copper tube, a third axis stress attachment, a thermolectrically cooled Peltier germanium detector, a thin film analysis system, a dedicated PC for data acquisition, and a turbomolecular-pumped furnace attachment permitting sample temperatures up to 2000 degrees C.

**Fuel Cell Testing Laboratory**

The department houses a lab for testing of solid oxide fuel cells (SOFC). Facilities include:

- 2 test stands for 4” cells and small stacks (Fuel Cell Technologies); test temperatures to 1000°C; professional turnkey LabView interface for system control and data acquisition
- 2 test stands for 1” cells; test temperatures to 1000°C; LabView interface for complete system control and data acquisition; Omega mass flow controllers; Keithley and Amrel electronics; AutoLab Electrochemical Analyzer for I-V, galvanostatic or amperometric testing and AC impedance spectroscopy
- All test stands contained in dedicated 20’ x 8’ enclosure rated for use with hydrogen, hydrogen sulfide, and carbon monoxide with ventilation system, leak detection, tank pressure monitors, alarm system
- Dedicated furnaces and ovens for preparing cells for testing

**The Solar-Durability and Lifetime Extension (S-DLE) Center**

The Solar-Durability and Lifetime Extension (S-DLE) Center located in CWRU’s White Hall, along with its S-DLE (Sun Farm) on CWRU’s West Quad is focused on long lifetime, environmentally exposed materials technologies such as photovoltaics, energy efficient lighting and building envelope applications. It is a Wright Projects center, funded by the Ohio Third Frontier commission. The center was founded to develop real-time and accelerated protocols for exposure to solar radiation and related environmental stressors to enable evaluation of the environmental durability and lifetime of materials, components, and products. Post-exposure optical and thermo-mechanical measurements are used to develop quantitative mechanistic models of degradation processes in the bulk of the device materials and at the inherent interfaces between dissimilar materials. The S-DLE Center’s capabilities include:

- Solar exposures: 2-axis solar trackers with multi-sun concentrators, and power degradation monitoring
- Solar simulators for 1 to 1000X exposures
- Multi-factor environmental test chambers with temperature, humidity, freeze/thaw and cycling
- A full suite of optical, interfacial, thermo-mechanical and electrical evaluations of materials, components and systems

**The Wind Energy Research and Commercialization (WERC) Center**

The WERC Center is a multidisciplinary center for use by students, faculty, and industry providing instrumentation for wind resource characterization and research platforms in operating wind turbines. The WERC Center was established in 2010 with funding from the Ohio Department of Development Third Frontier Wright Project and the Department of Energy. Additional support was provided by the following inaugural industrial partners: Cleveland Electric Laboratories, The Lubrizol Corporation, Parker Hannifin Corporation, Azure Energy LLC, Rockwell Automation, Inc., Swiger Coil Systems LLC, and Wm. Sopko & Sons Co.

The instruments in the WERC Center include:

- A continuous scan ZephIR LiDAR, manufactured by Natural Power. This instrument measures horizontal and vertical wind velocity along with wind direction at 1 Hz frequency at five user set heights up to 200 m.
- Five meteorological measurement systems: 3 on campus; 1 with the off campus wind turbines; and one at the City of Cleveland’s water intake crib located 3.5 miles offshore in Lake Erie.
- An ice thickness sensor that is deployed at the bottom of Lake Erie each fall and retrieved in the spring.
- A Nordex N-54 wind turbine manufactured by Northern Power Systems in Barre, VT USA. This 100kW community scale wind turbine has a direct drive generator with full power inverters, stall control blades with a 21 m rotor diameter, and a 37 m hub height. This wind turbine is located on campus just east of Van Horn field and began operation in November, 2010.
- A Vestas V-27 wind turbine originally manufactured by Vestas in Denmark. This 225kW medium scale wind turbine has a gearbox drive generator, pitch controlled blades with a 27 m rotor diameter, and a 30 m hub height. In addition it has a 50kW generator for low wind generation. This wind turbine is located at an industrial site in Euclid, OH about 15 minutes from campus and began operation in March, 2012.
- A Nordex N-54 wind turbine originally manufactured by Nordex in Germany. This 1.0MW utility scale wind turbine has a gearbox drive generator, stall control blades with a 54 m rotor diameter, and a 70 m hub height. In addition it has a 200kW generator for low wind generation. This wind turbine is located at an industrial site in Euclid, OH about 15 minutes from campus and is scheduled to begin operation in July, 2012.

**Faculty**

James D. McGuffin-Cawley, PhD
(Rensselaer Polytechnic Institute)

Chair; Arthur S. Holden Professor of Engineering; Great Lakes Professor of Ceramic Processing

Powder processing of ceramics; aggregation phenomena; oxidation, diffusion, and solid state reactions; silicate and active metal brazing of ceramics; joining of materials; ceramic matrix composites

William A. “Bud” Baeslack III, PhD
(Case Western Reserve University)

Provost and Executive Vice President

Welding, joining of materials, and titanium and aluminum metallurgy

Mark R. DeGuire, PhD
(Massachusetts Institute of Technology)

Associate Professor

Synthesis and properties of ceramics in bulk and thin-film form, including fuel cell materials, gas sensors, coatings for biomedical applications, photovoltaics, and ferrites. Testing and microstructural characterization of materials for alternative energy applications. High-temperature phase equilibria. Defect chemistry

Frank Ernst, PhD
(University of Göttingen)
Leonard Case Jr. Professor of Engineering
Microstructure and microcharacterization of materials; defects in crystalline materials; interface and stress-related phenomena; semiconductor heterostructures, plated metallization layers; photovoltaic materials; surface hardening of alloys, quantitative methods of transmission electron microscopy

Roger H. French, PhD
(Massachusetts Institute of Technology)
F. Alex Nason Professor of Materials Science
Optical materials science, including optical properties, electronic structure, and radiation durability of optical materials, polymers, ceramics and liquids using vacuum ultraviolet and optical spectroscopies and spectroscopic ellipsometry. Lifetime and degradation science of photovoltaic materials, components and systems including solar radiation durability and degradation mechanisms and rates. Quantum electrodynamics and van der Waals – London dispersion interactions applied to wetting, and long range interactions for manipulation of nanoscale objects such as carbon nanotubes and biomolecular materials.

Arthur H. Heuer, PhD, DSc
(University of Leeds, England)
Distinguished University Professor; Kyocera Professor of Materials; Director, Swagelok Center for Surface Analysis of Materials
Interstitial hardening and improved corrosion resistance of stainless steels and nickel-base alloys; oxidation and hot corrosion of nickel-base and iron-base alloys; improved corrosion resistance of aluminum base alloys; solid oxide fuel cells; high resolution and analytical electron microscopy; 3D reconstruction of soft tissue for life science applications; oxygen and aluminum lattice and grain boundary diffusion in aluminum oxide; dislocations and plastic deformation of aluminum oxide; quantum mechanics of point defects, dislocations, and grain boundaries of aluminum oxide; and electronic structure of aluminum oxide.

Harold Kahn, PhD
(Massachusetts Institute of Technology)
Research Associate Professor
Materials reliability in microsystems technology and microelectromechanical systems; surface engineering of steels and alloys; mechanical testing of biological nanofibrils; microfluidic and microoptical devices.

Peter Lagerlof, PhD
(Case Western Reserve University)
Associate Professor
Mechanical properties of ceramics and metals. Of particular interest is to understand how low temperature deformation twinning is related to plastic deformation by dislocation slip at elevated temperatures. Deformation twinning models for both basal and rhombohedral twinning in sapphire, which are properly related to dislocation slip at elevated temperatures, have been established. The basal twinning model has been confirmed experimentally using TEM techniques. Current research involves studies on how to generalize this twinning model to other materials systems; i.e., metals, intermetallic compounds and other ceramics.

John J. Lewandowski, PhD
(Carnegie-Mellon University)
Leonard Case Jr. Professor of Engineering and Director - Center for Mechanical Characterization of Materials
Mechanical behavior of materials; fracture and fatigue; micromechanisms of deformation and fracture; composite materials; bulk metallic glasses and composites; refractory metals; toughening of brittle materials; high-pressure deformation and fracture studies; hydrostatic extrusion; deformation processing

David H. Matthiesen, PhD
(Massachusetts Institute of Technology)
Associate Professor; Director, Wind Energy Research and Commercialization (WERC) Center
Materials for use in wind turbines; wind resource measurements onshore and offshore; materials interactions with ice; bulk crystal growth processing; process engineering in manufacturing; heat, mass, and momentum transport.

P. Pirouz, PhD
(Imperial College of Science and Technology, England)
Professor
Defects in semiconductors; heteroepitaxial growth of electronic materials; diffraction theory; transmission electron microscopy and its applications in materials science; fiber-reinforced composites; synthetic growth of diamond

Alp Sehirliogou, PhD
(University of Illinois at Urbana Champaign)
Research Assistant Professor
High-temperature piezoelectrics for actuators and ultrasonic applications; electro-thermal imaging; multifunctional electro-ceramics.

Ali Sayir, PhD
(Case Western Reserve University)
Research Associate Professor
Structure/property relationships in ferroelectric and piezoelectric ceramics, in actuators and sensors for engine and energy harvesting applications, thermoelectric energy conversion, high temperature ceramics for hydrogen separation.

David Schwam, PhD
(The Technion University)
Research Associate Professor
Gating of advanced aluminum and magnesium alloys, development of die and permanent mold materials, thermal fatigue testing, recycling.

Gerhard E. Welsch, PhD
(Case Western Reserve University)
Professor
Metals and oxides; high temperature properties, mechanical and electrical properties. Materials for capacitive energy storage; metal sponges; high temperature materials, metal-cell composites. Synthesis of materials

Secondary Faculty
Clemens Burda, PhD
Associate Professor of Chemistry
Walter Lambrecht, PhD
Professor of Physics
Nicole F. Steinmetz, PhD
Assistant Professor of Biomedical Engineering
Russell Wang, DDS
Associate Professor of Dentistry
Xiong (Bill) Yu, PhD, PE
Assistant Professor of Civil Engineering

Adjunct Faculty
Aron Chait
Adjunct Professor
Courses

EMSE 102. Materials Seminar. 1 Unit.
Topical lectures by faculty on current areas of materials research serving to complement the concepts introduced in EMSE 201. General discussion of overall curriculum and educational objectives. Recommended preparation: EMSE 201 or concurrent enrollment.

EMSE 103. Materials in Sports. 3 Units.
The relationships between optimizing sports activities and the performance requirements of sports equipment are developed. The inherent properties of materials are shown to be the controlling factors in the design of almost all types of sports equipment. Properties of the major classes of materials used to manufacture sports equipment are examined. Materials discussed include advanced composites, foams, metals, ceramics, and natural composites, e.g., wood and leather. The absorption, storage, and release of energy by equipment during sports activities are shown to relate to the basic structure of the materials from which it is made. Demonstration experiments are conducted periodically throughout the course.

EMSE 110. Transitioning Ideas to Reality I - Materials in Service of Industry and Society. 1 Unit.
In order for ideas to impact the lives of individuals and society they must be moved from "blue sky" to that which is manufacturable. Therein lies true creativity - design under constraint. Greater Cleveland is fortunate to have a diverse set of industries that serve medical, aerospace, electric, and advanced-materials technologies. This course involves trips to an array of work sites of leading companies to witness first-hand the processes and products, and to interact directly with practitioners. Occasional in-class speakers with demonstrations will be used when it is not logistically reasonable to visit off-site.

EMSE 120. Transitioning Ideas to Reality II - Manufacturing Laboratory. 2 Units.
This course complements EMSE 110. In that class students witness a diverse array of processing on-site in industry. In this class students work in teams and as individuals within processing laboratories working with an array of "real materials" to explore the potential of casting, machining, and deformation processes to produce real parts and/or components. An introduction to CAD as a means of communication is provided. The bulk of the term is spent in labs doing hands-on work. Planned work is carried out to demonstrate techniques and potential. Students have the opportunity to work independently or in teams to produce articles as varied as jewelry, electronics, transportation vehicles, or novel components or devices of the students choosing.

EMSE 125. Freshman Research in Materials Science and Engineering. 1 Unit.
Freshman students conduct independent research in the area of material science and engineering, working closely with graduate student(s) and/or postdoctoral fellow(s), and supervised by an EMSE faculty member. An average of 5-6 hr/wk in the laboratory, periodic updates, and an end of semester report is required. Prereq: Limited to freshman, with permission of instructor.

EMSE 201. Introduction to Materials Science and Engineering. 3 Units.
Introductory treatment of crystallography, phase equilibria, and materials kinetics. Application of these principles to examples in metals, ceramics, semiconductors, and polymers, illustrating the control of structure through processing to obtain desired mechanical and physical properties. Design content includes examples and problems in materials selection and of design of materials for particular performance requirements. Recommended preparation: ENGR 145 and PHYS 121 and MATH 121.

EMSE 202. Phase Diagrams and Transformations. 3 Units.

EMSE 203. Applied Thermodynamics. 3 Units.
Basic thermodynamics principles as applied to materials. Application of thermodynamics to material processing and performance including condensed phase and gaseous equilibria, stability diagrams, corrosion and oxidation, electrochemical and vapor phase reactions. Recommended preparation: CHEM 301.

EMSE 270. Materials Laboratory I. 2 Units.
Introduction to processing, microstructure and property relationships of metal alloys, ceramics and glass. Solidification of a binary alloy and metallography by optical and scanning electron microscopy. Synthesis of ceramics powders, thermal analysis using TGA and DTA, powder consolidation, sintering and grain growth kinetics. Processing and coloring of glass and glass-ceramics.

EMSE 280. Materials Laboratory II. 2 Units.
Synthesis and processing. Experiments designed to demonstrate and evaluate different ways to process different types of materials. Solidification of melts. Crystalization kinetics, processing using oxidation and oxidized microstructures. Laboratory teams are selected for all experiments.
EMSE 290. Materials Laboratory III. 2 Units.
Experiments designed to characterize and evaluate different microstructural designs produced by variations in processing. Fracture of brittle materials, fractography, thermal shock resistance, hardenability of steels, TTT and CT diagrams, composites, solidification of metals, solution annealing of alloys. Recommended preparation: EMSE 201.

EMSE 301. Fundamentals of Materials Processing. 3 Units.
Introduction to materials processing technology with an emphasis on the relation of basic concepts to the processes by which materials are made into engineering components. Includes casting, welding, forging, cold-forming, powder processing of metals and ceramics, and polymer and composite processing. Recommended preparation: EMSE 201 and EMSE 202 and EMSE 203.

EMSE 302. Fundamentals of Materials Processing Laboratory. 1 Unit.
Demonstration of basic processes of materials fabrication. Includes visits to commercial materials processing plants for tours and demonstrations. Graded pass/fail.

EMSE 303. Mechanical Behavior of Materials. 3 Units.
Review of elasticity and plasticity, Basic stress strain relationships of single crystal and polycrystalline materials, Yield criteria, Microstructural factors controlling deformation and fracture of polycrystalline materials, Strengthening mechanisms, Fracture toughness and fatigue behavior of engineering materials. Recommended preparation: EMSE 201 and ENGR 200.

EMSE 307. Foundry Metallurgy. 3 Units.
Introduction to solid-liquid phase transformations and their application to foundry and metal casting processes, Includes application of nucleation and growth to microstructural development, application of thermodynamics to molten metal reactions, application of the principles of fluid flow and heat transfer to gating and risering techniques, and introduction to basic foundry and metal casting technology. Recommended preparation: EMSE 202 and EMSE 203 and ENGR 225.

EMSE 310. Applications of Diffraction Principles. 1 Unit.
A lab sequence in conjunction with EMSE 312, Diffraction Principles, involving experiments on crystallography, optical diffraction, Laue backscattering on single crystals, powder diffraction of unknown compounds, electron diffraction and imaging, and chemical analysis using energy dispersive x-ray spectroscopy. Recommended preparation: EMSE 312 or consent of instructor.

EMSE 312. Diffraction Principles. 3 Units.

EMSE 313. Engineering Applications of Materials. 3 Units.
Optimum use of materials taking into account not only the basic engineering characteristics and properties of the materials, but also necessary constraints of component design, manufacture (including machining), abuse allowance (safety factors), and cost. Interrelations among parameters based on total system design concepts. Case history studies. Systems of failure analysis. Recommended preparation: EMSE 202 and ENGR 200.

EMSE 314. Electrical, Magnetic, and Optical Properties of Materials. 3 Units.

EMSE 325. Undergraduate Research in Materials Science and Engineering. 1 - 3 Unit.
Undergraduate laboratory research in materials science and engineering. Students will undertake an independent research project along side graduate student(s) and/or postdoctoral fellow(s), and will be supervised by an EMSE faculty member. Written and oral reports will be given on a regular basis, and an end of semester report is required. The course can be repeated up to four (4) times for a total of six (6) credit hours. Prereq: Sophomore or Junior standing and consent of instructor.

EMSE 335. Strategic Metals and Materials for the 21st Century. 3 Units.
This course seeks to create an understanding of the role of mineral-based materials in the modern economy focusing on how such knowledge can and should be used in making strategic choices in an engineering context. The history of the role of materials in emerging technologies from a historical perspective will be briefly explored. The current literature will be used to demonstrate the connectedness of materials availability and the development and sustainability of engineering advances with examples of applications exploiting structural, electronic, optical, magnetic, and energy conversion properties. Processing will be comprehensively reviewed from source through refinement through processing including property development through application of: titanium, beryllium, molybdenum, cobalt, vanadium, manganese, tantalum, rhenium, and rare earth group metals. The concept of strategic recycling, including design for recycling and waste stream management will be considered. Offered as EMSE 335 and EMSE 435. Prereq: Senior standing or graduate student.

EMSE 360. Transport Phenomena in Materials Science. 3 Units.
Review of momentum, mass, and heat transport from a unified point of view. Application of these principles to various phenomena in materials science and engineering with an emphasis on materials processing. Both analytical and numerical methodologies applied in the solution of problems. Recommended preparation: ENGR 225 and MATH 224 or equivalent.
EMSE 372. Relation of Materials to Design. 4 Units.
The design of mechanical and structural elements considering static failure, elastic stability, residual stresses, stress concentration, impact, fatigue, creep and environmental conditions on the mechanical behavior of engineering materials. Rational approaches to materials selection for new and existing designs of structures. Laboratory experiments coordinated with the classroom lectures. Offered as EMAE 372 and EMSE 372. Prereq: ECIV 310.

EMSE 396. Special Project or Thesis. 1 - 18 Unit.
Special research projects or undergraduate thesis in selected material areas.

EMSE 398. Senior Project in Materials I. 1 Unit.
Independent Research project. Projects selected from those suggested by faculty; usually entail original research. The EMSE 398 and 399 sequence form an approved SAGES capstone.

EMSE 399. Senior Project in Materials II. 2 Units.
Independent Research project. Projects selected from those suggested by faculty; usually entail original research. Requirements include periodic reporting of progress, plus a final oral presentation and written report. Recommended preparation: EMSE 398 or concurrent enrollment.

EMSE 400T. Graduate Teaching I. 0 Units.
To provide teaching experience for all Ph.D.-bound graduate students. This will include preparing exams/quizzes, homework, leading recitation sessions, tutoring, providing laboratory assistance, and developing teaching aids that include both web-based and classroom materials. Graduate students will meet with supervising faculty member throughout the semester. Grading is pass/fail. Students must receive three passing grades and up to two assignments may be taken concurrently. Recommended preparation: Ph.D. student in Materials Science and Engineering.

EMSE 401. Transformations in Materials. 3 Units.

EMSE 403. Modern Ceramic Processing. 3 Units.
Fundamental science and technology of modern ceramic powder processing and fabrication techniques. Powder synthesis techniques. Physical chemistry of aqueous and nonaqueous colloidal suspensions of solids. Shape forming techniques: extrusion; injection molding; slip and tape casting; dry, isostatic, and hot isostatic pressing. Recommended preparation: EMSE 316 or concurrent enrollment.

EMSE 404. Diffusion Processes in Solids and Melts. 3 Units.

EMSE 405. Dielectric, Optical and Magnetic Properties of Materials. 3 Units.
Electrical properties of nonmetals: ionic conductors, dielectrics, ferroelectrics, and piezo-electrics. Magnetic phenomena and properties of metals and oxides, including superconductors. Mechanisms of optical absorption in dielectrics. Optoelectronics. Applications in devices such as oxygen sensors, multilayer capacitors, soft and hard magnets, optical fibers, and lasers.

EMSE 406. Optical Materials, Elements and Technologies. 3 Units.
Optical materials, elements and technologies are the focus of this course. Inorganic or organic optical materials are defined by their optical properties, radiation durability under ultraviolet and solar irradiation, and ancillary properties required for robust application. Optical elements of, for example, photolithography (as used in the semiconductor industry) include photomasks, pellicles, and imaging fluids. Photovoltaics (PV) have reflective, refractive, anti-reflective, or encapsulating elements. To produce the desired optical function, both photolithography and photovoltaics rely on the structure-property relationships of materials and precise manufacturing methods. Ancillary properties of interest are latent image formation and development for photoreists and adhesion and environmental isolation for PV encapsulants. We will see how photolithography has been the dominant contributor to the continuous shrinkage of semiconductors, and, with photovoltaics, we will examine how PVs compete with current energy sources by potentially reducing the cost per kWh through technological advancement. Optimization of the optical, physical and economic performance of these materials and elements, including sufficient durability over their required lifetime, is a critical challenge for technological success. Higher performance materials and novel optical elements and system designs, coupled with increased PV module lifetimes and lower degradation rates, are important paths to cost-competitive PV electricity. We will also study the manner in which the evolution of technology has defined and driven the roadmaps of these optical technologies (Moore’s Law). The course will include two computational optics labs to design state-of-the-art optical technologies for photolithographic imaging of sub-wavelength semiconductor device feature sizes, and of non-imaging concentrating photovoltaic systems with high optical efficiencies.

EMSE 409. Deformation Processing. 3 Units.
Flow stress as a function of material and processing parameters; yielding criteria; stress states in elastic-plastic deformation; forming methods: forging, rolling, extrusion, drawing, stretch forming, composite forming. Recommended preparation: EMSE 303.

EMSE 411. Environmental Effects on Materials. 3 Units.
Oxidation, corrosion and modification of structure of properties of metallic, ceramic and carbonaceous materials in environments of air, gases and aqueous electrolytes at low and high temperatures; Coatings and other protection methods; Material selection for self-passivation. Conversion-reactions and anodizing for beneficial applications.

EMSE 412. Materials Science and Engineering Seminar. 0 Units.

EMSE 413. Fundamentals of Materials Engineering and Science. 3 Units.
Provides a background in materials for graduate students with undergraduate majors in other branches of engineering and science: reviews basic bonding relations, structure, and defects in crystals. Lattice dynamics; thermodynamic relations in multi-component systems; microstructural control in metals and ceramics; mechanical and chemical properties of materials as affected by structure; control of properties by techniques involving structure property relations; basic electrical, magnetic and optical properties.
EMSE 417. Properties of Materials at High Temperatures. 3 Units.

EMSE 419. Phase Equilibria and Microstructures of Materials. 3 Units.
The multi-component nature of most material systems require understanding of phase equilibria and descriptions of microstructure. Attention will be given to phase equilibria in multi-component (ternary and higher) systems, and the stereological description of the microstructure of multiphase systems.

EMSE 421. Fracture of Materials. 3 Units.

EMSE 426. Semiconductor Thin Film Science and Technology. 3 Units.

EMSE 427. Dislocations in Solids. 3 Units.
Elasticity and dislocation theory; dislocation slip systems; kinks and dislocation motion; jogs and dislocation interactions, dislocation dissociation and stacking faults; dislocation multiplication, applications to yield phenomena, work hardening and other mechanical properties.

EMSE 429. Crystallography and Crystal Chemistry. 3 Units.
Crystal symmetries, point groups, translation symmetries, space lattices, crystal classes, space groups, crystal chemistry, crystal structures and physical properties.

EMSE 435. Strategic Metals and Materials for the 21st Century. 3 Units.
This course seeks to create an understanding of the role of mineral-based materials in the modern economy focusing on how such knowledge can and should be used in making strategic choices in an engineering context. The history of the role of materials in emerging technologies from a historical perspective will be briefly explored. The current literature will be used to demonstrate the connectedness of materials availability and the development and sustainability of engineering advances with examples of applications exploiting structural, electronic, optical, magnetic, and energy conversion properties. Processing will be comprehensively reviewed from source through refinement through processing including property development through application of: titanium, beryllium, molybdenum, cobalt, vanadium, manganese, tantalum, rhenium, and rare earth group metals. The concept of strategic recycling, including design for recycling and waste stream management will be considered. Offered as EMSE 335 and EMSE 435. Prereq: Senior standing or graduate student.

EMSE 500T. Graduate Teaching II. 0 Units.
To provide teaching experience for all Ph.D.-bound graduate students. This will include preparing exams/quizzes/homework, leading recitation sessions, tutoring, providing laboratory assistance, and developing teaching aids that include both web-based and classroom materials. Graduate students will meet with supervising faculty member throughout the semester. Grading is pass/fail. Students must receive three passing grades and up to two assignments may be taken concurrently. Recommended preparation: Ph.D. student in Materials Science and Engineering.

EMSE 502. Mechanical Properties of Metals and Composites. 3 Units.
Microstructural effects on strength and toughness of advanced metals and composites. Review of dispersion hardening and composite strengthening mechanisms. Toughening of brittle materials via composite approaches such as fiber reinforcement, ductile phases, and combinations of approaches. Recommended preparation: ENGR 200 and EMSE 303 or EMSE 421; or consent.

EMSE 504. Thermodynamics of Solids. 3 Units.

EMSE 509. Conventional Transmission Electron Microscopy. 3 Units.
Introduction to transmission electron microscopy-theoretical background and practical work. Lectures and laboratory experiments cover the technical construction and operation of transmission electron microscopes, specimen preparation, electron diffraction by crystals, electron diffraction techniques of TEM, conventional TEM imaging, and scanning TEM. Examples from various fields of materials research illustrate the application and significance of these techniques. Recommended preparation: Consent of instructor.

EMSE 511. Failure Analysis. 3 Units.
Methods and procedures for determining the basic causes of failures in structures and components. Recognition of fractures and excessive deformations in terms of their nature and origin. Development and full characterization of fractures. Legal, ethical, and professional aspects of failures from service. Recommended preparation: EMSE 201 and EMSE 303 and ENGR 200; or consent.

EMSE 512. Advanced Techniques of Transmission Electron Microscopy. 3 Units.
Theory and laboratory experiments to learn advanced techniques of transmission electron microscopy, including high-resolution transmission electron microscopy (HRTEM), convergent-beam electron diffraction (CBED), microanalysis using X-ray energy-dispersive spectroscopy (XEDS) and electron energy-loss spectroscopy (EELS), and electron-spectroscopic imaging (ESI) for elemental mapping. Recommended preparation: EMSE 509.
**EMSE 514. Defects in Semiconductors. 3 Units.**
Presentation of the main crystallographic defects in semiconductors; point defects (e.g., vacancies, interstitials, substitutional and interstitial impurities), line defects (e.g., dislocations), planar defects (e.g., grain boundaries). Structural, electrical and optical properties of various defects. Interpretation of the properties from the perspective of semiconductor physics and materials science and correlation of these defects to physical properties of the material. Experimental techniques including TEM, EBIC, CL, DLTS, etc. Recommended preparation: EMSE 426.

**EMSE 515. Analytical Methods in Materials Science. 3 Units.**
Microcharacterization techniques of materials science and engineering: SPM (scanning probe microscopy), SEM (scanning electron microscopy), FIB (focused ion beam) techniques, SIMS (secondary ion mass spectrometry), EPMA (electron probe microanalysis), XPS (X-ray photoelectron spectrometry), and AES (Auger electron spectrometry), ESCA (electron spectrometry for chemical analysis). The course includes theory, application examples, and laboratory demonstrations.

**EMSE 600T. Graduate Teaching III. 0 Units.**
To provide teaching experience for all Ph.D.-bound graduate students. This will include preparing exam/quizzes/homework, leading recitation sessions, tutoring, providing laboratory assistance, and developing teaching aids that include both web-based and classroom materials. Graduate students will meet with supervising faculty member throughout the semester. Grading is pass/fail. Students must receive three passing grades and up to two assignments may be taken concurrently. Recommended preparation: Ph.D. student in Materials Science and Engineering.

**EMSE 601. Independent Study. 1 - 18 Unit.**

**EMSE 633. Special Topics. 1 - 18 Unit.**

**EMSE 649. Special Projects. 1 - 18 Unit.**

**EMSE 651. Thesis M.S.. 1 - 18 Unit.**
Required for Master’s degree. A research problem in metallurgy, ceramics, electronic materials, biomaterials or archeological and art historical materials, culminating in the writing of a thesis.

**EMSE 701. Dissertation Ph.D.. 1 - 18 Unit.**
Required for Ph.D. degree. A research problem in metallurgy, ceramics, electronic materials, biomaterials or archeological and art historical materials, culminating in the writing of a thesis. Prereq: Predoctoral research consent or advanced to Ph.D. candidacy milestone.
Department of Mechanical and Aerospace Engineering

The Department of Mechanical and Aerospace Engineering of the Case School of Engineering offers programs leading to bachelors, masters, and doctoral degrees. It administers the programs leading to the degrees of Bachelor of Science in Engineering with a major in aerospace engineering and Bachelor of Science in Engineering with a major in mechanical engineering. Both curricula are based on four-year programs of preparation for productive engineering careers or further academic training. The Bachelor of Science degree program in Mechanical Engineering and the Bachelor of Science degree program in Aerospace Engineering are accredited by the Engineering Accreditation Commission of ABET, www.abet.org (http://www.abet.org).

Departmental Mission

The mission of the Mechanical and Aerospace Engineering Department is to educate and prepare students at both the undergraduate and graduate levels for leadership roles in the fields of Mechanical Engineering and Aerospace Engineering and to conduct research for the benefit of society.

The undergraduate program emphasizes fundamental engineering science, analysis and experiments to insure that graduates will be strong contributors in their work environment, be prepared for advanced study at top graduate schools and be proficient lifelong learners. The graduate programs emphasize advanced methods of analysis, mathematical modeling, computational and experimental techniques applied to a variety of mechanical and aerospace engineering specialties including, applied mechanics, dynamic systems, robotics, biomechanics, fluid mechanics, heat transfer, propulsion and combustion. Leadership skills are developed by infusing the program with current engineering practice, design, and professionalism (including engineering ethics and the role of engineering in society) led by concerned educators and researchers.

The academic and research activities of the department center on the roles of mechanics, thermodynamics, heat and mass transfer, and engineering design in a wide variety of applications such as aeronautics, astronautics, biomechanics and orthopedic engineering, biomimetics and biological inspired robotics, energy, environment, machinery dynamics, mechanics of advanced materials, nanotechnology and tribology. Many of these activities involve strong collaborations with the Departments of Biology, Electrical Engineering and Computer Science, Materials Science and Engineering and Orthopaedics of the School of Medicine.

The significant constituencies of the Mechanical and Aerospace Engineering Department are the faculty, the students, the alumni and the external advisory boards. The educational program objectives are established and reviewed on an ongoing basis based on the feedback from the various constituencies as well as archival information about the program graduates. The faculty engages in continuing discussions of the academic programs in the regularly scheduled faculty meetings throughout the academic year. Periodic surveys of alumni provide data regarding the preparedness and success of the graduates as well as guidance in program development. Archival data include the placement information for graduating seniors, which provides direct information regarding the success of the graduates in finding employment or being admitted to graduate programs.

Mastery of Fundamentals

• A strong background in the fundamentals of chemistry, physics and mathematics.

• Methods of mechanical engineering analysis, both numerical and mathematical, applied to mechanics, dynamic systems and control, thermodynamics, fluid mechanics and heat transfer.

• Methods of modern experimental engineering analysis and data acquisition.

Creativity

• Ability to identify, model, and solve mechanical and aerospace engineering design problems.

• Ability to design experiments to resolve mechanical and aerospace engineering issues.

• Ability to perform an individual senior project that demonstrates original research and/or design content.

Societal Awareness

• Issues of environmental impact, efficient use of energy and resources, benefits of recycling.

• An awareness of the multi-disciplinary nature of mechanical and aerospace engineering.

• Impact of economic, product liability and other legal issues on mechanical and aerospace engineering manufacturing and design.

Leadership Skills

• An ability to work in teams.

• Ethical considerations in engineering decisions.

• Proficiency in oral and written communication.

• Professionalism

• Students are encouraged to develop as professionals through participation in the student chapters of the American Society of Mechanical Engineers (ASME) and the American Institute of Aeronautics and Astronautics (AIAA).

• Students are encouraged to augment their classroom experiences with the cooperative education program and the strong graduate research program of the department.

• Students are encouraged to take the Fundamentals of Engineering Examination as the first step in the process of becoming a registered professional engineer.

• The bachelor's candidate must complete an independent design project with an oral and written final report.

• The master's candidate must demonstrate independent research resulting in a thesis or project suitable for publication and/or presentation in peer reviewed journals and/or conferences.

• The doctoral candidate must complete a rigorous independent thesis containing original research results appropriate for publication in archival journals and presentation at leading technical conferences.

Aerospace Engineering

Aerospace engineering has grown dramatically with the rapid development of the computer in experiments, design and numerical analysis. The wealth of scientific information developed as a result of aerospace activity forms the foundation for the aerospace engineering major.

Scientific knowledge is being developed each day for programs to develop reusable launch vehicles (RLV), the International Space Station (ISS), High Speed Transport (HST), Human Exploration and Development of Space (HEDS) and micro-electro-mechanical sensors and control systems for advanced flight. New methods of analysis and
design for structural, fluid, and thermodynamic applications are required to meet these challenges.

The aerospace engineering major has been developed to address the needs of those students seeking career opportunities in the highly specialized and advancing aerospace industries.

**Mechanical Engineering**

Civilization, as we know it today, depends on the intelligent and humane use of our energy resources and machines. The mechanical engineer’s function is to apply science and technology to the design, analysis, development, manufacture, and use of machines that convert and transmit energy, and to apply energy to the completion of useful operations. The top ten choices of the millennium committee of the National Academy of Engineering, asked to select the 20 top engineering accomplishments of the 20th century, was abundant with mechanical engineering accomplishments, electrification (large scale power generation and distribution), automobiles, air travel (development of aircraft and propulsion), mechanized agriculture, and refrigeration and air conditioning.

**Research**

**Aerospace Technology and Space Exploration**

Flow in turbomachinery, molecular dynamics simulation of rarefied gas flow, two phase flow, supersonic combustion and propulsion, thermoacoustic refrigeration, in-situ resource utilization from space. Gravitational effects on transport phenomena, fluids and thermal processes in advance life support systems for long duration space travel, interfacial processes, g-jitter effects on microgravity flows, two phase flow in zero and reduced gravity.

**Combustion and Energy**

Hydrogen ignition and safety, catalytic combustion, flame spread, fire research and protection, combustion in micro- and partial gravity.

**Dynamics of Rotating Machinery**

Forced and instability vibration of rotor/bearing/seal systems, nonlinear rotor dynamics, torsional rotor vibration, rotor dynamic characteristics of bearings and seals (computational and experimental approach), control of rotor system dynamics, rub-impact studies on bearings and compressor/ turbine blading systems. Advanced rotating machinery monitoring and diagnostics.

**Heat Transfer**

Analysis of heat transfer in complex systems such as biological organisms, multi-functional materials and building enclosures.

**Engineering Design**

Optimization and computer-aided design, feasibility studies of kinematic mechanisms, kinematics of rolling element-bearing geometries, mechanical control systems, experimental stress analysis, failure analysis, development of biologically inspired methodologies.

**Manufacturing**

Agile manufacturing work cells developed to facilitate quick change over from assembly of one object to assembly of other objects contains multiple robots, a conveyor system and flexible parts feeders.

**Materials**

Development of novel experimental techniques to investigate material response at elevated temperatures and high rates of deformation. Constitutive modeling of damage evolution, shear localization and failure of advanced engineering materials. Fabrication of mechanical properties of composite materials; creep, rupture, and fatigue properties of engineering materials at elevated temperatures.

**Multiphase Flow Research**

Application of non-intrusive laser based diagnostic techniques and ultrasound techniques including pulsed ultrasound Doppler velocimetry to study solid-liquid, solid-gas, liquid-gas and solid-liquid-gas, multiphase flows encountered in slurry transport and bio-fluid mechanics.

**Nanotechnology**

Research related to various nanotechnology applications with particular emphasis on energy conversion, generation and storage in nanostructured materials including the synthesis of polymer-based nanocomposites. Current research projects include investigation of nanocomposites for thermoelectric devices, molecular simulation of thermal transport across interfacial regions, and biomimetic research on protein-based shark gel.

**Musculoskeletal Mechanics and Materials Research**

Design, modeling, and failure analysis of orthopaedic prostheses and material selection; mechanical properties of, and transport processes in, bone and soft tissue; tribology of native and tissue engineered cartilage; nondestructive mechanical evaluation of tissue engineered cartilage.

**Robotics**

Biologically inspired and biologically based design and control of legged robots. Dynamics, control and simulation of animals and robots.

**Tribology and Seals**

Time-resolved friction on nano- and microsecond time scale with applications to high speed machining and mechanics of armor penetration. Study of gas lubricated foil bearing systems with application to oil-free turbomachinery. Evaluation of advanced seal concepts and configurations for high temperature applications in gas turbine engines.

**Turbomachinery**

Vibration characteristics of seals and bearings and measurement of chaotic motion. Rub impact studies of blade tip/casing interactions, particle-blade/casing interactions in centrifugal pumps.

**Bachelor of Science in Engineering**

**Educational Objectives**

1. Graduates will enter and successfully engage in careers in Aerospace Engineering, Mechanical Engineering and other professions appropriate to their background, interests, and skills.
2. Graduates will engage in continued learning through post-baccalaureate education and/or professional development in engineering or other professional fields.
3. Graduates employed in engineering fields will (i) demonstrate technical ability by identifying, formulating, analyzing, and creating engineering solutions using appropriate contemporary engineering techniques, skills, and tools; (ii) communicate effectively; and (iii) positively and effectively work with and impact teams.
4. Graduates will develop as leaders in their chosen professions.

**Student Outcomes**

As preparation for achieving the above educational objectives, the B.S. degree programs in Aerospace Engineering and Mechanical Engineering are designed so that students attain:
• an ability to apply knowledge of mathematics, science, and engineering
• an ability to design and conduct experiments, as well as to analyze and interpret data
• an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
• an ability to function on multi-disciplinary teams
• an ability to identify, formulate, and solve engineering problems
• an understanding of professional and ethical responsibility
• an ability to communicate effectively
• the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
• a recognition of the need for, and an ability to engage in life-long learning
• a knowledge of contemporary issues
• an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

The Bachelor of Science in Mechanical Engineering and the Bachelor of Science in Aerospace Engineering degree programs are accredited by the Engineering Accreditation Commission of ABET, www.abet.org

Bachelor of Science in Engineering Major in Aerospace Engineering

Major Courses

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<th>Course Code</th>
<th>Course Title</th>
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<td>EMAE 160</td>
<td>Mechanical Manufacturing</td>
<td>3</td>
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<td>EMAE 181</td>
<td>Dynamics</td>
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<td>EMAE 250</td>
<td>Computers in Mechanical Engineering</td>
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<td>EMAE 285</td>
<td>Mechanical Engineering Measurements Laboratory</td>
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<td>EMAE 325</td>
<td>Fluid and Thermal Engineering II</td>
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<tr>
<td>EMAE 350</td>
<td>Mechanical Engineering Analysis</td>
<td>3</td>
</tr>
<tr>
<td>EMAE 355</td>
<td>Design of Fluid and Thermal Elements</td>
<td>3</td>
</tr>
<tr>
<td>EMAE 356</td>
<td>Aerospace Design</td>
<td>3</td>
</tr>
<tr>
<td>EMAE 359</td>
<td>Aero/Gas Dynamics</td>
<td>3</td>
</tr>
<tr>
<td>EMAE 376</td>
<td>Aerostructures</td>
<td>3</td>
</tr>
<tr>
<td>EMAE 381</td>
<td>Flight and Orbital Mechanics</td>
<td>3</td>
</tr>
<tr>
<td>EMAE 382</td>
<td>Propulsion</td>
<td>3</td>
</tr>
<tr>
<td>EMAE 398</td>
<td>Senior Project</td>
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</tbody>
</table>

Two technical electives

For the Engineering Core natural science and math requirement

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYS 221</td>
<td>Introduction to Modern Physics</td>
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Total Units 41

Bachelor of Science in Engineering Suggested Program of Study: Major in Aerospace Engineering

First Year

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
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<tbody>
<tr>
<td>CHEM 111</td>
<td>Principles of Chemistry for Engineers</td>
<td>4</td>
</tr>
<tr>
<td>MATH 121</td>
<td>Calculus for Science and Engineering I</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 121</td>
<td>General Physics I - Mechanics</td>
<td>4</td>
</tr>
<tr>
<td>ENGR 131</td>
<td>Elementary Computer Programming</td>
<td>3</td>
</tr>
<tr>
<td>ENGR 100</td>
<td>SAGES First Seminar</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 101</td>
<td>Physical Education Activities</td>
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</tr>
<tr>
<td>MATH 122</td>
<td>Calculus for Science and Engineering II</td>
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Second Year

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
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<tbody>
<tr>
<td>EMAE 160</td>
<td>Mechanical Manufacturing</td>
<td>3</td>
</tr>
<tr>
<td>EMAE 181</td>
<td>Dynamics</td>
<td>3</td>
</tr>
<tr>
<td>EMAE 250</td>
<td>Computers in Mechanical Engineering</td>
<td>3</td>
</tr>
<tr>
<td>EMAE 285</td>
<td>Mechanical Engineering Measurements Laboratory</td>
<td>4</td>
</tr>
<tr>
<td>EMAE 325</td>
<td>Fluid and Thermal Engineering II</td>
<td>4</td>
</tr>
<tr>
<td>EMAE 350</td>
<td>Mechanical Engineering Analysis</td>
<td>3</td>
</tr>
<tr>
<td>EMAE 355</td>
<td>Design of Fluid and Thermal Elements</td>
<td>3</td>
</tr>
<tr>
<td>EMAE 356</td>
<td>Aerospace Design</td>
<td>3</td>
</tr>
<tr>
<td>EMAE 359</td>
<td>Aero/Gas Dynamics</td>
<td>3</td>
</tr>
<tr>
<td>ENGR 376</td>
<td>Aerostructures</td>
<td>3</td>
</tr>
<tr>
<td>ENGR 381</td>
<td>Flight and Orbital Mechanics</td>
<td>3</td>
</tr>
<tr>
<td>ENGR 382</td>
<td>Propulsion</td>
<td>3</td>
</tr>
<tr>
<td>EMAE 398</td>
<td>Senior Project</td>
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Third Year

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<th>Course Title</th>
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<tbody>
<tr>
<td>ENGR 305</td>
<td>Strength of Materials (ECIV 310)</td>
<td>3</td>
</tr>
<tr>
<td>EMAE 350</td>
<td>Mechanical Engineering Analysis</td>
<td>3</td>
</tr>
<tr>
<td>ENGR 350</td>
<td>Aerosol Systems</td>
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</tr>
<tr>
<td>ENGR 356</td>
<td>Aerostructures</td>
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<td>Technical elective</td>
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Fourth Year

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
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<tbody>
<tr>
<td>ENGR 305</td>
<td>Strength of Materials (ECIV 310)</td>
<td>3</td>
</tr>
<tr>
<td>ENGR 350</td>
<td>Mechanical Engineering Analysis</td>
<td>3</td>
</tr>
<tr>
<td>ENGR 356</td>
<td>Aerostructures</td>
<td>3</td>
</tr>
<tr>
<td>Technical elective</td>
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Total Units in Sequence: 129

Hours required for graduation: 129

Engineering Core Course

<table>
<thead>
<tr>
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<th>Course Title</th>
<th>Units</th>
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<tbody>
<tr>
<td>ENGR 100</td>
<td>SAGES First Seminar</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 101</td>
<td>Physical Education Activities</td>
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</table>

b Engineering Core Course

d May be taken fall or spring semester.
Bachelor of Science in Engineering
Major in Mechanical Engineering

Major Courses

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>EMAE 160</td>
<td>Mechanical Manufacturing</td>
<td>3</td>
</tr>
<tr>
<td>EMAE 181</td>
<td>Dynamics</td>
<td>3</td>
</tr>
<tr>
<td>EMAE 250</td>
<td>Computers in Mechanical Engineering</td>
<td>3</td>
</tr>
<tr>
<td>EMAE 260</td>
<td>Design and Manufacturing I</td>
<td>3</td>
</tr>
<tr>
<td>EMAE 285</td>
<td>Mechanical Engineering Measurements Laboratory</td>
<td>4</td>
</tr>
<tr>
<td>EMAE 325</td>
<td>Fluid and Thermal Engineering II</td>
<td>4</td>
</tr>
<tr>
<td>EMAE 350</td>
<td>Mechanical Engineering Analysis</td>
<td>3</td>
</tr>
<tr>
<td>EMAE 355</td>
<td>Design of Fluid and Thermal Elements</td>
<td>3</td>
</tr>
<tr>
<td>EMAE 360</td>
<td>Design and Manufacturing II</td>
<td>3</td>
</tr>
<tr>
<td>EMAE 370</td>
<td>Design of Mechanical Elements</td>
<td>3</td>
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<td>EMAE 398</td>
<td>Senior Project</td>
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<tr>
<td></td>
<td>Four technical electives</td>
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<td></td>
<td>Total Units</td>
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Bachelor of Science in Engineering
Suggested Program of Study: Major in Mechanical Engineering

First Year

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Units</th>
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<tr>
<td>Principles of Chemistry for Engineers (CHEM 111)</td>
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<td></td>
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<tr>
<td>Calculus for Science and Engineering I (MATH 121)</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>General Physics I - Mechanics (PHYS 121)</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Elementary Computer Programming (ENGR 131)</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>FSCC 100 First Seminar</td>
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<tr>
<td>PHED 101 Physical Education Activities</td>
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<tr>
<td>Calculus for Science and Engineering II (MATH 122)</td>
<td>4</td>
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<tr>
<td>General Physics II - Electricity and Magnetism (PHYS 122)</td>
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<tr>
<td>University Seminar</td>
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<tr>
<td>Chemistry of Materials (ENGR 145)</td>
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<td>PHED 102 Physical Education Activities</td>
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Second Year

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<tr>
<th>Course Code</th>
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<th>Units</th>
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<tbody>
<tr>
<td>University Seminar</td>
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<tr>
<td>Statics and Strength of Materials (ENGR 200)</td>
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<td></td>
</tr>
<tr>
<td>Mechanical Manufacturing (MAE 160)</td>
<td>3</td>
<td></td>
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<tr>
<td>Calculus for Science and Engineering II (MATH 223)</td>
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<td></td>
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<tr>
<td>Computers in Mechanical Engineering (EMAE 250)</td>
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<td></td>
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<tr>
<td>EMAE 260 - Design and Manufacturing I</td>
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<td></td>
</tr>
<tr>
<td>Dynamics (EMAE 181)</td>
<td>3</td>
<td></td>
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<tr>
<td>Elementary Differential Equations (MATH 224)</td>
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<tr>
<td>Thermodynamics, Fluid Dynamics, Heat and Mass Transfer (ENGR 225)</td>
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<tr>
<td>Science elective</td>
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<td>Year Total:</td>
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Third Year

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Units</th>
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<tbody>
<tr>
<td>Humanities or Social Science elective</td>
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<td></td>
</tr>
<tr>
<td>Fluid and Thermal Engineering II (EMAE 325)</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Mechanical Engineering Measurements Laboratory (EMAE 285)</td>
<td>4</td>
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</table>

Strength of Materials (EGV 310)\(^d\) 3
Mechanical Engineering Analysis (EMAE 350) 3
Humans or Social Science elective 3
Introduction to Circuits and Instrumentation (ENGR 210)\(^b,d\) 4
Technical elective\(^d\) 3
Design of Mechanical Elements (EMAE 370) 3
Technical elective\(^d\) 3
Year Total: 17 16

Fourth Year

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Units</th>
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<tbody>
<tr>
<td>Humanities or Social Science elective</td>
<td>3</td>
<td></td>
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<tr>
<td>Signals and Systems (EECS 246)</td>
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<td></td>
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<tr>
<td>Design of Fluid and Thermal Elements (EMAE 355)(^d)</td>
<td>3</td>
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<tr>
<td>Design and Manufacturing II (EMAE 360)</td>
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<td></td>
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<tr>
<td>Open Elective(^d)</td>
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<td></td>
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<tr>
<td>Humans or Social Science elective</td>
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<td></td>
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<tr>
<td>Technical elective(^d)</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Senior Project (EMAE 398)(^b,d)</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Professional Communication for Engineers (ENGL 398N)(^d)</td>
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<td></td>
</tr>
<tr>
<td>Technical elective(^d)</td>
<td>3</td>
<td></td>
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<tr>
<td>Year Total:</td>
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</table>

Total Units in Sequence: 129

Hours required for graduation: 129

Technical Electives By Program

Aerospace Engineering: For students following the Design and Manufacturing Track
(see requirements for Design and Manufacturing below)
- All 200-, 300-, and 400-level courses from the following areas: EMAE all, EMAE cross-listed, EBME all, EBME cross-listed, ECIV all, EECS all, EECS cross-listed, & EMAC all
- All 300- and 400-level course in ECHE and EMSE areas
- All 300-level MATH and STAT courses with the concurrence of the advisor
- NOTE: We are not accepting EMSE 201 as a technical elective

Mechanical Engineering: For students following the Design and Manufacturing Track
See requirements for Design and Manufacturing below
- All 200-, 300-, and 400-level courses from the following areas: EMAE all, EMAE cross-listed, EBME all, EBME cross-listed, ECIV all, EECS all, EECS cross-listed, & EMAC all
- All 300- and 400-level course in ECHE and EMSE areas
- All 300-level MATH and STAT courses with the concurrence of the advisor
- NOTE: We are not accepting EMSE 201 as a technical elective
Science Electives for Mechanical Engineering Majors

The Student Information System is currently set up to accept PHYS 221 Introduction to Modern Physics or STAT 312 Basic Statistics for Engineering and Science as a science elective. Other courses for individual students can be selected with the approval of the student’s advisor and the chair using an Academic Advisement Requirement Form (http://www.case.edu/provost/ugstudies/ARcorrection.pdf).

Humanities and Social Science Requirements

Consult the Office of Undergraduate Studies section (p. 537) in this bulletin.

Double Major Mechanical and Aerospace Engineering

The department also offers a double major in Mechanical and Aerospace Engineering. The course selection details are provided in the course listing section. The number of additional courses required can vary from six or two courses depending upon the student’s program of study.

Five Year Program of Study

The department curriculum offers a five-year cooperative (co-op) education program and a combined bachelors-masters programs which may be completed in five years. Co-op weaves two 7-month industrial internships into the normal four-year program by combining a summer with either a fall or spring semester to form the 7-month industrial experiences. Students apply in the middle of the sophomore year and normally begin the internship in the spring semester of the junior year. After completing the second internship, students return to campus in the spring or fall to complete their final year of study.

The combined bachelors/masters program allows a student to double count 9 credit hours of graduate course work towards the Bachelor of Science degree in any one of the department’s two degree programs. By completing the remaining graduate credit hours and a thesis, a student may earn a Master of Science degree in mechanical or aerospace engineering. This may take 5 years or a little longer. Application to this program is initiated in the spring of the junior year with the department’s graduate student programs office. A minimum grade point of 3.2 is required for consideration for this accelerated program.

Another option is the 5 year TiME Program taught in conjunction with the Weatherhead School of Management in which a student completes a BS in Aerospace or Mechanical Engineering and earns a Master of Engineering Management.

The Design and Manufacturing Minor

Required:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>EMAE 160</td>
<td>Mechanical Manufacturing</td>
<td>3</td>
</tr>
<tr>
<td>EMAE 260</td>
<td>Design and Manufacturing I</td>
<td>3</td>
</tr>
<tr>
<td>EMAE 355</td>
<td>Design of Fluid and Thermal Elements</td>
<td>3</td>
</tr>
<tr>
<td>EMAE 360</td>
<td>Design and Manufacturing II</td>
<td>3</td>
</tr>
<tr>
<td>EMAE 363</td>
<td>Mechanical Engineering Modern Analysis Methods</td>
<td>4</td>
</tr>
<tr>
<td>EMAE 370</td>
<td>Design of Mechanical Elements</td>
<td>3</td>
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</table>

Elective courses used to satisfy the design and manufacturing track (choose three courses):

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>EMAE 290</td>
<td>Computer-Aided Manufacturing</td>
<td>3</td>
</tr>
<tr>
<td>EMAE 356</td>
<td>Aerospace Design</td>
<td>3</td>
</tr>
<tr>
<td>EMAE 378</td>
<td>Mechanics of Machinery I</td>
<td>3</td>
</tr>
<tr>
<td>EMAE 390</td>
<td>Advanced Manufacturing Technology</td>
<td>3</td>
</tr>
<tr>
<td>EMAE 397</td>
<td>Independent Laboratory Research</td>
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</tbody>
</table>

Total Units: 28

GRADUATE PROGRAMS

Master of Science Program

(Research or Project oriented)

For a research-oriented MS, each candidate must complete a minimum of 27 hours of graduate-level credits, including at least 18 hours of graduate-level courses and 9 credit hours of MS thesis research.

For the project-oriented option, students must complete 27 credit hours distributed in either of three ways: 21, 24, or 27 credit hours (7, 8 or 9 courses) of approved graduate course work and 6, or 3 credit hours of project replacing the MS thesis.

(Course Oriented)

Each MS candidate must complete 27 hours of graduate-level credits. The candidate has to pass a comprehensive examination upon completion of the course work.

In addition, a BS/ MS program and a 5-year TiME program (BS/ Master of Engineering Management) are also offered for our undergraduate students as indicated in the preceding section.

Master of Engineering Program

The Department of Mechanical and Aerospace Engineering participates in the practice-oriented Master of Engineering Program offered by the Case School of Engineering. In this program, students complete a core program consisting of five courses, and select a four-course sequence in an area of interest.

Doctor of Philosophy Program

Students wishing to pursue the doctoral degree in mechanical and aerospace engineering must successfully pass the doctoral qualifying examination consisting of both written and oral components. Qualifying exams are offered on applied mechanics, dynamics and design or fluid and thermal engineering sciences. Students can choose to take it in the fall or spring semesters. The minimum course requirements for the Ph.D. degree are as follows:

Depth Courses

All programs of study must include 6 graduate level mechanical courses in mechanical engineering or aerospace engineering. Usually these courses follow a logical development of a branch of mechanics, dynamics and design or fluid and thermal engineering science determined in conjunction with the student’s dissertation advisor to meet the objectives of the dissertation research topic.

Breadth and Basic Science Courses

A minimum of six graduate courses are required to fulfill the breadth and basic science courses. The basic science requirement is satisfied by taking two courses in the area of science and mathematics. Four additional courses are needed to provide the breadth outside the student’s area of research.

Dissertation Research

All doctoral programs must include a minimum of 18 credit hours of thesis research, EMAE 701.
Residence and Teaching Requirements

All doctoral programs must meet the residency requirements of the School of Graduate Studies and the teaching requirements of the Case School of Engineering.

Facilities

The education and research philosophy of the Department of Mechanical and Aerospace Engineering for both the undergraduate and graduate programs is based on a balanced operation of analytical, experimental, and computational activities. All three of these tools are used in a fundamental approach to the professional activities of research, development, and design. Among the major assets of the department are the experimental facilities maintained and available for the faculty, students, and staff.

The introductory undergraduate courses are taught through the Robert M. Ward ’41 Laboratory, the Bingham Student Workshop, the Reinberger Product and Process Development Laboratory, and the Reinberger Design Studio. The Ward Laboratory is modular in concept and available to the student at regularly scheduled class periods to conduct a variety of prepared experimental assignments. The lab is equipped with a variety of instruments ranging from classic analog devices to modern digital computer devices for the collection of data and the control of processes. Advanced facilities are available for more specialized experimental tasks in the various laboratories dedicated to each specific discipline. Most of these laboratories also house the research activities of the department, so students are exposed to the latest technology in their prospective professional practice. Finally, every undergraduate and graduate degree program involves a requirement, i.e., Project, Thesis or Dissertation, in which the student is exposed to a variety of facilities of the department.

The following is a listing of the major laboratory facilities used for the advanced courses and research of the department.

Biorobotics Laboratory Facilities

The Biorobotics Laboratory (http://birobots.cwru.edu/) consists of approximately 1080 square feet of laboratory and 460 square feet of office space. The lab includes two CNC machines for fabrication of smaller robot components. The lab’s relationship with CAISR (Center for Automation and Intelligent Systems Research) provides access to a fully equipped machine shop where larger components are fabricated. The laboratory hardware features several biologically inspired hexapod robots including two cockroach-like robots, Robot III and Robot IV. Both are based on the Blaberus cockroach and have 24 actuated revolute joints. They are 17 times larger than the insect (30 inches long). Robot IV is actuated with pneumatic artificial muscles. A compressed air facility has been installed to operate the robots. In addition, the lab contains structural dynamic testing equipment (sensors, DAQ boards, shakers) and an automated treadmill (5 feet by 6 feet) for developing walking robots. The Biorobotics Laboratory contains 20 PCs, and a dedicated LAN connected to the campus. Algor Finite Element Analysis software, Mechanical Desktop, and Pro/Engineer are installed for mechanical design and structural analysis. Also, the lab has developed dynamic simulation software for analyzing walking animals and designing walking robots.

Case Low Speed Research Wind Tunnel

The Case Low Speed Research Wind Tunnel provides very low free stream turbulence levels. The tunnel is completely modular, allowing a variety of different experimental configurations to be realized, greatly extending the tunnel’s functionality. The tunnel, originally constructed in the late 1940’s, has undergone a rebuilding effort with the construction of a new test section, the replacement of the entire upstream half of the wind tunnel, the rebuild of the drive section, and installation of a new drive motor and motor controller. The new upstream portion provides the incoming flow treatment necessary to produce a low free stream turbulence level. The improved drive section and motor increase the tunnel’s maximum speed while reducing noise and vibration levels. With these improvements, the tunnel now supports research of the highest quality as well as graduate and undergraduate student experiments.

Distributed Intelligence and Robotics Laboratory

The Distributed Intelligence and Robotics Laboratory (DIoRL) is a new laboratory in the Department of Mechanical and Aerospace Engineering that facilitates research activities on robotics and mechatronics. The primary research focuses on distributed intelligence, multi-agent systems, biologically-inspired robotics and medical applications. The laboratory is currently being constructed to house self-sufficient facilities and equipment for designing, testing and preliminary manufacturing. The DIoRL also conduct theoretical research related to design methodology and control algorithms based on information theory, complexity analysis and group theory.

Laser Flow Diagnostics Laboratory

A laser diagnostics laboratory is directed toward investigation of complex two-phase flow fields involved in energy-related areas, bio-fluid mechanics of cardiovascular systems, slurry flow in pumps and thermoacoustic power and refrigeration systems. The laboratory is equipped with state-of-the-art Particle Image Velocimetry (PIV) equipment, Pulsed Ultrasound Doppler Velocimeter, Ultrasound concentration measurement instrumentation and modern data acquisition and analysis equipment including PCs. The laboratory houses a clear centrifugal slurry flow pump loop and heart pump loop. Current research projects include investigation of flow through micro-chip devices, CSF flow in ventricles, investigation of solid-slurry flow in centrifugal pumps using ultrasound technique and PIV, thermo-acoustic refrigeration for space application.

Mechanics of Materials Experimental Facility

The major instructional as well as research facility for experimental methods in mechanics of materials is the Daniel K. Wright Jr. Laboratory. Presently, the facility houses a single-stage gas-gun along with tension/compression split Hopkinson bar and torsional Kolsky bar apparatus for carrying out fundamental studies in dynamic deformation and failure of advanced material systems. Hewlett Packard and Tektronix high speed, wide bandwidth digitizing oscilloscopes along with strain-gage conditioners and amplifiers are available for data recording and processing. The facility houses state-of-the-art laser interferometry equipment for making spatial and temporal measurements of deformation. High speed Hg-Cd-Te detector arrays are available for making time resolved multi-point non-contact temperature measurements.

A Schenck Pegasus digital servo-controlled hydraulic testing system with a 20Kip Universal testing load frame equipped with hydraulic grips and instrumentation is available for quasi-static mechanical testing under load or displacement control. A newly developed moiré microscope is available for studying large-scale inelastic deformation processes on micron size scales. CCD camera along with the appropriate hardware/
software for image-acquisition, processing and analyzing of full field experimental data from optical interferometers such as moiré microscope, photo-elasticity, and other laser based spatial interferometers are available.

**Rotating Machinery Dynamics and Tribology Laboratory**

This laboratory focuses on rotating machinery monitoring and diagnostic methods relating chaos content of dynamic non-linearity and model-based observers’ statistical measures to wear and impending failure modes. A double-spool-shaft rotor dynamics test rig provides independent control over spin speed and frequency of an adjustable magnitude circular rotor vibration orbit for bearing and seal rotor-dynamic characterizations.

Simultaneous radial and axial time-varying loads on any type of bearing can be applied on a second test rig. Real time control of rotor-mass unbalance at two locations on the rotor while it is spinning up to 10,000 rpm, simultaneous with rotor rubbing and shaft crack propagation, can be tested on a third rig. Self-excited instability rotor vibrations can be investigated on a fourth test rig.

**Musculoskeletal Mechanics and Materials Laboratories**

These laboratories are a collaborative effort between the Mechanical and Aerospace Engineering Department of the Case School of Engineering and the Department of Orthopaedics of the School of Medicine that has been ongoing for more than 40 years. Research activities have ranged from basic studies of mechanics of skeletal tissues and skeletal structures, experimental investigation of prosthetic joints and implants, measurement of musculoskeletal motion and forces, and theoretical modeling of mechanics of musculoskeletal systems. Many studies are collaborative, combining the forces of engineering, biology, biochemistry, and surgery. The Biomechanics Test labs include Instron mechanical test machines with simultaneous axial and torsional loading capabilities, a non-contacting video extensometer for evaluation of biological materials and engineering polymers used in joint replacements, acoustic emission hardware and software, and specialized test apparatus for analysis of joint kinematics. The Bio-imaging Laboratory includes microscopes and three-dimensional imaging equipment for evaluating tissue microstructure and workstations for three-dimensional visualization, measurement and finite element modeling. An Orthopaedic Implant Retrieval Analysis lab has resources for characterization and analysis of hard tissues and engineering polymers, as well as resources to maintain a growing collection of retrieved total hip and total knee replacements that are available for the study of implant design. The Soft Tissue Biomechanics lab includes several standard and special test machines. Instrumentation and a Histology facilities support the activities within the Musculoskeletal Mechanics and Materials Laboratories.

**National Center for Space Exploration Research**

The National Center for Space Exploration Research (NCSER) is a collaborative effort between the Universities Space Research Association (USRA), Case Western Reserve University (CWRU), and NASA Glenn Research Center (GRC) that provides GRC with specialized research and technology development capabilities essential to sustaining its leadership role in NASA missions. Expertise resident at NCSER includes reduced gravity fluid mechanics, reduced gravity combustion processes; heat transfer, two-phase flow, micro-fluidics, and phase change processes; computational multiphase fluid dynamics, heat and mass transfer, computational simulation of physico-chemical fluid processes and human physiological systems. This expertise has been applied to:

- Cryogenic fluid management
- Spacecraft fire safety
- Energy storage
- Thermal management and control
- ISS experiment development
- Astronaut health
- In situ resource utilization
- Materials synthesis
- On orbit repair of electronics
- Exploration life support
- Environmental monitoring/control
- Integrated system health monitoring
- Planetary Surface Mobility
- Bio-fluid mechanics
- Biosystems modeling

**nanoEngineering Laboratory**

The nanoEngineering Laboratory focuses on research related to various nanotechnology applications with particular emphasis on energy conversion, generation and storage in nanostructured and bio-inspired materials. Synthesis of polymer-based nanocomposites, nanofluids and individual nanostructures is accomplished with tools available in the laboratory. Furthermore, the laboratory houses various pieces of equipment for thermal and electrical characterization of these materials. Research projects include investigation of nanocomposites for thermoelectric devices, molecular simulation of thermal transport across interfacial regions, characterization of nanomaterials for thermal management (of electronics and buildings) as well as thermal insulation applications, and biomimetic research on a protein-based shark gel.

**Other Experimental Facilities**

The department facilities also include several specialized laboratories.

**The GM Engines Laboratory** is a modern facility for measuring the dynamic performance of internal combustion engines while monitoring behavioral parameters such as pressures, temperatures and exhaust emissions. The test cells can be operated completely by remote control with all data collected by digital computers.

**Engineering Services Fabrication Center** offers complete support to assist projects from design inception to completion of fabrication. Knowledgeable staff is available to assist Faculty, Staff, Students, Researchers, and personnel associated with Case Western Reserve University.

**The Harry A. Metcalf Computational Laboratory** offers 28 Dell Pentium IV computers ranging from 2.5 to 3.4GHz, running Windows XP Professional attached to 3 Dell dual processor servers, running Windows NT 4.0 Server or Windows Server 2003, via local area network running at 1Gb/s. The computer lab also offers 29 UTP connections for Laptops running at 10/100 Mb/s.

**The Harry A. Metcalf Computational Laboratory** provides access to a number of software packages. Some of these include SolidWorks 2008 SP4.0; Abaqus CAE 6.8 for FEA; Microsoft Visual C++; MatLab 2008A; Microsoft Office 2007 Professional; Mathematica 6.0.1; MathType 6.0; and LabView 8.5. All of the laboratory’s computers are directly linked to the campus network giving students access to a large variety of software on different libraries across campus. The lab is open for student use 24 hours a day 7 days a week via card access.

**The Bingham Student Workshop** is a 2380 sq.ft. facility complete with machining, welding, metal fabrication, and woodworking equipment. This facility is available for the Case undergrads in Mechanical Engineering. Before gaining access to the shop all ME students are required to take the EMAE 172, Mechanical Manufacturing course. This course gives the student a foundation in basic machining, welding, sheet metal fabrication,
and safety. Manual drafting, design, and computer-aided drafting is also included in the course. After completion the student can use the shop for other Mechanical Engineering courses requiring prototypes. The BSW, is also, used for senior projects and student organizations, such as, the SAE Baja and Formula and the Design Build and Fly.

The Reinerberger Design Studio includes a total of 33 computers consisting of 18 Dell 1GHz Pentium III, 10 Dell 3.4 GHz Pentium IV, and 5 Dell 2.6GHz Pentium IV workstations for Undergraduate Student design use. These machines are connected via a Gigabit local area network to a Dell Dual 500MHz Pentium III server running Windows NT 4.0 and a Dell Dual 800MHz Pentium III server running Windows NT 4.0. The Studio is tied directly to the campus network allowing information to be shared with the HAMCL and other network resources. The Studio is used for the instruction of the SolidWorks 2005 CAD software, MasterCam 9.0 CAM software, Solidworks CAD/CAM/FEA software, and Algor 16.1 FEA software. The RDS also offers a 3D Systems SLA 250 and a Dimension machine for generating SLA models from CAD models.

The Reinerberger Product and Process Development Laboratory is 1600 square feet of laboratory and office space dedicated to computer-aided engineering activities. The computer numerical control (CNC) laboratory includes both two industrial sized machine tools with additional space for lecture and group project activities. The CNC machine tools located in the laboratory are; a HAAS VF3 4 axis-machining center, a HAAS 2 axis lathe. A Mitutoyo coordinate measuring machine (CMM) located in its own laboratory space completes the facilities. The CMM enables students to inspect their manufactured components to a very degree of precision. The laboratory is used to support both undergraduate and graduate manufacturing courses (EMAE 390, EMAE 490).

High Performance Computing

For high performance computing the department uses the CWRU high performance computing cluster (HPCC). The HPCC consists of 112 compute nodes with Intel Pentium 4 Xeon EM64T processors. All nodes are interconnected with Gigabit Ethernet for MPI message passing and all nodes are interconnected by a separate Ethernet for the purpose of out-of-band cluster management. The MAE Department also has a direct access to all the Ohio Supercomputing Center and all NSF supercomputing centers, primarily to the Pittsburgh Supercomputing Center. Computing-intensive research projects can obtain an account on those supercomputers through their advisers. Research projects carried on in cooperation with the NASA Glenn Research Center can have access to NASA computing facilities. Sophisticated, extensive, and updated general and graphics software are available for applications in research and classroom assignments.

Faculty

J. Iwan D. Alexander, PhD
(Washington State University)
Chair; Cady Staley Professor of Engineering; Faculty Director, Great Lakes Energy Institute
Fluid dynamics; heat and mass transfer, low gravity fluid dynamics, interfacial transport capillary surface equilibria and dynamics, two-phase flow in porous media, vibrational convection
Jaikrishnan R. Kadambi, PhD
(University of Pittsburgh)
Professor and Associate Chair
Experimental fluid mechanics; multiphase flows; laser diagnostics; bio-fluid mechanics; turbomachinery
Alexis R. Abramson, PhD
(Case Western Reserve University)

Malcolm N. Cooke, PhD
(University of Pittsburgh)  
Professor  
Aerospace engineering, aerospace design

Roger D. Quinn, PhD
(Virginia Polytechnic Institute & State University)
Arthur P. Armington Professor of Engineering  
Biologically inspired robotics; agile manufacturing systems; structural dynamics, vibration and control

Joseph M. Mansour, PhD
(Rensselaer Polytechnic Institute)
Professor  
Mechanics of materials and structures  
Fluid mechanics; heat and mass transfer; tribology; turbomachinery

Maurice L. Adams, PhD
(UC Berkeley)  
Associate Professor  
Macro/micro/nanoscale heat transfer and energy transport

Paul Barnhart, PhD
(Case Western Reserve University)  
Associate Professor  
Robotics; distributed system design and control; modular robotics; multi-body dynamical systems

Kevin Lee, PhD
(John Hopkins University)  
Assistant Professor  
Computer graphics; virtual reality; computer animation

Vikas Prakash, PhD
(Brown University)  
Professor  
Experimental solid mechanics; distributed systems; structural dynamics, vibration and control

Ozan Akkus, PhD
(Case Western Reserve University)  
Associate Professor  
Biomechanics; applied mechanics

Melissa L. Knothe Tate, PhD
(Swiss Federal Institute of Technology, Zurich, CH)  
Professor  
Bio-Biomechanics; fracture mechanics; biomedical devices; biomaterials

Arthur P. Armington Professor of Engineering  
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Professor  
Bio-Biomechanics; fracture mechanics; biomedical devices; biomaterials
Associate Professor
Etiology and innovative treatment modalities for osteoporosis, fracture healing, osteolysis and osteonecrosis
James S. Tien, PhD
(Princeton University)
Leonard Case Jr. Professor of Engineering
Combustion; propulsion, and fire research

Emeritus Faculty
Dwight T. Davy, PhD, PE (University of Iowa)
Professor Emeritus
Musculo-skeletal biomechanics; applied mechanics

Isaac Greber, PhD (Massachusetts Institute of Technology)
Professor Emeritus
Fluid dynamics; molecular dynamics and kinetic theory; biological fluid mechanics; acoustics

Thomas P. Kicher, PhD (Case Institute of Technology)
Arthur P. Armington Professor Emeritus of Engineering
Elastic stability; plates and shells; composite materials; dynamics; design; failure analysis

Simon Ostrach, PhD, PE (Brown University)
Wilbert J. Austin Distinguished Professor Emeritus of Engineering
Fluid mechanics; heat transfer; micro-gravity phenomena; materials processing; physicochemical hydrodynamics

Eli Reshotko, PhD (California Institute of Technology)
Kent H. Smith Emeritus Professor of Engineering
Fluid Dynamics; heat transfer, propulsion; power generation

S. Stanford Manson, MS (University of Michigan)
Emeritus Professor
Metal fatigue, creep rupture, thermal stress, plasticity, fracture mechanics

Research Faculty
Richard J. Bachmann, PhD (Case Western Reserve University)
Assistant Research Professor
Biologically inspired robotics

R. Balasubramaniam, PhD (Case Western Reserve University)
Research Associate Professor, National Center for Space Exploration Research
Microgravity fluid mechanics

Uday Hegde, PhD (Georgia Institute of Technology)
Research Associate Professor, National Center for Space Exploration Research
Combustion, turbulence and acoustics

Mohammad Kassemi, PhD (University of Akron)
Research Associate Professor, National Center for Space Exploration Research
Computational fluid mechanics

Meng-Seng Liou, PhD (University of Michigan)
Research Associate Professor, National Center for Space Exploration Research
Computational fluid mechanics; aerodynamics; multi-objective optimization

Kenneth Loparo, PhD (Case Western Reserve University)
Professor of Electrical Engineering and Computer Science
Control; robotics; stability of dynamical systems; vibrations

David Matthiesen, PhD (Massachusetts Institute of Technology)
Associate Professor of Materials Science Engineering
Microgravity crystal growth

Wyatt S. Newman, PhD (Massachusetts Institute of Technology)
Professor of Electrical Engineering and Computer Science
Courses

EMAE 160. Mechanical Manufacturing. 3 Units.
The course is taught in two sections: Graphics and Manufacturing. To introduce manufacturing processes and materials and their relationships to mechanical design engineering. Course includes hands-on machining and metal fabrication lab. Also, each lab creates a virtual field trip of a manufacturing facility to be shared with the class. Graphics Development of mechanical engineering drawings in orthogonal, sectional, and pictorial views using manual drafting and computer-aided drafting (CAD software), dimensioning, tolerancing geometric dimensioning and tolerancing and assembly drawings will also be covered. All students are paired up to give a Manufacturing Design Presentation demonstrating the course material. The course has two (75) minute lectures and one (110) minute Machining Lab per week.

EMAE 181. Dynamics. 3 Units.
Elements of classical dynamics: particle kinematics and dynamics, including concepts of force, mass, acceleration, work, energy, impulse, momentum. Kinetics of systems of particles and of rigid bodies, including concepts of mass center, momentum, mass moment of inertia, dynamic equilibrium. Elementary vibrations. Recommended preparation: MATH 122 and PHYS 121 and ENGR. 200

EMAE 250. Computers in Mechanical Engineering. 3 Units.

EMAE 260. Design and Manufacturing I. 3 Units.
This is the second course of a 4-course sequence focusing on "Engineering Design and Manufacturing." This course develops students’ competence and self-confidence as design engineers by exposing the students to design as a creative process and its relationship with modern manufacturing practices. The outcomes of the course focus on the student's ability to apply their knowledge of mathematics, science and engineering to design a system, component, or process that meets desired needs within realistic, multi-dimensional constraints, such as: economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability. Additionally, students will be given the opportunity to identify, formulate, and solve engineering problems, while applying professional and ethical practices. Professional communication skills are emphasized and expected during all stages of the design process. The course has five main areas of emphasis: design as a creative process, decision-based design methodologies, project management, engineering economics, and design for manufacture (CAD/CAM/CAE) using industrial software tools. The course exposes the student to the integration of engineering design, manufacturing, and management disciplines and includes activities to consider and understand the complex processes associated with controlling and managing product data through all stages of the product life-cycle (PLM). Topics include: engineering ethics, design as a creative process, design methodologies, project management, engineering economics, product life-cycle management (PLM), CAD/CAE/CAM, and the role of digital manufacturing within the design process. Design/Rapid Prototyping Studio activities are an integral part of the course, and enable the students to be part of a design and build team working on various project-based tasks. Prereq: EMAE 160 or EMAE 172.

EMAE 282. Mechanical Engineering Laboratory I. 2 Units.
Techniques and devices used for experimental work in mechanical and aerospace engineering. Lecture topics include elementary statistics, linear regression, propagation of uncertainty, digital data acquisition, characteristics of common measurement systems, background for measurement laboratories, and elements of report writing. Hands-on laboratory experiences may include measurements in solid mechanics, dynamics, and fluid and thermal sciences, which are summarized in group reports. At least one report will focus on design of a measurement. Specific lecture and measurement topics will be chosen for each student on a case-by-case basis. Only students who have taken EMAE 283 but not EMAE 282 may take EMAE 282.

EMAE 283. Mechanical Engineering Laboratory II. 2 Units.
Techniques and devices used for experimental work in mechanical and aerospace engineering. Lecture topics include elementary statistics, linear regression, propagation of uncertainty, digital data acquisition, characteristics of common measurement systems, background for measurement laboratories, and elements of report writing. Hands-on laboratory experiences may include measurements in solid mechanics, dynamics, and fluid and thermal sciences, which are summarized in group reports. At least one report will focus on design of a measurement. Specific lecture and measurement topics will be chosen for each student on a case-by-case basis. Only students who have taken EMAE 282 but not EMAE 283 may take EMAE 283.
EMAE 285. Mechanical Engineering Measurements Laboratory. 4 Units.
Techniques and devices used for experimental work in mechanical and aerospace engineering. Lecture topics include elementary statistics, linear regression, propagation of uncertainty, digital data acquisition, characteristics of common measurement systems, background for measurement laboratories, and elements of report writing. Hands-on laboratory experiences may include measurements in solid mechanics, dynamics, and fluid and thermal sciences, which are summarized in group reports. At least one report will focus on design of a measurement. Recommended preparation: EMAE 181, ENGR 225 and ECIV 310.

EMAE 290. Computer-Aided Manufacturing. 3 Units.
An advanced design and manufacturing engineering course covering a wide range of topics associated with the 'design for manufacturability' concept. Students will be introduced to a number of advanced solid modeling assignments (CAD), rapid prototyping (RP), and computer-aided manufacturing (CAM). In addition students will be introduced to computer numerical control (CNC) manual part-programming for CNC milling and turning machine tools. All students will be given a design project requiring all detail and assembly drawings for a fully engineered design. The course has two (50) minute lectures and one (110) minute CAD/CAM Lab per week. Prereq: EMAE 172.

EMAE 325. Fluid and Thermal Engineering II. 4 Units.
The continuation of the development of the fundamental fluid and thermal engineering principles introduced in ENGR 225, Introduction to Fluid and Thermal Engineering. Applications to heat engines and refrigeration, chemical equilibrium, mass transport across semi-permeable membranes, mixtures and air conditioning, developing external and internal flows, boundary layer theory, hydrodynamic lubrication, the role of diffusion and convection in heat and mass transfer, radiative heat transfer and heat exchangers. Recommended preparation: ENGR 225.

EMAE 350. Mechanical Engineering Analysis. 3 Units.

EMAE 352. Thermodynamics in Energy Processes. 3 Units.
Thermodynamic properties of liquids, vapors and real gases, thermodynamic relations, non-reactive mixtures, psychometrics, combustion, thermodynamic cycles, compressible flow. Prereq: ENGR 225.

EMAE 355. Design of Fluid and Thermal Elements. 3 Units.

EMAE 356. Aerospace Design. 3 Units.
Interactive and interdisciplinary activities in areas of fluid mechanics, heat transfer, solid mechanics, thermodynamics, and systems analysis approach in design of aerospace vehicles. Projects involve developing (or improving) design of aerospace vehicles of current interest (e.g., hypersonic aircraft) starting from mission requirements to researching developments in relevant areas and using them to obtain conceptual design. Senior standing required.

EMAE 359. Aero/Gas Dynamics. 3 Units.

EMAE 360. Design and Manufacturing II. 3 Units.
This is the third course of a 4-course sequence focusing on “Engineering Design and Manufacturing,” and is the senior capstone design course focused on a semester-long design/build/evaluate project. The course draws on a student’s past and present academic and industrial experiences and exposes them to the design and manufacture of a product or device that solves an open-ended ”real world” problem with multidimensional constraints. The course is structured and time-tabled within the Case School of Engineering (CSE) to give the EMAE 360 students the opportunity to team with students from other CSE departments to form multidisciplinary design teams to work on the solution to a common problem. The outcomes of the course continue to focus on the student’s ability to function on multidisciplinary teams while applying their knowledge of mathematics, science and engineering to design a system, component, or process that meets desired needs within realistic, multidimensional constraints, such as: economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability. Professional communication skills are emphasized and expected during all stages of the design process and will include formal and informal oral presentations, periodic peer-focused design reviews, and a development through its various evolutionary stages to completion. Prereq: EMAE 160 or EMAE 172, and EMAE 260.

EMAE 363. Mechanical Engineering Modern Analysis Methods. 4 Units.
This is a required mechanical engineering course to develop an in-depth fundamental understanding of current analysis software tools, as well as to develop an ability to perform practical analyses using current software tools to analyze assigned industrial case studies for the following topical areas: (1) mechanism synthesis, (2) finite element analyses for stress and deflection, (3) machinery vibration, and (4) computational fluid dynamics. It is comprised of three lectures and one software application laboratory period per week. Prereq: ENGR 225, EMAE 181, EMAE 250, and ECIV 310.

EMAE 370. Design of Mechanical Elements. 3 Units.

EMAE 372. Relation of Materials to Design. 4 Units.
The design of mechanical and structural elements considering static failure, elastic stability, residual stresses, stress concentration, impact, fatigue, creep and environmental conditions on the mechanical behavior of engineering materials. Rational approaches to materials selection for new and existing designs of structures. Laboratory experiments coordinated with the classroom lectures. Offered as EMAE 372 and EMSE 372. Prereq: ECIV 310.
EMAE 376. Aerostructures. 3 Units.

EMAE 377. Birobotics Team Research. 3 Units.
Many exciting research opportunities cross disciplinary lines. To participate in such projects, researchers must operate in multi-disciplinary teams. The Birobotics Team Research course offers a unique capstone opportunity for undergraduate students to utilize skills they developed during their undergraduate experience while acquiring new teaming skills. A group of eight students form a research team under the direction of two faculty leaders. Team members are chosen from appropriate majors through interviews with the faculty. They will research a biological mechanism or principle and develop a robotic device that captures the actions of that mechanism. Although each student will cooperate on the team, they each have a specific role, and must develop a final paper that describes the research generated on their aspect of the project. Students meet for one class period per week and two 2-hour lab periods. Initially students brainstorm ideas and identify the project to be pursued. They then acquire biological data and generate robotic designs. Both are further developed during team meetings and reports. Final oral reports and a demonstration of the robotic device occur in week 15. Offered as BIOL 377, EMAE 377, BIOL 477, and EMAE 477.

EMAE 378. Mechanics of Machinery I. 3 Units.
Comprehensive treatment of design analysis methods and computational tools for machine components. Emphasis is on bearings, seals, gears, hydraulic drives and actuators, with applications to machine tools. Recommended preparation: EMAE 370. Offered as EMAE 378 and EMAE 478.

EMAE 379. Mechanics of Machinery II. 3 Units.
The focus of this course is Rotating Machinery Vibration, and it is comprised of four major components: 1) modeling, 2) analyses, 3) measurement techniques, and 4) physical insights into rotor vibration phenomena. Recommended preparation: EMAE 181. Offered as EMAE 379 and EMAE 479.

EMAE 381. Flight and Orbital Mechanics. 3 Units.
Aircraft performance: take-off and landing, unaccelerated flight, range and endurance, flight trajectories, static stability and control, simple maneuvers. Orbital mechanics: the solar system, elements of celestial mechanics, orbit transfer under impulsive thrust, continuous thrust, orbit transfer, decay of orbits due to drag, elements of lift-off and re-entry. Recommended preparation: ENGR 225. EMAE 359

EMAE 382. Propulsion. 3 Units.

EMAE 387. Vibration Problems in Engineering. 4 Units.

EMAE 390. Advanced Manufacturing Technology. 3 Units.
This course will focus on advanced design and manufacturing technologies and systems, with an emphasis on the total product life cycle and the challenges of secure and efficient product data management. Topics will include: traditional and rapid subtractive and additive prototyping and manufacturing technologies, design for manufacture (DFM), control and quality assurance of the design and manufacturing process, manufacturing system integration, "Globalization," and sustainable engineering. The course will be project-based and laboratory sessions will take place in the Reinberger and think[box] studios. Prereq: EMAE 290.

EMAE 396. Special Topics in Mechanical and Aerospace Engineering. 1 - 18 Unit.
(Credit as arranged.)

EMAE 397. Independent Laboratory Research. 1 - 3 Unit.
Independent research in a laboratory.

EMAE 398. Senior Project. 3 Units.
Individual or team design or experimental project under faculty supervision. Requirements include periodic reporting of progress, plus a final oral presentation and written report. Recommended preparation: Senior standing, EMAE 360, and consent of instructor.

EMAE 399. Advanced Independent Laboratory Research/Design. 1 - 3 Unit.
Students perform advanced independent research or an extended design project under the direct mentorship of the instructor. Typically performed as an extension to EMAE 397 or EMAE 398. Prereq: EMAE 397.

EMAE 400T. Graduate Teaching I. 0 Units.
This course will engage the Ph.D. candidate in a variety of teaching experiences that will include direct contact (for example, teaching recitations and laboratories, guest lectures, office hours) as well non-contact preparation (exams, quizzes, demonstrations) and grading activities. The teaching experiences will be conducted under the supervision of the faculty member(s) responsible for coordinating student teaching activities. All Ph.D. candidates enrolled in this course sequence will be expected to perform direct contact teaching at some point in the sequence. Recommended preparation: Ph.D. student in Mechanical Engineering.

EMAE 401. Mechanics of Continuous Media. 3 Units.
Vector and tensor calculus. Stress and traction, finite strain and deformation tensors. Kinematics of continuous media, general conservation and balance laws. Material symmetry groups and observer transformation. Constitutive relations with applications to solid and fluid mechanics problems.
EMAE 402. Muscles, Biomechanics, and Control of Movement. 4 Units.

EMAE 403. Aerophysics. 3 Units.
The course introduces the physical and chemical topics of basic importance in modern fluid mechanics, plasma dynamics, and combustion sciences: statistical calculations of thermodynamic properties of gases; quantum mechanical analysis of atomic and molecular structure; transport phenomena; propagation, emission, and absorption of radiation; chemical and physical equilibria; adiabatic flame temperatures of complex reacting systems; and reaction kinetics.

EMAE 415. Introduction to Musculo-skeletal Biomechanics. 3 Units.

EMAE 424. Introduction to Nanotechnology. 3 Units.
An exploration of emerging nanotechnology research. Lectures and class discussion on 1) nanostructures: superlattices, nanowires, nanotubes, quantum dots, nanoparticles, nanocomposites, proteins, bacteria, DNA; 2) nanoscale physical phenomena: mechanical, electrical, chemical, thermal, biological, optical, magnetic; 3) nanofabrication: bottom up and top down methods; 4) characterization: microscopy, property measurement techniques; 5) devices/applications: electronics, sensors, actuators, biomedical, energy conversion. Topics will cover interdisciplinary aspects of the field. Offered as EECS 424 and EMAE 424.

EMAE 453. Advanced Fluid Dynamics I. 3 Units.
Derivation and discussion of the general equations for conservation of mass, momentum, and energy using tensors. Several exact solutions of the incompressible Newtonian viscous equations. Kinematics and dynamics of inviscid, incompressible flow including free streamline theory developed using vector, complex variable, and numerical techniques.

EMAE 454. Advanced Fluid Dynamics II. 3 Units.

EMAE 455. Advanced Thermodynamics. 3 Units.
Basic ideas of thermodynamics and dominant methods of their development: operational, postulational, and statistical. Entropy and information theory. Irreversible thermodynamics. Applications.

EMAE 457. Combustion. 3 Units.
Chemical kinetics and thermodynamics; governing conservation equations for chemically reacting flows; laminar premixed and diffusion flames; turbulent flames; ignition; extinction and flame stabilization; detonation; liquid droplet and solid particle combustion; flame spread, combustion-generated air pollution; applications of combustion processes to engines, rockets, and fire research.

EMAE 459. Advanced Heat Transfer. 3 Units.
Analysis of engineering heat transfer from first principles including conduction, convection, radiation, and combined heat and mass transfer. Examples of significance and role of analytic solutions, approximate methods (including integral methods) and numerical methods in the solution of heat transfer problems. Recommended preparation: EMAE 453.

EMAE 460. Theory and Design of Fluid Power Machinery. 3 Units.
Fluid mechanic and thermodynamic aspects of the design of fluid power machinery such as axial and radial flow turbomachinery, positive displacement devices and their component characterizations. Recommended preparation: Consent of instructor.

EMAE 477. Biorobotics Team Research. 3 Units.
Many exciting research opportunities cross disciplinary lines. To participate in such projects, researchers must operate in multi-disciplinary teams. The Biorobotics Team Research course offers a unique capstone opportunity for undergraduate students to utilize skills they developed during their undergraduate experience while acquiring new teaming skills. A group of eight students form a research team under the direction of two faculty leaders. Team members are chosen from appropriate majors through interviews with the faculty. They will research a biological mechanism or principle and develop a robotic device that captures the actions of that mechanism. Although each student will cooperate on the team, they each have a specific role, and must develop a final paper that describes the research generated on their aspect of the project. Students meet for one class period per week and two 2-hour lab periods. Initially students brainstorm ideas and identify the project to be pursued. They then acquire biological data and generate robotic designs. Both are further developed during team meetings and reports. Final oral reports and a demonstration of the robotic device occur in week 15. Offered as BIOL 377, EMAE 377, BIOL 477, and EMAE 477.

EMAE 478. Mechanics of Machinery I. 3 Units.
Comprehensive treatment of design analysis methods and computational tools for machine components. Emphasis is on bearings, seals, gears, hydraulic drives and actuators, with applications to machine tools. Recommended preparation: EMAE 370. Offered as EMAE 378 and EMAE 478.

EMAE 479. Mechanics of Machinery II. 3 Units.
The focus of this course is Rotating Machinery Vibration, and it is comprised of four major components: 1) modeling, 2) analyses, 3) measurement techniques, and 4) physical insights into rotor vibration phenomena. Recommended preparation: EMAE 181. Offered as EMAE 379 and EMAE 479.
EMAE 480. Fatigue of Materials. 3 Units.

EMAE 481. Advanced Dynamics I. 3 Units.

EMAE 487. Vibration Problems in Engineering. 3 Units.

EMAE 488. Advanced Robotics. 3 Units.
This course will focus on up-to-date knowledge and theories related to robotics and multi-agent systems. Related mathematics and theories including group theory (Lie groups), rigid-body motions (SO(3) and SE(3)), kinematics, dynamics, and control will be studied. In addition, the class will also discuss structural, computational and task complexity in robotic systems based on combinatorial analysis, information theory, and graph theory. Lecture and discussion topics: Kinematics; Introduction to Group Theory and Lie Groups; Rigid-body Motions (SO(3), SE(3)); Multi-body Dynamical Systems: Order-N computational methods; Complexity Analysis for Robotic Systems; Structural complexity, information-theoretic complexity, and task complexity; Special Discussion Topics; Special discussion topics may vary each year. Students enrolled in this class will be required to conduct a final project. Two or three students will work as a team. The topics for student teams may include: computer simulation of multi-body dynamical systems, art robot design, and complexity analysis for coupled complex systems. The detailed information will be provided in the first week of the class. The final presentations and demonstrations will be held during the last week of class and will be open to the public audience. Students are also required to submit a final report following a IEEE conference paper template. Prereq: EMAE 181, EECS 246.

EMAE 489. Robotics I. 3 Units.

EMAE 490T. Graduate Teaching II. 0 Units.
This course will engage the Ph.D. candidate in a variety of teaching experiences that will include direct contact (for example, teaching, recitations and laboratories, guest lectures, office hours) as well non-contact preparation (exams, quizzes, demonstration) and grading activities. The teaching experience will be conducted under the supervision of the faculty member(s) responsible for coordinating student teaching activities. All Ph.D. candidates enrolled in this course sequence will be expected to perform direct contact teaching at some point in the sequence. Recommended preparation: Ph.D. student in Mechanical Engineering.

EMAE 500. Advanced Dynamics II. 3 Units.

EMAE 540. Advanced Dynamics II. 3 Units.
Nonlinear oscillations; including equations of Duffings, van der Pol, Hill, and Mathieu; and perturbation solution approaches. Bifurcation and jump phenomena, strange attractors, chaos. Poincare maps and related engineering applications.

EMAE 541. Dynamics of Nonlinear Systems. 3 Units.
Nonlinear oscillations; including equations of Duffings, van der Pol, Hill, and Mathieu; and perturbation solution approaches. Bifurcation and jump phenomena, strange attractors, chaos. Poincare maps and related engineering applications.

EMAE 545. Computational Fluid Dynamics. 3 Units.

EMAE 554. Turbulent Fluid Motion. 3 Units.
Fundamental law, initial and boundary conditions, basic equations for isotropic and anisotropic media, related physical problems, steady and transient temperature distributions in solid structures. Analytical, graphical, numerical, and experimental methods for constant and variable material properties. Recommended preparation: Consent of instructor.

EMAE 555. Conduction and Radiation. 3 Units.

EMAE 600T. Graduate Teaching III. 0 Units.
This course will engage the Ph.D. candidate in a variety of teaching experiences that will include direct contact (for example, teaching recitations and laboratories, guest lectures, office hours) as well non-contact preparation (exams, quizzes, demonstrations) and grading activities. The teaching experience will be conducted under the supervision of the faculty member(s) responsible for coordinating student teaching activities. All Ph.D. candidates enrolled in this course sequence will be expected to perform direct contact teaching at some point in the sequence. Recommended preparation: Ph.D. student in Mechanical Engineering.

EMAE 601. Independent Study. 1 - 18 Unit.

EMAE 651. Thesis M.S.. 1 - 18 Unit.
EMAE 657. Experimental Techniques in Fluid and Thermal Engineering Sciences. 3 Units.
Exposure to experimental problems and techniques provided by the planning, design, execution, and evaluation of an original project. Lectures: review of the measuring techniques for flow, pressure, temperature, etc.; statistical analysis of data; information theory concepts of instrumentation; electrical measurements and sensing devices; and the use of digital computer for data acquisition and reduction. Graduate standing or consent of instructor required.

EMAE 689. Special Topics. 1 - 18 Unit.

Prereq: Predoctoral research consent or advanced to Ph.D. candidacy milestone.

EMAE C100. Co-Op Seminar I for Mechanical Engineering. 1 Unit.
Professional development activities for students returning from cooperative education assignments. Recommended preparation: COOP 001.

EMAE C200. Co-Op Seminar II for Mechanical Engineering. 2 Units.
Professional development activities for students returning from cooperative education assignments. Recommended preparation: COOP 002 and EMAE C100.
Division of Education and Student Programs

The Division of Education and Student Programs (http://engineering.case.edu/desp) (DESP) designs, develops and administers programs and opportunities which complement and enhance the curricular offerings in the Case School of Engineering.

The DESP staff is committed to serving all engineering undergraduate and graduate students. We work closely with students, faculty, staff, and off-campus organizational representatives to deliver experiences designed to promote excellence in engineering education.

Mission Statement

The mission of the Division of Education and Student Programs is to support, through teaching and educational research, the Case School of Engineering’s educational programs, student programs, and outreach activities at all academic levels: K-12, undergraduate, graduate, and continuing education.

The activities supported by DESP include optional academic programs that enhance the engineering curriculum, such as Cooperative Education and the Dual Degree undergraduate programs, as well as global exchange programs and support of engineering student organizations.

Co-operative Education

Cooperative Education (Co-op) (http://engineering.case.edu/coop) is an academic program that enables students to alternate classroom studies with career based experiences in industry. It is a learning experience designed to integrate classroom theory with practical experience and professional development. Co-op is a paid full time work experience designed to maximize the student’s education. Case co-op assignments are typically for two seven-month periods, each period consisting of a summer and a contiguous spring or fall semester. This program is available to students pursuing degrees in engineering, accounting, management and all science majors except astronomy.

For additional information, please contact Ms. Mary Rose Tichar (http://bulletin.case.edu/schoolofengineering/educationandstudentprograms/mailto:mary.tichar@case.edu) at 216.368.4447.

Dual Degree (3-2) Engineering Program

The Dual Degree (3-2) (http://engineering.case.edu/desp/dualdegree) Engineering Program enables superior students, enrolled at approximately forty participating liberal arts colleges in the continental United States and Puerto Rico, to combine a strong liberal arts foundation with the study of engineering. While enrolled at a cooperating liberal arts college, students complete courses in mathematics, chemistry, physics, and computer science in addition to studies in the humanities and social sciences. Students complete these courses during their first three years and must obtain the approval of the designated faculty liaison at the liberal arts college prior to admission to the Case School of Engineering.

Qualified candidates continue at the Case School of Engineering for an additional two years of concentrated coursework in an engineering field. At the conclusion of five years, two baccalaureate degrees are awarded: one from the liberal arts college and the other a Bachelor of Science degree from Case Western Reserve University. For additional information, please contact Ms. Deborah Fatica (http://bulletin.case.edu/schoolofengineering/educationandstudentprograms/mailto:debora.fatica@case.edu) at 216.368.4449.

Engineering Student Organizations

The Case School of Engineering is known for having many dynamic student organizations. There are many clubs and organizations that enable you to meet more students while working towards a meaningful cause. To check out a complete list of Student Organizations, click here (http://engineering.case.edu/desp/studentorgs). If you’re unsure of which one would best match your interests, stop in the DESP office to get started! For additional information, please contact Ms. Maria Campbell (http://bulletin.case.edu/schoolofengineering/educationandstudentprograms/mailto:maria.campbell@case.edu) at 216.368.5024.

Global Programs

Global Programs (http://engineering.case.edu/desp/global-exchange) offer international opportunities for engineering students ranging from study abroad to short-term exchange programs, internships and cooperative education experiences, and research opportunities. Participation in global activities optimizes the student’s educational experience as well as contributes to their societal awareness. Exposure to global activities is a very valuable asset for leadership positions within multinational corporations.

The Division of Education and Student Programs designs and implements programs tailored to students’ interests. Currently, short term cultural and language immersion programs are offered in the summer at Waseda University in Tokyo, Japan; Tianjin University in Tianjin, China; and University of Stuttgart in Stuttgart, Germany, with more being established. At the University of Botswana, a three-week engineering core course is taught, which intertwines engineering content with regional issues specific to sub-Saharan Africa. New programs and opportunities continue to develop for students.

In addition, the Case School of Engineering hosts many students from various countries which enables students to learn about and interact with various cultures.

Students may also be interested in the student chapter of Engineers Without Borders, a national non-profit organization devoted to delivering engineering assistance to developing areas around the world.

Approximately 80% of the Case School of Engineering faculty collaborate with over one hundred universities and organizations in over thirty countries spanning six continents.

For additional information, please contact Ms. Deborah Fatica (http://bulletin.case.edu/schoolofengineering/educationandstudentprograms/mailto:debora.fatica@case.edu) at 216.368.4449.

K-12 Outreach

K-12 Outreach is an emerging arm of the DESP. The goals of the outreach work are to: 1) increase the understanding of engineering as a career among K-12 students, and 2) increase the Case Western Reserve University School of Engineering enrollment of underrepresented minorities and women. These goals are fulfilled through an array of activities in partnership with CWRU faculty, staff, students, area K-12 schools and youth-serving organizations. For additional information, please contact Ms. Me’lani Joseph (http://bulletin.case.edu/schoolofengineering/educationandstudentprograms/mailto:melani@case.edu) at 216.368.1651.
Engineering Physics

The Engineering Physics major allows students with strong interests in both physics and engineering to concentrate their studies in the common areas of these disciplines. The Engineering Physics major prepares students to pursue careers in industry, either directly after undergraduate studies, or following graduate study in engineering or physics. Many employers value the unique problem solving approach of physics, especially in industrial research and development. Its engineering science and design components prepare students to work as professional engineers.

Students majoring in engineering physics complete the Engineering Core as well as a rigorous course of study in physics. Students select a concentration area from an engineering discipline, and must complete a sequence of at least four courses in this discipline. In addition, a senior research project under the guidance of a faculty member is required. The project includes a written report and participation in the senior seminar and symposium.

Mission and Program Objectives

The mission of the Engineering Physics program is to prepare students for careers in engineering where physics principles can be applied to the advancement of technology. This education at the intersection of engineering and physics will enable students to seek employment in engineering upon graduation while providing a firm foundation for the pursuit of graduate studies in either engineering or physics. The Engineering Physics program will develop sufficient depth in both engineering and physics skills to produce engineers who can relate fundamental physics to practical engineering problems, and will possess the versatility to address new problems in our rapidly changing technological base. The program will provide a curriculum and environment to develop interdisciplinary collaboration, ethical and professional outlooks, communication skills, and the tools and desire for life-long learning.

Educational Objectives

1. Graduates of the Engineering Physics program will apply their strong problem solving skills as physicists along with an understanding of the approach, methods, and requirements of engineering and engineering design for a successful career in advancing technology.

2. Graduates of the Engineering Physics program will use their strong skills in problem solving, research experience and knowledge in physics and engineering as successful graduate students and researchers in highly ranked graduate programs.

Program Outcomes

As preparation for achieving the above program educational objectives, the BS degree program in Engineering Physics is designed so that students attain:

- an ability to apply knowledge of mathematics, science, and engineering
- an ability to design and conduct experiments, as well as to analyze and interpret data
- an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
- an ability to function on multi-disciplinary teams
- an ability to identify, formulate, and solve engineering problems
- an understanding of professional and ethical responsibility
- an ability to communicate effectively
- the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
- a recognition of the need for, and an ability to engage in life-long learning
- a knowledge of contemporary issues
- an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.


Bachelor of Science in Engineering

Sample Program of Study: Major in Engineering Physics

<table>
<thead>
<tr>
<th>First Year</th>
<th>Units</th>
<th>Fall</th>
<th>Spring</th>
</tr>
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<tbody>
<tr>
<td>Principles of Chemistry for Engineers (CHEM 111)</td>
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<tr>
<td>Calculus for Science and Engineering I (MATH 121)</td>
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<tr>
<td>General Physics I - Mechanics (PHYS 121)</td>
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<td></td>
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<tr>
<td>SAGES First Seminar</td>
<td>4</td>
<td></td>
<td></td>
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<tr>
<td>PHED Physical Education Activities</td>
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<tr>
<td>Calculus for Science and Engineering II (MATH 122)</td>
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<td>General Physics II - Electricity and Magnetism (PHYS 122)</td>
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<tr>
<td>Elementary Computer Programming (ENGR 131)</td>
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<tr>
<td>Chemistry of Materials (ENGR 145)</td>
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<tr>
<td>SAGES University Seminar</td>
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<tr>
<td>PHED Physical Education Activities</td>
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<tr>
<td>Year Total:</td>
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<th>Second Year</th>
<th>Units</th>
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<tr>
<td>Calculus for Science and Engineering III (MATH 223)</td>
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<tr>
<td>Introduction to Modern Physics (PHYS 221)</td>
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<tr>
<td>Statics and Strength of Materials (ENGR 200)</td>
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<tr>
<td>Introduction to Circuits and Instrumentation (ENGR 210)</td>
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<tr>
<td>SAGES University Seminar</td>
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<tr>
<td>Elementary Differential Equations (MATH 224)</td>
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<td>Instrumentation and Signal Analysis Laboratory (PHYS 208)</td>
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<td>Computational Methods in Physics (PHYS 250)</td>
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<td>Classical Mechanics (PHYS 310)</td>
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<td>Thermodynamics, Fluid Dynamics, Heat and Mass Transfer (ENGR 225)</td>
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<th>Third Year</th>
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<td>Thermodynamics and Statistical Mechanics (PHYS 313)</td>
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<td>Engineering Physics Laboratory I (PHYS 317)</td>
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<td>Advanced Laboratory Physics Seminar (PHYS 303)</td>
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<td>Introduction to Quantum Mechanics I (PHYS 331)</td>
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<td>Engineering Concentration</td>
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<tr>
<td>Humanities/Social Science elective</td>
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<td>Engineering Physics Laboratory II (PHYS 318)</td>
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## Electricity and Magnetism I (PHYS 324) 3
## Professional Communication for Engineers (ENGL 398N) 3
## Humanities/Social Science elective 3
## Engineering Concentration[C] 3

### Year Total: 16

### Fourth Year Units

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<th>Units</th>
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<td>Introduction to Solid State Physics (PHYS 315)</td>
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<tr>
<td>Electricity and Magnetism II (PHYS 325)</td>
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<tr>
<td>Senior Physics Project Seminar (PHYS 352)</td>
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<tr>
<td>Senior Engineering Physics Project (PHYS 353)</td>
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<tr>
<td>Engineering Concentration[C]</td>
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<tr>
<td>Humanities/Social Science elective</td>
<td>3</td>
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<tr>
<td>Senior Physics Project Seminar (PHYS 352)</td>
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<tr>
<td>Senior Engineering Physics Project (PHYS 353)</td>
<td>2</td>
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<tr>
<td>Applied Quantum Mechanics[d]</td>
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<td>Engineering Concentration[C]</td>
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<tr>
<td>Elective</td>
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### Year Total: 15

### Total Units in Sequence: 129

### Hours required for graduation: 129

**a**
Selected students may be invited to take MATH 124 Calculus II, MATH 227 Calculus III or MATH 228 Differential Equations in place of MATH 121 Calculus for Science and Engineering I, MATH 122 Calculus for Science and Engineering II, MATH 223 Calculus for Science and Engineering III or MATH 224 Elementary Differential Equations.

**b**
Selected students may be invited to take PHYS 123 Physics and Frontiers I - Mechanics or PHYS 124 Physics and Frontiers II - Electricity and Magnetism in place of PHYS 121 General Physics I - Mechanics or PHYS 122 General Physics II - Electricity and Magnetism.

**c**
Engineering Physics Concentration courses are flexible, but must be in a specific engineering discipline or study area and be approved by an advisor. Possible concentration areas include: Biomedical Engineering (Biomedical Systems and Analysis, Devices and Instrumentation, Biomaterials); Chemical Engineering; Civil Engineering (Solid Mechanics, Structural Engineering, Geotechnical Engineering, Environmental Engineering); Electrical Engineering and Computer Science (Solid State, Computer Science, Computer Engineering-Software, Computer Engineering-Hardware, Systems and Control); Macromolecular Science and Engineering; Materials Science and Engineering; Mechanical and Aerospace Engineering (Aerospace, Mechanics).

Students may choose to fulfill this requirement in their third year:
- PHYS 332 Introduction to Quantum Mechanics II
- PHYS 327 Quantum Electronics/PHYS 427 Quantum Electronics
- EECS 321 Semiconductor Electronic Devices
- EMSE 314 Electrical, Magnetic, and Optical Properties of Materials
- EMSE 405 Dielectric, Optical and Magnetic Properties of Materials
College of Arts and Sciences

The Case Western Reserve University College of Arts and Sciences (http://artsci.case.edu) combines a history of educational excellence with a commitment to innovation and discovery. Building on a 185-year-old tradition, the college traces its origins to several predecessor institutions, including Adelbert College, Flora Stone Mather College, Cleveland College, Western Reserve College, and the Case Institute of Technology. Today, the college offers educational and research programs in the arts and humanities, mathematics and natural sciences, and social sciences. It comprises 22 academic departments and 34 interdisciplinary programs and centers.

Brief History

Western Reserve College, the earliest of our predecessor institutions, was founded in 1826 in Hudson, Ohio, about 26 miles southwest of Cleveland. In 1882 the college moved to Cleveland, where it formed the basis for Western Reserve University. The institution expanded to include several professional and graduate schools in addition to its liberal arts programs. It also served as a magnet for other artistic, cultural, educational, medical, and scientific organizations, now its neighbors in the extraordinary setting known as University Circle.

Central to the heritage of the college are the traditions of the programs that preceded it: Adelbert College, as the men’s undergraduate unit of Western Reserve University was known after the move to Cleveland; Flora Stone Mather College, initially founded in 1888 as the Cleveland College for Women; and Cleveland College, founded in 1925 in downtown Cleveland to serve part-time and adult students. These three units, each with a distinguished history of scholarship and achievement, were brought together in 1972 under the revived name of Western Reserve College. The college took its present form in 1992, when undergraduate and graduate programs and research in the arts, humanities, and social sciences were united with those in the physical sciences to form the College of Arts and Sciences.

Since the early 19th century, the college and its predecessors have participated in important developments in higher education. Examples include:

- Engagement in issues of social justice. Western Reserve College’s early years in Hudson saw debates between two groups, each opposing slavery. Colonizationists believed that liberated slaves should be resettled in Africa; abolitionists did not favor such a policy. After long and bitter conflict, supporters of the abolitionist movement carried the day.

- Emergence of science. The college in Hudson was home to early and distinguished programs in astronomy and mathematics. Later, in 1887, Professor Edward Morley collaborated with Professor Albert Michelson of the Case School of Applied Science in a series of experiments that remain among the most significant in the history of physics.

- Education of women. In the 1850s, the college’s Cleveland-based Department of Medicine awarded six of the first seven medical degrees granted to women in this country. The founding of the College for Women in 1888 was only the second instance of a separate “coordinate” college for women at a major university.

- Demographic and technological change. Following World War II, enrollment in Cleveland College swelled with returning veterans. During this period, the introduction of new technologies and fields of study drove increasing demand for advanced education and research in a wide range of disciplines.

Undergraduate Programs

Undergraduates in the college can choose a major or minor from almost 60 programs, design their own courses of study, or enroll in integrated bachelor’s/master’s degree programs. The university offers great flexibility to students wishing to pursue double majors in disparate fields, such as physics and studio art. In addition, students from all fields are eligible to participate in the college’s vibrant performing arts programs, including music and dance ensembles.

Beyond their course work, students are encouraged to conduct independent research within the college, in other units of the university, or in the scientific and cultural institutions of University Circle. They also have opportunities to engage in service learning projects and internships in research institutions, businesses, cultural institutions, and governmental agencies. With funding from the college’s Experiential Learning Fellowship programs, undergraduates may design and carry out ambitious research projects in Cleveland or across the globe.

Graduate Programs

The college’s graduate offerings include doctoral programs in 19 fields and several distinctive master’s programs. Through a partnership with the Cleveland Play House, the Department of Theater has created one of the nation’s preeminent Master of Fine Arts programs in acting (http://theater.case.edu/grad.php). The Science and Technology Entrepreneurship Program (STEP) (http://step.case.edu) offers a three- or four-semester sequence of courses leading to a Master of Science degree in biotechnology, chemistry, or physics.

Centers in the College of Arts and Sciences

Baker-Nord Center for the Humanities

Established in 1996 with a generous endowment gift from Eric and Jane Nord, the Baker-Nord Center (http://artsci.case.edu/bakernord) is dedicated to: 1) highlighting and celebrating the arts and humanities at Case Western Reserve University (art history and art, classics, English, history, modern languages and literatures, music, philosophy, religious studies, theater, and dance) through public lectures, panels, performances, and special programs; 2) supporting research and creative work in the humanities and arts through fellowships, grants, and symposia, as well as encouraging new and innovative directions in research and creativity, including the digital humanities, through public forums and open discussion; and 3) facilitating cross-disciplinary and inter-disciplinary collaborations among Case Western Reserve University faculty and members of other University Circle institutions that address questions and problems of broad human interest, within and outside of the academy.

Center for Education and Research in Cosmology and Astrophysics

The Center for Education and Research in Cosmology and Astrophysics (http://www.case.edu/origins/sciences/cosmology.html) (CERCA) is a center for the advancement and promotion of the scientific understanding of the origin and evolution of the universe and its contents, and their connection to fundamental physics. CERCA connects scientists and educators in the Departments of Physics and Astronomy and at the Shafraian Planetarium of the Cleveland Museum of Natural History (CMNH). It draws together theoretical and experimental physicists and
Ernest B. Yeager Center for Electrochemical Sciences

The mission of the Ernest B. Yeager Center for Electrochemical Sciences (http://yces.case.edu) (YCES) is: 1) to enhance the education and training of students in fundamental and applied aspects of electrochemistry; 2) to provide a national and international resource for the dissemination of electrochemical knowledge within industrial, laboratory, and academic communities and to the general public and to support the continuing education of professional electrochemists; (3) to promote interactions between electrochemists and their research colleagues through seminars and symposia; and 4) to foster the improvement of the environment and human welfare through research in the design of materials and the development of processes and devices that will positively influence fields from medicine and microelectronics to energy conversion and energy storage.

Schubert Center for Child Studies

The Schubert Center for Child Studies (http://schubertcenter.case.edu/home.aspx) aims to strengthen links between child-related academic study, public policy formation, and professional practice. The Schubert Center convenes experts from across campus and throughout the Cleveland community to provide an innovative forum for multidisciplinary education, research, and communications focused on child policy.

Skeletal Research Center

The mission of the Skeletal Research Center (http://www.case.edu/artscli/biol/skeletal) (SRC) is to facilitate the advancement of basic research and to accelerate the translation of this new information into innovative clinical strategies for the regeneration and maintenance of skeletal tissues. Based in the Department of Biology, the center provides an organizational umbrella for the creative and innovative interactions of faculty. Although members of our faculty have long been recognized as leaders in skeletal research, the center was established in 1986 to draw these individuals together into a multidisciplinary group which could jointly approach current basic research and clinical problems. SRC is an administrative entity under the dean of the College of Arts and Sciences and the dean of the School of Medicine.

Center for Research on Tibet

The Center for Research on Tibet (http://www.case.edu/affil/tibet) at Case Western Reserve University was founded in 1987 and is administered within the Department of Anthropology. The center’s goal is to conceptualize and conduct research on Tibetan history, society, language, ecology/physiology, and culture so as to understand traditional Tibet and the manner in which it has changed.

Center for Science and Mathematics Education

The Center for Science and Mathematics Education (http://www.case.edu/artscli/csm) links the resources of the College of Arts and Sciences - including faculty, staff, and students - with needs in the K-12 STEM community. Its collaborations with external partners, including schools and public libraries, park systems, and science museums, enhance instruction and generate student interest in the STEM fields of science, technology, engineering, and mathematics. The center hosts the annual Northeast Ohio Regional Science Olympiad, conducts a summer Shipwreck Camp that includes lessons in meteorology and marine geology, and engages middle school students in biological fieldwork in its Environmental Heroes Program. Through the Gelfand Science and Engineering Fair Program, it provides support for science fairs in Northeast Ohio schools, and it recruits and trains undergraduates to assist younger students with their science fair projects. In addition, the center participates in the university’s Robert Noyce Teacher Scholarship Program, which provides mentoring and other support for future math and science teachers.

Center for the Study of Writing

The Center for the Study of Writing (http://www.case.edu/writing/csw) (CSW) is a flexible, cross-disciplinary center that fosters connections between innovative writing research and sound pedagogical practices, and between specialized faculty expertise and the needs and interests of aspiring undergraduate and graduate students.

Dittrick Medical History Center

The Dittrick Medical History Center (http://www.case.edu/artscli/dittrick/museum) is comprised of the Dittrick museum, archives, and collections of rare books, artifacts, and images. The center originated as part of the Cleveland Medical Library Association (est. 1894) and today functions as an interdisciplinary study center within the College of Arts and Sciences.

Center for Policy Studies

The Center for Policy Studies (http://policy.case.edu) has four objectives: 1) to make Case Western Reserve University a more attractive and rewarding institution for students and faculty who wish to learn about and engage in the creation of public policy; 2) to raise the public profile of the university by sponsoring programs and other activities that publicize and increase the reach of the work of CWRU’s policy analysts and their guests; 3) to contribute to the wider community by disseminating information and analysis of policy issues as generated both by faculty and by guests we bring to campus; and 4) to encourage creation of a community of policy studies on campus that may serve in the future as the basis for further development of policy-oriented curriculum at both the undergraduate and graduate levels.

Center for Research on Tibet

The Center for Research on Tibet (http://www.case.edu/affil/tibet) at Case Western Reserve University was founded in 1987 and is administered within the Department of Anthropology. The center’s goal is to conceptualize and conduct research on Tibetan history, society, language, ecology/physiology, and culture so as to understand traditional Tibet and the manner in which it has changed.

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The Center for Science and Mathematics Education (http://www.case.edu/artscli/csm) links the resources of the College of Arts and Sciences - including faculty, staff, and students - with needs in the K-12 STEM community. Its collaborations with external partners, including schools and public libraries, park systems, and science museums, enhance instruction and generate student interest in the STEM fields of science, technology, engineering, and mathematics. The center hosts the annual Northeast Ohio Regional Science Olympiad, conducts a summer Shipwreck Camp that includes lessons in meteorology and marine geology, and engages middle school students in biological fieldwork in its Environmental Heroes Program. Through the Gelfand Science and Engineering Fair Program, it provides support for science fairs in Northeast Ohio schools, and it recruits and trains undergraduates to assist younger students with their science fair projects. In addition, the center participates in the university’s Robert Noyce Teacher Scholarship Program, which provides mentoring and other support for future math and science teachers.

Center for the Study of Writing

The Center for the Study of Writing (http://www.case.edu/writing/csw) (CSW) is a flexible, cross-disciplinary center that fosters connections between innovative writing research and sound pedagogical practices, and between specialized faculty expertise and the needs and interests of aspiring undergraduate and graduate students.

Dittrick Medical History Center

The Dittrick Medical History Center (http://www.case.edu/artscli/dittrick/museum) is comprised of the Dittrick museum, archives, and collections of rare books, artifacts, and images. The center originated as part of the Cleveland Medical Library Association (est. 1894) and today functions as an interdisciplinary study center within the College of Arts and Sciences.

Ernest B. Yeager Center for Electrochemical Sciences

The mission of the Ernest B. Yeager Center for Electrochemical Sciences (http://yces.case.edu) (YCES) is: 1) to enhance the education and training of students in fundamental and applied aspects of electrochemistry; 2) to provide a national and international resource for the dissemination of electrochemical knowledge within industrial, laboratory, and academic communities and to the general public and to support the continuing education of professional electrochemists; (3) to promote interactions between electrochemists and their research colleagues through seminars and symposia; and 4) to foster the improvement of the environment and human welfare through research in the design of materials and the development of processes and devices that will positively influence fields from medicine and microelectronics to energy conversion and energy storage.

Schubert Center for Child Studies

The Schubert Center for Child Studies (http://schubertcenter.case.edu/home.aspx) aims to strengthen links between child-related academic study, public policy formation, and professional practice. The Schubert Center convenes experts from across campus and throughout the Cleveland community to provide an innovative forum for multidisciplinary education, research, and communications focused on child policy.

Skeletal Research Center

The mission of the Skeletal Research Center (http://www.case.edu/artscli/biol/skeletal) (SRC) is to facilitate the advancement of basic research and to accelerate the translation of this new information into innovative clinical strategies for the regeneration and maintenance of skeletal tissues. Based in the Department of Biology, the center provides an organizational umbrella for the creative and innovative interactions of faculty. Although members of our faculty have long been recognized as leaders in skeletal research, the center was established in 1986 to draw these individuals together into a multidisciplinary group which could jointly approach current basic research and clinical problems. SRC is an administrative entity under the dean of the College of Arts and Sciences and the dean of the School of Medicine.

Center for Policy Studies

The Center for Policy Studies (http://policy.case.edu) has four objectives: 1) to make Case Western Reserve University a more attractive and rewarding institution for students and faculty who wish to learn about and engage in the creation of public policy; 2) to raise the public profile of the university by sponsoring programs and other activities that publicize and increase the reach of the work of CWRU’s policy analysts and their guests; 3) to contribute to the wider community by disseminating information and analysis of policy issues as generated both by faculty and by guests we bring to campus; and 4) to encourage creation of a community of policy studies on campus that may serve in the future as the basis for further development of policy-oriented curriculum at both the undergraduate and graduate levels.

Center for Research on Tibet

The Center for Research on Tibet (http://www.case.edu/affil/tibet) at Case Western Reserve University was founded in 1987 and is administered within the Department of Anthropology. The center’s goal is to conceptualize and conduct research on Tibetan history, society, language, ecology/physiology, and culture so as to understand traditional Tibet and the manner in which it has changed.

Center for Science and Mathematics Education

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(Marquette University)
Assistant Dean, Development and External Relations
American Studies Program

The American Studies Program is designed to give students the flexibility to cross traditional intellectual boundaries in order to develop perspectives on American life that are more expansive and critical than those normally found within the limits of a single discipline. The interdisciplinary approach makes available a wide variety of materials, methods, theories, and themes to use as tools to investigate the complexities of the American past and present. The process of investigation is as important as the outcome, for it teaches students to analyze with breadth as well as depth, to think creatively as well as critically.

Undergraduate Programs

Major

Required courses: (30 credit hours)

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>AMST 117</td>
<td>Exploring American History Through Biography</td>
<td>3</td>
</tr>
<tr>
<td>HSTY 112</td>
<td>Introduction to American History</td>
<td>3</td>
</tr>
<tr>
<td>AMST 390</td>
<td>Independent Study</td>
<td>1-3</td>
</tr>
<tr>
<td>One of the following:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ARTH 270</td>
<td>American Art and Culture Before 1900</td>
<td>3</td>
</tr>
<tr>
<td>ENGL 368B</td>
<td>History of Film</td>
<td></td>
</tr>
<tr>
<td>HSTY 361</td>
<td>Crime and Culture in Early America</td>
<td></td>
</tr>
<tr>
<td>HSTY 381</td>
<td>City as Classroom</td>
<td></td>
</tr>
<tr>
<td>SOCI 349</td>
<td>Social Inequality</td>
<td></td>
</tr>
</tbody>
</table>

Elective Courses: (18 credit hours):

Students are to choose six electives, in two areas of concentration. An area of concentration consists of either 1) courses in a single department, or 2) courses from more than one department focusing on a theme or issue such as technology and culture, urban studies, literature and society, etc.

Minor

A minor consists of five courses: the introductory class and four electives that focus on a significant period, problem area, or aspect of American civilization. The rationale for selecting such a minor program, and its relation to the student’s career or intellectual interests, must be discussed with and approved by the minor advisor.

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>AMST 117</td>
<td>Exploring American History Through Biography</td>
<td>3</td>
</tr>
<tr>
<td>Four additional courses selected in consultation with the program director</td>
<td>12</td>
<td></td>
</tr>
</tbody>
</table>

Total Units: 15

Program Faculty

Renée M. Sentilles, PhD
Associate Professor, Department of History; Director, American Studies Program

Courses

AMST 117. Exploring American History Through Biography. 3 Units.
This discussion and lecture class uses various forms of biography to explore issues of American Identity throughout the course of American history. The class will discuss how certain biographies have created archetypal American identities, and how issues such as race, class, gender, sexuality, religion, and historical context have shaped the writing, reading and purpose of biography. The last third of the class will consider the process of "national memory," the way the United States has decide to remember its past. Here the “biography” is collective, and created by myriad strands of mass culture woven together to create a national mythology. We will explore the works of those striving to pull apart these different strands, and explore what these memories tell us about established national identity. Students will explore biographical process through their assignments, and consider such questions as: How do American biographies influence our understanding of what it means to be American? How does biographical medium affect the message? Can we accept biography as history? This course investigates biography as a constructed genre that comes in a variety of forms, including autobiography, biographical novels, oral histories, and film. Offered as AMST 117 and HSTY 117.

AMST 270. American Art and Culture Before 1900. 3 Units.
Survey of the development of American art from colonial times to the present which explores how art has expressed both American values and American anxieties. Painting is emphasized, but the course also considers architecture, the decorative arts, film, literature, and music. Offered as AMST 270 and ARTH 270.

AMST 271. American Art and Culture: The Twentieth Century. 3 Units.
Survey of the development of American art from 1900 to the present (and the future) which will explore how art has expressed both American values and American anxieties. Painting will be emphasized, but the course will also consider architecture, the decorative arts, film, literature, and music. Offered as AMST 271 and ARTH 271.

AMST 327. American Theater and Playwrights. 3 Units.
Designed to provide students an overview of the development of theater in the United States and to familiarize them with the work and themes of selected American playwrights. Offered as AMST 327 and THTR 327.

AMST 390. Independent Study. 1 - 3 Unit.
Asian Studies Program

Asian studies has become an increasingly important area of study in North American colleges and universities. This is due in part to a growing acknowledgment that Asian cultures are of significance both regionally and globally. The Asian Studies Program offers students the opportunity to explore these cultures from a multidisciplinary perspective so that they are able to understand the social, cultural, political, and other forces that shape and have shaped Asian nations.

The Asian Studies Program draws on faculty and courses from such departments as anthropology, art history and art, economics, modern languages and literatures, history, philosophy, political science, and religious studies. A current list of approved courses is available from the program advisor. Departmental seminars and senior capstone courses in the Asian Studies Program may count toward the completion of the SAGES General Education Requirements.

The undergraduate program in Asian studies offers a major and a minor. Students are encouraged to take courses in different disciplines in order to obtain broad exposure to the languages, literature, art, culture, religious traditions, and political, economic, and social institutions of Asian countries. The Asian Studies Program also offers an honors program to qualified majors.

In addition to course offerings, the Asian Studies Program sponsors extracurricular activities that enhance the formal study of Asia and give students additional opportunities to explore and understand Asia’s importance in the global community. The program sponsors lectures and films and administers a Web site devoted to Asia. It also encourages students to participate in study abroad programs in Asian countries and to utilize Asian resources at the Cleveland Museum of Art and other local institutions.

Undergraduate Program

Major

The Asian studies major, which leads to a Bachelor of Arts degree, consists of 31 credit hours, including:

- At least 16 credit hours (two years) of Chinese or Japanese language
- 15 credit hours of Asia-related courses, selected in consultation with the program advisor

The 15 hours in Asia-related courses must be at the 200 or 300 level and come from at least three different departments.

Minor

The minor in Asian studies consists of 18 credit hours of Asia-related courses, selected in consultation with the program advisor. Only one year (8 credits) of language study (Japanese or Chinese) counts toward the minor.

The 18 hours in Asia-related courses must be at the 200 or 300 level and come from at least three different departments.

Honors Program

Asian Studies Honors is a semester-long program for Asian studies majors, normally taken during the senior year, which involves researching and writing an honors thesis. Honors program requirements include the completion of 12 semester hours of approved Asia-related courses, at least two semesters of study of an Asian language, and maintenance of a GPA of at least 3.0 overall and 3.2 in Asian studies courses.

A participating student enrolls in ASIA 398 Honors Thesis and writes a thesis under the direction of an Asian studies faculty member. The student also receives guidance from a second reader, who must be a member of the Asian Studies Program. A third reader, who need not be a member of the Asian Studies Program, is optional. Each student must maintain regular contact with the supervising faculty member in the various stages of researching and writing the thesis. Detailed guidelines and deadlines for the course are available from the program advisor.

Courses Available in East Asian Studies

Course List

<table>
<thead>
<tr>
<th>Language Courses:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>CHIN 101</td>
<td>Elementary Chinese I</td>
</tr>
<tr>
<td>CHIN 102</td>
<td>Elementary Chinese II</td>
</tr>
<tr>
<td>CHIN 201</td>
<td>Intermediate Chinese I</td>
</tr>
<tr>
<td>CHIN 202</td>
<td>Intermediate Chinese II</td>
</tr>
<tr>
<td>CHIN 301</td>
<td>Advanced Chinese I</td>
</tr>
<tr>
<td>CHIN 302</td>
<td>Advanced Chinese II</td>
</tr>
<tr>
<td>CHIN 303</td>
<td>Topics in Chinese</td>
</tr>
<tr>
<td>CHIN 304</td>
<td>Topics in Chinese</td>
</tr>
<tr>
<td>CHIN 315</td>
<td>Business Chinese</td>
</tr>
<tr>
<td>CHIN 399</td>
<td>Independent Study</td>
</tr>
<tr>
<td>CHIN 415</td>
<td>Business Chinese</td>
</tr>
<tr>
<td>JAPN 101</td>
<td>Elementary Japanese I</td>
</tr>
<tr>
<td>JAPN 102</td>
<td>Elementary Japanese II</td>
</tr>
<tr>
<td>JAPN 201</td>
<td>Intermediate Japanese I</td>
</tr>
<tr>
<td>JAPN 202</td>
<td>Intermediate Japanese II</td>
</tr>
<tr>
<td>JAPN 301</td>
<td>Advanced Japanese I</td>
</tr>
<tr>
<td>JAPN 302</td>
<td>Advanced Japanese II</td>
</tr>
<tr>
<td>JAPN 225</td>
<td>Japanese Popular Culture</td>
</tr>
<tr>
<td>JAPN 245</td>
<td>Classical Japanese Literature in Translation</td>
</tr>
<tr>
<td>JAPN 255</td>
<td>Modern Japanese Literature in Translation</td>
</tr>
<tr>
<td>JAPN 350</td>
<td>Contemporary Japanese Texts I</td>
</tr>
<tr>
<td>JAPN 351</td>
<td>Contemporary Japanese Texts II</td>
</tr>
<tr>
<td>JAPN 355</td>
<td>Modern Japanese Novels and the West</td>
</tr>
<tr>
<td>JAPN 397</td>
<td>Senior Thesis I</td>
</tr>
<tr>
<td>JAPN 398</td>
<td>Senior Thesis II</td>
</tr>
<tr>
<td>JAPN 399</td>
<td>Independent Study</td>
</tr>
<tr>
<td>ANTH 353</td>
<td>Chinese Culture and Society</td>
</tr>
<tr>
<td>ASIA 235</td>
<td>Asian Cinema and Drama</td>
</tr>
<tr>
<td>ARTH 203</td>
<td>The Arts of Asia</td>
</tr>
<tr>
<td>ARTH 204</td>
<td>Arts of East Asia</td>
</tr>
<tr>
<td>ARTH 302</td>
<td>Buddhist Art in Asia</td>
</tr>
<tr>
<td>ARTH 307</td>
<td>Arts of China</td>
</tr>
<tr>
<td>ARTH 308</td>
<td>Arts of Japan</td>
</tr>
<tr>
<td>ARTH 340</td>
<td>Issues in the Art of China</td>
</tr>
<tr>
<td>ARTH 398</td>
<td>Independent Study in Art History</td>
</tr>
<tr>
<td>HSTY 285</td>
<td>Modern Japan</td>
</tr>
<tr>
<td>HSTY 383</td>
<td>Readings in PRC History</td>
</tr>
</tbody>
</table>

Case Western Reserve University
HSTY 385  
Offered as ASIA 133 and HSTY 133.

ASIA 133. Introduction to Chinese History and Civilization. 3 Units.
This course explains the continuities and discontinuities in the history of China by stressing the development and distinctive adaptations of cultural, religious, and political patterns from the origins of the Chinese civilization to the present. By focusing on major cultural, socioeconomic, and political issues such as Confucianism, Buddhism, trade relations, imperialism, and intellectual discourse in the overall Asian context (with particular reference to Korea and Japan), we discuss the historical development of China and its situation on entering the 21st century. Taking into account the key historical events in the last century, we examine the emergence of China as a modern nation-state and the fundamental transformation of Chinese society in the postwar period. Offered as ASIA 133 and HSTY 133.

ASIA 134. Introduction to Japanese History and Civilization. 3 Units.
This course provides an introduction to various aspects of Japanese civilization, from its origins to the present. By focusing on major cultural, socio-economic, and political issues such as the adaptation and transformation of Confucianism, Buddhism, Shintoism, social structures, material culture, foreign relations, militarism, nationalism, and intellectual discourse in the overall Asian context (with particular reference to Korea and China), we discuss the historical development of Japan and the country's position on entering the 21st century. We examine the emergence of Japan as a modern nation-state and the fundamental transformation of its society in the post-war period. Offered as ASIA 134 and HSTY 134.

ASIA 235. Asian Cinema and Drama. 3 Units.
Introduction to major Asian film directors and major traditional theatrical schools of India, Java/Bali, China, and Japan. Focus on the influence of traditional dramatic forms on contemporary film directors. Development of skills in cross-cultural analysis and comparative aesthetics. Offered as ASIA 235 and WLIT 235.

ASIA 288. Imperial China: The Great Qing. 3 Units.
This course is an introduction to the history of Imperial China, from the fall of the Ming Dynasty in 1644 to the creation of the Chinese republic in 1912. We will explore the major historical transformations (political, economic, social, and cultural) of the last imperial dynasty, the Qing (1644-1911), and develop an understanding of the major social, political, economic, and intellectual cultural forces shaping the formation of modern China. Contrary to commonly-held ideas in both West and in China that traditional Chinese society was timeless or stagnant, historians now see dramatic and significant changes during this period--to the economy, to gender relations, to religion, and to many other aspects of life. This course surveys the social, political, economic, and cultural history of this era, with emphasis on recent research. The main goals of the course will be to acquaint students with the key changes and to show the interplay between economic, social, and cultural changes on the one hand and political developments on the other. By the end of the semester you should have a good sense of how Chinese society was transformed over the course of the 17th through early 20th centuries. The topics we will discuss include urbanization and commerce; gender, family and kinship; education and the examination system; opium and free trade; and ethnicity and nationalism. Offered as ASIA 288 and HSTY 288.

ASIA 289. History of Twentieth Century China. 3 Units.
Completes a two-term sequence of the Chinese history survey, although HSTY 288 is not a prerequisite for this course. Beginning with the First Sino-Japanese War (1895), we review the historical development of intellectual discourse, public reaction, and political protest in later Imperial China through the creation of the People’s Republic in 1949 forward to contemporary times. In contrast to the conventional description of China from a Western point of view, this course tries to explain the emergence of modern China in the context of its intellectual, political, and socio-economic transformation as experienced by Chinese in the late 19th and into the 20th century. By discussing the influence of the West, domestic rebellions, and political radicalism, we examine how the Chinese state and society interacted in search for modernization and reforms, how these reforms were continued during the Republican period, and to what extent historical patterns can be identified in China’s present-day development. Offered as ASIA 289 and HSTY 289.
ASIA 398. Honors Thesis. 1 - 4 Unit.
Intensive study of a topic or problem under the direction of a faculty member, resulting in the preparation of an honors thesis.

ASIA 399. Independent Study. 1 - 3 Unit.
Tutorial in Asian Studies.
Biochemistry

The College of Arts and Sciences awards the Bachelor of Arts and Bachelor of Science degrees in biochemistry. The required courses for the majors and minor are offered by the Department of Biochemistry in the School of Medicine. For details about the department's undergraduate programs, please consult the Department of Biochemistry (p. 724) section of this bulletin.
Childhood Studies Program

The Childhood Studies Program is an educational opportunity for undergraduate students interested in a wide array of issues concerning children and the experience of childhood. This interdisciplinary minor focuses on the life stages of infancy through adolescence and enables students to pursue interests in parenting, child development, gender, the life course, and the place of children in society and culture.

While the Childhood Studies Program is situated in the College of Arts and Sciences, children and childhood are a focus of research and teaching in units throughout the university, including the School of Medicine, the Mandel School of Applied Social Sciences, the School of Law, the School of Dental Medicine, and the Frances Payne Bolton School of Nursing. In addition, the Schubert Center for Child Studies sponsors research, lectures, and programs on children and childhood and provides opportunities for student involvement in research, education, and policy, including externships with local nonprofits.

Undergraduate Program

Minor

The undergraduate minor in childhood studies is built on a foundation in the social sciences. It is also suited, however, to students interested in exploring childhood from the perspectives of the natural sciences, the humanities, or the arts. The minor requires a minimum of 15 hours of course work; the courses must be taken in at least two different departments.

The courses listed below are accepted toward the minor. Other courses may be accepted with approval from one of the program co-directors.

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Department</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANTH 306</td>
<td>The Anthropology of Childhood and the Family</td>
<td>Department of Anthropology</td>
<td>3</td>
</tr>
<tr>
<td>ANTH 313</td>
<td>The Anthropology of Adolescence</td>
<td>Department of Anthropology</td>
<td>3</td>
</tr>
<tr>
<td>ANTH 399</td>
<td>Independent Study</td>
<td>Department of Anthropology</td>
<td>1</td>
</tr>
<tr>
<td>CHST 301/ANTH 305</td>
<td>Child Policy</td>
<td>Department of Anthropology</td>
<td>3</td>
</tr>
<tr>
<td>CHST 302/ANTH 307</td>
<td>Experiential Learning in Child Policy</td>
<td>Department of Anthropology</td>
<td>3</td>
</tr>
<tr>
<td>CHST 398/ANTH 308</td>
<td>Child Policy Externship</td>
<td>Department of Anthropology</td>
<td>3</td>
</tr>
<tr>
<td>CHST/ANTH/PSCI 398C</td>
<td>Child Policy Externship and Capstone</td>
<td>Department of Anthropology</td>
<td>3</td>
</tr>
<tr>
<td>CHST 399</td>
<td>Independent Study</td>
<td>Department of Anthropology</td>
<td>1</td>
</tr>
<tr>
<td>COSI 313</td>
<td>Language Development</td>
<td>Department of Anthropology</td>
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</tr>
<tr>
<td>ENGL 369</td>
<td>Children's Literature</td>
<td>Department of English</td>
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</tr>
<tr>
<td>HSTY 387</td>
<td>Growing Up in America: 1607 - 2000</td>
<td>Department of History</td>
<td>3</td>
</tr>
<tr>
<td>MUED 391</td>
<td>Music in Early Childhood</td>
<td>Department of Music</td>
<td>3</td>
</tr>
<tr>
<td>NTRN 328</td>
<td>Child Nutrition, Development and Health</td>
<td>Department of Nursing</td>
<td>3</td>
</tr>
<tr>
<td>PSCL 230</td>
<td>Child Psychology</td>
<td>Department of Psychology</td>
<td>3</td>
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<tr>
<td>PSCL 329</td>
<td>Adolescence</td>
<td>Department of Psychology</td>
<td>3</td>
</tr>
<tr>
<td>PSCL 395C</td>
<td>Seminar and Practicum: Hospitalized Child</td>
<td>Department of Psychology</td>
<td>3</td>
</tr>
<tr>
<td>PSCL 344</td>
<td>Developmental Psychopathology</td>
<td>Department of Psychology</td>
<td>3</td>
</tr>
<tr>
<td>PSCL 393</td>
<td>Experimental Child Psychology</td>
<td>Department of Psychology</td>
<td>3</td>
</tr>
<tr>
<td>PSCL 397</td>
<td>Independent Study</td>
<td>Department of Psychology</td>
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</tr>
<tr>
<td>SASS 390</td>
<td>Independent Study for Undergraduates</td>
<td>Department of Sociology</td>
<td>1</td>
</tr>
<tr>
<td>SOCI 320</td>
<td>Delinquency and Juvenile Justice</td>
<td>Department of Sociology</td>
<td>3</td>
</tr>
<tr>
<td>SOCI 361</td>
<td>The Life Course</td>
<td>Department of Sociology</td>
<td>3</td>
</tr>
</tbody>
</table>

**Courses**

**CHST 301. Child Policy. 3 Units.**

This course introduces students to issues in public policy that impacts children and families. Local, state and federal child policy will be considered, and topics will include, for example, policies related to child poverty, education, child welfare, juvenile justice, and children's physical and mental health. Students will learn how policy is developed, how research informs policy and vice versa, and a framework for analyzing social policy. Recommended preparation: One social sciences course or consent. Offered as ANTH 305 and CHST 301.

**CHST 302. Experiential Learning in Child Policy. 3 - 6 Units.**

Focus on state and federal legislative policy impacting children, youth, and families. Course includes an experiential learning component at the state or federal level and a travel experience to either Columbus, OH or Washington, DC to learn firsthand how policy is formed. Students may take this course twice for credit. Offered as ANTH 307 and CHST 302. Prereq: CHST 301.

**CHST 398. Child Policy Externship. 3 Units.**

Externships offered through CHST 398/ANTH 308 give students an opportunity to work directly with professionals who design and implement policies that impact the lives of children and their families. Agencies involved are active in areas such as public health, including behavioral health, education, juvenile justice, childcare and/or child welfare. Students apply for the externships, and selected students are placed in local public or nonprofit agencies with a policy focus. Each student develops an individualized learning plan in consultation with the Childhood Studies Program faculty and the supervisor in the agency. CHST 398/ANTH 308 is a 3 credit-hour course and may be taken twice for a total of 6 credit hours. Offered as CHST 398 and ANTH 308. Prereq: CHST 301.
CHST 398C. Child Policy Externship and Capstone. 3 Units.
Externships offered through CHST/ANTH/PSCL 398C give students an opportunity to work directly with professionals who design and implement policies that impact the lives of children and their families. Agencies involved are active in areas such as public health, including behavioral health, education, juvenile justice, childcare and/or child welfare. Students apply for the externships, and selected students are placed in local public or nonprofit agencies with a policy focus. Each student develops an individualized learning plan in consultation with the Childhood Studies Program faculty and the supervisor in the agency. Offered as CHST 398C, ANTH 398C, and PSCL 398C. Prereq: CHST 301.

CHST 399. Independent Study. 1 - 6 Unit.
Students propose topics for independent reading and research.
Computer Science

The College of Arts and Sciences awards the Bachelor of Arts degree in computer science. The required courses for the major and minor are offered by the Department of Electrical Engineering and Computer Science in the Case School of Engineering.

For details about the department’s undergraduate programs, please consult the Department of Electrical Engineering and Computer Science (p. 60) section of this bulletin.
Department of Anthropology

Anthropology, with its broad comparative approach, is in a strategic position to contribute to the identification and resolution of many of the problems, both local and global, that challenge society today. The Department of Anthropology offers programs leading to both undergraduate (Bachelor of Arts) and graduate (Master of Arts, Doctor of Philosophy) degrees. In addition, the department offers joint graduate degree programs with Case Western Reserve University School of Medicine (MA or PhD/MPH and MD/MA or PhD) and with the Frances Payne Bolton School of Nursing (MSN/MA). Students graduating with a BA in anthropology normally must continue for the MA or PhD degree if they are interested in working as anthropologists.

General Anthropology | Medical Anthropology | Physical Anthropology | Archaeology | Minors

Undergraduate Programs

Majors

The undergraduate major requires a minimum of 30 semester hours in anthropology. The undergraduate program provides a cross-cultural perspective on human behavior, culture, and biology. Students may choose from four major concentrations.

1. The General Anthropology Concentration provides training in three subdisciplines of anthropology. The first, sociocultural anthropology, emphasizes relationships among socioeconomic institutions, cultural ecology, health and medicine, religion and symbolism, individual psychological variables, and language. The second, physical anthropology, emphasizes human ecology and adaptability, human growth and development, nutritional adaptation, epidemiology, and human and nonhuman primate evolution. The third, archaeology, deals with the long sequences of independent sociocultural, technological, and ecological evolution that have taken place under diverse conditions.

2. The Medical Anthropology Concentration provides training in the three subdisciplines discussed above, but with a focus on their relationship to physical and mental health, illness, disease, and medicine.

3. The Physical Anthropology Concentration deals with the biological nature of humans past and present. Physical anthropologists look beyond purely biological phenomena to understand how biology, behavior, and environment interact. Most course work is in the subdiscipline of human biology, which seeks to understand those interactions by studying physiology, genetics, nutrition, and epidemiology in modern human populations throughout the world. But the concentration also provides training in paleoanthropology, which documents the biological history of humans and, in conjunction with archaeology, analyzes those interactions for past humans.

4. The Archaeology Concentration focuses on the customs and daily life of people who lived in the past. Anthropologists excavate and analyze the material remains of the sites of human occupation. At the same time, archaeological research seeks to understand the evolution of culture and society by determining how and why changes in human society have occurred.

General Anthropology Concentration

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
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<tbody>
<tr>
<td>ANTH 102</td>
<td>Being Human: An Introduction to Social and Cultural Anthropology</td>
<td>3</td>
</tr>
<tr>
<td>ANTH 103</td>
<td>Introduction to Human Evolution</td>
<td>3</td>
</tr>
<tr>
<td>ANTH 319</td>
<td>Introduction to Statistical Analysis in the Social Sciences</td>
<td>3</td>
</tr>
<tr>
<td>Geographic area course, such as:</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>ANTH 331</td>
<td>The Most Ancient Near East</td>
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<tr>
<td>ANTH 333</td>
<td>Roots of Ancient India: Archaeology of South Asia</td>
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<tr>
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<tr>
<td>ANTH 349</td>
<td>Cultures of Latin America</td>
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<tr>
<td>ANTH 353</td>
<td>Chinese Culture and Society</td>
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Approved anthropology electives: 18

Total Units: 30

Medical Anthropology Concentration

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
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</thead>
<tbody>
<tr>
<td>ANTH 102</td>
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<tr>
<td>ANTH 353</td>
<td>Chinese Culture and Society</td>
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Three health/illness-related topics courses, such as: 9

<table>
<thead>
<tr>
<th>Course Code</th>
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<tbody>
<tr>
<td>ANTH 302</td>
<td>Darwinian Medicine</td>
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<tr>
<td>ANTH 304</td>
<td>Introduction to the Anthropology of Aging</td>
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</tr>
<tr>
<td>ANTH 306</td>
<td>The Anthropology of Childhood and the Family</td>
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<td>ANTH 313</td>
<td>The Anthropology of Adolescence</td>
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<td>ANTH 317</td>
<td>Asian Medical Systems</td>
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<tr>
<td>ANTH 318</td>
<td>Death and Dying</td>
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<td>ANTH 323</td>
<td>AIDS: Epidemiology, Biology, and Culture</td>
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<td>ANTH 326</td>
<td>Power, Illness, and Inequality: The Political Economy of Health</td>
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<td>ANTH 335</td>
<td>Illegal Drugs and Society</td>
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<tr>
<td>ANTH 337</td>
<td>Comparative Medical Systems</td>
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</tr>
<tr>
<td>ANTH 338</td>
<td>Maternal Health: Anthropological Perspectives on Reproductive Practices and Health Policy</td>
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<td>ANTH 351</td>
<td>Topics in International Health</td>
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<td>ANTH 359</td>
<td>Introduction to International Health</td>
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<td>ANTH 361</td>
<td>Urban Health</td>
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<td>ANTH 365</td>
<td>Gender and Sex Differences: Cross-cultural Perspective</td>
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<td>The Anthropology of Nutrition</td>
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<tr>
<td>ANTH 371</td>
<td>Culture, Behavior, and Person: Psychological Anthropology</td>
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<td>ANTH 376</td>
<td>Topics in the Anthropology of Health and Medicine</td>
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<tr>
<td>ANTH 393</td>
<td>Human Ecology: The Biology of Human Adaptability</td>
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Approved anthropology electives: 6

Total Units: 30

Physical Anthropology Concentration

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<th>Units</th>
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</thead>
<tbody>
<tr>
<td>ANTH 102</td>
<td>Being Human: An Introduction to Social and Cultural Anthropology</td>
<td>3</td>
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<td>Cultural Area Studies in Anthropology</td>
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<td>ANTH 349</td>
<td>Cultures of Latin America</td>
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<td>ANTH 353</td>
<td>Chinese Culture and Society</td>
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Three physical anthropology courses, such as: 9

<table>
<thead>
<tr>
<th>Course Code</th>
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<tr>
<td>ANTH 295</td>
<td>Comparative Primate Behavior</td>
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<tr>
<td>ANTH 302</td>
<td>Darwinian Medicine</td>
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</table>
The department offers four minor emphases in anthropology: general anthropology, medical anthropology, archaeology, and physical anthropology. All require a minimum of 15 semester hours in anthropology.

**General Anthropology Minor**

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<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
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<td>ANTH 102</td>
<td>Being Human: An Introduction to Social and Cultural Anthropology</td>
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<tr>
<td>ANTH 103</td>
<td>Introduction to Human Evolution</td>
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**Archaeology Concentration**

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<td>Being Human: An Introduction to Social and Cultural Anthropology</td>
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<td>ANTH 103</td>
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<td>ANTH 107</td>
<td>Archaeology: An Introduction</td>
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<tr>
<td>Three approved archaeology</td>
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<td>course, such as:</td>
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<td>ANTH 353</td>
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<tr>
<td>Summer fieldwork</td>
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<td>Total Units</td>
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**Medical Anthropology Minor**

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<td>3</td>
</tr>
<tr>
<td>ANTH 215</td>
<td>Health, Culture, and Disease: An Introduction to Medical Anthropology</td>
<td>3</td>
</tr>
<tr>
<td>One geographic area course,</td>
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<tr>
<td>such as:</td>
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<tr>
<td>ANTH 330</td>
<td>Special Topics in Prehistory</td>
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<tr>
<td>ANTH 331</td>
<td>The Most Ancient Near East</td>
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<td>Chinese Culture and Society</td>
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<tr>
<td>One health-related topics,</td>
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<tr>
<td>such as:</td>
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<tr>
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<td>Practices and Health Policy</td>
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<td>3</td>
</tr>
<tr>
<td>Total Units</td>
<td></td>
<td>30</td>
</tr>
</tbody>
</table>

**Departmental Honors**

This program is open to qualified majors in anthropology who have completed 15 hours of anthropology with a 3.25 GPA and who have an overall 3.0 GPA. Students should apply for the program in the fall semester of their junior year and, if approved, register for ANTH 391 Honors Tutorial and ANTH 392 Honors Tutorial in the spring of their junior year and the fall of their senior year.

Honors students are required to undertake a research project under the supervision of one or more faculty members and to present an acceptable research paper in the fall semester of their senior year. Students interested in the program should contact one of the department’s undergraduate advisors.

**Integrated Graduate Studies**

The Department of Anthropology participates in the Integrated Graduate Studies Program (p. 549). Interested students can find the general requirements and the admission procedures for the program in the Undergraduate Studies section of this bulletin and may consult the department for further information.

**Minors**

The department offers four minor emphases in anthropology: general anthropology, medical anthropology, archaeology, and physical anthropology. All require a minimum of 15 semester hours in anthropology.
Degree examinations can receive one of three grades: High Pass, Pass, or Fail. “High Pass” signifies performance sufficient for both the Master of Arts degree and advancement to the Doctor of Philosophy program, provided other requirements have also been satisfied. “Pass” signifies performance adequate for the master’s degree but insufficient to enter the doctoral program. “Fail” means a performance inadequate for the master’s degree. In the case of grades of Pass and Fail, the written examination may be retaken once.

### Doctor of Philosophy

The Doctor of Philosophy degree program includes specializations in medical anthropology and global health, cross-cultural aging, human biology/physical anthropology, and sociocultural anthropology. It requires a minimum of 36 credit hours.

PhD students will work with their doctoral advisor and faculty committee to determine prior to completing candidacy exams what foreign language, if any, is needed to successfully complete the PhD. If language competency is required, the language requirement can be met by a demonstration of competency either in a relevant written language or in an oral field language. The advisor, in consultation with the committee, will determine the level of competency needed and by what means language proficiency will be certified. Certification of competency must occur prior to the dissertation defense.

### Medical Anthropology and Global Health Program

The objective of the Medical Anthropology and Global Health Program is to train medical anthropologists, physicians, nurses, and other health professionals (1) to recognize and deal with, on both theoretical and practical levels, the complex relations between the biological, social, cultural, psychological, economic, and techno-environmental determinants and concomitants of sickness and health in both local and global settings; and (2) to analyze and evaluate how health services are organized and delivered.

Within the Medical Anthropology and Global Health Program, students may choose to specialize in medical anthropology, cross-cultural aging, human adaptation and disease, nutrition, social demography, and so on. All Master of Arts degree students in medical anthropology must complete 27 hours:

### MA Requirements

The main purpose of the Master of Arts degree program is to prepare students to begin teaching, research, or service careers with a solid background in anthropology. Undergraduate course work in anthropology, while helpful, is not a prerequisite for admission.

Requirements for the master’s degree include credit hour requirements, core course requirements, and a six-hour comprehensive written Master of Arts examination. A candidate for the master’s degree is required to complete 27 hours of class work, including an approved statistics course (3 hours) in which the student has earned a grade of C or better. No more than 6 credit hours of electives may be taken in 300-level courses (advanced undergraduate courses). All master’s degree candidates are required to attain a minimum cumulative grade point average of 3.0 in the core courses (described below) in order to qualify for the degree. Any student may retake an examination in a required course the next time it is given. The second grade will be the one considered for the student’s overall average.

All master’s degree candidates are required to take a six-hour comprehensive written examination in their field set by the department’s examination committee. This examination must be taken before the completion of 27 semester hours of graduate work. Written master’s degree examinations can receive one of three grades: High Pass, Pass, or Fail.

**Medical Anthropology and Global Health | Cross-Cultural Aging | Joint-Degree Programs**

**Graduate Programs**

The Department of Anthropology offers graduate programs leading to the Master of Arts and Doctor of Philosophy degrees in anthropology with specializations in medical anthropology and global health, cross-cultural aging, and other areas.

The department also offers three combined degrees:

- MA or PhD/MPH (with the School of Medicine)
- MD/MA or PhD (with the School of Medicine)
- MSN/MA (with the Frances Payne Bolton School of Nursing)

**Master of Arts**

The main purpose of the Master of Arts degree program is to prepare students to begin teaching, research, or service careers with a solid background in anthropology. Undergraduate course work in anthropology, while helpful, is not a prerequisite for admission.

Requirements for the master’s degree include credit hour requirements, core course requirements, and a six-hour comprehensive written Master of Arts examination. A candidate for the master’s degree is required to complete 27 hours of class work, including an approved statistics course (3 hours) in which the student has earned a grade of C or better. No more than 6 credit hours of electives may be taken in 300-level courses (advanced undergraduate courses). All master’s degree candidates are required to attain a minimum cumulative grade point average of 3.0 in the core courses (described below) in order to qualify for the degree. Any student may retake an examination in a required course the next time it is given. The second grade will be the one considered for the student’s overall average.

All master’s degree candidates are required to take a six-hour comprehensive written examination in their field set by the department’s examination committee. This examination must be taken before the completion of 27 semester hours of graduate work. Written master’s degree examinations can receive one of three grades: High Pass, Pass, or Fail. “High Pass” signifies performance sufficient for both the Master of Arts degree and advancement to the Doctor of Philosophy program, provided other requirements have also been satisfied. “Pass” signifies performance adequate for the master’s degree but insufficient to enter the doctoral program. “Fail” means a performance inadequate for the master’s degree. In the case of grades of Pass and Fail, the written examination may be retaken once.

### PhD Requirements

All PhD students in medical anthropology are required to complete the PhD requirements. Students develop a specific plan of study, requiring a minimum of 36 credit hours, in consultation with their advisor.
Students must take an approved statistics course (3 credits) and earn a grade of C or better if this requirement has not been fulfilled at the MA level.

Students must take ANTH 504 Anthropological Research Design.

Students must complete two approved seminars (500 level).

Students must take 6-15 credit hours in electives (depending on whether they need to take the statistics course or the 500-level seminars). Students may not take more than six total credit hours of ANTH 599 Tutorial: Advanced Studies in Anthropology.

Students must take 18 credit hours in dissertation (ANTH 701 Dissertation Ph.D.).

After completing course requirements, a student must take the written Doctor of Philosophy candidacy examination. Within one semester of successfully completing this examination, the student is required to defend a dissertation prospectus with the cooperation of his or her advisor and committee.

**Specializations in Medical Anthropology and Global Health**

**International Health**
The international health specialization offers students training in international health research as well as in evaluation of international health projects. The curriculum includes course work in medical anthropology, epidemiology, and special topics in international health, such as maternal and child health. Students are qualified to work in international health research, in academic positions, or in administrative positions in governmental or private agencies.

**Urban Health**
The urban health specialization prepares students for careers in anthropology, public health, or allied fields, with a special focus on racial and ethnic disparities in health and on underserved populations in urban areas around the world. Under the guidance of faculty with research experience both domestically and internationally, students will learn anthropological theory and methods focusing on health and illness among urban populations.

**Psychological Anthropology**
The psychological anthropology specialization prepares students for positions in teaching and research institutions. It is also relevant for mental health professionals concerned with research and theoretical issues related to multiethnic patient populations.

**Cross-Cultural Aging**
The cross-cultural aging specialization focuses on the processes of aging and the circumstances of older people throughout the world. Particular attention is given to the impact of social, cultural, economic, political, and demographic variables on the experience of aging.

All MA students in the cross-cultural aging specialization must complete 27 credit hours, including the medical anthropology core courses, an approved statistics course, and 12 credit hours of electives approved by the advisor. At the PhD level, students specializing in cross-cultural aging must develop a program with their advisor to meet all PhD requirements.

**Cross-Cultural Aging Program**
In addition to the cross-cultural aging specialization in the Medical Anthropology Program, the department offers a distinct Cross-Cultural Aging Program. Degree candidates are required to demonstrate mastery of the literature, theories, and methods appropriate to Western and non-Western gerontology, and are encouraged to gain research experience in both Western and non-Western settings. The program emphasizes the integration of qualitative and quantitative methodologies.

**MA Requirements**
Graduates of the master's program are qualified to work in research or administrative positions in governmental and private agencies, and to teach at the college and university levels. All MA students in cross-cultural aging must complete 27 credit hours including the following core courses:

<table>
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<tr>
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<th>Course Title</th>
<th>Credits</th>
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<tr>
<td>ANTH 401</td>
<td>Biological Aging in Humans</td>
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<td>ANTH 404</td>
<td>Introduction to the Anthropology of Aging</td>
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<tr>
<td>ANTH 462</td>
<td>Contemporary Theory in Anthropology</td>
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<tr>
<td>ANTH 504</td>
<td>Anthropological Research Design</td>
<td>3</td>
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</table>

Approved statistics course

Electives 12

Total Units 27

**PhD Requirements**
All PhD students in cross-cultural aging are required to develop a specific plan of study, with a minimum of 36 credit hours, in consultation with their advisor.

Students must take 18 credit hours in electives as approved by their advisory committee. (For those students who have not completed the MA statistics requirement, an approved 3-credit course in statistics is required.) Students must take 18 credit hours in dissertation (ANTH 701 Dissertation Ph.D.).

After completing course requirements, a student must take the written Doctor of Philosophy candidacy examination. Within one semester of successfully completing this examination, the student is required to defend a dissertation prospectus with the cooperation of his or her advisor and committee. Before a candidate is permitted to defend the dissertation, he or she must demonstrate a reading knowledge in a foreign language in which there is a scholarly literature relevant to his or her program of studies. A foreign-born student may substitute his or her native language (if it is not English) if it meets the above conditions.

**Other Specializations**
Students interested in graduate degrees in social-cultural or physical anthropology should contact the department about requirements.

**Joint-Degree Programs**

**MA or PhD/MPH Program with the School of Medicine**
The joint MA or PhD/MPH program provides students with the opportunity to receive an anthropology graduate degree and a public health degree simultaneously. A combined public health/anthropology degree will be especially valuable to students interested in working in urban health or international health, or within health policy programs. The joint MA/MPH requires 54 credit hours (21 in anthropology and 33 in public health). The joint PhD/MPH requires an additional 18 credit hours in anthropology beyond the MA level and 18 hours of ANTH 701 Dissertation Ph.D., for a total of 90 credit hours. All joint-degree students will develop a program of study with their advisors in both anthropology and public health.

**MD/MA or PhD Program with the School of Medicine**
The objectives of the joint MD/MA or PhD program are to train unusually qualified students to conduct research on a broad range of bio-cultural problems, with emphasis on the relationship between medicine,
ecology, subsistence variables, population dynamics, and disease epidemiology; and to identify and analyze sociocultural impediments to the successful introduction of effective functioning and evaluation of health care programs in diverse contexts. Applicants should make separate application for admission to the School of Medicine and the Department of Anthropology (through the School of Graduate Studies). Applications to the Department of Anthropology may include MCAT scores rather than GRE scores, in addition to other information indicated on the graduate school forms.

**MSN/MA Program with the Frances Payne Bolton School of Nursing**

The joint MSN/MA program affords students a unique opportunity to combine the cross-cultural expertise of medical anthropology with clinical expertise in nursing. This combination of skills and knowledge will be of particular value in preparing students for careers in international health and in our multicultural society. Students must complete a minimum of 19 credits in nursing core courses, 12 to 22 credits in clinical major courses, and a minimum of 18 credits in anthropology courses. The actual number of credits depends upon the nursing major selected. The total MSN/MA degree requirement is a minimum of 55 hours.

**Department Faculty**

Lawrence P. Greksa, PhD  
(Pennsylvania State University)  
*Professor and Chair*

Physical anthropology; human biology; growth and development; nutrition; modernization; Polynesia; Andes; Old Order Amish

Eileen Anderson-Fye, EdD  
(Harvard University)  
*Assistant Professor*

Psychological and medical anthropology; culture, gender, and human development; anthropology of adolescence; globalization; immigration; mental health; eating and body image disorders; child abuse and trauma; adolescent psychiatric medication usage; person-centered ethnography; mixed methods; Belize; Belizean immigrants in the United States

Cynthia Beall, PhD  
(Pennsylvania State University)  
*Distinguished University Professor and Sarah Idell Pyle Professor; Co-Director, Center for Research on Tibet*

Physical anthropology; adaptation to high-altitude hypoxia on the Andean, Tibetan, and East African plateaus

Atwood D. Gaines, PhD, MPH  
(University of California, Berkeley; University of California, Berkeley, School of Public Health)  
*Professor; Professor of Psychiatry and Professor of Bioethics, Case School of Medicine; Professor of Nursing, Frances Payne Bolton School of Nursing*

Medical and psychiatric anthropology; cultural studies of science and medicine; cultural bioethics; religion; aging and dementia; social identity and health; United States; France and the Mediterranean

Melvyn C. Goldstein, PhD  
(University of Washington)  
*John Reynolds Harkness Professor; Co-Director, Center for Research on Tibet; Professor of International Health, School of Medicine*

Social and cultural anthropology; development/population anthropology; cross-cultural and global aging; cultural ecology, ethnicity, and nationalism; anthropology and history; Tibet, China, Mongolia, Himalayas

Vanessa M. Hildebrand, PhD  
(Washington University)  
*Assistant Professor*

Sociocultural anthropology; maternal and reproductive health; science and technology studies; global health and global health policy; Southeast Asia, Indonesia, United States

Lee D. Hoffer, PhD, MPE  
(University of Colorado, Denver; Washington University School of Medicine)  
*Assistant Professor*

Cultural and medical anthropology; drug addiction; psychiatric epidemiology; ethnographic research methods; complex systems; computational modeling; economic anthropology; United States

Jill E. Korbin, PhD  
(University of California, Los Angeles)  
*Professor; Associate Dean, College of Arts and Sciences; Director, Schubert Center for Child Studies; Co-Director, Childhood Studies Program*

Cultural, medical, and psychological anthropology; culture and human development; child maltreatment; neighborhood; United States; Old Order Amish

Janet McGrath, PhD  
(Northwestern University)  
*Associate Professor; Director of Graduate Programs; Associate Professor of International Health, School of Medicine*

Biomedical anthropology; anthropology of infectious disease; international and global health; AIDS; urban health; United States, Africa

Jim Shaffer, PhD  
(University of Wisconsin, Madison)  
*Associate Professor*

Archaeology; Middle East, Central Asia, Indus Valley, India

**Adjunct Faculty**

Katia Almeida, PhD  
(Federal University of Rio Janeiro)  
*Adjunct Assistant Professor*

Cultural and social anthropology; art and aesthetics in cross-cultural perspective; Amazonian ethnology; Latin American studies

Jennifer Furin, MD  
(Harvard University; University of California), PhD  
(Los Angeles)  
*Adjunct Assistant Professor; Assistant Professor, Department of Medicine, Division of Infectious Diseases, TB Research Unit*

Medical anthropology; infectious diseases; HIV; TB; community health; health policy and programming; Haiti, Peru, former Soviet Union, Resothe, Rwanda

Nomi Greber, PhD  
(Case Western Reserve University)  
*Adjunct Associate Professor; Curator of Archaeology, Cleveland Museum of Natural History*

Archaeology; Early/Middle Woodland of Eastern North America; Adena/Hopewell; geophysical remote sensing; archaeoastronomy

Yohannes Haile-Selassie, PhD  
(University of California, Berkeley)  
*Adjunct Professor; Curator and Head of Physical Anthropology, Cleveland Museum of Natural History*

Human evolution

Bruce Latimer, PhD  
(Kent State University)
ANTH 102. Being Human: An Introduction to Social and Cultural Anthropology. 3 Units.
The nature of culture and humans as culture-bearing animals. The range of cultural phenomena including language, social organization, religion, and culture change, and the relevance of anthropology for contemporary social, economic, and ecological problems.

ANTH 103. Introduction to Human Evolution. 3 Units.
Physical, cultural, and technological evolution of humans. The systematic interrelationships between humans, culture, and environment.

ANTH 202. Archaeology of Eastern North America. 3 Units.
This course is an introduction to the archaeology and prehistory of the eastern woodlands of North America. Course material will focus on the archaeological record of native societies living east of the Mississippi River from the first arrivals at the end of the Pleistocene up to the coming of Europeans. Specific topics for discussion include late Pleistocene settlement, hunter-gatherer environmental adaptations, the origin of food production, and the development of ranked societies.

ANTH 215. Health, Culture, and Disease: An Introduction to Medical Anthropology. 3 Units.
This course is an introduction to the field of Medical Anthropology. Medical Anthropology is concerned with the cross-cultural study of culture, health, and illness. During the course of the semester, our survey will include (1) theoretical orientations and key concepts; (2) the cross-cultural diversity of health beliefs and practices (abroad and at home); and (3) contemporary issues and special populations (e.g., AIDS, homelessness, refugees, women’s health, and children at risk).

ANTH 225. Evolution. 3 Units.
Multidisciplinary study of the course and processes of organic evolution provides a broad understanding of the evolution of structural and functional diversity, the relationships among organisms and their environments, and the phylogenetic relationships among major groups of organisms. Topics include the genetic basis of micro- and macro-evolutionary change, the concept of adaptation, natural selection, population dynamics, theories of species formation, principles of phylogenetic inference, biogeography, evolutionary rates, evolutionary convergence, homology, Darwinian medicine, and conceptual and philosophic issues in evolutionary theory. Offered as ANTH 225, BIOL 225, EEPS 225, HSTY 225, and PHIL 225.

ANTH 233. Introduction to Jewish Folklore. 3 Units.
Exploration of a variety of genres, research methods and interpretations of Jewish folklore, from antiquity to the present. Emphasis on how Jewish folk traditions and culture give us access to the spirit and mentality of the many different generations of the Jewish ethnic group, illuminating its past and informing the direction of its future development. Offered as ANTH 233, RLGN 233, and JDST 233.

ANTH 295. Comparative Primate Behavior. 3 Units.
The behavior of non-human primates (prosimians, monkeys, and apes) and the relevance of these studies for understanding the evolution of human behavior. Biological and ecological influences on behavior. The social aspects of primate life, both human and nonhuman. Recommended preparation: ANTH 102 or ANTH 103 or consent of department.

ANTH 301. Biological Aging in Humans. 3 Units.
Biological aging phenomena, evidence that various sociocultural and environmental influences may slow or accelerate the aging process, and theories explaining the evolution of the aging process. Recommended preparation: ANTH 103. Offered as ANTH 301 and ANTH 401.
ANTH 302. Darwinian Medicine. 3 Units.
Darwinian medicine deals with evolutionary aspects of modern human disease. It applies the concepts and methods of evolutionary biology to the question of why we are vulnerable to disease. Darwinian (or evolutionary) medicine proposes several general hypotheses about disease causation including disease as evolutionary legacy and design compromise, the result of a novel environment, a consequence of genetic adaptation, the result of infectious organisms’ evolutionary adaptations, and disease symptoms as manifestation of defense mechanisms. It proposes that evolutionary ideas can explain, help to prevent and perhaps help to treat some diseases. This course presents the basic logic of Darwinian medicine and evaluates hypotheses about specific diseases that illustrate each of the hypotheses about disease causation. Recommended preparation: ANTH 103. Offered as ANTH 302 and ANTH 402.

ANTH 304. Introduction to the Anthropology of Aging. 3 Units.
Reviews historical and methodological approaches to the study of aging. Examines theoretical assumptions about aging by comparing studies from Western and non-Western societies that illustrate the differential importance of culture in the experience of aging. Recommended preparation: ANTH 102. Offered as ANTH 304 and ANTH 404.

ANTH 305. Child Policy. 3 Units.
This course introduces students to issues in public policy that impacts children and families. Local, state and federal child policy will be considered, and topics will include, for example, policies related to child poverty, education, child welfare, juvenile justice, and children’s physical and mental health. Students will learn how policy is developed, how research informs policy and vice versa, and a framework for analyzing social policy. Recommended preparation: One social sciences course or consent. Offered as ANTH 305 and CHST 301.

ANTH 306. The Anthropology of Childhood and the Family. 3 Units.
Child-rearing patterns and the family as an institution, using evidence from Western and non-Western cultures. Human universals and cultural variation, the experience of childhood and recent changes in the American family. Recommended preparation: ANTH 102. Offered as ANTH 306 and ANTH 406.

ANTH 307. Experiential Learning in Child Policy. 3 - 6 Units.
Focus on state and federal legislative policy impacting children, youth, and families. Course includes an experiential learning component at the state or federal level and a travel experience to either Columbus, OH or Washington, DC to learn firsthand how policy is formed. Students may take this course twice for credit. Offered as ANTH 307 and CHST 302. Prereq: CHST 301.

ANTH 308. Child Policy Externship. 3 Units.
Externships offered through CHST 398/ANTH 308 give students an opportunity to work directly with professionals who design and implement policies that impact the lives of children and their families. Agencies involved are active in areas such as public health, including behavioral health, education, juvenile justice, childcare and/or child welfare. Students apply for the externships, and selected students are placed in local public or nonprofit agencies with a policy focus. Each student develops an individualized learning plan in consultation with the Childhood Studies Program faculty and the supervisor in the agency. CHST 398/ANTH 308 is a 3 credit-hour course and may be taken twice for a total of 6 credit hours. Offered as CHST 398 and ANTH 308. Prereq: CHST 301.

ANTH 310. Introduction to Linguistic Anthropology. 3 Units.
This is an introduction to the core concepts, theories and methodologies that form the study of language from an anthropological point of view. The course provides exposure to current issues in linguistic anthropological research and reviews some of the foundational topics of research past, highlighting the contributions of linguistics to anthropology and social science. Topics to be explored include: 1) an overview of the study of language (language structure and patterns, the effects of linguistic categories on thought and behavior, meaning and linguistic relativity, cross-language comparison, and non-verbal communication); 2) doing linguistic anthropology "on the ground" (an intro to the laboratory and field techniques of linguistic anthropology); 3) the study of language as function and social action (language and social structure speech acts and events, verbal art, language and emotion); and 4) the study of language/discourse and power (language in politics, medicine, and law). Offered as ANTH 310 and ANTH 410.

ANTH 313. The Anthropology of Adolescence. 3 Units.
This course investigates the anthropology of adolescence. What are the conditions under which adolescence has appeared around the world as a life stage? What are the roles of adolescence cross-culturally? What are the varieties of adolescent experience? Through classic and contemporary texts, the course will address these questions as well as special topics particularly important to adolescence such as globalization, mental health, and sexuality. Offered as ANTH 313 and ANTH 413.

ANTH 314. Cultures of the United States. 3 Units.
This course considers the rich ethnic diversity of the U.S. from the perspective of social/cultural anthropology. Conquest, immigration, problems of conflicts and accommodation, and the character of the diverse regional and ethnic cultures are considered as are forms of racism, discrimination, and their consequences. Groups of interest include various Latina/o and Native peoples, African-American groups, and specific ethnic groups of Pacific, Mediterranean, European, Asian, and Caribbean origin. Offered as ANTH 314, ETHS 314, and ANTH 414.

ANTH 317. Asian Medical Systems. 3 Units.
Examines the philosophical assumptions and therapies of the traditional and contemporary medical systems of India, Tibet, China, and Japan. Particular attention will be given to the folk, popular, and institutional sectors of medical practice as well as to the contemporary relationship between traditional medicine and Western medicine in each of these societies. Recommended preparation: ANTH 102. Offered as ANTH 317 and ANTH 417.

ANTH 318. Death and Dying. 3 Units.
Examines cultural context of death and dying. Topics include social and psychological consequences of changing patterns of mortality, attitudes towards the taking of life, preparation for death, mortuary rituals, grief and mourning, and nature of relationship between living and dead. Recommended preparation: ANTH 102. Offered as ANTH 318 or ANTH 418.
ANTH 319. Introduction to Statistical Analysis in the Social Sciences. 3 Units.
Statistical description (central tendency, variation, correlation, etc.) and statistical evaluation (two sample comparisons, regression, analysis of variance, non-parametric statistics). Developing an understanding of statistical inference, particularly on proper usage of statistical methods. Examples from the social sciences. Cannot be used to meet the A&S Humanities and Social Sciences requirement. Not available for credit to students who have completed STAT 201 or PSCL 282. Prereq: Major in Anthropology.

ANTH 321. Methods in Archaeology. 3 Units.
This course reviews the basic methods and techniques used in modern anthropological archaeology. Topics to be discussed include the nature of the archaeological record, research design, techniques of field archaeology, methods of laboratory analysis, museum archaeology, ethnoarchaeology, and cultural interpretation. Prereq: ANTH 107.

ANTH 323. AIDS: Epidemiology, Biology, and Culture. 3 Units.
This course will examine the biological and cultural impact of AIDS in different societies around the world. Topics include: the origin and evolution of the virus, the evolutionary implications of the epidemic, routes of transmission, a historical comparison of AIDS to other epidemics in human history, current worldwide prevalences of AIDS, and cultural responses to the epidemic. Special emphasis will be placed on the long-term biological and social consequences of the epidemic. Recommended preparation: ANTH 102 or ANTH 103 or ANTH 105. Offered as ANTH 323 and ANTH 423.

ANTH 324. Field Methods in Archaeology. 3 - 6 Units.
This field course is designed to give the student a comprehensive introduction to archaeological field work. All participants will be introduced to the methods of archaeological survey, techniques of hand excavation, artifact identification, and the preparation of field notes and documentation. In large measure this is a "learning through doing" course which is supplemented by formal and informal lectures and discussions about archaeological methods and regional prehistory. The Fields School is held as two, three-week sessions of instruction in the field. All participants are required to attend an orientation meeting that is held at the Museum on the first day of each session. The remainder of each session will take place from Monday through Friday at an archaeological site in northeast Ohio. Students are responsible for their own transportation to and from the field site and must bring a sack lunch. All participants will receive a field manual which will provide detailed information on the course and techniques of field work.

ANTH 326. Power, Illness, and Inequality: The Political Economy of Health. 3 Units.
This course explores the relationship between social inequality and the distribution of health and illness across class, race, gender, sexual orientation, and national boundaries. Class readings drawn from critical anthropological approaches to the study of health emphasize the fundamental importance of power relations and economic constraints in explaining patterns of disease. The course critically examines the nature of Western biomedicine and inequality in the delivery of health services. Special consideration is given to political economic analysis of health issues in the developing world such as AIDS, hunger, reproductive health, and primary health care provision. Recommended preparation: ANTH 102 or ANTH 215. Offered as ANTH 326 and ANTH 426.

ANTH 327. Ancient Cultures of the Ohio Region. 3 Units.
This course surveys the archaeology of Native American cultures in the Great Lakes region from ca. 10,000 B.C. to A.D. 1700. The geographic scope of this course is the upper Midwest, southern Ontario, and the St. Lawrence Valley with a focus on the Ohio region. Recommended preparation: ANTH 107. Offered as ANTH 327 and ANTH 427.

ANTH 330. Special Topics in Prehistory. 3 Units.
Special topics or geographical areas of archaeological significance (e.g., the origins of food production, the archaeology of the Mediterranean, the archaeology of North America). Recommended preparation: ANTH 102 or ANTH 107.

ANTH 331. The Most Ancient Near East. 3 Units.
The Near East, archaeologically, is the most intensely researched area in the world. The research, spanning 150 years, reveals a continuous record of human adaptation spanning two million years, five human species, multiple major environmental changes, and shifts in human adaptive strategies from nomadic hunting and gathering to sedentary village agriculture and the emergence of urban centers "civilization." The archaeological record of this extraordinary period beginning two million years ago until about 4000 BC is reviewed. Emphasis is placed on the human response to social and ecological changes. The course examines how the emergence of sedentary settlements, surplus food production, population growth, interregional trade, and socially-economically stratified societies fundamentally changed the human condition. Recommended preparation: ANTH 102 or ANTH 107.

ANTH 333. Roots of Ancient India: Archaeology of South Asia. 3 Units.
Archaeological discoveries in South Asia (modern India, Pakistan, Sri Lanka, Bangladesh, and Nepal) reveal a continuous record of human habitation from almost two million years ago until the present. Early human populations in the region encountered dramatically changing ecological conditions resulting in various cultural adaptations over this long period. Beginning with the earliest hunter-gatherer populations, archaeological data reveal a diversity of cultural changes/adaptations in South Asia resulting in the indigenous development of sedentary agricultural societies coexisting with hunters and gatherers, and with pastoral nomadic groups interacting over diverse ecospheres. These cultural developments resulted in the formation of the Harappan (Indus Valley) culture - a unique, ancient (2600-1300 BC) Old World civilization. Archaeological data indicate this Harappan culture provided basic fundamental cultural traits that evolved into the culturally Early Historic Indian Tradition. Special attention is given to theoretical controversies surrounding the cultural continuity issue in South Asian culture history and its significance for understanding Old World archaeology. Recommended preparation: ANTH 102 or ANTH 107.

ANTH 335. Illegal Drugs and Society. 3 Units.
This course provides perspectives on illegal drug use informed by the social, political and economic dimensions of the issues. Framed by the history, epidemiology, and medical consequences of drug use, students will confront the complex challenges posed by addiction. Anthropological research conducted in the U.S. and cross-culturally will demonstrate, elaborate and juxtapose various clinical, public health, and law enforcement policies and perspectives. Topics examined will include: why exclusively using a bio-medical model of addiction is inadequate; how effective is the war on drugs; what prevention, intervention and treatment efforts work; and various ideological/moral perspectives on illegal drug use. Offered as ANTH 335 and ANTH 435.
ANTH 337. Comparative Medical Systems. 3 Units.
This course considers the world’s major medical systems. Foci include professional and folk medical systems of Asia and South Asia, North and South America, Europe and the Mediterranean, including the Christian and Islamic medical traditions. Attention is paid to medical origins and the relationship of popular to professional medicines. The examination of each medical tradition includes consideration of its psychological medicine and system of medical ethics. Recommended preparation: ANTH 215. Offered as ANTH 337 and ANTH 437.

ANTH 338. Maternal Health: Anthropological Perspectives on Reproductive Practices and Health Policy. 3 Units.
The reproductive process is shared by humans as biological beings. However, the experience of pregnancy and childbirth is also dependent on the cultural, social, political, historical, and political-economic setting. This course frames issues in reproductive health by looking at the complex issues associated with maternal health and mortality worldwide. After reviewing biomedical perspectives on reproductive processes this course will focus on childbirth and pregnancy as the process and ritual by which societies welcome new members. This course will review ethnomedical concepts; discuss the interaction between local, national, and global agendas shaping reproductive practices; and conclude with anthropological critiques of reproductive health initiatives. Offered as ANTH 338 and ANTH 438.

ANTH 339. Ethnographic and Qualitative Research Methods. 3 Units.
This is a course on applying ethnographic research methods in the social sciences. Ethnographic research seeks to understand and describe the experiences of research participants (i.e. subjects) through becoming involved in their daily lives. Findings from ethnography are generated through systematic observation within the natural context in which behavior occurs (i.e. fieldwork). Unlike methods that emphasize detachment, distance, and objectivity, ethnography involves developing knowledge by becoming an ad hoc member of the group(s) one is studying. The principal techniques of ethnography, "participant-observation" and "In-depth open ended interviewing," require actively engaging the research process. This class will explore ethnographic research techniques, as well as other qualitative research methods. In addition to addressing how such methods make claims about social phenomena, this class will also explore more practical topics such as: developing questions, entering the field, establishing rapport, taking and managing field notes, coding data, and data analysis. Lectures, readings, and class discussion will be complimented by assignments using techniques. Offered as ANTH 339 and ANTH 439. Prereq: ANTH 102.

ANTH 341. Cultural Area Studies in Anthropology. 3 Units.
Recommended preparation: ANTH 102. Offered as ANTH 341 and ANTH 441.

ANTH 347. Cultural Ecology: An Epistemological Approach to Environmental Sustainability. 3 Units.
This course provides the understanding that the realm of human culture is where both the cause and cure of nearly all contemporary environmental sustainability challenges are found. This is because culture is the medium through which humans as living systems perceive, interpret, and act upon their environment. Through understanding principles that guide living systems and applying them to human/nature interaction in diverse cultures throughout the world, students develop an ecological epistemology, or way of knowing nature. This leads to more effective advocacy for environmental sustainability and an increasing depth in interaction with nature, particularly in the domains of aesthetics and the sacred. This course is an approved SAGES Departmental seminar. Offered as ANTH 347 and ANTH 447. Prereq: ANTH 102.

ANTH 349. Cultures of Latin America. 3 Units.
The aim of this course is to consider cultural diversity and social inequality in contemporary Latin America from an anthropological perspective. A variety of aspects related to ethnicity, religion, music, gender, social movements, cuisine, urban spaces, violence, and ecology are considered in addition to current economic and political issues. These topics will be analyzed in relation to Latin America’s complex historical and social formation and its identity representations. The course takes under consideration various case studies in which not just local communities but also perceptions of national institutions and practices will be analyzed from pluralistic approaches (provided by either Latin American and non-Latin American researchers) that combine fieldwork, interviews and life experiences with textual and media sources. Special attention will be paid to contemporary global issues affecting Latin America. Offered as ANTH 349 and ANTH 449. Prereq: ANTH 102.

ANTH 351. Topics in International Health. 3 Units.
Special topics of interest in International Health. Recommended preparation: ANTH 102 or ANTH 215. Offered as ANTH 351 and ANTH 451.

ANTH 352. Japanese Culture and Society. 3 Units.
Focuses on contemporary Japanese cultural and social institutions. Topics include child-rearing, personality, values, education, gender roles, the dual economy, and popular culture. Recommended preparation: ANTH 102. Offered as ANTH 352 and ANTH 452.

ANTH 353. Chinese Culture and Society. 3 Units.
Focuses on Chinese cultural and social institutions during the Maoist and post-Maoist eras. Topics include ideology, economics, politics, religion, family life, and popular culture. Recommended preparation: ANTH 102. Offered as ANTH 353 and ANTH 453.

ANTH 357. Native American Cultures. 3 Units.
Intensive examination of the cultures of selected Native American peoples, including historical, political, religious, social organizational, linguistic, and medical/psychiatric aspects of American Indian life. Not available for credit to students who have completed USSO 219. Recommended preparation: ANTH 102. Offered as ANTH 357 and ANTH 457.

ANTH 359. Introduction to International Health. 3 Units.
Critical health problems and needs in developing countries. Prevalence of infectious disease, malnutrition, chronic disease, injury control. Examines strategies for improvement of health in less developed countries. Recommended preparation: ANTH 102. Offered as ANTH 359 and ANTH 459.
ANTH 361. Urban Health. 3 Units.
This course provides an anthropological perspective on the most important health problems facing urban population around the world. Special attention will be given to an examination of disparities in health among urban residents based on poverty, race/ethnicity, gender, and nationality. Offered as ANTH 361 and ANTH 461.

ANTH 362. Contemporary Theory in Anthropology. 3 Units.
A critical examination of anthropological thought in England, France and the United States during the second half of the twentieth century. Emphasis will be on the way authors formulate questions that motivate anthropological discourse, on the way central concepts are formulated and applied and on the controversies and debates that result. Readings are drawn from influential texts by prominent contemporary anthropologists. Recommended preparation: ANTH 102. Offered as ANTH 362 and ANTH 462.

ANTH 365. Gender and Sex Differences: Cross-cultural Perspective. 3 Units.
Gender roles and sex differences throughout the life cycle considered from a cross-cultural perspective. Major approaches to explaining sex roles discussed in light of information from both Western and non-Western cultures. Offered as ANTH 365 and ANTH 465 and WGST 365. Prereq: ANTH 102 or consent of department.

ANTH 367. Topics in Evolutionary Biology. 3 Units.
The focus for this course on a special topic of interest in evolutionary biology will vary from one offering to the next. Examples of possible topics include theories of speciation, the evolution of language, the evolution of sex, evolution and biodiversity, molecular evolution. ANAT/ANTH/EEPS/PHIL/PHOL 467 BIOL 468 will require a longer, more sophisticated term paper, and additional class presentation. Offered as ANTH 367, BIOL 368, EEPS 367, PHIL 367, ANAT 467, ANTH 467, BIOL 468, EEPS 467, PHIL 467 and PHOL 467. Prereq: ANTH 225 or equivalent.

ANTH 368. Evolutionary Biology Capstone. 3 Units.
This course focuses on a special topic of interest in evolutionary biology that will vary from one offering to the next. Examples of possible topics include theories of speciation, the evolution of language, the evolution of sex, evolution and biodiversity, molecular evolution. Students will participate in discussions and lead class seminars on evolutionary topics and in collaboration with an advisor or advisors, select a topic for a research paper or project. Each student will write a major research report or complete a major project and will make a public presentation of her/his findings. Offered as ANTH 368, BIOL 369, PHIL 368. Prereq: ANTH 225, BIOL 225, GEOL 225, HSTY 225, PHIL 225 or its equivalent or permission of instructor.

ANTH 369. The Anthropology of Nutrition. 3 Units.
Examines human nutrition and physical performance within the framework of human adaptability theory. The emphasis is on the measurement of energetic intake and expenditure in human populations; the assessment, health consequences, and bio-cultural correlates of malnutrition and obesity; and the uses of energetic data in assessing human population adaptation. Recommended preparation: ANTH 103. Offered as ANTH 369 and ANTH 469.

ANTH 369D. The Anthropology of Nutrition. 3 Units.
Human nutrition is examined from an anthropological perspective. We will briefly cover methods for assessing and evaluating dietary intake and dietary patterns. The remainder of the course will focus on various social, ecological, and genetic factors which influence human nutritional patterns and the causes and consequences of protein-energy malnutrition. The course will be taught in a seminar format and is designed to enhance your skills in critically reading the anthropological literature and in improving your written and oral communication skills. A student may not receive credit for both ANTH 369 and ANTH 369D. Recommended preparation: ANTH 102, ANTH 103.

ANTH 370. Field Seminar in Paleoanthropology. 12 Units.
Paleoanthropology is the study of human physical and cultural evolution based on fossils and cultural remains from ancient geological times. These fossils and cultural remains are collected by conducting fieldwork in various parts of the world where geological phenomena have exposed fossiliferous sedimentary windows from the deep past. Hence, fieldwork is one of the major backbones of paleoanthropology. This course is designed for advanced undergraduate students who are interested in pursuing higher degrees in paleoanthropology, human paleobiology, evolutionary biology, or other related disciplines. This course introduces students to the principles and methods of paleontological fieldwork in real time. It introduces students to paleoanthropological fieldwork from locating fossiliferous areas based on aerial photo interpretations to survey methodology; from methods of systematic excavation, fossil collection and documentation in the field, to curation and preparation of fossil specimens in laboratories; from conducting scientific analyses in laboratory environments to subsequently publishing the results in peer-reviewed journals. Recommended preparation: ANTH 377. Prereq: ANTH 103 and ANTH 375.

ANTH 371. Culture, Behavior, and Person: Psychological Anthropology. 3 Units.
Cross-cultural perspectives on personality, human development, individual variability, cognition, deviant behavior, and the role of the individual in his/her society. Classic and contemporary anthropological writings on Western and non-Western societies. Recommended preparation: ANTH 102. Offered as ANTH 371 and ANTH 471.

ANTH 375. Human Evolution: The Fossil Evidence. 3 Units.
This course will survey the biological and behavioral changes that occurred in the hominid lineage during the past five million years. In addition to a thorough review of the fossil evidence for human evolution, students will develop the theoretical framework in evolutionary biology. Recommended preparation: ANTH 377, BIOL 225. Offered as ANAT 375, ANTH 375, ANTH 475 and ANTH 475. Prereq: ANTH 103.

ANTH 376. Topics in the Anthropology of Health and Medicine. 3 Units.
Special topics of interest, such as the biology of human adaptability; the ecology of the human life cycle health delivery systems; transcultural psychiatry; nutrition, health, and disease; paleoepidemiology; and population anthropology. Recommended preparation: ANTH 102 or ANTH 103. Offered as ANTH 376 and ANTH 476.

ANTH 377. Human Osteology. 4 Units.
This course for upper division undergraduates and graduate students will review the following topics: human skeletal development and identification; and forensic identification (skeletal aging, sex identification and population affiliation). Offered as ANAT 377, ANTH 377, ANAT 477 and ANTH 477.
ANTH 378. Reproductive Health: An Evolutionary Perspective. 3 Units.
This course provides students with an evolutionary perspective on the factors influencing human reproductive health, including reproductive biology, ecology, and various aspects of natural human fertility. Our focus will be on variation in human reproduction in mostly non-western populations. Recommended preparation for ANTH 378: ANTH 103. Offered as ANTH 378 and ANTH 478.

ANTH 379. Topics in Cultural and Social Anthropology. 3 Units.
Special topics of interest across the range of social and cultural anthropology. Recommended preparation: ANTH 102. Offered as ANTH 379 and ANTH 479.

ANTH 380. Independent Study in Laboratory Archaeology I. 1 - 3 Unit.
This course provides an introduction to the basic methods and techniques of artifact curation and laboratory analysis in archaeology. Under the supervision of the instructor, each student will develop and carry out a focused project of material analysis and interpretation using the archaeology collections of the Cleveland Museum of Natural History. Each student is required to spend a minimum of two hours per week in the Archaeology laboratory for each credit hour taken. By the end of the course, the student will prepare a short report describing the results of their particular project. Recommended preparation: ANTH 107 and permission of department, and prior permission of Department of Archaeology at the Cleveland Museum of Natural History.

ANTH 381. Independent Study in Laboratory Archaeology II. 1 - 3 Unit.
This course provides an introduction to the basic methods and techniques of artifact curation and laboratory analysis in archaeology. Under the supervision of the instructor, each student will develop and carry out a focused project of material analysis and interpretation using the archaeology collections of the Cleveland Museum of Natural History. Each student is required to spend a minimum of two hours per week in the Archaeology laboratory for each credit hour taken. By the end of the course, the student will prepare a short report describing the results of their particular project. Recommended preparation: ANTH 107 and permission of department, and prior permission of Department of Archaeology at the Cleveland Museum of Natural History.

ANTH 382. Anthropological and Ecological Perspectives on Preserving and Restoring the Natural World. 3 Units.
Now that the environmentally deleterious effects of modern Western culture on the natural world have reached major proportions it has become crucial to explore innovative solutions to this dilemma. In this course novel perspectives derived from the intersection of anthropology and ecology are discussed. The primary perspective focused upon is the understanding that human culture and the natural world in which it is embedded are essentially communicative, or semiotic processes, which thrive upon diverse interaction and feedback. Preserving and restoring the Natural World thus shifts from protecting individual species and particular cultural practices to enhancing the communicative matrix of life and multiple cultural views of the environment. Through this understanding, students will learn to apply a more elegant, effective, and aesthetically pleasing perspective to the challenging environmental issues facing our contemporary world. An in-depth examination of the North American Prairie, along with a comparison of influences on the landscape by indigenous and modern Western Culture will serve as the particular region of focus. This course is an approved SAGES departmental seminar. Offered as ANTH 382 and ANTH 482.

ANTH 385. Applied Anthropology. 3 Units.
This class will provide students with an overview of how anthropologists put theories, methods, and findings to use in addressing social issues and problems. Applied projects presented will span a diverse range of topics and fields, including: healthcare and medicine, nutrition, international development, displacement of populations, education, as well projects from business and industry. Class discussion will address orientations of and advantages in applied approaches, as well the ethical questions such projects often encounter. Offered as ANTH 385 and ANTH 485.

ANTH 388. Globalization, Development and Underdevelopment: Anthropological Persp. 3 Units.
This course examines both theoretical and practical perspectives on globalization and economic development in the "Third World." From "Dependency," "Modernization," and "World System" theory to post-structuralist critiques of development discourse, the class seeks to provide a framework for understanding current debates on development and globalization. The "neoliberal monologue" that dominates the contemporary development enterprise is critically examined in the context of growing global inequality. Special consideration is given to the roles of international agencies such as the World Bank, International Monetary Fund, United Nations, and non-governmental organizations (NGOs) in the "development industry." The course also focuses on the contribution of anthropologists to development theory and practice with emphasis on the impact of development on the health of the poor and survival of indigenous cultures. Opportunities for professional anthropologists in the development field are reviewed. Offered as ANTH 388 and ANTH 488. Prereq: ANTH 102.

ANTH 391. Honors Tutorial. 3 Units.
Prereq: Acceptance into Honors Program.

ANTH 392. Honors Tutorial. 3 Units.
Prereq: Acceptance into Honors Program.

ANTH 393. Human Ecology: The Biology of Human Adaptability. 3 Units.
The place of human populations in the ecosystem. The importance of biological and behavioral responses of populations ranging from hunters and gatherers to contemporary and industrial societies. The effect of various natural and manmade stresses on man’s adaptation to the environment. Recommended preparation: ANTH 103. Offered as ANTH 393 and ANTH 493.

ANTH 394. Seminar in Evolutionary Biology. 3 Units.
This seminar investigates 20th-century evolutionary theory, especially the Modern Evolutionary synthesis and subsequent expansions of and challenges to that synthesis. The course encompasses the multidisciplinary nature of the science of evolution, demonstrating how disciplinary background influences practitioners’ conceptualizations of pattern and process. This course emphasizes practical writing and research skills, including formulation of testable theses, grant proposal techniques, and the implementation of original research using the facilities on campus and at the Cleveland Museum of Natural History. Offered as ANTH 394, BIOL 394, EEPS 394, HSTY 394, PHIL 394, ANTH 494, BIOL 494, EEPS 494, HSTY 494, and PHIL 494.
ANTH 396. Undergraduate Research in Evolutionary Biology. 3 Units.
Students propose and conduct guided research on an aspect of evolutionary biology. The research will be sponsored and supervised by a member of the CASE faculty or other qualified professional. A written report must be submitted to the Evolutionary Biology Steering Committee before credit is granted. Offered as ANTH 396, BIOL 396, EEPS 396, and PHIL 396. Prereq: ANTH 225 or equivalent.

ANTH 398. Anthropology SAGES Capstone. 3 Units.
Supervised original research on a topic in anthropology, culminating in a written report and a public presentation. The research project may be in the form of an independent research project, a literature review, or some other original project with anthropological significance. The project must be approved and supervised by faculty. Group research projects are acceptable, but a plan which clearly identifies the distinct and substantial role of each participant must be approved by the supervising faculty. Prereq: Major in Anthropology.

ANTH 398C. Child Policy Externship and Capstone. 3 Units.
Externships offered through CHST/ANTH/PSCL 398C give students an opportunity to work directly with professionals who design and implement policies that impact the lives of children and their families. Agencies involved are active in areas such as public health, including behavioral health, education, juvenile justice, childcare and/or child welfare. Students apply for the externships, and selected students are placed in local public or nonprofit agencies with a policy focus. Each student develops an individualized learning plan in consultation with the Childhood Studies Program faculty and the supervisor in the agency. Offered as CHST 398C, ANTH 398C, and PSCL 398C. Prereq: CHST 301.

ANTH 399. Independent Study. 1 - 6 Unit.
Students may propose topics for independent reading and research.

ANTH 401. Biological Aging in Humans. 3 Units.
Biological aging phenomena, evidence that various sociocultural and environmental influences may slow or accelerate the aging process, and theories explaining the evolution of the aging process. Recommended preparation: ANTH 103. Offered as ANTH 301 and ANTH 401.

ANTH 402. Darwinian Medicine. 3 Units.
Darwinian medicine deals with evolutionary aspects of modern human disease. It applies the concepts and methods of evolutionary biology to the question of why we are vulnerable to disease. Darwinian (or evolutionary) medicine proposes several general hypotheses about disease causation including disease as evolutionary legacy and design compromise, the result of a novel environment, a consequence of genetic adaptation, the result of infectious organisms’ evolutionary adaptations, and disease symptoms as manifestation of defense mechanisms. It proposes that evolutionary ideas can explain, help to prevent and perhaps help to treat some diseases. This course presents the basic logic of Darwinian medicine and evaluates hypotheses about specific diseases that illustrate each of the hypotheses about disease causation. Recommended preparation: ANTH 103. Offered as ANTH 302 and ANTH 402.

ANTH 404. Introduction to the Anthropology of Aging. 3 Units.
Reviews historical and methodological approaches to the study of aging. Examines theoretical assumptions about aging by comparing studies from Western and non-Western societies that illustrate the differential importance of culture in the experience of aging. Recommended preparation: ANTH 102. Offered as ANTH 304 and ANTH 404.

ANTH 406. The Anthropology of Childhood and the Family. 3 Units.
Child-rearing patterns and the family as an institution, using evidence from Western and non-Western cultures. Human universals and cultural variation, the experience of childhood and recent changes in the American family. Recommended preparation: ANTH 102. Offered as ANTH 306 and ANTH 406.

ANTH 410. Introduction to Linguistic Anthropology. 3 Units.
This is an introduction to the core concepts, theories and methodologies that form the study of language from an anthropological point of view. The course provides exposure to current issues in linguistic anthropological research and reviews some of the foundational topics of research past, highlighting the contributions of linguistics to anthropology and social science. Topics to be explored include: 1) an overview of the study of language (language structure and patterns, the effects of linguistic categories on thought and behavior, meaning and linguistic relativity, cross-language comparison, and non-verbal communication); 2) doing linguistic anthropology "on the ground" (an intro to the laboratory and field techniques of linguistic anthropology); 3) the study of language as function and social action (language and social structure speech acts and events, verbal art, language and emotion); and 4) the study of language/discourse and power (language in politics, medicine, and law). Offered as ANTH 310 and ANTH 410.

ANTH 413. The Anthropology of Adolescence. 3 Units.
This course investigates the anthropology of adolescence. What are the conditions under which adolescence has appeared around the world as a life stage? What are the roles of adolescence cross-culturally? What are the varieties of adolescent experience? Through classic and contemporary texts, the course will address these questions as well as special topics particularly important to adolescence such as globalization, mental health, and sexuality. Offered as ANTH 313 and ANTH 413.

ANTH 414. Cultures of the United States. 3 Units.
This course considers the rich ethnic diversity of the U.S. from the perspective of social/cultural anthropology. Conquest, immigration, problems of conflicts and accommodation, and the character of the diverse regional and ethnic cultures are considered as are forms of racism, discrimination, and their consequences. Groups of interest include various Latina/o and Native peoples, African-American groups, and specific ethnic groups of Pacific, Mediterranean, European, Asian, and Caribbean origin. Offered as ANTH 314, ETHS 314, and ANTH 414.

ANTH 417. Asian Medical Systems. 3 Units.
Examines the philosophical assumptions and therapies of the traditional and contemporary medical systems of India, Tibet, China, and Japan. Particular attention will be given to the folk, popular, and institutional sectors of medical practice as well as to the contemporary relationship between traditional medicine and Western medicine in each of these societies. Recommended preparation: ANTH 102. Offered as ANTH 317 and ANTH 417.
ANTH 418. Death and Dying. 3 Units.
Examines cultural context of death and dying. Topics include social and psychological consequences of changing patterns of mortality, attitudes towards the taking of life, preparation for death, mortuary rituals, grief and mourning, and nature of relationship between living and dead. Recommended preparation: ANTH 102. Offered as ANTH 318 or ANTH 418.

ANTH 423. AIDS: Epidemiology, Biology, and Culture. 3 Units.
This course will examine the biological and cultural impact of AIDS in different societies around the world. Topics include: the origin and evolution of the virus, the evolutionary implications of the epidemic, routes of transmission, a historical comparison of AIDS to other epidemics in human history, current worldwide prevalences of AIDS, and cultural responses to the epidemic. Special emphasis will be placed on the long-term biological and social consequences of the epidemic. Recommended preparation: ANTH 102 or ANTH 103 or ANTH 105. Offered as ANTH 323 and ANTH 423.

ANTH 426. Power, Illness, and Inequality: The Political Economy of Health. 3 Units.
This course explores the relationship between social inequality and the distribution of health and illness across class, race, gender, sexual orientation, and national boundaries. Class readings drawn from critical anthropological approaches to the study of health emphasize the fundamental importance of power relations and economic constraints in explaining patterns of disease. The course critically examines the nature of Western biomedicine and inequality in the delivery of health services. Special consideration is given to political economic analysis of health issues in the developing world such as AIDS, hunger, reproductive health, and primary health care provision. Recommended preparation: ANTH 102 or ANTH 215. Offered as ANTH 326 and ANTH 426.

ANTH 427. Ancient Cultures of the Ohio Region. 3 Units.
This course surveys the archaeology of Native American cultures in the Great Lakes region from ca. 10,000 B.C. to A.D. 1700. The geographic scope of this course is the upper Midwest, southern Ontario, and the St. Lawrence Valley with a focus on the Ohio region. Recommended preparation: ANTH 107. Offered as ANTH 327 and ANTH 427.

ANTH 435. Illegal Drugs and Society. 3 Units.
This course provides perspectives on illegal drug use informed by the social, political and economic dimensions of the issues. Framed by the history, epidemiology, and medical consequences of drug use, students will confront the complex challenges posed by addiction. Anthropological research conducted in the U.S. and cross-culturally will demonstrate, elaborate and juxtapose various clinical, public health, and law enforcement policies and perspectives. Topics examined will include: why exclusively using a bio-medical model of addiction is inadequate; how effective is the war on drugs; what prevention, intervention and treatment efforts work; and various ideological/moral perspectives on illegal drug use. Offered as ANTH 335 and ANTH 435.

ANTH 437. Comparative Medical Systems. 3 Units.
This course considers the world’s major medical systems. Foci include professional and folk medical systems of Asia and South Asia, North and South America, Europe and the Mediterranean, including the Christian and Islamic medical traditions. Attention is paid to medical origins and the relationship of popular to professional medicines. The examination of each medical tradition includes consideration of its psychological medicine and system of medical ethics. Recommended preparation: ANTH 215. Offered as ANTH 337 and ANTH 437.

ANTH 438. Maternal Health: Anthropological Perspectives on Reproductive Practices and Health Policy. 3 Units.
The reproductive process is shared by humans as biological beings. However, the experience of pregnancy and childbirth is also dependent on the cultural, social, political, historical, and political-economic setting. This course frames issues in reproductive health by looking at the complex issues associated with maternal health and mortality worldwide. After reviewing biomedical perspectives on reproductive processes this course will focus on childbirth and pregnancy as the process and ritual by which societies welcome new members. This course will review ethnomedical concepts; discuss the interaction between local, national, and global agendas shaping reproductive practices; and conclude with anthropological critiques of reproductive health initiatives. Offered as ANTH 338 and ANTH 438.

ANTH 439. Ethnographic and Qualitative Research Methods. 3 Units.
This is a course on applying ethnographic research methods in the social sciences. Ethnographic research seeks to understand and describe the experiences of research participants (i.e. subjects) through becoming involved in their daily lives. Findings from ethnography are generated through systematic observation within the natural context in which behavior occurs (i.e. fieldwork). Unlike methods that emphasize detachment, distance, and objectivity, ethnography involves developing knowledge by becoming an ad hoc member of the group(s) one is studying. The principal techniques of ethnography, "participant-observation" and "in-depth open ended interviewing," require actively engaging the research process. This class will explore ethnographic research techniques, as well as other qualitative research methods. In addition to addressing how such methods make claims about social phenomena, this class will also explore more practical topics such as: developing questions, entering the field, establishing rapport, taking and managing field notes, coding data, and data analysis. Lectures, readings, and class discussion will be complimented by assignments using techniques. Offered as ANTH 339 and ANTH 439.

ANTH 441. Cultural Area Studies in Anthropology. 3 Units.
Recommended preparation: ANTH 102. Offered as ANTH 341 and ANTH 441.

ANTH 442. The Challenge of Suffering: Meaning, Responses, and Potential for Growth. 3 Units.
The interdisciplinary course will address the multiple facets of suffering, including the meaning of suffering, potential for growth and transformation, policies and practices that influence suffering, and those factors that affect quality of life and quality of death. Concepts and theories will be drawn from the social sciences and humanities, as well as from the health disciplines. The influence of socio-political, cultural, and economic forces of suffering will be addressed. Graduate standing or permission of instructor is required. Offered as: ANTH 442 and MEDS 9440 and NURS 440.
ANTH 447. Cultural Ecology: An Epistemological Approach to Environmental Sustainability. 3 Units.
This course provides the understanding that the realm of human culture is where both the cause and cure of nearly all contemporary environmental sustainability challenges are found. This is because culture is the medium through which humans as living systems perceive, interpret, and act upon their environment. Through understanding principles that guide living systems and applying them to human/nature interaction in diverse cultures throughout the world, students develop an ecological epistemology, or way of knowing nature. This leads to more effective advocacy for environmental sustainability and an increasing depth in interaction with nature, particularly in the domains of aesthetics and the sacred. This course is an approved SAGES Departmental seminar. Offered as ANTH 347 and ANTH 447.

ANTH 449. Cultures of Latin America. 3 Units.
The aim of this course is to consider cultural diversity and social inequality in contemporary Latin America from an anthropological perspective. A variety of aspects related to ethnicity, religion, music, gender, social movements, cuisine, urban spaces, violence, and ecology are considered in addition to current economic and political issues. These topics will be analyzed in relation to Latin America’s complex historical and social formation and its identity representations. The course takes under consideration various case studies in which not just local communities but also perceptions of national institutions and practices will be analyzed from pluralistic approaches (provided by either Latin American and non-Latin American researchers) that combine fieldwork, interviews and life experiences with textual and media sources. Special attention will be paid to contemporary global issues affecting Latin America. Offered as ANTH 349 and ANTH 449.

ANTH 451. Topics in International Health. 3 Units.
Special topics of interest in International Health. Recommended preparation: ANTH 102 or ANTH 215. Offered as ANTH 351 and ANTH 451.

ANTH 452. Japanese Culture and Society. 3 Units.
Focuses on contemporary Japanese cultural and social institutions. Topics include child-rearing, personality, values, education, gender roles, the dual economy, and popular culture. Recommended preparation: ANTH 102. Offered as ANTH 352 and ANTH 452.

ANTH 453. Chinese Culture and Society. 3 Units.
Focuses on Chinese cultural and social institutions during the Maoist and post-Maoist eras. Topics include ideology, economics, politics, religion, family life, and popular culture. Recommended preparation: ANTH 102. Offered as ANTH 353 and ANTH 453.

ANTH 457. Native American Cultures. 3 Units.
Intensive examination of the cultures of selected Native American peoples, including historical, political, religious, social organizational, linguistic, and medical/psychiatric aspects of American Indian life. Not available for credit to students who have completed USSO 219. Recommended preparation: ANTH 102. Offered as ANTH 357 and ANTH 457.

ANTH 459. Introduction to International Health. 3 Units.
Critical health problems and needs in developing countries. Prevalence of infectious disease, malnutrition, chronic disease, injury control. Examines strategies for improvement of health in less developed countries. Recommended preparation: ANTH 102. Offered as ANTH 359 and ANTH 459.

ANTH 461. Urban Health. 3 Units.
This course provides an anthropological perspective on the most important health problems facing urban population around the world. Special attention will be given to an examination of disparities in health among urban residents based on poverty, race/ethnicity, gender, and nationality. Offered as ANTH 361 and ANTH 461.

ANTH 462. Contemporary Theory in Anthropology. 3 Units.
A critical examination of anthropological thought in England, France and the United States during the second half of the twentieth century. Emphasis will be on the way authors formulate questions that motivate anthropological discourse, on the way central concepts are formulated and applied and on the controversies and debates that result. Readings are drawn from influential texts by prominent contemporary anthropologists. Recommended preparation: ANTH 102. Offered as ANTH 362 and ANTH 462.

ANTH 465. Gender and Sex Differences: Cross-cultural Perspective. 3 Units.
Gender roles and sex differences throughout the life cycle considered from a cross-cultural perspective. Major approaches to explaining sex roles discussed in light of information from both Western and non-Western cultures. Offered as ANTH 365 and ANTH 465 and WGST 365.

ANTH 467. Topics in Evolutionary Biology. 3 Units.
The focus for this course on a special topic of interest in evolutionary biology will vary from one offering to the next. Examples of possible topics include theories of speciation, the evolution of language, the evolution of sex, evolution and biodiversity, molecular evolution. ANAT/ANTH/EEPS/PHIL/PHOL 467/BIOL 468 will require a longer, more sophisticated term paper, and additional class presentation. Offered as ANTH 367, BIOL 368, EEPS 367, PHIL 367, ANAT 467, ANTH 467, BIOL 468, EEPS 467, PHIL 467 and PHOL 467.

ANTH 469. The Anthropology of Nutrition. 3 Units.
Examines human nutrition and physical performance within the framework of human adaptability theory. The emphasis is on the measurement of energetic intake and expenditure in human populations; the assessment, health consequences, and bio-cultural correlates of malnutrition and obesity; and the uses of energetic data in assessing human population adaptation. Recommended preparation: ANTH 103. Offered as ANTH 369 and ANTH 469.

ANTH 470. Tutorial in Physical Anthropology. 3 Units.
Guided readings in physical anthropology. Recommended preparation: Graduate standing and consent of department.

ANTH 471. Culture, Behavior, and Person: Psychological Anthropology. 3 Units.
Cross-cultural perspectives on personality, human development, individual variability, cognition, deviant behavior, and the role of the individual in his/her society. Classic and contemporary anthropological writings on Western and non-Western societies. Recommended preparation: ANTH 102. Offered as ANTH 371 and ANTH 471.

ANTH 475. Human Evolution: The Fossil Evidence. 3 Units.
This course will survey the biological and behavioral changes that occurred in the hominid lineage during the past five million years. In addition to a thorough review of the fossil evidence for human evolution, students will develop the theoretical framework in evolutionary biology. Recommended preparation: ANTH 377, BIOL 225. Offered as ANTH 375, ANTH 375, ANAT 475 and ANTH 475. Prereq: ANTH 103.
ANTH 476. Topics in the Anthropology of Health and Medicine. 3 Units.
Special topics of interest, such as the biology of human adaptability; the ecology of the human life cycle health delivery systems; transcultural psychiatry; nutrition, health, and disease; paleoepidemiology; and population anthropology. Recommended preparation: ANTH 102 or ANTH 103. Offered as ANTH 376 and ANTH 476.

ANTH 477. Human Osteology. 4 Units.
This course for upper division undergraduates and graduate students will review the following topics: human skeletal development and identification; and forensic identification (skeletal aging, sex identification and population affiliation). Offered as ANAT 377, ANTH 377, ANAT 477 and ANTH 477.

ANTH 478. Reproductive Health: An Evolutionary Perspective. 3 Units.
This course provides students with an evolutionary perspective on the factors influencing human reproductive health, including reproductive biology, ecology, and various aspects of natural human fertility. Our focus will be on variation in human reproduction in mostly non-western populations. Recommended preparation for ANTH 378: ANTH 103. Offered as ANTH 378 and ANTH 478.

ANTH 479. Topics in Cultural and Social Anthropology. 3 Units.
Special topics of interest across the range of social and cultural anthropology. Recommended preparation: ANTH 102. Offered as ANTH 379 and ANTH 479.

ANTH 480. Medical Anthropology and Global Health I. 3 Units.
The first in a sequence of two graduate core courses in medical anthropology and global health. This course focuses on foundational concepts and theories in medical anthropology, as well as topical areas which have been central to the development of the field. Prereq: Graduate Standing in Anthropology.

ANTH 481. Medical Anthropology and Global Health II. 3 Units.
The second in a sequence of two graduate core courses in medical anthropology and global health. This course focuses on the application of medical anthropology theory and methods to the study of global health. Recommended preparation: ANTH 480. Prereq: Graduate Standing in Anthropology.

ANTH 482. Anthropological and Ecological Perspectives on Preserving and Restoring the Natural World. 3 Units.
Now that the environmentally deleterious effects of modern Western culture on the natural world have reached major proportions it has become crucial to explore innovative solutions to this dilemma. In this course novel perspectives derived from the intersection of anthropology and ecology are discussed. The primary perspective focused upon is the understanding that human culture and the natural world in which it is embedded are essentially communicative, or semiotic processes, which thrive upon diverse interaction and feedback. Preserving and restoring the Natural World thus shifts from protecting individual species and particular cultural practices to enhancing the communicative matrix of life and multiple cultural views of the environment. Through this understanding, students will learn to apply a more elegant, effective, and aesthetically pleasing perspective to the challenging environmental issues facing our contemporary world. An in-depth examination of the North American Prairie, along with a comparison of influences on the landscape by indigenous and modern Western Culture will serve as the particular region of focus. This course is an approved SAGES departmental seminar. Offered as ANTH 382 and ANTH 482.

ANTH 485. Applied Anthropology. 3 Units.
This class will provide students with an overview of how anthropologists put theories, methods, and findings to use in addressing social issues and problems. Applied projects presented will span a diverse range of topics and fields, including: healthcare and medicine, nutrition, international development, displacement of populations, education, as well projects from business and industry. Class discussion will address orientations of and advantages in applied approaches, as well the ethical questions such projects often encounter. Offered as ANTH 385 and ANTH 485.

ANTH 488. Globalization, Development and Underdevelopment: Anthropological Persp. 3 Units.
This course examines both theoretical and practical perspectives on globalization and economic development in the "Third World." From "Dependency," "Modernization," and "World System" theory to post-structuralist critiques of development discourse, the class seeks to provide a framework for understanding current debates on development and globalization. The "neoliberal monologue" that dominates the contemporary development enterprise is critically examined in the context of growing global inequality. Special consideration is given to the roles of international agencies such as the World Bank, International Monetary Fund, United Nations, and non-governmental organizations (NGOs) in the "development industry." The course also focuses on the contribution of anthropologists to development theory and practice with emphasis on the impact of development on the health of the poor and survival of indigenous cultures. Opportunities for professional anthropologists in the development field are reviewed. Offered as ANTH 388 and ANTH 488.

ANTH 493. Human Ecology: The Biology of Human Adaptability. 3 Units.
The place of human populations in the ecosystem. The importance of biological and behavioral responses of populations ranging from hunters and gatherers to contemporary and industrial societies. The effect of various natural and manmade stresses on man's adaptation to the environment. Recommended preparation: ANTH 103. Offered as ANTH 393 and ANTH 493.
ANTH 494. Seminar in Evolutionary Biology. 3 Units.
This seminar investigates 20th-century evolutionary theory, especially the Modern Evolutionary synthesis and subsequent expansions of and challenges to that synthesis. The course encompasses the multidisciplinary nature of the science of evolution, demonstrating how disciplinary background influences practitioners' conceptualizations of pattern and process. This course emphasizes practical writing and research skills, including formulation of testable theses, grant proposal techniques, and the implementation of original research using the facilities on campus and at the Cleveland Museum of Natural History. Offered as ANTH 394, BIOL 394, EEPS 394, HSTY 394, PHIL 394, ANTH 494, BIOL 494, EEPS 494, HSTY 494, and PHIL 494.

ANTH 495. Research Practicum in Medical Anthropology and Global Health. 3 Units.
This course prepares selected Anthropology graduate students for research in medical anthropology and global health in both local and global settings, with the goal of enhancing the research skills of students early in their graduate careers. Prereq: Graduate standing in Anthropology.

ANTH 496. Public Policy and Aging. 3 Units.
Overview of aging and the aged. Concepts in the study of public policy. Policies on aging and conditions that they address. The politics of policies on aging. Emergent trends and issues. Offered as ANTH 498, BETH 496, EPBI 408, GERO 496, HSTY 480, MPH 408, NURS 479, NURS 579, POSC 480, and SOCI 496.

ANTH 502. Research Practicum in Med Anthropology and Cross-cultural Gerontology. 3 Units.
Provides M.A. students with firsthand experience in applying anthropology to health and aging problems. Prereq: Graduate standing.

ANTH 503. Seminar in Social Cultural Anthropology. 3 Units.

ANTH 504. Anthropological Research Design. 3 Units.
Practical and theoretical issues in the selection of questions for health and aging research in societal settings. Illustration of frameworks and designs for research. Discussion of the problems of collection, analysis, and interpretation of data along with the nonscientific influences on the research process and the use of results. Prereq: Graduate standing in anthropology.

ANTH 506. Seminar in Comparative Health Systems. 3 Units.
Prereq: ANTH 480.

ANTH 507. Seminar in Controversial Issues in Anthropology. 3 Units.
The goals of this course are to provide students with opportunities to: (1) Familiarize themselves with the (alleged) facts of various controversial issues that have characterized the field of anthropology over the past 50 years; (2) enhance their skills in analyzing and assessing the nature and quality of the arguments and empirical data employed by parties to the controversies; (3) develop an appreciation of the role of historical and political contexts in shaping the emergence and evolution of the controversies; and (4) consider the ethics involved in the practice and public representation of anthropology. Prereq: ANTH 480 and ANTH 481.

ANTH 508. Seminar in Policy and Program Planning and Evaluation. 3 Units.
Prereq: ANTH 504.

(Credit as arranged.) Advanced studies in anthropology.

(Credit as arranged.) Advanced studies in anthropology.

ANTH 601. Independent Research. 1 - 18 Unit.
(Credit as arranged.)

ANTH 651. Thesis M.A.. 1 - 18 Unit.
(Assigned.)

ANTH 701. Dissertation Ph.D.. 1 - 18 Unit.
(Credit as arranged.) Prereq: Predoctoral research consent or advanced to Ph.D. candidacy milestone.
Department of Art History and Art

The Department of Art History and Art (http://www.case.edu/artsci/arth/arth.html) offers opportunities to study art history, to participate in a broad range of studio offerings, to pursue state teacher licensure in art education, and to engage in pre-professional museum training. The Bachelor of Arts degree is granted in art history and in pre-architecture (second major only), and the Bachelor of Science degree in art education. The department offers graduate programs leading to the degrees of Master of Arts in art history, Master of Arts in art history and museum studies, and Master of Arts in art education, Doctor of Philosophy in art history, and Doctor of Philosophy in art history and museum studies. Qualified undergraduates majoring in art history or art education may participate in the Integrated Graduate Studies Program.

All art programs are considerably enhanced by close cooperation with cultural institutions located in University Circle, in particular the Cleveland Museum of Art, the Cleveland Institute of Art, and the Museum of Contemporary Art (MOCA).

Art History Program

Students majoring in art history have a wide variety of career opportunities. Graduates with a strong background in art history are employed as college and university professors; as museum professionals (in curatorial, educational, and administrative positions); as art librarians and archivists; as journalists; as art gallery or auction house staff members; as art conservators and restorers; as art specialists in the diplomatic service and at all levels of government; and in other careers in industry, film, and television. Some of these specialties require additional study and professional preparation beyond the bachelor’s degree. Other art history majors who have fulfilled the required prerequisites go on to attend law, medical, or business school.

The graduate programs in art history are offered as part of the joint program in art history of Case Western Reserve University and the Cleveland Museum of Art. Many classes, undergraduate and graduate level, are taught at the museum, and some courses are offered or co-taught by museum curators who hold adjunct appointments in the department. Students taking advanced-level courses use the museum’s extensive research library, and all students have an opportunity to study original works of art in the museum’s superb collections.

Art Education Program

The Art Education Program’s mission is “to prepare proactive, scholar-practitioner art educators who will develop into leaders, teachers, and talented artists in the field of art education.”

The undergraduate and graduate degree programs in art education are offered in conjunction with the Cleveland Institute of Art. Art education majors have the advantage of pursuing their academic studies in a university environment and their studio studies at a professional art school that educates artists and designers. Students participate in educational field experiences conducted in many of Greater Cleveland’s urban and suburban school systems, museums, and cultural institutions. Graduates of the Art Education Program have pursued careers as teachers, supervisors, and consultants in public and private schools, colleges, art schools, and museums; as administrators of galleries and art organizations; as designers of educational programs for industry; and as practicing artists. The program is especially proud of its record in recruiting and graduating students from diverse backgrounds.

The program offers pre-architecture as a second major and as a minor for students who expect to continue architectural studies at the graduate level or who simply wish to pursue an area of interest. For students seeking to develop and nurture their artistic and creative talents, the program offers a variety of introductory and intermediate art studio courses, taught by experienced artists/teachers.

Art Studio Program

The Art Studio Program offers a variety of art courses that can be taken for personal enjoyment to gain experience in a variety of art media. Courses in drawing, painting, design, ceramics, enameling and jewelry, textiles, photography, digital media, and architecture are taught at various skill levels by experienced, professional artists. These courses can be taken as university electives to fulfill minors in art studio, photography, or architecture, or to complete a second major in pre-architecture. At the end of each semester there is a comprehensive exhibition of student work in the Art Gallery.

BA Art History | BS Art Education | BA Pre-Architecture | Minors

Undergraduate Programs

The art history curriculum is designed to give students a broad grounding in painting, sculpture, architecture, and the decorative arts, with a strong emphasis on understanding the cultural context in which they were produced. Students develop a technical and critical vocabulary as well as sound writing skills to analyze works of art.

Integrated Graduate Studies Program. Qualified undergraduates majoring in art history or art education may also participate in the Integrated Graduate Studies Program (p. 549). Interested students should note the general requirements and the admission procedures in this bulletin and may consult the department for further information.

Majors

Bachelor of Arts in Art History

This major requires 36 hours of course work in art history, including:

- ARTH 101 Art History I: Pyramids to Pagodas 3
- ARTH 102 Art History II: Michelangelo to Maya Lin 3
- Art History 200-level courses 3-6
- ARTH 396 Majors Seminar 3
- Art History electives at the 300 level 15-18
- Art Studio courses 3-6

Foreign language study (French, German, or Italian) is highly recommended.

Departmental Honors. Majors who wish to earn the Bachelor of Arts degree with honors in art history must make written application to the department chair no later than the fall semester of their senior year. Departmental honors are awarded upon fulfillment of the following requirements: a grade point average of at least 3.5 in the major and an A in ARTH 399 Honors Thesis.

Bachelor of Science in Art Education

The Bachelor of Science in art education requires a total of 124 credits and is designed to educate professional teachers of art for the public and private schools who are also competent, creative artists. The program meets the requirements of the Ohio Board of Education to qualify its university-recommended students for Pre-K-12 Visual Art Specialist Licensure to teach art in the public schools of Ohio and more than 40 reciprocating states.

This program is conducted jointly by Case Western Reserve University and the Cleveland Institute of Art. Admission requires application to Case
Western Reserve and submission of an art portfolio to the Cleveland Institute of Art. Credentials must be acceptable to both institutions. Academic work is taken at Case Western Reserve, and the majority of art studio courses at the Cleveland Institute of Art, as follows:

**Academic Courses at Case Western Reserve University**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARTS 295</td>
<td>Introduction to Art Education</td>
<td>3</td>
</tr>
<tr>
<td>ARTS 393</td>
<td>Art Content, Pedagogy, Methodology, and Assessment</td>
<td>3</td>
</tr>
<tr>
<td>ARTH Electives (one must be at 300 level)</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>PHED Physical Education (2 semesters)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Retention and Advanced Standing (Undergraduate Level)**

The Bachelor of Science program in art education is designed to educate professional teachers of art. There are four decision points in the program, and for each of these decision points, there are three possible outcomes: unconditional admission; conditional admission with a prescribed remedial plan which when successfully completed will result in unconditional admission; or denial of admission. Denial of admission at any decision point means the student is no longer able to pursue an art education degree at Case Western Reserve.

**Decision Point 1: Application for Admission to the Program**

Official admission to the Art Education Program generally occurs at the end of the fall semester of the sophomore year after a student completes ARTS 295 Introduction to Art Education. Admission to the program requires:

1. being accepted to the university
2. being accepted as an art major through a portfolio review before matriculation
3. successful completion of ARTS 295 Introduction to Art Education, including evaluation of an initial Teaching ePortfolio
4. cumulative Case GPA of 2.5 or better
5. submission of a signed Statement of Assurance of Good Moral Character
6. a satisfactory interview with art education faculty, documented on the Teacher Licensure Admission Assessment Form

**Decision Point 2: Application for Advanced Standing**

The Application for Advanced Standing should be submitted by the junior year and the fall semester after Decision Point 1. The application requires:

1. a successful review of the updated Teaching ePortfolio
2. submission of a current DPR form documenting the following: a cumulative GPA of 2.5 or better, an art course GPA of 2.5 or better, and an education GPA of 3.0 or better
3. a passing score on the Candidate Disposition Assessment Inventory, completed by the art education faculty

**Decision Point 3: Application for Student Teaching**

The Application for Student Teaching should be completed by week 8 of the semester prior to student teaching. The application requires:

1. a successful review of the updated Teaching ePortfolio
2. submission of a current DPR form documenting the following: a cumulative GPA of 2.5 or better, an art course GPA of 2.5 or better, and an education GPA of 3.0 or better
3. a passing score on the Candidate Disposition Assessment Inventory, completed by the art education faculty
4. passing a TB test
5. presenting documentation of Hepatitis B vaccination
6. passing official Federal and State criminal background checks

**Decision Point 4: Application for Initial Licensure**

Application for Initial Licensure occurs after successful completion of all degree requirements. The application requires:

1. a successful review of the completed Teaching ePortfolio
2. submission of a current DPR form documenting the following: a cumulative GPA of 2.5 or better, an art course GPA of 2.5 or better, and an education GPA of 3.0 or better
3. a passing score on the Candidate Disposition Assessment Inventory, completed by the art education faculty
4. achievement of state-mandated scores on the two Praxis II national teacher exams
5. completion of the Case Student Teaching Final Assessment by the cooperating teacher and university supervisor with a grade of B or better
6. completion of the Case Teacher Licensure Exit Interview and Survey

After successfully completing all requirements at the four decision points, the student is recommended by the university’s director of teacher education for the Ohio Visual Art (Pre-K-12) License. Completion of the Bachelor of Science in art education does not ensure that the State of
Ohio’s Visual Art Teacher License will be awarded. Teacher licensure is also obtainable through the Art Education Graduate Program of Study. Additional information on this program is available in the office of the director of art education.

**Bachelor of Arts in Pre-Architecture**

The Pre-Architecture Program introduces the student to the forms, history, and functions of architecture as well as to the studio skills relevant to its practice. The program is designed to provide a background for undergraduate students who plan to continue architectural studies at the graduate level, as well as for those interested in the study of architecture as part of a liberal or technical education.

Pre-architecture may be chosen only as a second major. The double major is required so that the perspectives provided by this interdisciplinary program may be complemented by a concentrated disciplinary experience. For a student who completes a Bachelor of Science degree (BS, BSE, or BSN), pre-architecture may serve as the sole major for a BA degree.

To declare a pre-architecture major, students should have declared a first major and have sophomore or junior standing. Up to 6 credits in general education requirements and elective courses taken by students for their first major may be applied to their pre-architecture major.

The major consists of a minimum of 30 credit hours, 15 of which are in required courses and the remainder of which are approved elective courses. Detailed information about approved electives is available in the departmental office.

The required courses are:

- ARTH 101 Art History I: Pyramids to Pagodas 3
- ARTH 102 Art History II: Michelangelo to Maya Lin 3
- ARTS 106 Creative Drawing I 3
- ARTS 302 Architecture and City Design I 3
- ARTS 303 Architecture and City Design II 3
- Art history courses 6
- Two of the following: 6
  - ARTS 101 Design and Color I
  - ARTS 201 Design and Color II
  - ARTS 206 Creative Drawing II
  - ARTS 220 Photography Studio I
  - THTR 223 Introduction to Scenic Design
  - THTR 224 Introduction to Lighting Design
- One of the following: 3
  - MATH 125 Math and Calculus Applications for Life, Managerial, and Social Sci
  - MATH 126 Math and Calculus Applications for Life, Managerial, and Social Sci II
  - PHYS 115 Introductory Physics I
  - PHYS 116 Introductory Physics II
  - PHYS 121 General Physics I - Mechanics
  - PHYS 122 General Physics II - Electricity and Magnetism

*For students whose interests lie in aesthetics and the history of architecture, the required 3 hours may be in sociology, American studies, anthropology, history (specifically courses on the history of science and technology), civil engineering, or earth, environmental, and planetary sciences.

**Minors**

Four minors, each requiring 18 credit hours, are available: one in art history, and three through the Art Studio Program.

**Art History**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARTH 101</td>
<td>Art History I: Pyramids to Pagodas</td>
<td>3</td>
</tr>
<tr>
<td>ARTH 102</td>
<td>Art History II: Michelangelo to Maya Lin</td>
<td>3</td>
</tr>
<tr>
<td>Art History electives (at least 3 hours must be taken at the 200 level)</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td><strong>Total Units</strong></td>
<td></td>
<td><strong>18</strong></td>
</tr>
</tbody>
</table>

**Art Studio**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARTS 101</td>
<td>Design and Color I</td>
<td>3</td>
</tr>
<tr>
<td>ARTS 106</td>
<td>Creative Drawing I</td>
<td>3</td>
</tr>
<tr>
<td>Four additional studio courses, two of which must be in the same area (i.e., drawing, painting, design, textiles, photography, ceramics and enameling)</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td><strong>Total Units</strong></td>
<td></td>
<td><strong>18</strong></td>
</tr>
</tbody>
</table>

**Photography**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARTS 220</td>
<td>Photography Studio I</td>
<td>3</td>
</tr>
<tr>
<td>ARTS 320</td>
<td>Photography Studio II</td>
<td>3</td>
</tr>
<tr>
<td>ARTS 322</td>
<td>Digital Photography I</td>
<td>3</td>
</tr>
<tr>
<td>ARTS 325</td>
<td>Creative Photography</td>
<td>3</td>
</tr>
<tr>
<td>or ARTS 365D</td>
<td>B&amp;W Photography Studio</td>
<td></td>
</tr>
<tr>
<td>ARTS 365E</td>
<td>Color Studio</td>
<td>3</td>
</tr>
<tr>
<td>One of the following:</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>ARTS 399</td>
<td>Independent Study in Art Studio</td>
<td></td>
</tr>
<tr>
<td>ARTH 102</td>
<td>Art History II: Michelangelo to Maya Lin</td>
<td></td>
</tr>
<tr>
<td>ARTS 350</td>
<td>Multimedia I</td>
<td></td>
</tr>
<tr>
<td><strong>Total Units</strong></td>
<td></td>
<td><strong>18</strong></td>
</tr>
</tbody>
</table>

**Pre-Architecture**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARTH 101</td>
<td>Art History I: Pyramids to Pagodas</td>
<td>3</td>
</tr>
<tr>
<td>ARTH 102</td>
<td>Art History II: Michelangelo to Maya Lin</td>
<td>3</td>
</tr>
<tr>
<td>ARTS 106</td>
<td>Creative Drawing I</td>
<td>3</td>
</tr>
<tr>
<td>ARTS 302</td>
<td>Architecture and City Design I</td>
<td>3</td>
</tr>
<tr>
<td>ARTS 303</td>
<td>Architecture and City Design II</td>
<td>3</td>
</tr>
</tbody>
</table>
| Art history courses 6
| Two of the following: 6
| ARTS 101     | Design and Color I                        |       |
| ARTS 201     | Design and Color II                       |       |
| ARTS 206     | Creative Drawing II                       |       |
| ARTS 220     | Photography Studio I                      |       |
| THTR 223     | Introduction to Scenic Design             |       |
| THTR 224     | Introduction to Lighting Design           |       |
| One of the following: 3
| MATH 125     | Math and Calculus Applications for Life, Managerial, and Social Sci |       |
| MATH 126     | Math and Calculus Applications for Life, Managerial, and Social Sci II |       |
| PHYS 115     | Introductory Physics I                    |       |
| PHYS 116     | Introductory Physics II                   |       |
| PHYS 121     | General Physics I - Mechanics             |       |
| PHYS 122     | General Physics II - Electricity and Magnetism |       |
| **Total Units** |                                           | **18** |

**Graduate Programs**

**Master of Arts in Art History**

The MA program in art history is designed to provide the student with a broad knowledge of the major art historical periods, the scholarly and bibliographical resources, and the methodologies of art history. It also offers an opportunity to investigate art historical problems in some depth. In addition to the regular graduate school application form, applicants to the graduate program in art history are required to submit GRE scores and copies of two research papers that they consider to represent their best work. The minimum GRE score for acceptance is equivalent to 500 on the former scoring system. Applicants for the MA should have a BA major or minor concentration in art history or a related humanities field and a minimum GPA of 3.5.

The master’s degree in art history is conducted exclusively under Plan B as described under the School of Graduate Studies (p. 662) in this bulletin. All other requirements of the MA program must be fulfilled:

- ARTH 495 Methodologies of Art History (3)
• Eight graduate courses on the 400 level or above, three of which must be seminars on the 500 level. These eight courses must include one course each from four of the following five areas: world art; ancient; medieval; Renaissance/Baroque; modern and American (24).
• ARTH 489 M.A. Qualifying Paper (3)
• A reading knowledge of one foreign language (normally French, German, or Italian)
• Successful performance on the MA comprehensive examination

Total: 30 hours

Master of Arts in Art History and Museum Studies

The MA program in art history and museum studies includes the same broad requirements and objectives of the MA program in art history, along with a year-long museum studies course and two supervised museum internships. In addition to the regular graduate school application form, applicants to the graduate program in art history are required to submit GRE scores and copies of two research papers that they consider to represent their best work. The minimum GRE score for acceptance is equivalent to 500 on the former scoring system. Applicants for the MA should have a BA major or minor concentration in art history or a related humanities field and a minimum GPA of 3.5.

The requirements include:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARTH 495</td>
<td>Methodologies of Art History</td>
<td>3</td>
</tr>
<tr>
<td>ARTH 490A</td>
<td>Visual Arts and Museums I</td>
<td>3</td>
</tr>
<tr>
<td>ARTH 490B</td>
<td>Visual Arts and Museums: II</td>
<td>3</td>
</tr>
<tr>
<td>ARTH 491A</td>
<td>Visual Arts and Museums: Internship</td>
<td>1</td>
</tr>
<tr>
<td>ARTH 491B</td>
<td>Visual Arts and Museums: Internship</td>
<td>3</td>
</tr>
</tbody>
</table>

• Six graduate courses on the 400 level or above (18), three of which must be seminars on the 500 level (9). These six courses must include one course each from four of the following five areas: world art; ancient; medieval; Renaissance/Baroque; modern and American.
• A reading knowledge of one foreign language (normally French, German or Italian)
• Successful performance on the MA comprehensive examination

Total: 31 hours

Master of Arts in Art Education

The Master of Arts in Art Education is offered in two plans: Plan I for those who already hold teacher licenses and who desire advanced studio- and art-related studies; Plan II for those holding the Bachelor of Fine Arts or equivalent degree who desire multi-age teacher licensure as visual art specialists. Both programs are offered jointly by Case Western Reserve University and the Cleveland Institute of Art, and both require 36 semester hours.

The admission procedure includes an online application, three letters of recommendation, a college transcript, which are to be submitted to the Art Education office, and an interview with the program director in which students show a portfolio of artwork and discuss their program of study. For students pursuing Plan I, The Cleveland Institute of Art admission procedure requires a portfolio. Approval by both the University and the Cleveland Institute of Art is required for admission into Plan I. Information and application forms are available online through the Office of Graduate Admission at Case Western Reserve University.

Plan I

• 18 hours in studio to be taken at the Cleveland Institute of Art or Case Western Reserve University at the 300 level or above; and 18 hours in academic courses to be taken at Case Western Reserve University at the 400 level or above, to be selected in consultation with the director of art education; or
• 30 semester hours of course credit: 18 hours in studio to be taken at the Cleveland Institute of Art at the 300 level or above; and 12 hours in academic courses to be taken at Case Western Reserve University at the 400 level or above, to be selected in consultation with the director of art education; AND a thesis exhibition based on individual research (not less than 6 semester hours of registration).

Plan II

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDUC 401</td>
<td>Introduction to Education</td>
<td>3</td>
</tr>
<tr>
<td>EDUC 494</td>
<td>Educational Psychology</td>
<td>3</td>
</tr>
<tr>
<td>EDUC 486</td>
<td>Introduction to Instructional Technology</td>
<td>3</td>
</tr>
<tr>
<td>ARTS 385</td>
<td>Clinical/Field Based Experience I</td>
<td>1</td>
</tr>
<tr>
<td>ARTS 386</td>
<td>Clinical/Field Based Experience II</td>
<td>1</td>
</tr>
<tr>
<td>ARTS 387</td>
<td>Clinical/Field Based Experience III</td>
<td>1</td>
</tr>
<tr>
<td>ARTS 400</td>
<td>Current Issues in Art Education</td>
<td>3</td>
</tr>
<tr>
<td>ARTS 493</td>
<td>Art Content, Pedagogy, Methodology, and Assessment</td>
<td>3</td>
</tr>
<tr>
<td>ARTS 466A</td>
<td>Student Teaching in Art: Pre-K - 6th Grade</td>
<td>4</td>
</tr>
<tr>
<td>ARTS 466B</td>
<td>Student Teaching in Art: 7th - 12th Grade</td>
<td>4</td>
</tr>
<tr>
<td>ARTS 465</td>
<td>Seminar for Art Teachers</td>
<td>4</td>
</tr>
<tr>
<td>ARTS 602</td>
<td>Study in Art Education</td>
<td>3</td>
</tr>
<tr>
<td>ARTS 497</td>
<td>Summer Workshop in Art Education</td>
<td>3</td>
</tr>
</tbody>
</table>

Total Units: 36

The Master’s Plan II Program in Art Education is designed to educate professional teachers of art. There are four decision points in the Art Education Program. For each of the decision points, there are three possible outcomes: unconditional admission; conditional admission with a prescribed remedial plan which when successfully completed will result in unconditional admission; or denial of admission. Denial of admission at any decision point means the student is no longer able to pursue an art education degree at Case Western Reserve University.

Decision Point 1: Application for Admission to the Program

Application for admission to the program requires:
1. being accepted to the university
2. being accepted as an art major through an art portfolio review
3. submission of a signed Statement of Assurance of Good Moral Character
4. a satisfactory interview with art education faculty, documented on the Teacher Licensure Admission Assessment Form

Decision Point 2: Application for Advanced Standing

Application for advanced standing requires:
1. a successful review of the updated Teaching ePortfolio
2. submission of a current transcript documenting the following: a cumulative GPA of 3.0 or better, an art course GPA of 3.0 or better, and an education GPA of 3.0 or better
3. a passing score on the Candidate Disposition Assessment Inventory, completed by the art education faculty at the end of the first semester

Decision Point 3: Application for Student Teaching

Application for student teaching requires:
1. a successful review of the updated Teaching ePortfolio
2. submission of a current transcript documenting the following: a cumulative GPA of 3.0 or better, an art course GPA of 3.0 or better, and an education GPA of 3.0 or better
3. a passing score on the Candidate Disposition Assessment Inventory, completed by the art education faculty
4. passing a TB test
5. presenting documentation of Hepatitis B vaccination
6. passing official Federal and state criminal background checks

**Decision Point 4: Application for Initial Licensure**

Application for initial licensure occurs after successful completion of all degree requirements. The application requires:

1. a successful review of the updated Teaching ePortfolio
2. submission of a current final transcript documenting the following: a cumulative GPA of 3.0 or better, an art course GPA of 3.0 or better, and an education GPA of 3.0 or better
3. a passing score on the Candidate Disposition Assessment Inventory, completed by the art education faculty
4. achievement of state-mandated scores on the two Praxis II national teacher exams
5. completion of the Case Student Teaching Final Assessment by the cooperating teacher and university supervisor with a grade of B or better
6. completion of the Case Teacher Licensure Exit Interview and Survey

After successfully completing all requirements at the four decision points, the student is recommended by the university’s director of teacher education for the Ohio Provisional Art (Pre-K-12) License. Completion of the Master’s Plan II Program in Art Education degree does not ensure that the State of Ohio’s Provisional Visual Art Teacher License will be awarded.

**Doctor of Philosophy in Art History**

The doctoral program in art history is designed to allow advanced graduate students the opportunity to specialize in designated areas. Admission to the program requires an MA in art history or its equivalent, including a reading knowledge of one approved foreign language (normally French, German, or Italian). Admission to the program is made on the basis of academic record, experience, recommendations, and personal interviews. Applicants are required to submit GRE scores and two research papers written during their matriculation for a master's degree, or a thesis if completed by the time of application. Reading knowledge of one approved foreign language (normally French, German, or Italian) is also required for admission.

Students in the museum studies program are required to take a minimum of 48 hours of graduate study as follows:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARTH 490A</td>
<td>Visual Arts and Museums I</td>
<td>3</td>
</tr>
<tr>
<td>ARTH 490B</td>
<td>Visual Arts and Museums: II</td>
<td>3</td>
</tr>
<tr>
<td>Three elective courses at the 400 level or above</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>Three graduate seminars at the 500 level</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>ARTH 610A</td>
<td>Advanced Visual Arts and Museums: Internship I</td>
<td>3</td>
</tr>
<tr>
<td>ARTH 610B</td>
<td>Advanced Visual Arts and Museums Internship II</td>
<td>3</td>
</tr>
<tr>
<td>ARTH 701</td>
<td>Dissertation Ph.D.</td>
<td>18</td>
</tr>
</tbody>
</table>

**Total Units**: 48

The requirement to take ARTH 490A and B will be waived for students who received the Master of Arts in art history and museum studies from Case Western Reserve University from 2011 onward. Students who have not taken ARTH 495 Methodologies of Art History or its equivalent should take this course as part of their preparation. During the two-semester internship, the student will be assigned to one or more departments in the Cleveland Museum of Art for supervised study and practice that will be evaluated by a member of the faculty in art history. The dissertation subject should be related to some aspect of art museum research; it may take the form of a special collection or exhibition catalogue, but it must satisfy the scholarly standards of the department and the university.

Doctoral students must demonstrate an ability to read two approved languages (other than English) useful in art historical research. German is normally required as one of the two languages for students concentrating in Western art. Both languages must be approved by the department at the time of admission or during the first semester of doctoral study. The general examination cannot be taken until the language requirement is fulfilled.

Doctoral students are required to pass a written and oral general examination before being advanced to candidacy. Within two weeks after the written examination, the faculty examining committee will administer the oral examination. A final evaluation will be based on the student’s performance in both the written and oral sections of the general examination.
student’s performance in both the written and oral sections of the general examination.

**Department Faculty**

Catherine B. Scallen, PhD  
(Princeton University)  
*Associate Professor and Chair*  
Northern Renaissance and Baroque art and historiography

Henry Adams, PhD  
(Yale University)  
*Professor*  
American art

Erin Benay, PhD  
(Rutgers University)  
*Assistant Professor*  
Early Modern Southern European Art

Elina Gertsman, PhD  
(Boston University)  
*Assistant Professor*  
Medieval art in Europe

Noelle Giuffrida, PhD  
(University of Kansas)  
*Assistant Professor*  
Asian art

Anne Helmreich, PhD (on leave January 2011 through July 2013)  
(Northernwestern University)  
*Associate Professor*  
18th- and 19th-century European art

Ellen G. Landau, PhD  
(University of Delaware)  
*Andrew W. Mellon Professor of the Humanities*  
20th-century American and European art; critical theory and gender studies

Jennifer Neils, PhD  
(Princeton University)  
*Ruth Coulter Heede Professor of Art History*  
Ancient art and classical archaeology

**Secondary Faculty**

Charles Burroughs, PhD  
(The Warburg Institute)  
*Elise B. Smith Professor in the Liberal Arts, Department of Classics*

Miriam R. Levin, PhD  
(University of Massachusetts)  
*Professor, Department of History*

**Adjunct Faculty from the Cleveland Museum of Art**

Michael Bennett, PhD  
(Harvard University)  
*Curator, Greek and Roman Art*

Susan Bergh, PhD  
(Columbia University)  
*Curator, Art of the Ancient Americas*

David Franklin, PhD  
(Courtauld Institute of Art)  
*Museum Director*  
16th-century Italian art

Jane Glaubinger, PhD  
(Case Western Reserve University)  
*Curator of Prints*

Caroline Goeser, PhD  
(Rutgers University)  
*Director of Education and Interpretation*

Heather Lemonedes, PhD  
(The Graduate School and University Center, City University of New York)  
*Associate Curator of Drawings*

Constantine Petridis, PhD  
(Ghent University)  
*Curator, African Art*

William Robinson, PhD  
(Case Western Reserve University)  
*Curator, Modern European Art*

Jon Seydl, PhD  
(University of Pennsylvania)  
*The Paul J. and Edith Ingalls Vignos, Jr. Curator of European Paintings and Sculpture (1500-1800)*

Marjorie Williams, MA  
(University of Michigan)  
*Senior Director of Endowment Development*  
Asian art

**Adjunct Art History Faculty**

Gary Sampson, PhD  
(University of California, Santa Barbara)  
*Associate Dean, Graduate Studies, Cleveland Institute of Art*  
History of photography

Holly Witchey, PhD  
(Case Western Reserve University)  
*Museum studies*

**Art Education**

Tim Shuckerow, MA  
(Case Western Reserve University)  
*Director, Art Education and Art Studio*  
Painting, ceramics

Judy Flamik, BA, NBCT  
(Lake Erie College)  
*University Supervisor, Secondary Student Teaching*

Sandra Noble, MA  
(Cleveland State University)  
*University Supervisor, Elementary Student Teaching and Clinical/Field-Based Experience*

**Art Studio**

Tim Shuckerow, MA  
(Case Western Reserve University)  
*Director, Art Education and Art Studio*
Painting, ceramics
Alexander Aitkin, MFA
(Ohio University)
Photography, creative photography
Jared Bendis, MA
(Case Western Reserve University)
Multimedia
Gail Berg, MA
(Case Western Reserve University)
Photography
Margaret Fischer, MA
(Case Western Reserve University)
Enameling and jewelry
JoAnn Giordano, MFA
(Cranbrook Academy of Art)
Weaving, fibers, and textiles
Sally Levine, MA
(University of Illinois)
Architecture
Martha Lois, MFA
(Kent State University)
Ceramics
Christopher Pekoc
Creative drawing
Mary Jo Sinclair, BFA
(Cleveland Institute of Art)
Design
Barney Taxel, BA
(Case Western Reserve University)
Digital photography

Emeriti
D. Harvey Buchanan
Professor Emeritus of Humanities and Art History and Provost Emeritus
Walter S. Gibson
Andrew W. Mellon Professor Emeritus of the Humanities
Edward J. Olszewski
Professor Emeritus
Anita Rogoff
Professor Emerita of Art

ARTH Courses

ARTH 101. Art History I: Pyramids to Pagodas. 3 Units.
The first half of a two-semester survey of world art highlighting the major monuments of the ancient Mediterranean, medieval Europe, Mesoamerica, Africa, and Asia. Special emphasis on visual analysis, and socio-cultural contexts, and objects in the Cleveland Museum of Art.

ARTH 102. Art History II: Michelangelo to Maya Lin. 3 Units.
The second half of a two-semester survey of world art highlighting the major monuments of art made in Africa, the Americas, Asia, and Europe from 1400 to the present. Special emphasis on visual analysis, historical and sociocultural contexts, and objects in the Cleveland Museum of Art.

ARTH 203. The Arts of Asia. 3 Units.
A survey of Japanese and Chinese art from the Bronze Age to the 18th century, with particular emphasis on objects in the Cleveland Museum of Art. The relationship of art works to Buddhism and Hinduism is explored along with cultural rituals, ceremonies, and traditions.

ARTH 204. Arts of East Asia. 3 Units.
A survey of the major developments in the arts of East Asia from the bronze age to the present in a wide range of media, including sculpture, painting, ceramics, architecture, calligraphy, prints, and installations. The course explores factors behind the making of works of art, including social, political and religious meanings, while examining the historical contexts for the arts of China, Japan, and Korea. Attention will be paid to the relationship between art and the ideas and practices of Buddhism, Shinto, Daoism, and Confucianism. Our topics include: secular and sacred narrative scroll painting, ceramics and tea culture, landscape painting, Buddhist cave temples, ancient bronzes, mortuary art, expressions of resistance and reclusion in visual arts, cross-cultural exchanges within the region and with the West, and the role of East Asian artists in the contemporary international art market.

ARTH 220. Jewish Traditional Art and Architecture. 3 Units.
Tradition and transformation in Jewish artistic expression over time and across space. Course will begin with biblical period and continue down to the present day in Israel and America. Examination of how concepts such as “Jewish” and “art” undergo change within the Jewish community over this period. Offered as ARTH 220 and JDST 220.

ARTH 221. Building on Antiquity. 3 Units.
Beginning with Ancient Greece and Rome and ending in Cleveland, the course will provide orientation in the architectural orders and in most periods of European and Euro-American architectural history, as well as, to an extent, architectural criticism. The issue of how architecture has meaning will be central, not least in connection with the formalized “language” of classicism and the emergence of development of building types (temple, museum, civic hall, transportation buildings, etc.). We will also review more subtle ways in which architecture conveys meaning or mood, and the assignment of gendered associations to certain architectural elements. The course will consider more or less blatant political uses of architecture and architectural imagery, but also more elusive and/or ambiguous cases, as well as the phenomenon of the shifting meanings of architecture through changes of era, owner, audience, etc. Offered as ARTH 221 and CLSC 221.

ARTH 227. Ancient Cities and Sanctuaries. 3 Units.
A selection of cities and sanctuaries from the ancient Near East, Egypt, the Aegean, Greece, Etruria, and Rome; their political and religious institutions and the relationship to contemporary art forms. Offered as ARTH 227 and CLSC 227.

ARTH 228. Ancient Greek Athletics. 3 Units.
Exploration of the role of athletics in the ancient, primarily Greek world, and their reflection in the art of the period. Offered as ARTH 228 and CLSC 228.
ARTH 240. Architecture: Ancient to 1850. 3 Units.
Western traditions of architecture and urban design from antiquity to the early nineteenth century, with emphasis on pre-industrial cities and landscapes. Interactions between western theory and practice and certain non-western cultures, especially the Arab/Turkish world and China.

ARTH 241. Medieval Art. 3 Units.
This course will introduce students to the pivotal works of art created between approximately 250 and 1500. We will discuss painting, sculpture, architecture, manuscript illumination, and graphic arts. Medieval visual and material culture will be considered within the framework of socio-political developments, rapid urban growth, the flowering of monastic culture, the rise of universities, and changes in devotional practices. While the course will primarily focus on western part of the medieval Christendom, we will also discuss Jewish, Byzantine, and Islamic art. Visits to the CMA will form an integral part of the course.

ARTH 250. Art in the Age of Discovery. 3 Units.
A survey of developments in Renaissance art and architecture in northern Europe and Italy during a new age of science, discovery and exploration, 1400-1600.

ARTH 260. Art in Early Modern Europe. 3 Units.
A survey of European art in the seventeenth and eighteenth centuries, an era of rising nationalism, political aggrandizement, religious expansion and extravagant art patronage. The tensions between naturalism and idealization, court and city, public and private, church and secular patronage, grand commissions and an open air market, will provide themes of the course as we explore what characterized the arts of Austria, Belgium, England, France, Germany, Italy, The Netherlands, and Spain.

ARTH 270. American Art and Culture Before 1900. 3 Units.
Survey of the development of American art from colonial times to the present which explores how art has expressed both American values and American anxieties. Painting is emphasized, but the course also considers architecture, the decorative arts, film, literature, and music. Offered as AMST 270 and ARTH 270.

ARTH 271. American Art and Culture: The Twentieth Century. 3 Units.
Survey of the development of American art from 1900 to the present (and the future) which will explore how art has expressed both American values and American anxieties. Painting will be emphasized, but the course will also consider architecture, the decorative arts, film, literature, and music. Offered as AMST 271 and ARTH 271.

ARTH 280. Modern Art and Modern Science. 3 Units.
An examination of the development of painting, sculpture, and architecture from the 19th to the mid 20th century. Special attention is given to the emergence of "modernism" and the influence of science on such movements as Impressionism and Cubism.

ARTH 284. History of Photography. 3 Units.
A survey of the history of photography from its inception in 1839 to the present. Emphasis is on the complex relationship between technological innovations and picture-making; the artistic, documentary, and personal uses of photography; and the relationship of photography to other art forms.

ARTH 301. Museums and Globalization. 3 Units.
Museums are everywhere contested spaces today. Historically designed as symbols of power, centers for research, agents of public education and community formation in Western industrial societies, they have become sites of development and cultural controversy on a global scale. From Cleveland and Paris to Nairobi and Dubai museums figure in urban redevelopment, national identity formation, conflicts between religion and science, and global tourism. Questions we will consider in this course: what are the fundamental features of museums as institutions? what ties have linked them to wider national and international communities of academics, NGO’s and business? to political, economic and social concerns? how do museums in Asia, Africa the Middle East and Latin America figure in the current international contention over heritage rights? This is an innovative course allowing students to collaborate on projects, engage with guest lecturers and access museums across the globe. The course is organized in three parts: Part I: National Identity Building and Museums; Part II: Museums and Identity Politics; Part III: Museums and Global Development. Offered as HSTY 329, ARTH 301, HSTY 429, and ARTH 401.

ARTH 302. Buddhist Art in Asia. 3 Units.
This course explores the visual culture of Buddhism in Asia from its origins in India to its transmission and transformation in China, Korea, Japan, Tibet, Nepal, and Southeast Asia. Our historically and culturally structured examination will trace major developments in Buddhist art and their relationship with belief, practice, and ritual. We will consider the ways that artistic traditions have adapted and evolved both within individual cultures and cross-culturally. The study of sculpture, architecture, and painting in their religious contexts will be our primary focus, but we will also consider the movement of Buddhist art from temples to sites of secular display in museums around the world and the religious and cultural issues that arise from these moves. Topics include: representations of the life of the historical Buddha; visual programs of temples; artistic representations of paradies and hells; sacred sites and architecture; Imperial patronage of Buddhist art; the role of art in pilgrimage and ritual; and visual imagery associated with schools of Buddhism such as Pure Land, Chan, and Zen. Offered as ARTH 302 and ARTH 402.

ARTH 307. Arts of China. 3 Units.
A survey of the major developments in Chinese art from the Neolithic period to the present, including archaeological discoveries, bronzes, calligraphy, painting, sculpture, ceramics, architecture, performance art, and installations. Among topics covered are: ancient funerary art and tombs; painting and sculpture of early Buddhist grottoes; landscape painting; art commissioned and collected by the imperial court; literati painting and calligraphy; public and private art associated with Daoist; Buddhist, and Confucian religious practices and sites; art produced during periods of non-Chinese rule under the Tanguts, Mongols, and Manchus; foreign influences on Chinese artists; and the role of Chinese artists in the contemporary international art market. The course explores factors behind the creation and reception of works of art, including social, political and religious meanings, while examining the historical contexts for and artistic traditions of the visual culture of China. Recommended preparation: Students with some Asian studies, Chinese language, Chinese history, or other appropriate background. Offered as ARTH 307 and ARTH 407. Prereq: One 100- or 200-level ARTH course or requisites not met permission from instructor.
ARTH 308. Arts of Japan. 3 Units.
A survey of the major developments in Japanese art from prehistoric times to the present in a wide range of media, including sculpture, ceramics, architecture, calligraphy, painting, garden design, woodblock prints, film, and installations. Among topics covered are: Buddhist art, narrative handscrolls, ink painting and portraiture associated with Zen, ceramics for tea ceremony, Edo and Meiji period woodblock prints, and Western and Chinese influences on Japanese artists. Modern and contemporary artists and filmmakers such as Isamu Noguchi, Akira Kurosawa, Yayoi Kusama, Yasumasa Morimura, and Takashi Murakami are also investigated. The course explores factors behind the making of works of art, including social and religious meanings, while examining the historical contexts for and aesthetic principles of the arts of Japan. Prerequisites include one previous art history course at the 100- or 200-level or permission of instructor. Students with some Asian studies, Japanese language, Japanese history, or other appropriate background by be permitted to enroll at the discretion of the instructor. Offered as: ARTH 308 and ARTH 408. Prereq: One 100- or 200-level ARTH course or by permission of instructor.

ARTH 311. Rome: City and Image. 3 Units.
This course studies the architectural and urban history of Rome from the republican era of the ancient city up to the eighteenth century using the city itself as the major "text." The emphasis will be placed on the extraordinary transformations wrought in the city, or at least in key districts, by powerful rulers and/or elites, especially in the ancient empire and in the Renaissance and baroque eras. In a larger perspective, the great construction projects exerted a far-reaching effect within and beyond Europe, but we will study them in relation to their topographical situation, their functions, and their place in a long history of variations on prestigious themes since many of the artworks and the urban settings featured in the course carry the mark of the Long history of the city itself. Recommended preparation: At least one 200-level course in ANTH, ARTH, CLSC, ENGL, HSTY, or RLGN. Offered as ARTH311/411 and CLSC 311.

ARTH 332. Art and Archaeology of Ancient Italy. 3 Units.
The arts of the Italian peninsula from the 8th century B.C. to the 4th century A.D., with emphasis on recent archaeological discoveries. Lectures deal with architecture, sculpture, painting, and the decorative arts, supplemented by gallery tours at the Cleveland Museum of Art. Offered as ARTH 332, CLSC 332, and ARTH 432.

ARTH 333. Greek and Roman Painting. 3 Units.
Greek vase painting. Etruscan tomb painting and Roman wall painting. The development of monumental painting in antiquity. Offered as ARTH 333, CLSC 333, and ARTH 433.

ARTH 334. Art and Archaeology of Greece. 3 Units.
A survey of the art and architecture of Greece from the beginning of the Bronze Age (3000 B.C.) to the Roman conquest (100 B.C.) with emphasis on recent archaeological discoveries. Lectures deal with architecture, sculpture, painting, and the decorative arts, supplemented by gallery tours at the Cleveland Museum of Art. Offered as ARTH 334, CLSC 334, and ARTH 434.

ARTH 335. Issues in Ancient Art. 3 Units.
Various topics in Ancient art. Lectures, discussions and reports. Offered as ARTH 335 and ARTH 435.

ARTH 340. Issues in the Art of China. 3 Units.
This is a topics course. Each offering will focus on a specific topic within the area of Chinese art. Sample topics may include: Women painters in Beijing, Modern Artists in China-1980-Present, Shang Dynasty Tombs, Yuan Dynasty Buddhist Art. Lectures, discussions, and reports. Offered as ARTH 340 and ARTH 440.

ARTH 341. Issues in the Art of Japan. 3 Units.
This is a topics course. Each offering will focus on a specific topic within the area of Japanese art. Sample topics may include: Muromachi Hanging Scrolls, Ryoan-ji Temple Garden Architecture, Rimpa School Panel Screens, Buddhist Painting in the Edo Period. Lectures, discussions, and reports. Offered as ARTH 341 and ARTH 441.

ARTH 344. Issues in the Art of Africa. 3 Units.
This is a topics course. Each offering will focus on a specific topic within the area of African art. Sample topics may include: Ritual Masks, Sub-Saharan Religious Architecture, Carvings of Twins in Fertility Rites, Benin Bronze Warrior Reliefs. Lectures, discussions, and reports. Offered as ARTH 344 and ARTH 444.

ARTH 349. Gothic Art: Vision and Matter. 3 Units.
This course will examine the development and dissemination of Gothic art in Western Europe in the High and Late Middle Ages. We will consider a variety of media, including architecture, metalwork, sculpture, manuscript illumination, panel paintings, fresco cycles, and small devotional objects. As we study medieval art in its socio-historical contexts--private and public, monastic and political, liturgical and lay--we will pay special attention to issues of patronage, relationships between texts and images, the introduction of visionary and mystical devotion, attitudes towards education and authority, differences between male and female piety, modes of medieval viewing, and reception and manipulation of art by medieval audiences. Visits to the CMA will form an integral part of the course. Offered as ARTH 349 and ARTH 449.

ARTH 350. Issues in Medieval Art. 3 Units.
Various topics in Medieval Art. Lectures, discussions, and reports. Offered as ARTH 350 and ARTH 450.

ARTH 351. Late Gothic Art in Italy. 3 Units.
Sculpture of the Pisani; early trends in Pisa, Siena, and Florence; Cimabue and Giotto; Duccio, Simone Martini, and the Lorenzetti; painting in Florence and Siena after the Black Death. Offered as ARTH 351 and ARTH 451.

ARTH 352. Italian Art of the 15th Century. 3 Units.
The early 15th century in Florence, civic humanism, the sculpture of Ghiberti and Donatello, the painting of Masaccio; the International Style in painting, the art of Uccello, Piero della Francesca, Mantegna, and Botticelli; Carpaccio and the Bellini in Venice. Offered as ARTH 352 and ARTH 452.

ARTH 353. Sixteenth Century Italian Art. 3 Units.
The development of the High Renaissance and Mannerist styles in Italy and late 16th century trends: painting and sculpture. Offered as ARTH 353 and ARTH 453.
ARTH 358. Medieval Body. 3 Units.
This course will explore the meanings and representations of the body in western medieval culture. Topics will include bleeding bodies, fragmented bodies, lactating bodies, labile bodies, cosmic bodies, physiological bodies, mystical bodies, suffering bodies, edible bodies, enclosed bodies, gendered bodies, Christ's bodies, Mary's bodies, decomposing bodies, macabre bodies, resurrected bodies, dead bodies, intercessory bodies, unhinging bodies, translucent bodies, martyred bodies, desirable bodies, desirous bodies, abhorrent bodies, mimetic bodies, nude bodies, marginalized bodies, defleshed bodies, social bodies, political bodies, monstrous bodies, mnemonic bodies, and deformed bodies. We will explore the complex rhetoric of embodiment as it manifests itself in the ambiguous discourse—both medieval and contemporary—on the relationships between the material and intangible, spiritual and physical, somatic and mental, corporeal and ethereal. Offered as ARTH 358 and ARTH 458.

ARTH 359. Visual Culture of Medieval Women. 3 Units.
This course will explore works made by and for women—as well as images of women—in the Romanesque and Gothic periods. We will discuss female monastics who commissioned and produced art, and the roles of women as patrons and consumers. The course will explore different ways of seeing, reading, figuring, and interacting with images of the female body, frequently seen as a fraught site of desire and repulsion, fear and fascination. Primary sources will include works of Hildegard of Bingen, Christine of Pizan, and the Roman de la Rose among others. Students will be asked to read critical material that addresses different constructions of gender and sex in medieval images and secular as well as religious texts. The course, therefore, will not simply focus on artistic production, but will include readings and discussions of social and political history, theology, and literature of the Middle Ages. Offered as ARTH 359 and ARTH 459.

ARTH 360. Renaissance Art in Northern Europe. 3 Units.
Painting, sculpture, and the graphic arts in Belgium, France, Germany, and The Netherlands, 1400-1580, highlighting the careers and contributions of specific artists such as Jan van Eyck, Albrecht Durer, and Pieter Bruegel. We will also analyze the changing social, cultural, religious, and political circumstances of the art made during this period, which saw the invention of printmaking, the Protestant Revolution, and increased strife between rulers and their subjects. The rise of new subjects such as landscape and scene of everyday life will be explored, and changes in patronage will be discussed, concentrating on the shift from church and noble patronage to increasingly middle-class patronage related to the beginnings of the open art market. Offered as ARTH 360 and ARTH 450.

ARTH 361. 17th-Century Art in Belgium and The Netherlands. 3 Units.
The arts of painting, drawing, and printmaking in Belgium and The Netherlands are discussed in relationship to political, social, cultural, and religious contexts. We will explore the careers and production of individual artists such as Rubens, Van Dyck, Hals, Rembrandt, and Vermeer. Developments in new subjects, artistic specialization, and the expansion of the open market are seen as important factors in shaping Belgian and Dutch art. Offered as ARTH 361 and ARTH 461.

ARTH 362. Issues in Renaissance Art. 3 Units.
Various topics in Renaissance art. Lectures, discussions and reports. Offered as ARTH 362 and ARTH 462.

ARTH 367. 17th and 18th Century Art in France. 3 Units.
A Survey of the arts of painting, sculpture and architecture in France from 1600-1780, a period in which France became the leading political and cultural power in Europe. We will focus on the relationship between the arts and changing social, cultural, religious and political circumstances at a time that saw the rise of the absolute state before the French Revolution, the increased use of art for political propaganda, and the burgeoning of a consumer culture in the middle class. Offered as ARTH 367 and ARTH 467.

ARTH 374. Impressionism to Symbolism. 3 Units.
Major developments in European painting and sculpture during the latter half of the nineteenth century. Post-impressionism synthesis, symbolism, and the arts and crafts movement considered in their socio-cultural contexts. Works of Degas, Manet, Monet, Klimt, Bocklin, Gauguin, etc. Offered as ARTH 374 and ARTH 474.

ARTH 379. Issues in 19th Century Art. 3 Units.
Various topics in 19th century art, with class lectures, discussions and reports. Consult department for current topic. Offered as ARTH 379 and ARTH 479.

ARTH 380. Abstract Expressionism and Its Aftermath. 3 Units.
An examination of the development and influences of Abstract Expressionism, including the impact on the Beat Generation and Pop Art. Offered as ARTH 380 and ARTH 480.

ARTH 383. Gender Issues in Feminist Art: The 20th/21st Century. 3 Units.
An in-depth thematic approach to issues affecting works of art by and about women. Focus on the late 20th century. Emphasis on a specifically modern use of feminine myths, subjects and modes of production, and feminist criticism. Offered as ARTH 383, WGST 383 and ARTH 483.

ARTH 384. American Art and Architecture in the Age of Washington and Jefferson. 3 Units.
In the 18th century, Americans created not only a political revolution but an artistic and creative one as well. In the 17th century, most Americans were subsistence farmers and most of their products, manufactures, and buildings were relatively crude. In the 18th century, Americans not only established a new and lasting form of government, but for the first time produced paintings, buildings, furniture and silver that rivaled the finest productions of Europe. Notably, many of the leaders of the American Revolution, such as Paul Revere, George Washington, and Thomas Jefferson, also made significant contributions to the arts. Offered as ARTH 384 and ARTH 484.

ARTH 385. American Avant-Garde: 1900 - 1925. 3 Units.
An examination of the development of avant-garde styles in New York during the early twentieth century. In-depth discussion of the Photo-secession, Stieglitz's "291" gallery, the Armory Show, Marcel Duchamp's move to America, and the formation and demise of the New York Dada movement. Offered as ARTH 385 and ARTH 485.

ARTH 386. Issues in American Art. 3 Units.
Various topics in American art. Each offering will focus on a specific topic within American art. Lectures, discussions, and report. The course will entail regular oral classroom reports and short writing assignments as well as a final paper. Producing an intellectually significant final paper is the major goal of the class. Graduate students are expected to produce a final paper of greater length than Undergraduates and that shows evidence of original scholarship. Offered as ARTH 386 and ARTH 486.
ARTH 390. Introduction to the Art Object and its Explication. 3 Units.
A basic introduction to the museum and gallery worlds as institutions with a focus on the work of art, and on the institution's responsibility to the art object. Skills are to be developed in stylistic and conceptual analyses, problem solving, and critical thought. Emphasis will be placed on written and verbal expression to be developed to articulate visual works of art. The institutional function of the museum or gallery is studied as driven by the acquisition, care, and explication of the object as an entity, or in connection with others of like kind. That there is a building, a director, a Board of Trustees, curators, conservators, a Registrar, security officers, a maintenance crew, is all in response to the art object as one in a gathering of such, or collection. The course is intended as a pre-professional, experiential introduction to the functioning of the art museum with site visits and presentations by museum professionals. Prereq: ARTH 101, ARTH 102, and any 200-level ARTH course.

ARTH 392. Issues in 20th/21st Century Art. 3 Units.
Various topics in 20th/21st century art, with class lectures, discussions, and reports. Offered as ARTH 392 and ARTH 492.

ARTH 393. Contemporary Art: Critical Directions. 3 Units.
An examination of the directions taken by avant-garde American art and criticism in the aftermath of Abstract Expressionism. Includes the rise and fall of modernism in the 1960s and '70s, as well as an investigation of Post-modern trends and theories. Offered as ARTH 393 and ARTH 493.

ARTH 394. Departmental Seminar. 3 Units.
The Department of History of Art and Art departmental seminar. A topical course, emphasizing disciplinary writing and modes of investigation and analysis. It is recommended for Art History majors before the majors seminar/capstone course, typically taken in the junior or senior years. The course advances the goals of SAGES within the disciplinary context of art history by focusing on close readings of art history texts (with an emphasis upon methodological approaches), examination of original works of art when possible, analytical writing, and intensive seminar-style discussion. Prereq: ARTH 101 or ARTH 102 and at least one 200-level ARTH course.

ARTH 395. Internship. 3 Units.
This course is designated for students seeking professional experience in art history. It focuses on the museum experience (registration, exhibition, interpretation, and administration) although students may also elect to conduct internships in museum-related environments such as art conservation. Students are encouraged to have gained significant experience in art history coursework before embarking on an internship. Students must identify an internship and supervisor as well as a campus internship supervisor the semester before enrolling in the internship. Recommended preparation: ARTH 101, ARTH 102, or ARTH 104, and consent.

ARTH 396. Majors Seminar. 3 Units.
Capstone course required of all undergraduate Art History majors, typically taken in senior year. Requires professional-level research with peer and faculty oversight culminating in formal written and oral presentations. Limited to Art History majors.

ARTH 398. Independent Study in Art History. 1 - 3 Unit.
Individual research and reports on special topics.

ARTH 399. Honors Thesis. 3 Units.
Intensive study of a topic or problem leading to the preparation of an honors thesis.

ARTH 401. Museums and Globalization. 3 Units.
Museums are everywhere contested spaces today. Historically designed as symbols of power, centers for research, agents of public education and community formation in Western industrial societies, they have become sites of development and cultural controversy on a global scale. From Cleveland and Paris to Nairobi and Dubai museums figure in urban redevelopment, national identity formation, conflicts between religion and science, and global tourism. Questions we will consider in this course: what are the fundamental features of museums as institutions? what ties have linked them to wider national and international communities of academics, NGO's and business? to political, economic and social concerns? how do museums in Asia, Africa the Middle East and Latin America figure in the current international contention over heritage rights? This is an innovative course allowing students to collaborate on projects, engage with guest lecturers and access museums across the globe. The course is organized in three parts: Part I: National Identity Building and Museums; Part II: Museums and Identity Politics; Part III: Museums and Global Development. Offered as HSTY 329, ARTH 301, HSTY 429, and ARTH 401.

ARTH 402. Buddhist Art in Asia. 3 Units.
This course explores the visual culture of Buddhism in Asia from its origins in India to its transmission and transformation in China, Korea, Japan, Tibet, Nepal, and Southeast Asia. Our historically and culturally structured examination will trace major developments in Buddhist art and their relationship with belief, practice, and ritual. We will consider the ways that artistic traditions have adapted and evolved both within individual cultures and cross-culturally. The study of sculpture, architecture, and painting in their religious contexts will be our primary focus, but we will also consider the movement of Buddhist art from temples to sites of secular display in museums around the world and the religious and cultural issues that arise from these moves. Topics include: representations of the life of the historical Buddha; visual programs of temples; artistic representations of paradises and hells; sacred sites and architecture; Imperial patronage of Buddhist art; the role of art in pilgrimage and ritual; and visual imagery associated with schools of Buddhism such as Pure Land, Chan, and Zen. Offered as ARTH 302 and ARTH 402.

ARTH 407. Arts of China. 3 Units.
A survey of the major developments in Chinese art from the Neolithic period to the present, including archaeological discoveries, bronzes, calligraphy, painting, sculpture, ceramics, architecture, performance art, and installations. Among topics covered are: ancient funerary art and tombs; painting and sculpture of early Buddhist grottoes; landscape painting; art commissioned and collected by the imperial court; literati painting and calligraphy; public and private art associated with Daoist; Buddhist, and Confucian religious practices and sites; art produced during periods of non-Chinese rule under the Tanguts, Mongols, and Manchus; foreign influences on Chinese artists; and the role of Chinese artists in the contemporary international art market. The course explores factors behind the creation and reception of works of art, including social, political and religious meanings, while examining the historical contexts for and artistic traditions of the visual culture of China. Recommended preparation: Students with some Asian studies, Chinese language, Chinese history, or other appropriate background. Offered as ARTH 307 and ARTH 407.
ARTH 408. Arts of Japan. 3 Units.
A survey of the major developments in Japanese art from prehistoric times to the present in a wide range of media, including sculpture, ceramics, architecture, calligraphy, painting, garden design, woodblock prints, film, and installations. Among topics covered are: Buddhist art, narrative handscrolls, ink painting and portraiture associated with Zen, ceramics for tea ceremony, Edo and Meiji period woodblock prints, and Western and Chinese influences on Japanese artists. Modern and contemporary artists and filmmakers such as Isamu Noguchi, Akira Kurosawa, Yayoi Kusama, Yasumasa Morimura, and Takashi Murakami are also investigated. The course explores factors behind the making of works of art, including social and religious meanings, while examining the historical contexts for and aesthetic principles of the arts of Japan. Prerequisites include one previous art history course at the 100- or 200-level or permission of instructor. Students with some Asian studies, Japanese language, Japanese history, or other appropriate background by be permitted to enroll at the discretion of the instructor. Offered as: ARTH 308 and ARTH 408. Prerequisite: One 100- or 200-level ARTH course or by permission of instructor.

ARTH 411. Rome: City and Image. 3 Units.
This course studies the architectural and urban history of Rome from the republican era of the ancient city up to the eighteenth century using the city itself as the major "text." The emphasis will be placed on the extraordinary transformations wrought in the city, or at least in key districts, by powerful rulers and/or elites, especially in the ancient empire and in the Renaissance and baroque eras. In a larger perspective, the great construction projects exerted a far-reaching effect within and beyond Europe, but we will study them in relation to their topographical situation, their functions, and their place in a long history of variations on prestigious themes since many of the artworks and the urban settings featured in the course carry the mark of the Long history of the city itself. Recommended preparation: At least one 200-level course in ANTH, ARTH, CLSC, ENGL, HSTY, or RLGN. Offered as ARTH 311/411 and CLSC 311.

ARTH 432. Art and Archaeology of Ancient Italy. 3 Units.
The arts of the Italian peninsula from the 8th century B.C. to the 4th century A.D., with emphasis on recent archaeological discoveries. Lectures deal with architecture, sculpture, painting, and the decorative arts, supplemented by gallery tours at the Cleveland Museum of Art. Offered as ARTH 332, CLSC 332, and ARTH 432.

ARTH 433. Greek and Roman Painting. 3 Units.
Greek vase painting, Etruscan tomb painting and Roman wall painting. The development of monumental painting in antiquity. Offered as ARTH 333, CLSC 333, and ARTH 433.

ARTH 434. Art and Archaeology of Greece. 3 Units.
A survey of the art and architecture of Greece from the beginning of the Bronze Age (3000 B.C.) to the Roman conquest (100 B.C.) with emphasis on recent archaeological discoveries. Lectures deal with architecture, sculpture, painting, and the decorative arts, supplemented by gallery tours at the Cleveland Museum of Art. Offered as ARTH 334, CLSC 334, and ARTH 434.

ARTH 435. Issues in Ancient Art. 3 Units.
Various topics in Ancient art. Lectures, discussions and reports. Offered as ARTH 335 and ARTH 435.

ARTH 440. Issues in the Art of China. 3 Units.
This is a topics course. Each offering will focus on a specific topic within the area of Chinese art. Sample topics may include: Women painters in Beijing, Modern Artists in China-1980-Present, Shang Dynasty Tombs, Yuan Dynasty Buddhist Art. Lectures, discussions, and reports. Offered as ARTH 340 and ARTH 440.

ARTH 441. Issues in the Art of Japan. 3 Units.
This is a topics course. Each offering will focus on a specific topic within the area of Japanese art. Sample topics may include: Muromachi Hanging Scrolls, Ryoan-ji Temple Garden Architecture, Rimpa School Panel Screens, Buddhist Painting in the Edo Period. Lectures, discussions, and reports. Offered as ARTH 341 and ARTH 441.

ARTH 444. Issues in the Art of Africa. 3 Units.
This is a topics course. Each offering will focus on a specific topic within the area of African art. Sample topics may include: Ritual Masks, Sub-Saharan Religious Architecture, Carvings of Twins in Fertility Rites, Benin Bronze Warrior Reliefs. Lectures, discussions, and reports. Offered as ARTH 344 and ARTH 444.

ARTH 449. Gothic Art: Vision and Matter. 3 Units.
This course will examine the development and dissemination of Gothic art in Western Europe in the High and Late Middle Ages. We will consider a variety of media, including architecture, metalwork, sculpture, manuscript illumination, panel paintings, fresco cycles, and small devotional objects. As we study medieval art in its socio-historical contexts--private and public, monastic and political, liturgical and lay--we will pay special attention to issues of patronage, relationships between texts and images, the introduction of visionary and mystical devotion, attitudes towards education and authority, differences between male and female piety, modes of medieval viewing, and reception and manipulation of art by medieval audiences. Visits to the CMA will form an integral part of the course. Offered as ARTH 349 and ARTH 449.

ARTH 450. Issues in Medieval Art. 3 Units.
Various topics in Medieval Art. Lectures, discussions, and reports. Offered as ARTH 350 and ARTH 450.

ARTH 451. Late Gothic Art in Italy. 3 Units.
Sculpture of the Pisani; early trends in Pisa, Siena, and Florence; Cimabue and Giotto; Duccio, Simone Martini, and the Lorenzetti; painting in Florence and Siena after the Black Death. Offered as ARTH 351 and ARTH 451.

ARTH 452. Italian Art of the 15th Century. 3 Units.
The early 15th century in Florence, civic humanism, the sculpture of Ghiberti and Donatello, the painting of Masaccio; the International Style in painting, the art of Uccello, Piero della Francesca, Mantegna, and Botticelli; Carpaccio and the Bellini in Venice. Offered as ARTH 352 and ARTH 452.

ARTH 453. Sixteenth Century Italian Art. 3 Units.
The development of the High Renaissance and Mannerist styles in Italy and late 16th century trends: painting and sculpture. Offered as ARTH 353 and ARTH 453.
ARTH 458. Medieval Body. 3 Units.
This course will explore the meanings and representations of the body in western medieval culture. Topics will include bleeding bodies, fragmented bodies, lactating bodies, labile bodies, cosmic bodies, physiological bodies, mystical bodies, suffering bodies, edible bodies, enclosed bodies, gendered bodies, Christ's bodies, Mary's bodies, decomposing bodies, macabre bodies, resurrected bodies, dead bodies, intercessory bodies, unhinging bodies, translucent bodies, martyred bodies, desirable bodies, desirous bodies, abhorrent bodies, mimetic bodies, nude bodies, marginalized bodies, defleshed bodies, social bodies, political bodies, monstrous bodies, mnemonic bodies, and deformed bodies. We will explore the complex rhetoric of embodiment as it manifests itself in the ambiguous discourse—both medieval and contemporary—on the relationships between the material and intangible, spiritual and physical, somatic and mental, corporeal and ethereal. Offered as ARTH 358 and ARTH 458.

ARTH 459. Visual Culture of Medieval Women. 3 Units.
This course will explore works made by and for women—as well as images of women—in the Romanesque and Gothic periods. We will discuss female monastics who commissioned and produced art, and consider the roles of women as patrons and consumers. The course will explore different ways of seeing, reading, figuring, and interacting with images of the female body, frequently seen as a fraught site of desire and repulsion, fear and fascination. Primary sources will include works of Hildegard of Bingen, Christine of Pizan, and the Roman de la Rose among others. Students will be asked to read critical material that addresses different constructions of gender and sex in medieval images and secular as well as religious texts. The course, therefore, will not simply focus on artistic production, but will include readings and discussions of social and political history, theology, and literature of the Middle Ages. Offered as ARTH 359 and ARTH 459.

ARTH 460. Renaissance Art in Northern Europe. 3 Units.
Painting, sculpture, and the graphic arts in Belgium, France, Germany, and The Netherlands, 1400-1580, highlighting the careers and contributions of specific artists such as Jan van Eyck, Albrecht Durer, and Pieter Bruegel. We will also analyze the changing social, cultural, religious, and political circumstances of the art made during this period, which saw the invention of printmaking, the Protestant Revolution, and increased strife between rulers and their subjects. The rise of new subjects such as landscape and scene of everyday life will be explored, and changes in patronage will be discussed, concentrating on the shift from church and noble patronage to increasingly middle-class patronage related to the beginnings of the open art market. Offered as ARTH 360 and ARTH 460.

ARTH 461. 17th-Century Art in Belgium and The Netherlands. 3 Units.
The arts of painting, drawing, and printmaking in Belgium and The Netherlands are discussed in relationship to political, social, cultural, and religious contexts. We will explore the careers and production of individual artists such as Rubens, Van Dyck, Hals, Rembrandt, and Vermeer. Developments in new subjects, artistic specialization, and the expansion of the open market are seen as important factors in shaping Belgian and Dutch art. Offered as ARTH 361 and ARTH 461.

ARTH 462. Issues in Renaissance Art. 3 Units.
Various topics in Renaissance art. Lectures, discussions and reports. Offered as ARTH 362 and ARTH 462.

ARTH 467. 17th and 18th Century Art in France. 3 Units.
A Survey of the arts of painting, sculpture and architecture in France from 1600-1780, a period in which France became the leading political and cultural power in Europe. We will focus on the relationship between the arts and social change, cultural, religious and political circumstances at a time that saw the rise of the absolute state before the French Revolution, the increased use of art for political propaganda, and the burgeoning of a consumer culture in the middle class. Offered as ARTH 367 and ARTH 467.

ARTH 474. Impressionism to Symbolism. 3 Units.
Major developments in European painting and sculpture during the latter half of the nineteenth century. Post-impressionism synthethism, symbolism, and the arts and crafts movement considered in their socio-cultural contexts. Works of Degas, Manet, Monet, Klimt, Bocklin, Gauguin, etc. Offered as ARTH 374 and ARTH 474.

ARTH 479. Issues in 19th Century Art. 3 Units.
Various topics in 19th century art, with class lectures, discussions and reports. Consult department for current topic. Offered as ARTH 379 and ARTH 479.

ARTH 480. Abstract Expressionism and Its Aftermath. 3 Units.
An examination of the development and influences of Abstract Expressionism, including the impact on the Beat Generation and Pop Art. Offered as ARTH 380 and ARTH 480.

ARTH 483. Gender Issues in Feminist Art: The 20th/21st Century. 3 Units.
An in-depth thematic approach to issues affecting works of art by and about women. Focus on the late 20th century. Emphasis on a specifically modern use of feminine myths, subjects and modes of production, and feminist criticism. Offered as ARTH 383, WGST 383 and ARTH 483.

ARTH 484. American Art and Architecture in the Age of Washington and Jefferson. 3 Units.
In the 18th century, Americans created not only a political revolution but an artistic and creative one as well. In the 17th century, most Americans were subsistence farmers and most of their products, manufactures, and buildings were relatively crude. In the 18th century, Americans not only established a new and lasting form of government, but for the first time produced paintings, buildings, furniture and silver that rivaled the finest productions of Europe. Notably, many of the leaders of the American Revolution, such as Paul Revere, George Washington, and Thomas Jefferson, also made significant contributions to the arts. Offered as ARTH 384 and ARTH 484.

ARTH 485. American Avant-Garde: 1900 - 1925. 3 Units.
An examination of the development of avant-garde styles in New York during the early twentieth century. In-depth discussion of the Photo-secession, Stieglitz’s “291” gallery, the Armory Show, Marcel Duchamp’s move to America, and the formation and demise of the New York Dada movement. Offered as ARTH 385 and ARTH 485.

ARTH 486. Issues in American Art. 3 Units.
Various topics in American art. Each offering will focus on a specific topic within American art. Lectures, discussions, and report. The course will entail regular oral classroom reports and short writing assignments as well as a final paper. Producing an intellectually significant final paper is the major goal of the class. Graduate students are expected to produce a final paper of greater length than Undergraduates and that shows evidence of original scholarship. Offered as ARTH 386 and ARTH 486.
ARTH 489. M.A. Qualifying Paper. 3 Units.
Individual research and intensive study of a specific topic in art history that culminates in a written M.A. Qualifying Paper. Prereq: To be taken only after completion of 18 credit hours of graduate Art History coursework.

ARTH 490A. Visual Arts and Museums I. 3 Units.
This course examines the idea of the art museum in both its historical and contemporary manifestations, focusing on the context of Western Europe and the United States. As a result of this course, students should be familiar with the following topics: the historic development of the museum, from its origins in collecting practices to its modern incarnation as an institution; the development and care of a collection, including acquisition, cataloguing, and conservation; the display and housing of a collection, including internal and external museum architecture; the study and interpretation of the collection/exhibition, considering diverse publics; the governance of the institution, including project management, finance, and administration. Through the study of these topics, the student should be familiar with the following concepts: the museum as a place for learning, research and scholarship and the museum as steward of cultural property and the attendant issues of ethics and the law. ARTH 490A concentrates on museum collections and related aspects of care, research, interpretation and scholarship. Students who successfully complete ARTH 490A and ARTH 490B may be considered for admission into ARTH 491A, a supervised internship in an art museum or gallery situation.

ARTH 490B. Visual Arts and Museums: II. 3 Units.
This course examines the idea of the art museum in both its historical and contemporary manifestations, focusing on the context of Western Europe and the United States. As a result of this course, students should be familiar with the following topics: the historic development of the museum, from its origins in collecting practices to its modern incarnation as an institution; the development and care of a collection, including acquisition, cataloguing, and conservation; the display and housing of a collection, including internal and external museum architecture; the study and interpretation of the collection/exhibition, considering diverse publics; the governance of the institution, including project management, finance, and administration. Through the study of these topics, the student should be familiar with the following concepts: the museum as a place for learning, research and scholarship and the museum as steward of cultural property and the attendant issues of ethics and the law. ARTH 490B concentrates on the museum as an institution, including physical aspects, management and governance, and as a site of learning. The interconnections between these broad fields and individual departments will be demonstrated and reinforced throughout the semester. Students who successfully complete ARTH 490A and ARTH 490B may be considered for admission into ARTH 491A, a supervised internship in an art museum or gallery situation.

ARTH 491A. Visual Arts and Museums: Internship. 1 Unit.
Recommended preparation: ARTH 490.

ARTH 491B. Visual Arts and Museums: Internship. 3 Units.
Second semester of Internship sequence. This internship focuses on the implementation of a comprehensive project that would serve a function similar to the requirement of a qualifying paper for the completion of a master’s degree in art history. It is recommended that students undertake this internship in the same division in which their first internship was situated although students may find opportunities to parlay the skills acquired in the first internship to successful advanced work in another division. The key distinction here is that the work in ARTH 491B should build upon the expertise developed in ARTH 491 and represent a significant advance in responsibilities and skills. By week 10 of ARTH 491, students should begin to identify a potential project for ARTH 491B. By the first week of the semester in which ARTH 491B is to be completed, the student must file an internship agreement form with the department that includes a brief description of the project to be completed, including a summary of the project and major milestones/time line. In addition to working under the direct supervision of a museum mentor, the student must obtain a faculty mentor for the project and this information should be included in the internship agreement form. Students must file a mid-term and final report describing their duties and responsibilities and a self-assessment of their performance and a final portfolio with a final version of their project as well as examples of drafts and feedback received in the course of completing the project. Students must also keep a journal that tracks their milestones in completing their projects. The faculty supervisor will solicit a letter of assessment from the internship supervisor immediately upon the close of the internship and in sufficient time for final grades. Recommended preparation: ARTH 490, ARTH 491A.

ARTH 492. Issues in 20th/21st Century Art. 3 Units.
Various topics in 20th/21st century art, with class lectures, discussions, and reports. Offered as ARTH 392 and ARTH 492.

ARTH 493. Contemporary Art: Critical Directions. 3 Units.
An examination of the directions taken by avant-garde American art and criticism in the aftermath of Abstract Expressionism. Includes the rise and fall of modernism in the 1960s and ’70s, as well as an investigation of Post-modern trends and theories. Offered as ARTH 393 and ARTH 493.

ARTH 494A. Directed Readings in Non-Western Art. 1 - 3 Unit.
Directed reading.

ARTH 494B. Ancient Art. 1 - 3 Unit.

ARTH 494C. Medieval Art. 1 - 3 Unit.

ARTH 494D. Renaissance and Baroque Art. 1 - 3 Unit.

ARTH 494E. American Art. 1 - 3 Unit.

ARTH 494F. Modern Art. 1 - 3 Unit.

ARTH 495. Methodologies of Art History. 3 Units.
The study of art history as a discipline in its practical and theoretical aspects. Consideration given to research methods, style and historical context, and a critical examination of selected major art historical texts with a view to understanding traditional as well as recent approaches. Special attention is given to art historical writing, employing selected original works in the Cleveland Museum of Art. Required of first-year graduate students in the Ph.D. and Master’s programs.

ARTH 512. Seminar in Ancient Art. 3 Units.
ARTH 518B. Seminar in Asian Art. 3 Units.

ARTH 545B. Seminar in Medieval Art. 3 Units.

ARTH 551. Seminar in Renaissance Art. 3 Units.

ARTH 552. Seminar in Baroque Art. 3 Units.

ARTH 565. Seminar in American Art. 3 Units.

ARTH 570. Seminar: 19th Century Art. 3 Units.

ARTH 575. Critical Theory Seminar. 3 Units.
In-depth study of controversial revisionist writings which demonstrate the strong impact of structuralist, poststructuralist, semiotic, Marxist, psychoanalytic, film, and gender theories on recent art historical discourse. Discussion of a wide range of current theoretical positions applied to visual and critical analysis of 19th and 20th century art works. Recommended preparation: ARTH 495.

ARTH 576. Seminar in Modern Art. 3 Units.

ARTH 590. History and Practice of Connoisseurship. 3 Units.
In this seminar we will consider the history, historiography, and practice of connoisseurship. In western cultures connoisseurship, the practice of attributing works of art to specific artists, regions, and time periods and assessing their quality, can be traced back to classical antiquity. It was practiced with renewed vigor in Europe from the sixteenth century onward and in the nineteenth century was a foundational methodology for the academic discipline of art history. While it came under criticism in the twentieth century as a method too closely aligned with the art market, connoisseurship continues to be practiced today, especially in museums and auction houses, as a vital and necessary methodological approach. In recent decades art historians have also begun to reevaluate the history, practices and historiographic importance of this methodology. Class discussions of the scholarly literature of connoisseurship and case studies of its practice will alternate with sessions held in the Cleveland Museum of Art to examine objects from the permanent collections. The museum sessions, led by curators and conservators, will also emphasize the role that physical condition plays in making connoisseurship assessments. Specific topics will be designated each time the course is offered. Prereq: ARTH 495.

ARTH 601. Research in Art History. 1 - 18 Unit.
(Credit as arranged.)

ARTH 610A. Advanced Visual Arts and Museums: Internship I. 3 Units.
First semester of the internship sequence. The intern will work under the supervision of a museum professional to plan and execute a specific project. The student must also obtain a faculty mentor for the project. An internship agreement form must be filed with the department by the end of the first week of classes that includes a brief description of the project. If it is a project to be completed in one semester, a time line should be included as well. The intern must file a mid-term and final report describing their duties and responsibilities and a self-assessment of their performance. A portfolio kept in the department will include the final version of their project as it stands at the end of the semester, as well as examples of drafts and any evaluation received in the course of completing the project. The intern must also keep a journal that tracks their milestones in the execution of their project. The faculty supervisor will solicit a letter of assessment from the museum supervisor immediately upon the close of the internship and in sufficient time to assign a final grade. Prereq: ARTH 490A and ARTH 490B.

ARTH 610B. Advanced Visual Arts and Museums Internship II. 3 Units.
Second semester of the internship sequence. The intern will either continue with the execution of the project begun in the first semester (ARTH 610A) or, when appropriate, undertake a new project. The intern will work under the supervision of a museum professional, and must obtain a faculty mentor for the project. An internship agreement form must be filed with the department by the end of the first week of classes that includes a brief description of the project. A time line should be included as well. The intern must file a mid-term and final report describing their duties and responsibilities and a self-assessment of their performance. A portfolio kept in the department will include the final version of their project as it stands at the end of the semester, as well as examples of drafts and any evaluation received in the course of completing the project. The intern must also keep a journal that tracks their milestones in the execution of their project. The faculty supervisor will solicit a letter of assessment from the museum supervisor immediately upon the close of the internship and in sufficient time to assign a final grade. Prereq: ARTH 490A and 490B and ARTH 610A.

ARTH 701. Dissertation Ph.D.. 1 - 18 Unit.
(Credit as arranged.) Prereq: Predoctoral research consent or advanced to Ph.D. candidacy milestone.

ARTS Courses

ARTS 101. Design and Color I. 3 Units.
Organizational and structural projects as a basis for the development of style. Studies in line, texture, shape, space, value, color, and two dimensional composition through studio problems, art studio media and techniques.

ARTS 106. Creative Drawing I. 3 Units.
Development of graphic fluency in black and white through direct observation of nature and the model. Drawing as a means of enlarging visual sensitivity using a wide range of media and subject matter. Work from nude model.

ARTS 201. Design and Color II. 3 Units.
ARTS 204. Printmaking. 3 Units.
Printmaking is an introductory studio class of basic fine art printmaking processes. Students will learn how to make original printed images from a wide variety of matrix printing surfaces, including linoleum, copper metal plate, plastic and cardboard. Intaglio and relief processes will be learned. Prereqs: ARTS 101 or ARTS 106.

ARTS 206. Creative Drawing II. 3 Units.
Continuation of ARTS 205. Advanced work in graphic representation. Development of visual acuity and a personal drawing style while working in color. Work from nude model. Prereq: ARTS 106.

ARTS 210. Enameling and Jewelry I. 3 Units.
Techniques in the application of vitreous enamel on copper and of constructed metal jewelry. Technical skill and suitability of design as applied to the medium.

ARTS 212. Weaving, Fibers, and Textiles I. 3 Units.

ARTS 214. Ceramics I. 3 Units.
The techniques of hand building in pinch, coil and slab methods. Development of sensitivity to design and form. Basic work in stoneware, earthenware, and glazing.

ARTS 216. Painting I. 3 Units.
The creative, conceptual, visual, and technical aspects of painting. Style ranging from naturalism to abstraction. Work in acrylic and mixed media.

ARTS 220. Photography Studio I. 3 Units.
Camera, film, and darkroom techniques. Development of basic black and white perceptual and photographic skills. Darkroom and photographic field and lab work. 35mm camera required.

ARTS 295. Introduction to Art Education. 3 Units.
General history and theories of art education. Development of personal philosophy as basis for teaching art. Topics in professional standards, creativity, aesthetic theory, and art criticism. (Clinical/field experience required.)

ARTS 300. Current Issues in Art Education. 3 Units.
Contemporary issues in Art Education; understanding art goals and standards of National Art Education Association and the Ohio State Department of Education for teachers, students and administrators. Special topics: art and technology, multiculturalism, special populations and classroom management. Offered as ARTS 300 and ARTS 400. Prereq: ARTS 295.

ARTS 302. Architecture and City Design I. 3 Units.
The social, spatial, and aesthetic elements in architecture; the components of the building: the window, door, roof, enclosing walls, and character of interior and exterior space. Projects related to small, intimate scale and residential structures. Lectures, field trips, studio experiences. Recommended ARTS 101 or ARTS 106 courses prior to enrollment. Offered as ARTS 302 or ARTS 402.

ARTS 303. Architecture and City Design II. 3 Units.
The social, spatial, and aesthetic elements of the urban setting of architecture, the organizational components of the city, the path, the node, the edge, and the grid. Projects related to large-scale and public buildings and their relationship to the encompassing visual world. Lectures, field trips, studio experiences. Recommended ARTS 101 or ARTS 106 courses prior to enrollment. Offered as ARTS 303 or ARTS 403.

ARTS 304. Architecture and City Design III. 3 Units.
A study of historic precedents and the social implications of modern and contemporary architecture including analysis and form interpretation as it relates to building and materials technologies. Practical application and synthesis of architectural knowledge through site visits and research of local and regional architecture. Discussions of historic and contemporary architects, engineers and significant architecture and engineering firms. Prereq: ARTS 302 and ARTS 303.

ARTS 310. Enameling and Jewelry II. 3 Units.

ARTS 312. Weaving, Fibers, and Textiles II. 3 Units.
Continuation of ARTS 212. Exploration of a selected area of textiles in surface design or constructed textiles. Development of a personal aesthetic through design and execution of a series of projects. Prereq: ARTS 212.

ARTS 314. Ceramics II. 3 Units.

ARTS 316. Painting II. 3 Units.
The creative, conceptual, visual and technical aspects of painting. Styles ranging from expressionism, cubism, surrealism and abstraction. Work in acrylic and mixed media leading to the development of personal painting style. Prereq: ARTS 216.

ARTS 320. Photography Studio II. 3 Units.
Continuation of ARTS 220. Advanced theory and black and white techniques. Development of personal aesthetic encouraged. Field work. 35mm camera required. Prereq: ARTS 220.

ARTS 322. Digital Photography I. 3 Units.

ARTS 325. Creative Photography. 3 Units.
Creative photography through photographing and responding to photographs. The question of self-expression and photographic medium explored in the pursuit of understanding images. Prereq: ARTS 220 and ARTS 320 or ARTS 322.
ARTS 350. Multimedia I. 3 Units.
Fundamental concepts and skills for using technology to design, create, express, and present. This project-oriented class will develop knowledge and competencies related to digital imaging, animation, video, multimedia, production and presentation. Offered as ARTS 350 and ARTS 450. Prereq: One from ARTS 101, ARTS 106, ARTS 216, or ARTS 220 or permission of the Director of Art Education.

ARTS 365A. Painting. 3 Units.
Advanced painting projects determined in consultation with instructor. Prereq: ARTS 216 and ARTS 316.

ARTS 365B. Design and Color. 3 Units.
Advanced design projects determined in consultation with instructor. Prereq: ARTS 101 and ARTS 201.

ARTS 365C. Enameling and Jewelry. 3 Units.
Advanced enameling and jewelry projects determined in consultation with instructor. Prereq: ARTS 210 and ARTS 310.

ARTS 365D. B&W Photography Studio. 3 Units.
Advanced black and white projects determined in consultation with instructor. Prereq: ARTS 220 and ARTS 320.

ARTS 365E. Color Studio. 3 Units.
Advanced digital color studio projects determined in consultation with instructor. Prereq: ARTS 220 and ARTS 322.

ARTS 365G. Ceramics. 3 Units.
Advanced ceramics projects determined in consultation with instructor. Prereq: ARTS 214 and ARTS 314.

ARTS 365H. Weaving, Fibers, and Textiles. 3 Units.
Advance textile projects determined in consultation with instructor. Prereq: ARTS 212 and ARTS 312.

ARTS 366A. Student Teaching in Art: Pre-K - 6th Grade. 4 Units.

ARTS 366B. Student Teaching in Art: 7th - 12th Grade. 4 Units.

ARTS 385. Clinical/Field Based Experience I. 1 Unit.
Art education students observe and assist art teachers in classes in a variety of public and private educational environments such as local schools, Cleveland Museum of Art. Students study, identify, and analyze differences in art curriculum taught at the various art programs that they observe. Written reports using departmental observation guidelines are required. Prereq: ARTS 295.

ARTS 386. Clinical/Field Based Experience II. 1 Unit.
Art education students become sensitized to serving needs of "special" populations. Observation of educational strategies for teaching learning disabled and/or physically disabled students. Written reports using departmental observation guidelines required. Prereq: ARTS 295.

ARTS 387. Clinical/Field Based Experience III. 1 Unit.
Art education students observe and assist in art programs for artistically gifted students working in specialized art areas (drawing, painting, sculpture, printmaking, art history). Written reports using departmental observation guidelines are required. Prereq: ARTS 295.

ARTS 389. Art Content, Pedagogy, Methodology, and Assessment. 3 Units.
Growth and development of image making from Pre-K through young adult. Principles and practices of art instruction in grades Pre-K through 12th grade. Issues in art education. Curriculum construction, implementation and assessment of art lessons that address content areas of art production, art history, art appreciation, and art criticism. Clinical field experiences required. Offered as ARTS 393 and ARTS 493. Prereq: ARTS 295.

ARTS 395. Introduction to Multimedia Technology. 3 Units.
Fundamental concepts and skills for using technology in art, electronic portfolio development, and teaching and learning. This project-oriented class will develop knowledge and competencies related to digital imaging and video, multimedia production and presentation, the Internet, information processing, computer systems and management as they relate to art education. Offered as ARTS 395 and ARTS 495. Prereq: ARTS 101 and ARTS 201 or ARTS 220 and ARTS 320.

ARTS 399. Independent Study in Art Studio. 1 - 3 Unit.
Independent Study in Art Studio; by permit of Director only.

ARTS 400. Current Issues in Art Education. 3 Units.
Contemporary issues in Art Education; understanding art goals and standards of National Art Education Association and the Ohio State Department of Education for teachers, students and administrators. Special topics: art and technology, multiculturalism, special populations and classroom management. Offered as ARTS 300 and ARTS 400.

ARTS 402. Architecture and City Design I. 3 Units.
The social, spatial, and aesthetic elements in architecture; the components of the building: the window, door, roof, enclosing walls, and character of interior and exterior space. Projects related to small, intimate scale and residential structures. Lectures, field trips, studio experiences. Recommended ARTS 101 or ARTS 106 courses prior to enrollment. Offered as ARTS 302 or ARTS 402.

ARTS 403. Architecture and City Design II. 3 Units.
The social, spatial, and aesthetic elements of the urban setting of architecture, the organizational components of the city, the path, the node, the edge, and the grid. Projects related to large-scale and public buildings and their relationship to the encompassing visual world. Lectures, field trips, studio experiences. Recommended ARTS 101 or ARTS 106 courses prior to enrollment. Offered as ARTS 303 or ARTS 403.

ARTS 450. Multimedia I. 3 Units.
Fundamental concepts and skills for using technology to design, create, express, and present. This project-oriented class will develop knowledge and competencies related to digital imaging, animation, video, multimedia, production and presentation. Offered as ARTS 350 and ARTS 450.
ARTS 465. Seminar for Art Teachers. 4 Units.
For art education majors and teacher licensure candidates. Principles and practice in school art instruction grades Pre-K through 12th grade. Organization and management of the art program that incorporates writing sequential art curriculum that integrates art production, art history, appreciation, and criticism. Planning, development, and evaluation of teaching materials, lessons, and units. The seminar includes discussion of professional issues, ethics, art advocacy, and classroom management. Prereq: ARTS 295 or ARTS 602, and ARTS 393 or ARTS 493. Coreq: ARTS 366A and ARTS 366B or ARTS 466A and ARTS 466B.

ARTS 466A. Student Teaching in Art: Pre-K - 6th Grade. 4 Units.
Teaching art for early childhood, elementary, and middle school students in a school setting. Includes art curriculum development, implementation, and assessment. Professional standards and practices. Offered as ARTS 366A and ARTS 466A. Prereq: ARTS 385, ARTS 386, ARTS 387, ARTS 400, ARTS 493, and ARTS 602. Coreq: ARTS 465 and ARTS 466B.

ARTS 466B. Student Teaching in Art: 7th - 12th Grade. 4 Units.
Teaching adolescents and young adults art in a school setting. Includes art curriculum development, implementation, assessment and classroom management. Professional standards and practices. Offered as ARTS 366B and ARTS 466B. Prereq: ARTS 385, ARTS 386, ARTS 387, ARTS 400, ARTS 493, and ARTS 602. Coreq: ARTS 465 and ARTS 466A.

ARTS 493. Art Content, Pedagogy, Methodology, and Assessment. 3 Units.
Growth and development of image making from Pre-K through young adult. Principles and practices of art instruction in grades Pre-K through 12th grade. Issues in art education. Curriculum construction, implementation and assessment of art lessons that address content areas of art production, art history, art appreciation, and art criticism. Clinical field experiences required. Offered as ARTS 393 and ARTS 493. Prereq: ARTS 602.

ARTS 494. Teaching Art. 3 Units.
Research contrasting theories of art education in relationship to a variety of educational settings in elementary and secondary schools. Developing innovative, interdisciplinary, comprehensive curriculum models for a specific organization. For licensed art teachers only or consent of instructor.

ARTS 495. Introduction to Multimedia Technology. 3 Units.
Fundamental concepts and skills for using technology in art, electronic portfolio development, and teaching and learning. This project-oriented class will develop knowledge and competencies related to digital imaging and video, multimedia production and presentation, the Internet, information processing, computer systems and management as they relate to art education. Offered as ARTS 395 and ARTS 495.

ARTS 497. Summer Workshop in Art Education. 3 Units.
A current art education issue is covered in depth.

ARTS 602. Study in Art Education. 3 Units.
General history and theories of art education. Development of personal philosophy as basis for teaching art. Topics in professional standards, creativity, aesthetic theory, and art criticism. Students produce an art education research paper. Clinical/Field experiences are required.

ARTS 605. Final Creative Thesis. 1 - 3 Unit.
Students receive individual guidance for an approved self-designed creative project from program faculty members. A public exhibition or presentation is required. By permit only.
Department of Astronomy

The Department of Astronomy offers two undergraduate degrees, a Bachelor of Science and a Bachelor of Arts. The primary difference between them is that the BA degree allows somewhat more flexibility in choice of courses. The department offers a minor in astronomy as well.

The curriculum emphasizes a broad and substantial education in astronomy, physics and mathematics. A faculty actively engaged in research provides first-rate instruction and opportunities for undergraduate involvement in research.

A bachelor’s degree in astronomy can prepare students for graduate study in astronomy (about 50% of our graduates take this path), but those who seek employment in other fields can fill the same jobs as physics and computer science majors.

The department offers a graduate program leading to the degree of Doctor of Philosophy in astronomy. Current research provides opportunities in observational and theoretical studies of galaxy formation and evolution, galaxy cluster evolution, astronomical instrumentation, and cosmology.

Facilities

The Department of Astronomy operates the Kitt Peak Station of the Warner and Swasey Observatory near Tucson, Arizona, home of the Burrell Schmidt telescope. This telescope is used for surveys and ultra-deep imaging with a large format CCD. The department is also a member of the Sloan Digital Sky Survey, which operates a 2.5m telescope with multi-object spectrographs and wide-field imager at Apache Point, New Mexico. The third incarnation of this survey includes a Baryon Oscillation survey of the large-scale structure of the universe and a spectroscopic survey of the Milky Way galaxy. A 9.5-inch refractor permanently mounted on the roof of the A. W. Smith Building is available for use by students. The department also houses a research and instruction computer laboratory and has access to the university’s high-performance computing cluster.

BS Astronomy I BA Astronomy I Minor

Bachelor of Science in Astronomy

The Bachelor of Science in astronomy requires 122 credit hours, including 20 hours in astronomy, 43 hours in physics, 14 hours in math, and 12 hours in technical electives.

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<th>Major courses</th>
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<td>ASTR 221 Stars and Planets</td>
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<td>ASTR 222 Galaxies and Cosmology</td>
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<td>ASTR 306 Astronomical Techniques</td>
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<td>ASTR 323 The Local Universe</td>
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<th>Additional required courses</th>
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<tbody>
<tr>
<td>MATH 121 Calculus for Science and Engineering I</td>
<td>4</td>
</tr>
<tr>
<td>MATH 122 Calculus for Science and Engineering II</td>
<td>4</td>
</tr>
<tr>
<td>or MATH 124 Calculus II</td>
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</tr>
<tr>
<td>MATH 223 Calculus for Science and Engineering III</td>
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</tr>
<tr>
<td>or MATH 227 Calculus III</td>
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</tr>
<tr>
<td>MATH 224 Elementary Differential Equations</td>
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<tr>
<td>or MATH 228 Differential Equations</td>
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</tr>
<tr>
<td>PHYS 121 General Physics I - Mechanics</td>
<td>4</td>
</tr>
<tr>
<td>or PHYS 123 Physics and Frontiers I - Mechanics</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 122 General Physics II - Electricity and Magnetism</td>
<td>4</td>
</tr>
<tr>
<td>or PHYS 124 Physics and Frontiers II - Electricity and Magnetism</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 203 Analog and Digital Electronics</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 204 Advanced Instrumentation Laboratory</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 221 Introduction to Modern Physics</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 250 Computational Methods in Physics</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 301 Classical Mechanics</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 313 Thermodynamics and Statistical Mechanics</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 324 Electricity and Magnetism I</td>
<td>3</td>
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<td>PHYS 325 Electricity and Magnetism II</td>
<td>3</td>
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<tr>
<td>PHYS 326 Physical Optics</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 331 Introduction to Quantum Mechanics I</td>
<td>3</td>
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</tbody>
</table>

Approved technical electives (these can be from astronomy, chemistry, mathematics, statistics, physics, or earth, environmental, and planetary sciences; check with advisor for complete list)

| MATH 201 Introduction to Linear Algebra | 3 |
| EEPS 345 Planetary Materials | 3 |
| PHYS 316 Introduction to Nuclear and Particle Physics | 3 |
| PHYS 349 Methods of Mathematical Physics I | 3 |
| PHYS 350 Methods of Mathematical Physics II | 3 |

Total Units: 86

Six hours of mathematics and natural science (physics) are double counted towards the SAGES breadth requirements, and one required math course is double counted towards the SAGES Quantitative Reasoning requirement.

Sample Plan of Study: Bachelor of Science in Astronomy

<table>
<thead>
<tr>
<th>First Year</th>
<th>Units</th>
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<tbody>
<tr>
<td>Calculus for Science and Engineering I (MATH 121)</td>
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<tr>
<td>General Physics I - Mechanics (PHYS 121)</td>
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<td>PHED (2 half semester courses)</td>
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<tr>
<td>SAGES First Seminar</td>
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<tr>
<td>Social Science I</td>
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</tr>
<tr>
<td>Calculus for Science and Engineering II (MATH 122)</td>
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<tr>
<td>or Calculus II (MATH 124)</td>
<td>4</td>
</tr>
<tr>
<td>General Physics II - Electricity and Magnetism (PHYS 122)</td>
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</tr>
<tr>
<td>or Calculus II (MATH 124)</td>
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<tr>
<td>PHED (2 half semester courses)</td>
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</tr>
<tr>
<td>Elementary Computer Programming (ENGR 131)</td>
<td>3</td>
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<tr>
<td>Doing Astronomy (ASTR 151)</td>
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<tr>
<td>Arts &amp; Humanities I</td>
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<tr>
<td>Year Total:</td>
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<table>
<thead>
<tr>
<th>Second Year</th>
<th>Units</th>
</tr>
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<tbody>
<tr>
<td>Stars and Planets (ASTR 221)</td>
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<tr>
<td>Calculus for Science and Engineering III (MATH 223)</td>
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<tr>
<td>Calculus III (MATH 227)</td>
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<td>Introduction to Modern Physics (PHYS 221)</td>
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<td>or Calculus III (MATH 227)</td>
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</tr>
<tr>
<td>Analog and Digital Electronics (PHYS 203)</td>
<td>4</td>
</tr>
<tr>
<td>SAGES University Seminar</td>
<td>3</td>
</tr>
<tr>
<td>Galaxies and Cosmology (ASTR 222)</td>
<td>3</td>
</tr>
<tr>
<td>Elementary Differential Equations (MATH 224)</td>
<td>3</td>
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<tr>
<td>or Differential Equations (MATH 228)</td>
<td>3</td>
</tr>
<tr>
<td>Advanced Instrumentation Laboratory (PHYS 204)</td>
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<tr>
<td>Computational Methods in Physics (PHYS 250)</td>
<td>3</td>
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<tr>
<td>Classical Mechanics (PHYS 310)</td>
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<td>SAGES University Seminar</td>
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</tr>
<tr>
<td>Year Total:</td>
<td>16 19</td>
</tr>
</tbody>
</table>
### Bachelor of Arts in Astronomy

The Bachelor of Arts in astronomy requires 120 credit hours, including 17 hours in astronomy, 29 hours in physics, 14 hours in math, and 6 hours in technical electives.

<table>
<thead>
<tr>
<th>Year</th>
<th>Units</th>
<th>Fall</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Third Year</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stellar Physics (ASTR 311)&lt;sup&gt;b&lt;/sup&gt;</td>
<td>3</td>
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<tr>
<td>Thermodynamics and Statistical Mechanics (PHYS 313)</td>
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<td>Technical Elective</td>
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<tr>
<td>Arts &amp; Humanities II</td>
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<td>Social Science II</td>
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<tr>
<td>Cosmology and the Structure of the Universe (ASTR 328)&lt;sup&gt;b&lt;/sup&gt;</td>
<td>3</td>
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<tr>
<td>Electricity and Magnetism I (PHYS 324)</td>
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<td></td>
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<tr>
<td>Physical Optics (PHYS 326)</td>
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<tr>
<td>Quantitative Reasoning</td>
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<tr>
<td>Technical Elective</td>
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<th>Fall</th>
<th>Spring</th>
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<td><strong>Fourth Year</strong></td>
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<tr>
<td>Introduction to Quantum Mechanics I (PHYS 331)</td>
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<tr>
<td>Astronomy Capstone Project (ASTR 351)&lt;sup&gt;c&lt;/sup&gt;</td>
<td>1 - 3</td>
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<td>Technical Elective</td>
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<tr>
<td>Global and Cultural Diversity</td>
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<tr>
<td>Astrophysics Seminar II (ASTR 310)</td>
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<tr>
<td>The Local Universe (ASTR 323)&lt;sup&gt;b&lt;/sup&gt;</td>
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<tr>
<td>Introduction to Quantum Mechanics II (PHYS 332)</td>
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<td></td>
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<tr>
<td>Astronomy Capstone Project (ASTR 351)&lt;sup&gt;c&lt;/sup&gt;</td>
<td>1 - 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Social Science II</td>
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<td></td>
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<tr>
<td>Technical Elective</td>
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<td><strong>Year Total:</strong></td>
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<td><strong>Total Units:</strong></td>
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Six hours of mathematics and natural science (physics) are double counted towards the SAGES breadth requirements, and one required math course is double counted towards the SAGES Quantitative Reasoning requirement.

### Sample Plan of Study: Bachelor of Arts in Astronomy

#### First Year

<table>
<thead>
<tr>
<th>Course</th>
<th>Fall</th>
<th>Spring</th>
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<tbody>
<tr>
<td>Calculus for Science and Engineering I (MATH 121)</td>
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<tr>
<td>General Physics I - Mechanics (PHYS 121)</td>
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<td></td>
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<tr>
<td>SAGES First Seminar</td>
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<td></td>
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<tr>
<td>PHED (2 half semester courses)</td>
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<td></td>
</tr>
<tr>
<td>Social Science I</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Calculus for Science and Engineering II (MATH 122)</td>
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<td></td>
</tr>
<tr>
<td>or Calculus II (MATH 124)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>General Physics II - Electricity and Magnetism (PHYS 122)</td>
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<td></td>
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<tr>
<td>Elementary Computer Programming (ENGR 131)</td>
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<td></td>
</tr>
<tr>
<td>PHED (2 half semester courses)</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Doing Astronomy (ASTR 151)&lt;sup&gt;*&lt;/sup&gt;</td>
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<td>Social Science II</td>
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<td><strong>Year Total:</strong></td>
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#### Second Year

<table>
<thead>
<tr>
<th>Course</th>
<th>Fall</th>
<th>Spring</th>
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</thead>
<tbody>
<tr>
<td>Stars and Planets (ASTR 221)</td>
<td>3</td>
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</tbody>
</table>
Calculus for Science and Engineering III (MATH 223) or Calculus III (MATH 227) 3
Introduction to Modern Physics (PHYS 221) 3
SAGES University Seminar 3
Galaxies and Cosmology (ASTR 222) 3
Elementary Differential Equations (MATH 224) or Differential Equations (MATH 228) 3
Computational Methods in Physics (PHYS 250) 3
Classical Mechanics (PHYS 310) 3
SAGES University Seminar 3
Year Total: 12 15

Third Year

Stellar Physics (ASTR 311)\(a\) 3
Thermodynamics and Statistical Mechanics (PHYS 313) 3
Arts & Humanities I 3
Arts & Humanities II 3
Technical Elective 3
Cosmology and the Structure of the Universe (ASTR 328)\(a\) 3
Electricity and Magnetism I (PHYS 324) 3
Physical Optics (PHYS 326) 3
Quantitative Reasoning 3
Technical Elective 3
Year Total: 15 15

Fourth Year

Astronomical Techniques (ASTR 306)\(a\) 3
Astrophysics Seminar I (ASTR 309) 1
Introduction to Quantum Mechanics I (PHYS 331) 3
Astronomy Capstone Project (ASTR 351)\(b\) 1 - 3
Global and Cultural Diversity 3
Astrophysics Seminar II (ASTR 310) 1
Astronomy Capstone Project (ASTR 351) 1 - 3
Year Total: 11-13 2-4

Total Units in Sequence: 100-104

Graduate Program

The PhD degree in astronomy is granted to those students who have shown an extensive knowledge of advanced astronomy and the ability to do original research. The student is required to pass a general qualifying examination in astronomy, usually taken at the end of the second year. The student must then prepare a dissertation based on the results of independent research. A PhD candidate must also satisfy the general requirements of the School of Graduate Studies.

Full-time graduate students who maintain satisfactory academic performance while pursuing the PhD degree in astronomy normally receive a stipend for teaching and/or research, which includes full tuition and a monthly amount sufficient to cover living expenses.

Department Faculty

J. Christopher Mihos, PhD
(University of Michigan)
Professor and Chair; Director of the Warner and Swasey Observatory
Galaxy evolution; interacting and merging galaxies; galaxy clusters; computational and observational astronomy

R. Earle Luck, PhD
(University of Texas, Austin)
Worcester R. and Cornelia B. Warner Professor of Astronomy
Stellar and galactic chemical evolution; stellar spectrophotometry

Stacy S. McGaugh, PhD
(University of Michigan)
Professor
Galaxy formation and evolution, low surface brightness galaxies, cosmology, dark matter, and gravity

Idit Zehavi, PhD
(Racah Institute of Physics, Hebrew University of Jerusalem)
Assistant Professor
Cosmology and the large-scale structure of the universe; galaxy biasing; galaxy formation and evolution; structure formation; clustering of galaxies; cosmic flows.

Minor in Astronomy

The requirements for the minor in astronomy are as follows:

One of the following: 4

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYS 115</td>
<td>Introductory Physics I</td>
</tr>
<tr>
<td>PHYS 121</td>
<td>General Physics I - Mechanics</td>
</tr>
<tr>
<td>PHYS 123</td>
<td>Physics and Frontiers I - Mechanics</td>
</tr>
</tbody>
</table>

One of the following: 4

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYS 116</td>
<td>Introductory Physics II</td>
</tr>
</tbody>
</table>

Graduate Program

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Stacy S. McGaugh, PhD
(University of Michigan)
Professor
Galaxy formation and evolution, low surface brightness galaxies, cosmology, dark matter, and gravity

Heather L. Morrison, PhD
(Australian National University)
Professor
Galaxy formation via observational studies of the Milky Way and nearby galaxies; dark matter

Idit Zehavi, PhD
(Racah Institute of Physics, Hebrew University of Jerusalem)
Assistant Professor
Cosmology and the large-scale structure of the universe; galaxy biasing; galaxy formation and evolution; structure formation; clustering of galaxies; cosmic flows.

Secondary Faculty

John Ruhl, PhD
(Princeton University)
Professor, Department of Physics
Experimental astrophysics and cosmology
ASTR 151. Doing Astronomy. 1 Unit.
This course is intended to introduce students to how astronomy is done. The course will focus on the astronomical research process, the scientific community, and on career paths in astronomy. Course activities will include readings and class discussions focusing on various topics in modern astronomy, including ongoing research activity in the department. This course is largely intended for first- and second-year students considering majoring or minoring in astronomy, or pursuing a career in astronomy. Prereq: First- or second-year academic standing.

ASTR 201. The Sun and its Planets. 3 Units.
An overview of the solar system; the planets and other objects that orbit about the Sun and the Sun itself as the dominant mass and the most important source of energy in the solar system. Concepts and the development of our knowledge will be emphasized. Not available for credit to astronomy majors.

ASTR 202. Stars, Galaxies, and the Universe. 3 Units.
Stellar structure, energy sources, and evolution, including red giants, white dwarfs, supernovae, pulsars, and black holes. Stellar populations in the Milky Way and external galaxies. The universe and its evolution. Not available for credit to astronomy majors.

ASTR 204. Einstein’s Universe. 3 Units.
This course is intended to introduce the non-scientist to the concepts of modern cosmology—the structure and evolution of the universe. No mathematical background beyond simple algebra is needed.

ASTR 206. Life in the Universe. 3 Units.
This course is intended to introduce the non-scientist to the field of astrobiology - the interdisciplinary study of, and the search for, extraterrestrial life and the conditions for extraterrestrial life in the Universe. We will explore questions such as: How did life begin on Earth? What conditions are necessary for life to survive? What conditions are required for the long-term habitability of the Earth? Can life exist elsewhere in our Galaxy? Students may receive credit for ASTR 206 or USNA 217 (Astrobiology), but not for both.

ASTR 221. Stars and Planets. 3 Units.

ASTR 222. Galaxies and Cosmology. 3 Units.

ASTR 223. The Local Universe. 3 Units.

ASTR 224. Cosmology and the Structure of the Universe. 3 Units.

ASTR 231. Stellar Physics. 3 Units.
Radiative transfer, atomic and molecular opacities, and the observable properties of stars. Stellar interiors, nuclear processes, and energy generation. The evolution of stars of varying mass and production of the elements within supernovae explosions. Offered as ASTR 311 and ASTR 411. Prereq: ASTR 222.

ASTR 306. Astronomical Techniques. 3 Units.
This course covers the techniques astronomers use to conduct research, including observations using ground- and space-based telescopes, computer simulations and other numerical methods, and statistical data mining of large on-line astronomical datasets. Offered as ASTR 306 and ASTR 406. Prereq: ASTR 222.

ASTR 309. Astrophysics Seminar I. 1 Unit.
Selected topics in astronomy not covered ordinarily in courses. Presentation of talks by the students.

ASTR 310. Astrophysics Seminar II. 1 Unit.
Selected topics in astronomy not covered ordinarily in courses. Presentation of talks by students.

ASTR 321. Stellar Structure and Energy Production. 3 Units.

ASTR 323. The Local Universe. 3 Units.

ASTR 351. Astronomy Capstone Project. 1 - 3 Unit.
A two semester course (1 hour in the Fall Semester and either 2 or 3 hours in the Spring Semester) for students desiring a Capstone Experience in astronomy. Students pursue a project based on experimental, theoretical or teaching research under the supervision of an astronomy faculty member. A departmental Capstone Project Committee must approve all project proposals (by the end of the Fall Semester) and this same committee will receive regular oral and written progress reports. Final results are presented at the end of the semester as a paper in a style suitable for publication in a professional journal as well as an oral report in a public symposium. Prereq: ASTR 222.

ASTR 369. Undergraduate Research. 1 - 3 Unit.
Supervised research on topics of interest. Can be used as a thesis course if desired. Students may register more than once for a maximum of 9 credits overall (1-3 credits each semester).
ASTR 396. Special Topics in Astronomy. 1 - 3 Unit.
Open to astronomy majors only.

ASTR 406. Astronomical Techniques. 3 Units.
This course covers the techniques astronomers use to conduct research, including observations using ground- and space-based telescopes, computer simulations and other numerical methods, and statistical data mining of large on-line astronomical datasets. Offered as ASTR 306 and ASTR 406.

ASTR 411. Stellar Physics. 3 Units.
Radiative transfer, atomic and molecular opacities, and the observable properties of stars. Stellar interiors, nuclear processes, and energy generation. The evolution of stars of varying mass and production of the elements within supernovae explosions. Offered as ASTR 311 and ASTR 411.

ASTR 423. The Local Universe. 3 Units.

ASTR 428. Cosmology and the Structure of the Universe. 3 Units.

ASTR 497. Special Topics in Astronomy. 1 - 3 Unit.

ASTR 601. Research. 1 - 18 Unit.
Original research under the guidance of the staff.

ASTR 651. Thesis M.S.. 1 - 18 Unit.
(Credit as arranged.)

(Credit as arranged.) Prereq: Predoctoral research consent or advanced to Ph.D. candidacy milestone.
Department of Biology

The mission of the Department of Biology at Case Western Reserve University is to promote research programs of national and international prominence and to provide strong undergraduate and graduate educational programs that emphasize integrative approaches to biological problems. In doing so, our programs support preparation and professional development for careers related to the biological and health sciences.

The department offers courses leading to the degrees of Bachelor of Science, Bachelor of Science in Systems Biology, Bachelor of Arts, Master of Science, and Doctor of Philosophy. Cooperative programs between the Department of Biology and the Case Western Reserve University School of Medicine, the Cleveland Museum of Natural History, the Cleveland Botanical Garden, the Cleveland Metroparks Zoo, the Holden Arboretum, the Cleveland Institute of Art, and other departments in Case Western Reserve University significantly extend the range of resources available to biology students. Undergraduate students are encouraged to conduct individual supervised research projects with biology faculty and with faculty in cooperating departments. A supervised research project is required of all students in the BS biology program.

The undergraduate programs in biology provide excellent preparation for graduate or professional schools, including medical, dental, and veterinary schools and the many specialized graduate programs in the biological sciences. A biology degree also prepares students for careers in industry and government. For students interested in biotechnology—a field with growing career opportunities—the department offers elective sequences within the BA and BS degrees.

In addition to formal courses for credit, the department offers weekly seminars during the academic year, presenting recent advances in biology. These seminars are held every Thursday at 4:15 p.m. and are open to the university community.

BA Biology | BS Biology | Teacher Licensure | BS Systems Biology | Minors

Undergraduate Programs

Majors

Major programs share a core of foundation courses and provide options for specialization in a variety of areas, including biotechnology and genetic engineering, molecular and cellular biology, genetics, immunology, chemical biology, physiology and biophysics, neurobiology and animal behavior, developmental biology, population biology, ecology, and environmental science. Theoretical, mathematical, and computational approaches to these fields are emphasized in the Systems Biology BS program. Individual research projects form a significant part of the curriculum for many undergraduates in all programs, and are specifically required for students in the Biology BS program. Advanced biology majors may register, with permission, for graduate-level courses in the department and in the School of Medicine.

The department offers programs leading to the BA and BS degrees. Thirty hours of biology are required for the Biology BA, 39 hours for the Biology BS, and 30 hours for the Systems Biology BS. Ordinarily, all students begin their biology programs in the freshman year. All students must complete the SAGES seminar and General Education Requirements (GER) of the College of Arts and Sciences. While some BIOL courses serve as SAGES Departmental Seminars or SAGES Capstones, none of these are required courses for biology degree candidates, with the specific exception of BIOL 388S Undergraduate Research - SAGES Capstone for the Biology BS degree. A Biology BA student, for example, is free to take a non-BIOL SAGES Departmental Seminar or SAGES Capstone course, assuming that prerequisites are met (or waived by the instructor).

Bachelor of Arts in Biology

The Biology BA degree program provides a general background in biology, and has the most flexible scheduling of the three biology degrees offered. It is especially recommended for students who are pre-professional, have multiple majors, intend to do a junior year abroad or an internship program, or have significant extracurricular commitments (e.g., varsity athletics, student government, Greek life, or other campus involvement). Since the Biology BA degree does not formally require undergraduate research, students interested in graduate research careers should plan to take at least one semester of undergraduate research as an elective (BIOL 388 Undergraduate Research or BIOL 388S Undergraduate Research - SAGES Capstone) sometime during the senior year.

### Biology core courses

- **BIOL 214** Genes, Evolution and Ecology
- **BIOL 214L** Genes, Evolution and Ecology Lab
- **BIOL 215** Cells and Proteins
- **BIOL 215L** Cells and Proteins Laboratory
- **BIOL 216** Development and Physiology
- **BIOL 216L** Development and Physiology Lab

One course from any two of the following three subject areas (breadth requirement) 6

- **Cell and molecular biology**
  - **BIOL 308** Molecular Biology: Genes and Genetic Engineering
  - **BIOL 316** Fundamental Immunology
  - **BIOL 324** Introduction to Stem Cell Biology
  - **BIOL 325** Cell Biology
  - **BIOL 326** Genetics
  - **BIOL 328** Plant Genomics and Proteomics
- **BIOL 334** Structural Biology
- **BIOL 342** Parasitology
- **BIOL 343** Microbiology
- **BIOL 365** Evo-Devo: Evolution of Body Plans
- **BIOL 366** Genes, Embryos and Fossils

- **Organismal biology**
  - **BIOL 223** Vertebrate Biology
  - **BIOL 302** Human Learning and the Brain
  - **BIOL 314** Animal Cognition and Consciousness
  - **BIOL 318** Introductory Entomology
  - **BIOL 338** Ichthyology
  - **BIOL 340** Human Physiology
  - **BIOL 346** Human Anatomy
  - **BIOL 362** Principles of Developmental Biology
  - **BIOL 373** Introduction to Neurobiology
  - **BIOL 374** Neurobiology of Behavior
  - **BIOL 379** Neuroscience of Communication and Communication Disorders
  - **BIOL 382** Drugs, Brain, and Behavior
  - **BIOL 385** Seminar on Biological Processes in Learning and Cognition

- **Population biology and ecology**
  - **BIOL 225** Evolution
  - **BIOL 307** Evolutionary Biology of the Invertebrates
  - **BIOL 336** Aquatic Biology
  - **BIOL 351** Principles of Ecology
  - **BIOL 358** Animal Behavior
  - **BIOL 364** Research Methods in Evolutionary Biology
  - **BIOL 368** Topics in Evolutionary Biology
BIOL 384 Reading and Writing Like an Ecologist
BIOL 394 Seminar in Evolutionary Biology

Two additional laboratory courses (excluding BIOL 388, BIOL 388S, and BIOL 390) 4-8
BIOL 223 Vertebrate Biology
BIOL 300 Dynamics of Biological Systems: A Quantitative Introduction to Biology
BIOL 301 Biotechnology Laboratory: Genes and Genetic Engineering
BIOL 304 Fitting Models to Data: Maximum Likelihood Methods and Model Selection
BIOL 305 Herpetology
BIOL 312 Environmental Sculpture
BIOL 315 Quantitative Biology Laboratory
BIOL 339 Aquatic Biology Laboratory
BIOL 344 Laboratory for Microbiology
BIOL 345 Mammal Diversity and Evolution
BIOL 351 Laboratory for Ecology Laboratory
BIOL 358 Animal Behavior
BIOL 359 Genetic Basis of Behavior
BIOL 363 Experimental Developmental Biology
BIOL 376 Neurobiology Laboratory
BIOL 377 Biorobotics Team Research

Biological electives (excluding 100-level courses, BIOL 240, BIOL 250, BIOL 251, and BIOL 390) 6-8

Mathematics core courses
MATH 125 Math and Calculus Applications for Life, Managerial, and Social Sci I 4
or MATH 121 Calculus for Science and Engineering I
MATH 126 Math and Calculus Applications for Life, Managerial, and Social Sci II 4
or MATH 122 Calculus for Science and Engineering II

Chemistry core courses
CHEM 105 Principles of Chemistry I 3
CHEM 106 Principles of Chemistry II 3
CHEM 113 Principles of Chemistry Laboratory 2
CHEM 223 Introductory Organic Chemistry I 3
or CHEM 323 Organic Chemistry I
CHEM 224 Introductory Organic Chemistry II 3
or CHEM 324 Organic Chemistry II
CHEM 233 Introductory Organic Chemistry Laboratory I 2

Physics core courses
PHYS 115 Introductory Physics I 4
or PHYS 121 General Physics I - Mechanics
PHYS 116 Introductory Physics II 4
or PHYS 122 General Physics II - Electricity and Magnetism

Total Units 60-66

At least 15 hours of the selected electives and additional laboratory courses must be at the 300 level or higher.

**BA Biology, Suggested Sequence of Courses**

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| Math and Calculus Applications for Life, Managerial, and Social Sci II (MATH 126) | 4     |      |        |
| or Calculus for Science and Engineering II (MATH 122) |      |      |        |
| Principles of Chemistry II (CHEM 106) | 3     |      |        |
| Principles of Chemistry Laboratory (CHEM 113) | 2     |      |        |
| SAGES University Seminar | 3     |      |        |
| PHED Physical Education | 0     |      |        |

Year Total: 15  16

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Year Total: 15  15

Total Units in Sequence: 121-125

**Teacher Licensure**

Students may become eligible for teacher licensure in the field of Life Sciences (Adolescents and Young Adults) by completing content area requirements as well as 35 semester hours in education courses (including student teaching) offered through Case Western Reserve and John Carroll University. For more details, please see the program requirements.
description for teacher licensure elsewhere in this bulletin. Students interested in pursuing this option should consult Richard F. Drushel, executive officer for the Department of Biology.

**Subject Area Requirements**

**Biology core courses**
- BIOL 214 Genes, Evolution and Ecology 3
- BIOL 214L Genes, Evolution and Ecology Lab 1
- BIOL 215 Cells and Proteins 3
- BIOL 215L Cells and Proteins Laboratory 1
- BIOL 216 Development and Physiology 3
- BIOL 216L Development and Physiology Lab 1

**Chemistry core courses**
- CHEM 105 Principles of Chemistry I 3
- CHEM 106 Principles of Chemistry II 3
- CHEM 113 Principles of Chemistry Laboratory 2
- CHEM 223 Introductory Organic Chemistry I 3
- CHEM 224 Introductory Organic Chemistry II 3
- CHEM 233 Introductory Organic Chemistry Laboratory I 2

**Mathematics core courses**
- MATH 125 Math and Calculus Applications for Life, Managerial, and Social Sciences I 4
- MATH 126 Math and Calculus Applications for Life, Managerial, and Social Sciences II 4

**One earth, environmental, and planetary sciences (EEPS) course**
- EEPS 101 The Earth and Planets 3
- EEPS 110 Physical Geology
- EEPS 115 Introduction to Oceanography
- EEPS 117 Weather and Climate

**One genetics or molecular biology course**
- BIOL 308 Molecular Biology: Genes and Genetic Engineering 3-4
- BIOL 326 Genetics
- BIOL 334 Microbiology

**One genetics or molecular biology laboratory course**
- BIOL 301 Biotechnology Laboratory: Genes and Genetic Engineering 2-3
- BIOL 344 Laboratory for Microbiology

**One animal behavior course**
- BIOL 358 Animal Behavior 3-4
- BIOL 373 Introduction to Neurobiology
- BIOL 374 Neurobiology of Behavior
- BIOL 382 Drugs, Brain, and Behavior

**One organismal biology laboratory course**
- BIOL 223 Vertebrate Biology 3-4
- BIOL 305 Herpetology
- BIOL 336 Aquatic Biology

**Physics core courses**
- PHYS 115 Introductory Physics I 4
- PHYS 116 Introductory Physics II 4

**Total Units** 58-62

**Bachelor of Science in Biology**

The Biology BS degree program is intended to prepare students for work as traditional bench or field research scientists. In addition to a general background in biology (the same as provided by the Biology BA program), the Biology BS program requires two semesters of undergraduate research, plus additional courses in quantitative methods (computer programming, statistics, data analysis) and physical chemistry. The research may be done at the university or at any of its affiliated institutions, but the biology department does not formally place students into laboratories. Because of the extra course work and research requirements, the Biology BS program may present scheduling challenges to students who wish to pursue multiple majors, a junior year abroad or internship, or significant extracurricular activities. Early, careful planning in consultation with the major advisor is essential to stay on schedule.

**Biology core courses**
- BIOL 214 Genes, Evolution and Ecology 3
- BIOL 214L Genes, Evolution and Ecology Lab 1
- BIOL 215 Cells and Proteins 3
- BIOL 215L Cells and Proteins Laboratory 1
- BIOL 216 Development and Physiology 3
- BIOL 216L Development and Physiology Lab 1

**One course from any two of the following three subject areas (breadth requirement)**
- BIOL 308 Molecular Biology: Genes and Genetic Engineering
- BIOL 316 Fundamental Immunology
- BIOL 324 Introduction to Stem Cell Biology

**One course from any two of the following three subject areas (breadth requirement)**
- BIOL 325 Cell Biology
- BIOL 326 Genetics
- BIOL 328 Plant Genomics and Proteomics

**One course from any two of the following three subject areas (breadth requirement)**
- BIOL 334 Structural Biology
- BIOL 342 Parasitology
- BIOL 343 Microbiology

**One course from any two of the following three subject areas (breadth requirement)**
- BIOL 365 Evo-Devo: Evolution of Body Plans
- BIOL 366 Genes, Embryos and Fossils

**Organismal biology**
- BIOL 223 Vertebrate Biology
- BIOL 302 Human Learning and the Brain
- BIOL 314 Animal Cognition and Consciousness
- BIOL 318 Introductory Entomology
- BIOL 338 Ichthyology
- BIOL 340 Human Physiology
- BIOL 346 Human Anatomy

**One course from any two of the following three subject areas (breadth requirement)**
- BIOL 362 Principles of Developmental Biology
- BIOL 373 Introduction to Neurobiology
- BIOL 374 Neurobiology of Behavior

**One course from any two of the following three subject areas (breadth requirement)**
- BIOL 379 Neuroscience of Communication and Communication Disorders
- BIOL 382 Drugs, Brain, and Behavior
- BIOL 385 Seminar on Biological Processes in Learning and Cognition

**Population biology and ecology**
- BIOL 225 Evolution
- BIOL 307 Evolutionary Biology of the Invertebrates
- BIOL 336 Aquatic Biology
- BIOL 358 Animal Behavior
- BIOL 364 Research Methods in Evolutionary Biology
- BIOL 368 Topics in Evolutionary Biology
- BIOL 384 Reading and Writing Like an Ecologist
- BIOL 394 Seminar in Evolutionary Biology

**One genetics course**
- BIOL 301 Biotechnology Laboratory: Genes and Genetic Engineering
- BIOL 328 Genetics

**One quantitative biology laboratory course**
- BIOL 300 Dynamics of Biological Systems: A Quantitative Introduction to Biology
- BIOL 304 Fitting Models to Data: Maximum Likelihood Methods and Model Selection
- BIOL 315 Quantitative Biology Laboratory

**One additional laboratory course (excluding BIOL 388, BIOL 388S, and BIOL 390)**
- BIOL 223 Vertebrate Biology
- BIOL 300 Dynamics of Biological Systems: A Quantitative Introduction to Biology
- BIOL 301 Biotechnology Laboratory: Genes and Genetic Engineering
### First Year

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<td>Environmental Sculpture</td>
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<td>Quantitative Biology Laboratory</td>
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<td>BIOL 339</td>
<td>Aquatic Biology Laboratory</td>
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<td>BIOL 344</td>
<td>Laboratory for Microbiology</td>
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<td>Mammal Diversity and Evolution</td>
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<td>Neurobiology Laboratory</td>
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<td>BIOL 377</td>
<td>Biorobotics Team Research</td>
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Biology electives (excluding 100-level courses, BIOL 240, BIOL 250, and BIOL 251) 6-8

**Undergraduate research** 6

**Total Units**: 15-17

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### Second Year

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<td>&amp; BIOL 390</td>
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Mathematics core courses

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<td>Math and Calculus Applications for Life, Managerial, and Social Sci</td>
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Chemistry core courses

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Physics core courses

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<td>or PHYS 122</td>
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One advanced mathematics or statistics course 3

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<td>MATH 304</td>
<td>Discrete Mathematics</td>
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<td>STAT 312</td>
<td>Basic Statistics for Engineering and Science</td>
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**Total Units**: 16

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### Third Year

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Advanced Mathematics or Statistics Course 3

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**Total Units**: 15-17

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### Fourth Year

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Undergraduate Research - SAGES Capstone (BIOL 388S) (SAGES Capstone) 3

**Total Units**: 15-17

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At least 11 hours of the selected electives and additional laboratory courses must be at the 300 level or higher.

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**BS Biology, Suggested Sequence of Courses**

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**Second Year**

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<td>GER Course</td>
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<td>Year Total:</td>
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**Third Year**

<table>
<thead>
<tr>
<th>Units</th>
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<tbody>
<tr>
<td>BIOL Elective</td>
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<tr>
<td>Quantitative Biology Laboratory</td>
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<tr>
<td>Dynamics of Biological Systems: A Quantitative Introduction to Biology (BIOL 300)</td>
<td></td>
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<tr>
<td>Fitting Models to Data: Maximum Likelihood Methods and Model Selection (BIOL 304)</td>
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<td>Quantitative Biology Laboratory (BIOL 315)</td>
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<tr>
<td>Introductory Physics II (PHYS 116)</td>
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<tr>
<td>or General Physics II - Electricity and Magnetism (PHYS 122)</td>
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<tr>
<td>SAGES Departmental Seminar</td>
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**Fourth Year**

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<tr>
<th>Units</th>
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<tr>
<td>Undergraduate Research - SAGES Capstone (BIOL 388S) (SAGES Capstone)</td>
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<tr>
<td>BIOL Elective</td>
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<tr>
<td>BIOL Laboratory (if needed)</td>
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<tr>
<td>or BIOL Elective</td>
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<td>Introductory Physical Chemistry I (CHEM 301)</td>
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<tr>
<td>Open Elective</td>
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</tr>
<tr>
<td>Advanced Undergraduate Research (BIOL 390)</td>
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</table>
Bachelor of Science in Systems Biology

Systems biology is a rapidly emerging area of research activity at the interface of mathematics, computer science, and the biological sciences. Many modern areas of biology research (e.g., biochemical, neural, behavioral, and ecosystem networks) require the mastery of advanced quantitative and computational skills. The Systems Biology BS degree program is intended to provide the quantitative and multidisciplinary understanding that is necessary for work in these areas. This skill set is different from that produced by traditional undergraduate programs in biology. Consequently, the Systems Biology BS program includes a specialized four-course core curriculum (different from the three-course core used in the Biology BA and BS programs), as well as foundation courses from computer science and advanced mathematics. Undergraduate research is recommended (as BIOL 388S Undergraduate Research and BIOL 390 Advanced Undergraduate Research), but is not required.

Systems Biology core courses

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
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<tbody>
<tr>
<td>BIOL 250</td>
<td>Introduction to Cell and Molecular Biology Systems</td>
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</tr>
<tr>
<td>BIOL 251</td>
<td>Introduction to Organismal and Population Systems</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 300</td>
<td>Dynamics of Biological Systems: A Quantitative Introduction to Biology</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 306</td>
<td>Dynamics of Biological Systems II: Tools for Mathematical Biology</td>
<td>3</td>
</tr>
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</table>

Approved subspecialty sequence (choose one of the following four sequences) 6

Neuroscience (two courses)

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
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<tbody>
<tr>
<td>BIOL 373</td>
<td>Introduction to Neurobiology</td>
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</tr>
<tr>
<td>BIOL 374</td>
<td>Neurobiology of Behavior</td>
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<td>BIOL 376</td>
<td>Neurobiology Laboratory</td>
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<tr>
<td>BIOL 378 or MATH 378</td>
<td>Computational Neuroscience</td>
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</tr>
<tr>
<td>BIOL 382</td>
<td>Drugs, Brain, and Behavior</td>
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Genetics (any two courses)

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<tr>
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<tbody>
<tr>
<td>BIOL 301</td>
<td>Biotechnology Laboratory: Genes and Genetic Engineering</td>
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<tr>
<td>BIOL 326</td>
<td>Genetics</td>
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</tr>
<tr>
<td>BIOL 328</td>
<td>Plant Genomics and Proteomics</td>
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</tr>
<tr>
<td>EECS 359</td>
<td>Bioinformatics in Practice</td>
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Evolutionary biology (two courses)

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<tr>
<th>Course</th>
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<tbody>
<tr>
<td>BIOL 364</td>
<td>Research Methods in Evolutionary Biology</td>
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</tr>
<tr>
<td>BIOL 225</td>
<td>Evolution</td>
<td></td>
</tr>
<tr>
<td>BIOL 307</td>
<td>Evolutionary Biology of the Invertebrates</td>
<td></td>
</tr>
<tr>
<td>BIOL 336</td>
<td>Aquatic Biology</td>
<td></td>
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<tr>
<td>BIOL 345</td>
<td>Mammal Diversity and Evolution</td>
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<tr>
<td>BIOL 351</td>
<td>Principles of Ecology</td>
<td></td>
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<tr>
<td>BIOL 358</td>
<td>Animal Behavior</td>
<td></td>
</tr>
<tr>
<td>BIOL 365</td>
<td>Evo-Devo: Evolution of Body Plans</td>
<td></td>
</tr>
<tr>
<td>BIOL 366</td>
<td>Genes, Embryos and Fossils</td>
<td></td>
</tr>
<tr>
<td>BIOL 368</td>
<td>Topics in Evolutionary Biology</td>
<td></td>
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</table>

Cellular and molecular biology (any two courses)

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
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<tbody>
<tr>
<td>BIOL 325</td>
<td>Cell Biology</td>
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</tr>
<tr>
<td>BIOL 343</td>
<td>Microbiology</td>
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</tr>
<tr>
<td>BIOL 362</td>
<td>Principles of Developmental Biology</td>
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BS Systems Biology - Suggested Sequence of Courses

First Year

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<tr>
<th>Course</th>
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<th>Units</th>
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<tbody>
<tr>
<td>MATH 121</td>
<td>Calculus for Science and Engineering I</td>
<td>4</td>
</tr>
<tr>
<td>CHEM 105</td>
<td>Principles of Chemistry I</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 106</td>
<td>Principles of Chemistry II</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 113</td>
<td>Principles of Chemistry Laboratory</td>
<td>2</td>
</tr>
<tr>
<td>PHYS 121</td>
<td>General Physics I - Mechanics</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 123 or PHYS 122</td>
<td>Physics and Frontiers I - Mechanics</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 122</td>
<td>General Physics II - Electricity and Magnetism</td>
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<tr>
<td>PHYS 124</td>
<td>Physics and Frontiers II - Electricity and Magnetism</td>
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</tr>
<tr>
<td>EECS 132</td>
<td>Introduction to Programming in Java</td>
<td>3</td>
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<tr>
<td>EECS 233</td>
<td>Introduction to Data Structures</td>
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<tr>
<td>EECS 302</td>
<td>Discrete Mathematics</td>
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<tr>
<td>EECS 304</td>
<td>Discrete Mathematics</td>
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<tr>
<td>BIOL 304</td>
<td>Fitting Models to Data: Maximum Likelihood Methods and Model Selection</td>
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<tr>
<td>MATH 201</td>
<td>Introduction to Linear Algebra</td>
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<tr>
<td>BIOL 319</td>
<td>Applied Probability and Stochastic Processes for Biology</td>
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<tr>
<td>EECS 340</td>
<td>Algorithms and Data Structures</td>
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<tr>
<td>EECS 341</td>
<td>Introduction to Database Systems</td>
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<tr>
<td>EECS 365</td>
<td>Complex Systems Biology</td>
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</tr>
<tr>
<td>EECS 346</td>
<td>Signals and Systems</td>
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<tr>
<td>BIOL 304</td>
<td>Fitting Models to Data: Maximum Likelihood Methods and Model Selection</td>
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<tr>
<td>MATH 201</td>
<td>Introduction to Linear Algebra</td>
<td>3</td>
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<tr>
<td>BIOL 319</td>
<td>Applied Probability and Stochastic Processes for Biology</td>
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<td>EECS 340</td>
<td>Algorithms and Data Structures</td>
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<td>EECS 341</td>
<td>Introduction to Database Systems</td>
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<td>EECS 365</td>
<td>Complex Systems Biology</td>
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<td>EECS 411</td>
<td>Optimization Modeling</td>
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Fall

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<td>BIOL 382</td>
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<td>Calculus for Science and Engineering I</td>
<td>4</td>
</tr>
<tr>
<td>CHEM 105</td>
<td>Principles of Chemistry I</td>
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<tr>
<td>CHEM 106</td>
<td>Principles of Chemistry II</td>
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<tr>
<td>CHEM 113</td>
<td>Principles of Chemistry Laboratory</td>
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<tr>
<td>PHYS 121</td>
<td>General Physics I - Mechanics</td>
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<td>PHYS 123 or PHYS 122</td>
<td>Physics and Frontiers I - Mechanics</td>
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<td>PHYS 122</td>
<td>General Physics II - Electricity and Magnetism</td>
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<td>Physics and Frontiers II - Electricity and Magnetism</td>
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<td>Algorithms and Data Structures</td>
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<td>Introduction to Database Systems</td>
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<td>EECS 365</td>
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<tr>
<td>EECS 346</td>
<td>Signals and Systems</td>
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<tr>
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<td>Applied Probability and Stochastic Processes for Biology</td>
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<tr>
<td>MATH 201</td>
<td>Introduction to Linear Algebra</td>
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<tr>
<td>BIOL 319</td>
<td>Applied Probability and Stochastic Processes for Biology</td>
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<td>EECS 340</td>
<td>Algorithms and Data Structures</td>
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<td>EECS 341</td>
<td>Introduction to Database Systems</td>
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<td>EECS 365</td>
<td>Complex Systems Biology</td>
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<td>Optimization Modeling</td>
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Spring

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<td>CHEM 105</td>
<td>Principles of Chemistry I</td>
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<td>CHEM 106</td>
<td>Principles of Chemistry II</td>
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<td>CHEM 113</td>
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<td>PHYS 124</td>
<td>Physics and Frontiers II - Electricity and Magnetism</td>
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<td>EECS 340</td>
<td>Algorithms and Data Structures</td>
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<td>EECS 365</td>
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<td>Complex Systems Biology</td>
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<tr>
<td>EECS 411</td>
<td>Optimization Modeling</td>
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</tbody>
</table>

Total Units: 79 Units

Total Units in Sequence: 121-125
Concentrations in Areas of the Biological Sciences

Students are encouraged to utilize their elective courses in the biology major to take advantage of concentrations in various specialized areas. These concentrations have been developed between the biology department, the basic science departments of the School of Medicine, and other departments. Currently, concentrations have been developed in the following areas: biotechnology and genetic engineering; computational biology; developmental biology; genetics; cell and molecular biology; neurobiology and animal behavior; population biology, ecology and environmental science. Note: these concentrations are informal; they are not declared, and will not appear on the student’s diploma at graduation.

Co-op Program in Biology

The Co-op (Cooperative Education) program offers full-time undergraduate students in good academic standing the opportunity to engage in full-time, paid employment consistent with their major fields of study. Typically students participate in the co-op program for one or two seven-month periods, such as summer-fall and/or spring-summer, beginning after their sophomore or junior year. Although participation in this program extends the time required to achieve a bachelor’s degree, students often benefit from higher starting salaries and greater lifetime earnings that can result from the experience acquired in co-op assignments. Co-op employment opportunities may exist at local companies engaged in biotechnology research, pharmaceuticals, or other areas involving the life sciences. Students interested in this program should contact the biology department office.

Advising

Biology faculty advisors are assigned to students at the time of major or minor declaration. All biology majors are required to meet with their departmental advisors at least once each semester to discuss their academic program, receive clearance for electronic course registration, and obtain approval for any drops, adds, or withdrawals. Contact Richard F. Drushel, executive officer for the Department of Biology, for information about major or minor declaration.

Departmental Honors

To receive a bachelor’s degree “with Honors in Biology” (formally noted as such on the student’s diploma at graduation), the student must meet the following criteria:

1. Maintain a 3.4 overall grade point average, with a 3.6 in BIOL courses
2. Carry out two semesters of independent research (taken as BIOL courses) at Case Western Reserve University
3. Write a senior honors thesis with the approval of the faculty supervisor
4. Submit the thesis for review by an ad hoc honors committee
5. Successfully defend the thesis at an oral examination

Additional information and application forms are available from the biology department office.

Minors

Two tracks are available for the minor, each requiring a total of 16 hours of biology courses. One track consists of any two of the three biology core lectures with their associated laboratories, plus electives:

Any two of the following biology core classes (and associated labs) 8

<table>
<thead>
<tr>
<th>Course</th>
<th>Description</th>
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<tbody>
<tr>
<td>BIOL 214 &amp; 214L</td>
<td>Genes, Evolution and Ecology &amp; Cells and Proteins</td>
</tr>
<tr>
<td>BIOL 215 &amp; 215L</td>
<td>Genes, Evolution and Ecology Lab &amp; Cells and Proteins Lab</td>
</tr>
<tr>
<td>BIOL 216 &amp; 216L</td>
<td>Development and Physiology &amp; Development and Physiology Lab</td>
</tr>
</tbody>
</table>
BIOL electives (excluding 100-level courses, BIOL 240, BIOL 250, BIOL 251, and BIOL 390) 8
Total Units 16

An alternative track, for students using the Systems Biology core, consists of:

Required courses
- BIOL 250 Introduction to Cell and Molecular Biology Systems 3
- BIOL 251 Introduction to Organismal and Population Systems 3
- BIOL electives (excluding 100-level courses, BIOL 214, BIOL 215, BIOL 216, BIOL 240, and BIOL 390) 10
Total Units 16

Graduate Programs

Master of Science
The Department of Biology offers both thesis and non-thesis Master of Science degree programs. Both programs require a minimum of 30 semester hours of courses at the 300 level or higher. A minimum of 18 semester hours of formal course work is required for the thesis degree, and a minimum of 24 semester hours of formal course work for the non-thesis degree. The remaining credits may be research credits (BIOL 601 Research and BIOL 651 Thesis M.S.).

Doctor of Philosophy
The Doctor of Philosophy degree in biology is granted upon the completion of original research under the guidance of a faculty member in the Department of Biology.

Department Faculty

Christopher A. Cullis, PhD
(University of East Anglia, United Kingdom)
Francis Hobart Herrick Professor of Biology; Chair
Plant molecular biology and genetics; modifications of the information content of plant cells

Radhika Atit, PhD
(University of Cincinnati)
Associate Professor
Developmental biology and genetics; origin and patterning of skin

Michael F. Benard, PhD
(University of California, Davis)
George B. Mayer Chair in Urban and Environmental Studies; Assistant Professor
Ecology; evolutionary biology

Rebecca Benard, PhD
(University of California, Davis)
Instructor
Plant population ecology; physiology

Jean H. Burns, PhD
(Florida State University)
Assistant Professor
Plant ecology; community assembly; invasibility; the role of phylogeny in assembly; the role of demographic processes in biological invasions

Arnold I. Caplan, PhD
(Johns Hopkins University)
Professor; Director, Skeletal Research Center
Developmental biology and biochemistry; molecular and cellular aspects of muscle, cartilage, and bone development

Hillel J. Chiel, PhD
(Massachusetts Institute of Technology)
Professor
Neurobiology and animal behavior; cellular dynamics of neuronal computation

Richard F. Drushel, PhD
(Case Western Reserve University)
Instructor and Executive Officer
Vertebrate anatomy and physiology; kinematic modeling and neural control; autonomous robotics

Stephen E. Haynesworth, PhD
(Case Western Reserve University)
Associate Professor; Associate Dean, College of Arts and Sciences
Developmental and aging biology

Valerie Haywood, PhD
(University of California, Davis)
Instructor
Plant developmental biology; molecular biology

Emmitt R. Jolly, PhD
(University of California, San Francisco)
Assistant Professor
Molecular biology and genetics; developmental biology; parasitology; schistosomiasis

Barbara A. Kuemerle, PhD
(Case Western Reserve University)
Instructor
Molecular biology and genetics; developmental neuroscience

Claudia M. Mizutani, PhD
(Federal University of Rio de Janeiro, Brazil)
Assistant Professor
Developmental biology and genetics; embryonic body-axis formation

Ronald G. Oldfield, PhD
(University of Michigan)
Instructor
Evolutionary ecology of cichlid fishes; ichthyology

Roy E. Ritzmann, PhD
(University of Virginia)
Professor
Neurobiology of behavior; insect locomotion and brain studies

Charles E. Rozek, PhD
(Wayne State University)
Associate Professor; Vice Provost and Dean of Graduate Studies
Molecular genetics; developmental biology

Robin Snyder, PhD
(University of California, Santa Barbara)
Associate Professor
Theoretical ecology

Rui S. de Sousa-Neves, PhD
(Federal University of Rio de Janeiro, Brazil)
Instructor
Developmental biology; molecular genetics

Mark A. Willis, PhD
(University of California, Riverside)
Associate Professor
Neurobiology and behavior; sensorimotor control of insect flight; animal behavior
James E. Zull, PhD
(University of Wisconsin, Madison)
Professor
Human learning; brain function in education

Research Faculty

David A. Carrino, PhD
(Case Western Reserve University)
Research Professor
Extracellular matrix and its role in development and wound healing; structure and function of proteoglycans
Jean F. Welter, MD, PhD
(Leopold Franzens Universität, Austria; Case Western Reserve University)
Research Associate Professor
Tissue engineering and cell-based therapies; bioreactor design; mechanobiology; bone transplantation; imaging; fluorescence spectroscopy; drug delivery

Secondary Faculty

Darin Croft, PhD
(The University of Chicago)
Associate Professor, Department of Anatomy, School of Medicine
Vertebrate paleontology and fieldwork; mammals, especially those of South America; paleoecology and ancient ecosystems
Brian M. McDermott, PhD
(Columbia University)
Assistant Professor, Department of Otolaryngology, University Hospitals of Cleveland
Neurobiology; hearing and deafness; zebrafish; mechanotransduction; synapse development
Scott W. Simpson, PhD
(Kent State University)
Associate Professor, Department of Anatomy, School of Medicine
Homind paleontology and fieldwork; hominid dentition; locomotor capacities of early Homo erectus
Peter Thomas, PhD
(The University of Chicago)
Assistant Professor, Department of Mathematics
Synchronization and reliability of neural activity; gradient sensing, signal transduction and information theory; pattern formation in the visual cortex; malaria informatics

Adjunct Faculty

David J. Burke, PhD
(Rutgers University)
Adjunct Assistant Professor, Holden Arboretum
Rhizosphere ecology; plant-microbe interactions; molecular microbial ecology; plant ecology
Pam Dennis, PhD, DVM
(The Ohio State University; College of Veterinary Medicine, North Carolina State University)
Adjunct Assistant Professor, Clinical Assistant Professor, Cleveland Metroparks Zoo
Veterinary wildlife epidemiology in zoo and free-ranging animal populations
Anthony Giordano, PhD
(The Ohio State University)
Adjunct Assistant Professor, President and CEO, TheraVasc, Inc.
Drug discovery and development in the treatment of cancer, vascular diseases, and Alzheimer's disease; entrepreneurship
Ana B. Locci, PhD
(Case Western Reserve University)
Adjunct Assistant Professor, University Farm
Aquatic ecology and population biology
Kristen E. Lukas, PhD
(Georgia Institute of Technology)
Adjunct Assistant Professor, Curator, Conservation and Science, Cleveland Metroparks Zoo
Applied animal behavior; behavior and health; visitor attitudes and behavior
Kurt Smemo, PhD
(Cornell University)
Adjunct Assistant Professor, Holden Arboretum
Soil biogeochemistry
Mandi M. Vick, PhD
(University of Kentucky)
Adjunct Assistant Professor, Associate Research Curator, Cleveland Metroparks Zoo
Endocrinology and reproductive physiology
Peter A. Zimmerman, PhD
(Case Western Reserve University)
Professor, Center for Global Health and Diseases, School of Medicine
Infectious diseases; genetics; genomic epidemiology and evolution

Lecturers

James Bader, MS
(Case Western Reserve University)
Lecturer, Director, Center for Science and Mathematics Education
Aquatic ecology
Deborah L. Harris, MS
(Wright State University)
Lecturer
Aquatic biofouling; mycology
Dianne M. Kube, PhD
(University of North Dakota School of Medicine)
Lecturer, Microbiology
Cell biology, cystic fibrosis

Emeritus Faculty

Morris Burke, PhD
(University of New South Wales, Australia)
Professor Emeritus
Muscle physiology; protein chemistry
Robert P. Davis, PhD
(Cornell University)
Associate Professor Emeritus; Dean Emeritus of Collegiate Affairs
Developmental biology
Darhl L. Foreman, PhD
BIOL 114. Principles of Biology. 3 Units.
A one-semester course in biology designed for the non-major. A primary objective of this course is to demonstrate how biological principles impact an individual’s daily life. BIOL 114 introduces students to the molecules of life, cell structure and function, respiration and photosynthesis, molecular genetics, heredity and human genetics, evolution, diversity of life, and ecology. Minimal background is required; however, some exposure to biology and chemistry at the high school level is helpful. This course is not open to students with credit for BIOL 214 or BIOL 250. This course does not count toward any Biology degree. Prereq or Coreq: BIOL 114.

BIOL 116. Introduction to Human Anatomy and Physiology I. 3 Units.
This is the first course in a two-semester sequence that covers human anatomy and physiology for the non-major. BIOL 116 covers homeostasis, cell structure and function, membrane transport, tissue types and the integumentary, skeletal, muscular and nervous systems. This course is not open to students with credit for BIOL 216, BIOL 251, BIOL 340, or BIOL 346. This course does not count toward any Biology degree. Prereq or Coreq: BIOL 114.

BIOL 117. Introduction to Human Anatomy and Physiology II. 3 Units.
This is the second course in a two-semester sequence that covers human anatomy and physiology for the non-major. BIOL 117 covers the endocrine, circulatory, respiratory, digestive, lymphatic, urinary systems including acid-base regulation, and reproductive systems. This course is not open to students with credit for BIOL 216, BIOL 251, BIOL 340, or BIOL 346. This course does not count toward any Biology degree. Prereq: BIOL 114 and BIOL 116.

BIOL 119. Concepts for a Molecular View of Biology I. 3 Units.
The first semester of a two-course sequence in elementary inorganic, organic, and biochemistry, intended for nursing students or non-majors. Topics include: atomic theory, the periodic table, chemical bonds, molecular geometry, ideal gas laws, equilibrium and reaction rates, acids and bases, nuclear chemistry, and nomenclature and reactions of organic compounds (including alkyl, aryl, alcohol, carbonyl, and amino compounds). Problems involving numeric computation are emphasized. This course is not open to students with credit for CHEM 105 or CHEM 111. This course does not count toward any Biology degree. Prereq or Coreq: CHEM 106 or CHEM 111.

BIOL 214. Genes, Evolution and Ecology. 3 Units.
First in a series of three courses required of the Biology major. Topics include: biological molecules (focus on DNA and RNA); mitotic and meiotic cell cycles, gene expression, genetics, population genetics, evolution, biological diversity and ecology. Prereq or Coreq: CHEM 105 or CHEM 111.

BIOL 214L. Genes, Evolution and Ecology Lab. 1 Unit.
First in a series of three laboratory courses required of the Biology major. Topics include: biological molecules (with a focus on DNA and RNA); basics of cell structure (with a focus on malaria research); molecular genetics, biotechnology; population genetics and evolution, ecology. Assignments will be in the form of a scientific journal submission. Prereq or Coreq: BIOL 214.

BIOL 215. Cells and Proteins. 3 Units.
Second in a series of three courses required of the Biology major. Topics include: biological molecules (focus on proteins, carbohydrates, and lipids); cell structure (focus on membranes, energy conversion organelles and cytoskeleton); protein structure-function; enzyme kinetics, cellular energetics, and cell communication and motility strategies. Prereq: BIOL 214 and (CHEM 105 or CHEM 111). Prereq or Coreq: CHEM 106 or ENGR 145.

BIOL 215L. Cells and Proteins Laboratory. 1 Unit.
Second in a series of three laboratory courses required of the Biology major. Topics to include: protein structure-function, enzymes kinetics; cell structure; cellular energetics, respiration and photosynthesis. In addition, membrane structure and transport will be covered. Laboratory and discussion sessions offered in alternate weeks. This course is not available for students who have taken BIOL 215 as a 4-credit course. Prereq: BIOL 214L and Prereq or Coreq: BIOL 215.
BIOL 216. Development and Physiology. 3 Units.
This is the final class in the series of three courses required of the Biology major. As with the two previous courses, BIOL 214 and 215, this course is designed to provide an overview of fundamental biological processes. It will examine the complexity of interactions controlling reproduction, development and physiological function in animals. The Developmental Biology section will review topics such as gametogenesis, fertilization, cleavage, gastrulation, the genetic control of development, stem cells and cloning. Main topics included in the Physiology portion consist of: homeostasis, the function of neurons and nervous systems; the major organ systems and processes involved in circulation, excretion, osmoregulation, gas exchange, feeding, digestion, temperature regulation, endocrine function and the immunologic response. Prereq: BIOL 214.

BIOL 216L. Development and Physiology Lab. 1 Unit.
Third in a series of three laboratory courses required of the Biology major. Students will conduct laboratory experiments designed to provide hands-on, empirical laboratory experience in order to better understand the complex interactions governing the basic physiology and development of organisms. Laboratories and discussion sessions offered in alternate weeks. Prereq: BIOL 214L. Prereq or Coreq: BIOL 216.

BIOL 223. Vertebrate Biology. 3 Units.
A survey of vertebrates from jawless fishes to mammals. Functional morphology, physiology, behavior and ecology as they relate to the groups’ relationships with their environment. Evolution of organ systems. Two lectures and one laboratory per week. The laboratory will involve a study of the detailed anatomy of the shark and cat used as representative vertebrates. Students are expected to spend at least three hours of unscheduled laboratory each week. This course fulfills a laboratory requirement for the biology major.

BIOL 225. Evolution. 3 Units.
Multidisciplinary study of the course and processes of organic evolution provides a broad understanding of the evolution of structural and functional diversity, the relationships among organisms and their environments, and the phylogenetic relationships among major groups of organisms. Topics include the genetic basis of micro- and macro-evolutionary change, the concept of adaptation, natural selection, population dynamics, theories of species formation, principles of phylogenetic inference, biogeography, evolutionary rates, evolutionary convergence, homology, Darwinian medicine, and conceptual and philosophic issues in evolutionary theory. Offered as ANTH 225, BIOL 225, EEPS 225, HSTY 225, and PHIL 225.

BIOL 240. Personalized Medicine. 3 Units.
The emphasis of clinical practice is slowly shifting from one-disease and one-treatment-fits-all to more personalized care based on molecular markers of disease risk, disease subtype, drug effectiveness, and adverse drug reactions. This course, designed for non-biology majors, will introduce how the developments in gene sequencing, genetic markers, and stem cells can be applied for predictive testing and personalized therapies. Core concepts to be covered include the principles of genetics including the inheritance of traits determined by single genes and by multiple genes, the assignment of risk to particular genetic constitutions, and the nature and use of stem cells. The emergence of private companies as resources for the performance of the tests, and how the general public will be able to interpret their own data (with or without the access to genetic counselors), will also be covered. The course will include hands-on laboratory experiences of DNA manipulation and detection using the polymerase chain reaction and gel electrophoresis. The ethical, legal, and social issues associated with personal genetic testing will also be covered. This course does not count towards any Biology degree, nor towards the Biology minor.

BIOL 250. Introduction to Cell and Molecular Biology Systems. 3 Units.
This course will emphasize an understanding of living organisms at the cellular level from a molecular point of view. Topics to be covered will include: unity and diversity of living things, evolutionary relatedness, cells, tissues and organelles, life as a biochemical process, molecular building blocks of life, gene structure and function, uses of model organisms and molecular experimental methods. The topics to be covered are relevant to current practices in biotechnology, medicine and agriculture and these connections will be highlighted. This course is not open to students who have received credit for BIOL 214 and/or BIOL 215.

BIOL 251. Introduction to Organismal and Population Systems. 3 Units.
This course will emphasize an understanding of the regulation of the structure and function of organismal and population systems. Adopting an evolutionary perspective, the course will provide students with a comparative analysis of plant and animal solutions to the problem of multicellularity. Detailed exploration of animals will focus on the development of tissue and organ systems and their coordination at an organismal level. This systems approach will then be extended to regulation of ecosystems and abundance of organisms in populations.

BIOL 300. Dynamics of Biological Systems: A Quantitative Introduction to Biology. 3 Units.
This course will introduce students to dynamic biological phenomena, from the molecular to the population level, and models of these dynamical phenomena. It will describe a biological system, discuss how to model its dynamics, and experimentally evaluate the resulting models. Topics will include molecular dynamics of biological molecules, kinetics of cell metabolism and the cell cycle, biophysics of excitability, scaling laws for biological systems, biomechanics, and population dynamics. Mathematical tools for the analysis of dynamic biological processes will also be presented. Students will manipulate and analyze simulations of biological processes, and learn to formulate and analyze their own models. This course satisfies a laboratory requirement for the biology major. Offered as BIOL 300 and EBME 300.
BIOL 301. Biotechnology Laboratory: Genes and Genetic Engineering. 3 Units.
Laboratory training in recombinant DNA techniques. Basic microbiology, growth, and manipulation of bacteriophage, bacteria and yeast. Students isolate and characterize DNA, construct recombinant DNA molecules, and reintroduce them into eukaryotic cells (yeast, plant, animal) to assess their viability and function. Two laboratories per week. Offered as BIOL 301 and BIOL 401. Prereq: BIOL 215 or BIOL 250.

BIOL 302. Human Learning and the Brain. 3 Units.
This course focuses on the question, "How does the human brain learn?" Through assigned readings, extensive class discussions, and a major paper, each student will explore personal perspectives on learning. Specific topics include, but are not limited to: the brain's cycle of learning; neocortex structure and function; emotion and limbic brain; synapse dynamics and changes in learning; images in cognition; symbolic brain (language, mathematics, music); memory formation; and creative thought and brain mechanisms. The major paper will be added to each student's SAGES writing portfolio. In addition, near the end of the semester, each student will make an oral presentation on a chosen topic. Offered as: BIOL 302 and COGS 322.

BIOL 303. Principles of Chemical Biology. 4 Units.
This is a computer-assisted course and offers a detailed introduction into biological macromolecular structure and function with particular emphasis on proteins. Computer-assisted learning will follow each lecture and will involve either searching the Web for appropriate sources of information covered in the lecture or using spreadsheets and graphics to examine data extracted from the chemical biology and biomedical literature. For example, the protein database (PDB) and Rasmol software will be used to visualize and measure biological macromolecules and extracted data from the biomedical literature will be analyzed by standard graphical procedures employing the computer. This new format will offer the student the ability to learn to use the information resources on the Web together with the computing ability of the computer to explore the concepts presented in the course. This course satisfies a laboratory requirement for the biology major. Prereq: CHEM 105 and CHEM 106 or CHEM 111 and ENGR 145.

BIOL 304. Fitting Models to Data: Maximum Likelihood Methods and Model Selection. 3 Units.
This course will introduce students to maximum likelihood methods for fitting models to data and to ways of deciding which model is best supported by the data (model selection). Along the way, students will learn some basic tenets of probability and develop competency in R, a commonly used statistical package. Examples will be drawn from ecology, epidemiology, and potentially other areas of biology. The second half of the course is devoted to in-class projects, and students are encouraged to bring their own data. Offered as BIOL 304 and BIOL 404. Prereq: MATH 121 and MATH 122 OR MATH 125 and MATH 126.

BIOL 305. Herpetology. 4 Units.
Amphibians and reptiles exhibit tremendous diversity in development, physiology, anatomy, behavior and ecology. As a result, amphibians and reptiles have served as model organisms for research in many different fields of biology. This course will cover many aspects of amphibian and reptile biology, including anatomy, evolution, geographical distribution, physiological adaptations to their environment, reproductive strategies, moisture-, temperature-, and food-relations, sensory mechanisms, predator-prey relationships, communication (vocal, chemical, behavioral), population biology, and the effects of venomous snake bite. Laboratory sessions will be devoted to learning species identification and evolutionary relationships, discussion of the ecology of Ohio's amphibians and reptiles, survey techniques for determining population size and structure, and observations of the behavior of live reptiles and amphibians. Laboratory sessions may include trips to Squire Valleeve Farm, Cleveland Museum of Natural History, and Cleveland Metroparks Zoo. Prereq: BIOL 214 or BIOL 251.

BIOL 306. Dynamics of Biological Systems II: Tools for Mathematical Biology. 3 Units.
Building on the material in Biology 300, this course focuses on the mathematical tools used to construct and analyze biological models, with examples drawn largely from ecology but also from epidemiology, developmental biology, and other areas. Analytic "paper and pencil" techniques are emphasized, but we will also use computers to help develop intuition. By the end of the course, students should be able to recognize basic building blocks in biological models, be able to perform simple analysis, and be more fluent in translating between verbal and mathematical descriptions. Offered as BIOL 306 and MATH 376. Prereq: BIOL 300 or MATH 224 or MATH 228.

BIOL 307. Evolutionary Biology of the Invertebrates. 3 Units.
Important events in the evolution of invertebrate life, as well as structure, function, and phylogeny of major invertebrate groups.

BIOL 308. Molecular Biology: Genes and Genetic Engineering. 4 Units.
An examination of the flow of genetic information from DNA to RNA to protein. Topics include: nucleic acid structure; mechanisms and control of DNA, RNA, and protein biosynthesis; recombinant DNA; and mRNA processing and modification. Where possible, eukaryotic and prokaryotic systems are compared. Special topics include yeast as a model organism, molecular biology of cancer, and molecular biology of the cell cycle. Current literature is discussed briefly as an introduction to techniques of genetic engineering. Recommended preparation for BIOL 408 and BIOL 408: BIOC 307 or BIOL 214. Offered as BIOC 308, BIOL 308, BIOC 408, and BIOL 408. Prereq: BIOL 215 or BIOC 307.
BIOL 309. Introduction to Research in Mathematical Biology. 1 Unit.
The purpose of this seminar is to introduce students to some of the
research being done at Case that explores questions at the intersection
of mathematics and biology. Students will explore roughly five research
collaborations, spending two weeks with each research group. In the first
three classes of each two-week block, students will read and discuss
relevant papers, guided by members of that research group, and the two-
week period will culminate in a talk in which a member of the research
group will present a potential undergraduate project in that area. After
the final group’s talk, students will divide themselves into groups of two to
four people and choose one project for further exploration. Together, they
will write up this project as a research proposal, introducing the problem,
explaining how it connects to broader scientific questions, and outlining
the proposed work. It is expected that students will use the associated
research group as a resource, but the proposal should be their own work.
Students will submit a first draft, receive feedback, and then submit a
revised draft. Offered as BIOL 309 and MATH 342.

BIOL 312. Environmental Sculpture. 3 Units.
This course explores sculptural/architectural possibilities within three
environmental realms: the natural, urban, and social/communal. The
definition and application of “Sculpture” and “Architecture” may vary
dramatically from project to project, where the boundary between
sculpture and architecture may be blurred. Throughout, an emphasis on
ecological awareness will be maintained, as it relates to environmental
impact of structures in the landscape, as well as the materials and
pathway of construction. This course satisfies a laboratory requirement
for the biology major.

BIOL 314. Animal Cognition and Consciousness. 4 Units.
This course examines the notions of intelligence, cognition, reasoning,
consciousness, and mental content as they appear in the philosophical
views and empirical studies of animals in individual and social contexts.
We will review scientific findings that suggest striking likenesses and
intriguing differences in the (apparent) thought processes of humans
and animals, and ask whether the research techniques that brought us
these results are fully adequate to measuring such unobservable entities
as conscious experience and thought. Techniques of measurement
range from naturalistic observation, to the processing of vocalizations, to
memory and problem solving tasks, and the imaging of brain processes
through fMRI scans, etc. Students will face the challenges and rewards of
practicing these techniques and reworking philosophical theories in the
service component of the course. Students will participate in veterinary
or shelter work to provide needed animal care while studying animal
behavior using cognitive ethological methods. We will compare methods
for measuring consciousness and intelligence in animals to those used
for human beings, and ask questions about the possibility of machine
consciousness and the emergent property of group consciousness.
Offered as BIOL 314, COGS 314, PHIL 314 and PHIL 414.

BIOL 315. Quantitative Biology Laboratory. 3 Units.
This course will apply a range of quantitative techniques to explore
structure-function relations in biological systems. Using a case study
approach, students will explore causes of impairments of normal function,
will assemble diverse sets of information into a database format for the
analysis of causes of impairment, will analyze the data with appropriate
statistical and other quantitative tools, and be able to communicate their
results to both technical and non-technical audiences. The course has
one lecture and one lab per week. Students will be required to maintain a
journal of course activities and demonstrate mastery of quantitative tools
and statistical techniques. Graduate students will have a final project that
applies these techniques to a problem of their choice. Offered as BIOL
315 and BIOL 415. Prereq: BIOL 214 or BIOL 251.

BIOL 316. Fundamental Immunology. 4 Units.
Introductory immunology providing an overview of the immune system,
including activation, effector mechanisms, and regulation. Topics include
antigen-antibody reactions, immunologically important cell surface
receptors, cell-cell interactions, cell-mediated immunity, innate versus
adaptive immunity, cytokines, and basic molecular biology and signal
transduction in B and T lymphocytes, and immunopathology. Three
weekly lectures emphasize experimental findings leading to the concepts
of modern immunology. An additional recitation hour is required to
integrate the core material with experimental data and known immune
mediated diseases. Five mandatory 90 minute group problem sets per
semester will be administered outside of lecture and recitation meeting
times. Graduate students will be graded separately from undergraduates,
and 22 percent of the grade will be based on a critical analysis of a
recently published, landmark scientific article. Offered as BIOL 316, BIOL
416, CLBY 416, and PATH 416. Prereq: BIOL 215 and 215L.

BIOL 318. Introductory Entomology. 4 Units.
The goal of this course is to discover that, for the most part, insects
are not aliens from another planet. Class meetings will alternate with
some structured as lectures, while others are laboratory exercises.
Sometimes we will meet at the Cleveland Museum of Natural History,
or in the field to collect and observe insects. The 50 minute discussion
meeting once a week will serve to address questions from both lectures
and lab exercises. The students will be required to make a small but
comprehensive insect collection. Early in the semester we will focus on
collecting the insects, and later, when insects are gone for the winter,
we will work to identify the specimens collected earlier. Students will be
graded based on exams, class participation and their insect collections.
Offered as BIOL 318 and BIOL 418. Prereq: BIOL 214 and BIOL 215
and BIOL 216 or BIOL 250 and BIOL 251.
BIOL 319. Applied Probability and Stochastic Processes for Biology. 3 Units.
Applications of probability and stochastic processes to biological systems. Mathematical topics will include: introduction to discrete and continuous probability spaces (including numerical generation of pseudo random samples from specified probability distributions), Markov processes in discrete and continuous time with discrete and continuous state spaces, point processes including homogeneous and inhomogeneous Poisson processes and Markov chains on graphs, and diffusion processes including Brownian motion and the Ornstein-Uhlenbeck process. Biological topics will be determined by the interests of the students and the instructor. Likely topics include: stochastic ion channels, molecular motors and stochastic ratchets, actin and tubulin polymerization, random walk models for neural spike trains, bacterial chemotaxis, signaling and genetic regulatory networks, and stochastic predator-prey dynamics. The emphasis will be on practical simulation and analysis of stochastic phenomena in biological systems. Numerical methods will be developed using both MATLAB and the R statistical package. Student projects will comprise a major part of the course. Offered as BIOL 319, EECS 319, MATH 319, BIOL 419, EBMK 419, and PHOL 419. Prereq: MATH 224 or MATH 223 and BIOL 300 or BIOL 306 and MATH 201 or MATH 307 or consent of instructor.

BIOL 324. Introduction to Stem Cell Biology. 3 Units.
This discussion-based course will introduce students to the exciting field of stem cell research. Students will first analyze basic concepts of stem cell biology, including stem cell niche, cell quiescence, asymmetric cell division, cell proliferation and differentiation, and signaling pathways involved in these processes. This first part of the course will focus on invertebrate genetic models for the study of stem cells. In the second part of the course, students will search for primary research papers on vertebrate and human stem cells, and application of stem cell research in regenerative medicine and cancer. Finally, students will have the opportunity to discuss ethical controversies in the field. Students will rotate in weekly presentations, and will write two papers during the semester. Students will improve skills in searching and reading primary research papers, gain presentation skills, and further their knowledge in related subjects in the fields of cell biology, genetics and developmental biology. This course may be used as a cell/molecular subject area elective for the B.A. and B.S. Biology degrees. Offered as BIOL 324 and BIOL 424. Prereq: BIOL 325 or BIOL 326 or BIOL 362.

BIOL 325. Cell Biology. 3 Units.
This course will emphasize an understanding of the structure and function of eukaryotic cells from a molecular viewpoint. We will explore cell activities by answering the questions what do cells do and how do they do it. The answers to these questions will be developed using experimental evidence from the literature and explanations from the text. An important part of this course will be appreciation of the experimental evidence which supports our current understanding of cell function. To achieve this aim, students will read papers from the primary literature to supplement the text. Topics will include cell structure, protein structure and function, internal organization of the eukaryotic cell, membrane structure and function, protein sorting, organelle biogenesis, and cytoskeleton structure and function. The course will also cover the life cycles of cells, their interactions and finally use the immune response as a model of cell behavior. Prereq: BIOL 215 or BIOL 250.

BIOL 326. Genetics. 3 Units.
Transmission genetics, nature of mutation, microbial genetics, somatic cell genetics, recombinant DNA techniques and their application to genetics, human genome mapping, plant breeding, transgenic plants and animals, uniparental inheritance, evolution, and quantitative genetics. Offered as BIOL 326 and BIOL 426. Prereq: BIOL 214 or BIOL 250.

BIOL 328. Plant Genomics and Proteomics. 3 Units.
The development of molecular tools has impacted agriculture as much as human health. The application of new techniques to improve food crops, including the development of genetically modified crops, has also become controversial. This course covers the nature of the plant genome and the role of sequenced-based methods in the identification of the genes. The application of the whole suite of modern molecular tools to understand plant growth and development, with specific examples related agronomically important responses to biotic and abiotic stresses, is included. The impact of the enormous amounts of data generated by these methods and their storage and analysis (bioinformatics) is also considered. Finally, the impact on both the developed and developing world of the generation and release of genetically modified food crops will be covered. Recommended preparation: BIOL 326. Offered as BIOL 328 and BIOL 428.

BIOL 334. Structural Biology. 3 Units.
Introduces basic chemical properties of proteins and discusses the physical forces that determine protein structure. Topics include: the elucidation of protein structure by NMR and by X-ray crystallographic methods; the acquisition of protein structures from data bases; and simple modeling experiments based on protein structures. Offered as BIOL 334, BIOL 335, BIOL 434, and BIOL 435.

BIOL 336. Aquatic Biology. 3 Units.
Physical, chemical, and biological dynamics of lake ecosystems. Factors governing the distribution, abundance, and diversity of freshwater organisms. Prereq: BIOL 214 or BIOL 251.

BIOL 338. Ichthyology. 3 Units.
Biology of fishes. Students will first develop fundamental understanding of the evolutionary history and systematics of fishes to provide a context within which they can address diverse aspects of biology including anatomy, physiology (e.g., in species that change sex; osmoregulation in freshwater vs. saltwater), and behavior (e.g. visual, auditory, chemical, electric communication; social structures). Finally, this knowledge will be used to explore the biodiversity of fishes around the world, with emphasis on Ohio species, by examining preserved specimens in class and making two local field trips to (1) observe captive living specimens, and (2) to observe, capture, and identify wild fishes in their natural habitats. The course will conclude with an analysis of the current global fisheries crisis that has resulted from human activities. Fishes will be used to address broad topics in ecology and evolutionary biology that transcend the pure study of ichthyology. Recommended preparation for BIOL 438: BIOL 216. Offered as BIOL 338 and BIOL 438. Prereq: BIOL 216 or BIOL 251.

BIOL 339. Aquatic Biology Laboratory. 2 Units.
The physical, chemical, and biological limnology of freshwater ecosystems will be investigated. Emphasis will be on identification of the organisms inhabiting these systems and their ecological interactions with each other. This course will combine both field and laboratory analysis to characterize and compare the major components of these ponds. Students will have the opportunity to design and conduct individual projects. Prereq or Coreq: BIOL 336.
BIOL 340. Human Physiology. 3 Units.
This course will provide functional correlates to the students' previous knowledge of human anatomy. Building upon the basic principles covered in BIOL 216 and 346, the physiology of organs and organ systems of humans, including the musculoskeletal, nervous, cardiovascular, lymphatic, immune, respiratory, digestive, excretory, reproductive, and endocrine systems, will be studied at an advanced level. The contribution of each system to homeostasis will be emphasized. Prereq: BIOL 346 and BIOL 215 and BIOL 216 or BIOL 346 and BIOL 250 and BIOL 251.

BIOL 342. Parasitology. 3 Units.
This course will introduce students to classical and current parasitology. Students will discuss basic principles of parasitology, parasite life cycles, host-parasite interaction, therapeutic and control programs, epidemiology, and ecological and societal considerations. The course will explore diverse classes of parasitic organisms with emphasis on protozoan and helminthic diseases and the parasites' molecular biology. Group discussion and selected reading will facilitate further integrative learning and appreciation for parasite biology. This course counts as an elective in the cell/molecular biology subject area for the Biology BA and BS degrees. Offered as BIOL 342 and BIOL 442. Prereq: BIOL 214, 215, 216 and 326.

BIOL 343. Microbiology. 3 Units.
An introduction to the physiology, genetics, biochemistry, and diversity of microorganisms. The subject will be approached both as a basic biological science that studies the molecular and biochemical processes of cells and viruses, and as an applied science that examines the involvement of microorganisms in human disease as well as in workings of ecosystems, plant symbioses, and industrial processes. The course is divided into four major areas: bacteria, viruses, medical microbiology, and environmental and applied microbiology. Prereq: BIOL 215 or BIOL 250.

BIOL 344. Laboratory for Microbiology. 2 Units.
Practical microbiology, with an emphasis on bacteria as encountered in a variety of situations. Sterile techniques, principles of identification, staining and microscopy, growth and nutritional characteristics, genetics, enumeration methods, epidemiology, immunological techniques (including ELISA and T cell identification), antibiotics and antibiotic resistance, chemical diagnostic tests, sampling the human environment, and commercial applications. One lab per week. Prereq or Coreq: BIOL 343.

BIOL 345. Mammal Diversity and Evolution. 3 Units.
This course focuses on the morphologic and taxonomic diversity of mammals in a phylogenetic context. By the end of the course, students will be able to (1) describe the key morphological and physiological features of mammals; (2) identify the main anatomical characteristics of all orders and most families of extant, non-volant mammals; (3) interpret a phylogenetic tree and the data used to generate it; (4) appreciate major historical patterns in mammal diversity and biogeography. Two lectures and one lab each week; most labs will be specimen-based and will take place at the Cleveland Museum of Natural History. One weekend field trip to Cleveland Metroparks Zoo. This course satisfies a laboratory requirement for the biology major. Offered as ANAT 445, BIOL 345, and BIOL 445. Prereq: BIOL 214.

BIOL 346. Human Anatomy. 3 Units.
Gross anatomy of the human body. Two lectures and one laboratory demonstration per week. Prereq: BIOL 216 or BIOL 251.

BIOL 348. Human Anatomy and Physiology. 4 - 5 Units.
The anatomy and physiology of the human body. Enrollment is restricted to students majoring in nutrition. Four lectures and one laboratory per week. Offered as BIOL 348 and BIOL 448.

BIOL 351. Principles of Ecology. 3 Units.
This lecture course explores spatial and temporal relationships involving organisms and the environment at individual, population, and community levels. An underlying theme of the course will be neo-Darwinian evolution through natural selection with an emphasis on organismal adaptations to abiotic and biotic environments. Studies and models will illustrate ecological principles, and there will be some emphasis on the applicability of these principles to ecosystem conservation. Students taking the graduate level course will prepare a grant proposal in which hypotheses will be based on some aspect of ecological theory. Offered as BIOL 351 and BIOL 451. Prereq: BIOL 214 or BIOL 251.

BIOL 351L. Principles of Ecology Laboratory. 2 Units.
Students in this laboratory course will conduct a variety of ecological investigations that are designed to examine relationships involving organisms and the environment at individual, population, and community levels. Descriptive and hypothesis-driven investigations will take place at Case Western Reserve University's Squire Valleeve Farm, in both field and greenhouse settings. The course is designed to explore as well as test a variety of ecological paradigms. Students taking the graduate level course will prepare a grant proposal in which hypotheses will be based on a select number of lab investigations. This course satisfies a laboratory requirement for biology majors. Recommended preparation for BIOL 451L: prior or concurrent enrollment in BIOL 451. Offered as BIOL 351L and BIOL 451L. Prereq or Coreq: BIOL 351.

BIOL 353. Ecophysiology of Global Change. 3 Units.
Climate changes and natural selection, prior to human activities, have pre-equipped autotrophic organisms with a suite of adaptations to natural abiotic stress. Whether these adaptations are capable of dealing with current and future levels (magnitude, speed) of non-natural abiotic change is of great interest. This course will examine, in detail, the tight physiological interactions between plants and their variable environment. Emphasizing major aspects of indirect (UV-B, global warming, altered precipitation) and direct (CO2, O3, SOx, NOx) anthropogenic pollution, relevant plant cellular processes, and responses of plants to abiotic stress, will be examined. With this foundation, class discussions will explore scaled collective consequences of global change to plant-dominated terrestrial and aquatic ecosystems. Offered as BIOL 353 and BIOL 453. Prereq: BIOL 214 or BIOL 251.

BIOL 355. Ecophysiology of Global Change. 3 Units.
Climate changes and natural selection, prior to human activities, have pre-equipped autotrophic organisms with a suite of adaptations to natural abiotic stress. Whether these adaptations are capable of dealing with current and future levels (magnitude, speed) of non-natural abiotic change is of great interest. This course will examine, in detail, the tight physiological interactions between plants and their variable environment. Emphasizing major aspects of indirect (UV-B, global warming, altered precipitation) and direct (CO2, O3, SOx, NOx) anthropogenic pollution, relevant plant cellular processes, and responses of plants to abiotic stress, will be examined. With this foundation, class discussions will explore scaled collective consequences of global change to plant-dominated terrestrial and aquatic ecosystems. Offered as BIOL 353 and BIOL 453. Prereq: BIOL 214 or BIOL 251.
BIOL 357. Backyard Behavior Capstone. 3 Units.
Interesting animal behavior is all around us. We need not go into a laboratory to observe it, but laboratory tools can help to understand the behaviors that we encounter every day. We interact with animals in our homes, in forests and wilderness areas and even in our own backyards. As pet dogs or cats interact with wild squirrels and birds, they provide insights regarding predation, neumomechanics, and mating behaviors, just to list a few concepts. This course takes advantage of the rich behavior that exists around us to provide a capstone experience for students who have an interest in animal behavior. The course will be open to 10 senior Biology majors who have emphasized the animal behavior and neurobiology courses offered by the Biology department. Each student will have taken at least one advanced course in Animal Behavior, Neurobiology, or Neuroethology. Entry into the course will be by permit, and permits will be issued only after an interview in which each student demonstrates to the instructor a deep interest in animal behavior and underlying neural control systems. Through classroom discussion, viewing of behaviorally-based video shows, and field trips, each student will choose one behavior to investigate in detail over the course of the semester. In order to move beyond casual observation to in-depth analysis, video cameras will be available to the students, as well as computer based motion analysis systems. The class will meet as a group twice weekly. During this formal classroom period, students will discuss behaviors in general and , as the course progresses, the specific topics that each student is investigating. They will present journal articles that are relevant to their topics, a prospectus on their intended study, and ultimately describe their projects outside of class time and will present a poster at a public poster fair. Prereq: BIOL 305 or BIOL 318 or BIOL 358 or BIOL 373 or BIOL 374.

BIOL 358. Animal Behavior. 4 Units.
Ultimately the success or failure (i.e., life or death) of any individual animal is determined by its behavior. The ability to locate and capture food, avoid being food, acquiring and defending territory, and successfully passing your genes to the next generation, are all dependent on complex interactions between an animal’s design, environment and behavior. This course will be an integrative approach emphasizing experimental studies of animal behavior. You will be introduced to state-of-the-art approaches to the study of animal behavior, including neural and hormonal mechanisms, genetic and developmental mechanisms and ecological and evolutionary approaches. We will learn to critique examples of current scientific papers, and learn how to conduct observations and experiments with real animals. We will feature guest appearances by the Curator of Research from the Cleveland MetroParks Zoo and visits to working animal behavior research labs here at CWRU. Group discussions and writing will be emphasized. This course satisfies a laboratory requirement for biology majors. Offered as BIOL 358 and BIOL 458. Prereq: BIOL 214 and BIOL 215 and BIOL 216 or BIOL 250 and BIOL 251.

BIOL 359. Genetic Basis of Behavior. 3 Units.
In this course, students will discuss scientific papers on Drosophila behavior. Emphasis will be given to studies that employ the powerful genetic tools available in Drosophila to the study of behavior. The topics covered will include: innate behaviors (e.g. sexual behavior); learning and memory; sensory information processing; anatomy of the Drosophila adult brain; genetic screenings for behavioral mutants; genetic tools to interfere with behavioral response. Students will be required to write and develop an objective project that combines genetics with behavioral tests. Students will be graded in presentations as well as a final grant proposal. Lab component will consist of experimentation in flies using genetics and behavioral analyses, to be carried out in the last 6 weeks of the course. Counts as a Biology laboratory course for the B.A. and B.S. Biology degrees. Offered as BIOL 359 and BIOL 459. Prereq: BIOL 216 or BIOL 251.

BIOL 361. Building an Educational Website: Zebrafish in the Classroom. 3 Units.
Students with backgrounds in computer science and biology will work together to build a “Zebrafish in the Classroom” website. The zebrafish model system has many characteristics that make it an excellent tool for teaching: embryos are easy to obtain in large numbers, development can be observed in vivo using simple dissecting microscopes, and mutants can be used to demonstrate principles of development and genetics. Although scientists around the world are using zebrafish in their courses, there is no centralized place for educators and students to share ideas and materials. During this course, students will create content for and build a website that will disseminate ideas for using zebrafish as a teaching tool. In its mature form, the website will contain protocols for using zebrafish in laboratory courses for students at all stages of their education, tours, movies, discussion and question boards, and an online journal where students can publish their work. Students enrolling in this course should have background in web design or developmental biology. Prereq: BIOL 362.

BIOL 362. Principles of Developmental Biology. 3 Units.
The descriptive and experimental aspects of animal development. Gametogenesis, fertilization, cleavage, morphogenesis, induction, differentiation, organogenesis, growth, and regeneration. Prereq: BIOL 216 or BIOL 251 or EBME 201 and EBME 202.

BIOL 363. Experimental Developmental Biology. 3 Units.
This laboratory course will teach concepts and techniques in developmental biology. Emphasis will be on the mechanisms that pattern the embryo during development and how these mechanisms are explored using molecular, cellular, and genetic approaches. A term research paper is required. Students taking the graduate level course will prepare a grant proposal. One laboratory and one lecture per week. Offered as BIOL 363 and BIOL 463. Prereq: BIOL 362.
BIOL 364. Research Methods in Evolutionary Biology. 3 Units.
The process of evolution explains not only how the present diversity of life on earth has formed, but also provides insights into current pressing issues today, including the spread of antibiotic resistance, the causes of geographic variation in genetic diseases, and explanations for modern patterns of extinction risk. Students in Research Methods in Evolutionary Biology will be introduced to several of the major research approaches of evolutionary biology, including methods of measuring natural selection on the phenotypic and genotypic levels, quantifying the rate of evolution, reconstructing evolutionary relationships, and assessing the factors that affect rates of speciation and extinction. The course will consist of a combination of interactive lectures, in-class problem solving and data analysis, and the discussion of peer-reviewed scientific papers. Grades are based on participation in class, discussions and written summaries of published papers, in-class presentations, and two writing assignments. Offered as BIOL 364 and BIOL 464. Prereq: BIOL 214 or BIOL 251.

BIOL 365. Evo-Devo: Evolution of Body Plans. 3 Units.
This discussion-based course offers a detailed introduction to Evolutionary Developmental Biology. The field seeks to explain evolutionary events through the mechanisms of Developmental Biology and Genetics. The course is structured into different modules. First we will look at the developmental genetic mechanisms that can cause variation. Then we focus on how alterations of these mechanisms can generate novel structural changes. We will then examine a few areas of active debate, where Evo-Devo is attempting to solve major problems in evolutionary biology. We will conclude with two writing assignments. Students will be required to present, read, and discuss primary literature in each module. Offered as BIOL 365 and BIOL 465. Prereq: BIOL 225 or BIOL 251 or BIOL 362

BIOL 366. Genes, Embryos and Fossils. 3 Units.
This multidisciplinary seminar course is designed to help students understand fundamental concepts of development and evolution of biological systems. Because scientists communicate their ideas through journal articles, seminars, and in grant proposals, the course will focus upon reading and synthesizing primary literature. In this discussion-based course, students will also learn to effectively present and write on three topics that are at the exciting intersection of genetics, developmental biology, and evolution. Finally, students will be provided with the technical and intellectual skills which are needed to write a grant proposal and a literature review. Prereq: BIOL 225, BIOL 326, BIOL 251, BIOL 362 or BIOL 365.

BIOL 368. Topics in Evolutionary Biology. 3 Units.
The focus for this course on a special topic of interest in evolutionary biology will vary from one offering to the next. Examples of possible topics include theories of speciation, the evolution of language, the evolution of sex, evolution and biodiversity, molecular evolution. ANAT/ ANTH/EEPS/PHIL/PHOL 467/BIOL 468 will require a longer, more sophisticated term paper, and additional class presentation. Offered as ANTH 367, BIOL 368, EEPS 367, PHIL 367, ANAT 467, ANTH 467, BIOL 468, EEPS 467, PHIL 467 and PHOL 467.

BIOL 369. Evolutionary Biology Capstone. 3 Units.
This course focuses on a special topic of interest in evolutionary biology that will vary from one offering to the next. Examples of possible topics include theories of speciation, the evolution of language, the evolution of sex, evolution and biodiversity, molecular evolution. Students will participate in discussions and lead class seminars on evolutionary topics and in collaboration with an advisor or advisors, select a topic for a research paper or project. Each student will write a major research report or complete a major project and will make a public presentation of her/his findings. Offered as ANTH 368, BIOL 369, PHIL 368.

BIOL 373. Introduction to Neurobiology. 3 Units.
How nervous systems control behavior. Biophysical, biochemical, and molecular biological properties of nerve cells, their organization into circuitry, and their function within networks. Emphasis on quantitative methods for modeling neurons and networks, and on critical analysis of the contemporary technical literature in the neurosciences. Term paper required for graduate students. Offered as BIOL 373, BIOL 473, and NEUR 473.

BIOL 374. Neurobiology of Behavior. 3 Units.
In this course, students will examine how neurobiologists interested in animal behavior study the linkage between neural circuitry and complex behavior. Various vertebrate and invertebrate systems will be considered. Several exercises will be used in this endeavor. Although some lectures will provide background and context on specific neural systems, the emphasis of the course will be on classroom discussion of specific journal articles. In addition, students will each complete a project in which they will observe some animal behavior and generate both behavioral and neurobiological hypotheses related to it. In lieu of examinations, students will complete three written assignments, including a theoretical grant proposal, a one-page Specific Aims paper related to the project, and a final project paper. These assignments are designed to give each student experience in writing biologically-relevant documents. Classroom discussions will help students understand the content and format of each type document. They will also present their projects orally to the entire class. Offered as BIOL 374, BIOL 474, and NEUR 474.

BIOL 376. Neurobiology Laboratory. 3 Units.
Introduction to the basic laboratory techniques of neurobiology. Intracellular and extracellular recording techniques, forms of synaptic plasticity, patch clamping, immunohistochemistry and confocal microscopy. During the latter weeks of the course students will be given the opportunity to conduct an independent project. One laboratory and one discussion session per week. Recommended preparation for BIOL 476 and NEUR 476: BIOL 216. Offered as BIOL 376, BIOL 476 and NEUR 476. Prereq: BIOL 216 or BIOL 251.
BIOL 377. Biorobotics Team Research. 3 Units.
Many exciting research opportunities cross disciplinary lines. To participate in such projects, researchers must operate in multi-disciplinary teams. The Biorobotics Team Research course offers a unique capstone opportunity for undergraduate students to utilize skills they developed during their undergraduate experience while acquiring new teaming skills. A group of eight students form a research team under the direction of two faculty leaders. Team members are chosen from appropriate majors through interviews with the faculty. They will research a biological mechanism or principle and develop a robotic device that captures the actions of that mechanism. Although each student will cooperate on the team, they each have a specific role, and must develop a final paper that describes the research generated on their aspect of the project. Students meet for one class period per week and two 2-hour lab periods. Initially students brainstorm ideas and identify the project to be pursued. They then acquire biological data and generate robotic designs. Both are further developed during team meetings and reports. Final oral reports and a demonstration of the robotic device occur in week 15. Offered as BIOL 377, EMAE 377, BIOL 477, and EMAE 477.

BIOL 378. Computational Neuroscience. 3 Units.
Computer simulations and mathematical analysis of neurons and neural circuits, and the computational properties of nervous systems. Students are taught a range of models for neurons and neural circuits, and are asked to implement and explore the computational and dynamic properties of these models. The course introduces students to dynamical systems theory for the analysis of neurons and neural learning, models of brain systems, and their relationship to artificial and neural networks. Term project required. Students enrolled in MATH 478 will make arrangements with the instructor to attend additional lectures and complete additional assignments addressing mathematical topics related to the course. Recommended preparation: MATH 223 and MATH 224 or BIOL 300 and BIOL 306. Offered as BIOL 378, COGS 378, MATH 378, BIOL 478, EBME 478, EECS 478, MATH 478 and NEUR 478.

BIOL 379. Neuroscience of Communication and Communication Disorders. 3 Units.
The course focus is neuroanatomy and neurophysiology related to motor control and cognition, particularly aspects of cognition involved in language functions. Topics to be addressed include: principles of neurophysiology and neurochemistry; functional neuroanatomy of the central and peripheral nervous systems; neurological and neuropsychological assessment of communication; neurodiagnostic methods. In part, the course material will be presented in a problem-based learning format. That is, normal aspects of human neuroscience will be discussed in the context of neurological disorders affecting communication. COSI 405 is an introduction to COSI 557 and COSI 561. Offered as BIOL 379 and COSI 305 and COSI 405.

BIOL 382. Drugs, Brain, and Behavior. 3 Units.
This course is concerned with the mechanisms underlying neurochemical signaling and the impact of drugs on those mechanisms. The first half of the course emphasizes the fundamental mechanisms underlying intra- and extracellular communication of neurons and the basic principles of how drugs interact with the nervous system. The second half of the course emphasizes understanding the neural substrates of disorders of the nervous system, and the mechanisms underlying the therapeutic effects of drugs at the cellular and behavioral levels. This course will consist of lectures designed to give the student necessary background for understanding these basic principles and class discussion. The class discussion will include viewing video examples of behavioral effects of disorders of the nervous system, and analysis of research papers. The goal of the class discussions is to enhance the critical thinking skills of the student and expose the student to contemporary research techniques. Offered as BIOL 382, BIOL 482, and NEUR 482. Prereq: BIOL 215 and BIOL 216 or BIOL 250 and BIOL 251.

BIOL 384. Reading and Writing Like an Ecologist. 3 Units.
Students usually learn from textbooks, but scientists communicate with each other through journal articles. The purpose of this class is to help you learn to read and write like an ecologist. We will spend our time reading and discussing journal articles about three or four issues in ecology, including papers from both empirical and theoretical perspectives. In addition to the science, we’ll talk about strategies for how to keep reading when you encounter something you don’t understand and what makes a paper well or poorly written. At the end of each section, you will synthesize your ideas into a review article. Your initial paper will be submitted to me as hypothetical journal editor. I will send your paper out for review to two fellow classmates, and I’ll send their comments back to you along with brief comments of my own. As all scientists know, it is virtually unheard of for a journal to accept a paper for publication without revisions. After this peer review, you will revise your papers and resubmit them to me. Your grade will be based on your participation in class discussions, your papers (both drafts) and your work as a reviewer for other students. Prereq: BIOL 214 or BIOL 251.

BIOL 385. Seminar on Biological Processes in Learning and Cognition. 3 Units.
Students will read and discuss research papers on a range of topics relevant to the biological processes that lead to cognition and learning in humans. Sample topics are: cellular and molecular mechanisms of memory; visual sensory detection of images, movement, and color; role of slow neurotransmitters in synaptic plasticity; cortical distribution of cognitive functions such as working memory, decision making, and image analysis; functions of emotion-structures and their role in cognition; brain structures and mechanisms involved in language creation; others. Some papers will be assigned and others will be selected by students. Discussions will focus on the methods used, the experimental results, and the interpretations of significance. Students will work in groups on a research project to be presented near the end of the semester. Prereq: BIOL 302.

BIOL 388. Undergraduate Research. 1 - 3 Units.
Guided laboratory research under the sponsorship of a biology faculty member. May be carried out within the biology department or in associated departments. May be taken only one semester during the student’s academic career. Appropriate forms must be secured in the biology department office. A written report must be approved by the biology sponsor and submitted to the chairman of the biology department before credit is granted.
BIOL 388S. Undergraduate Research - SAGES Capstone. 3 Units.
Guided laboratory research under the sponsorship of a biology faculty member. May be carried out within the biology department or in associated departments. May be taken only one semester during the student's academic career. Appropriate forms must be secured in the biology department office. A written report must be approved by the biology sponsor and submitted to the chairman of the biology department before credit is granted. A public presentation is required.

BIOL 389. Selected Topics. 1 - 3 Unit.
Individual library research projects under the guidance of a biology sponsor. A major paper must be submitted and approved before credit is awarded.

BIOL 389S. Selected Topics in Biology--SAGES Capstone. 3 Units.
Individual library research projects under the guidance of a biology sponsor. A major paper must be submitted and approved before credit is awarded. A public presentation is required.

BIOL 390. Advanced Undergraduate Research. 1 - 3 Unit.
Offered on a credit only basis. Students may carry out research in biology or related departments, but a biology sponsor is required. Does not count toward the 30 hours required for a major in biology, but may be counted toward the total number of hours required for graduation. A written report must be submitted to the chairman's office and approved before credit is granted.

BIOL 394. Seminar in Evolutionary Biology. 3 Units.
This seminar investigates 20th-century evolutionary theory, especially the Modern Evolutionary synthesis and subsequent expansions of and challenges to that synthesis. The course encompasses the multidisciplinary nature of the science of evolution, demonstrating how disciplinary background influences practitioners' conceptualizations of pattern and process. This course emphasizes practical writing and research skills, including formulation of testable theses, grant proposal techniques, and the implementation of original research using the facilities on campus and at the Cleveland Museum of Natural History. Offered as ANTH 394, BIOL 394, EEPS 394, HSTY 394, PHIL 394, ANTH 494, BIOL 494, EEPS 494, HSTY 494, and PHIL 494.

BIOL 395. Research Discussions. 1 Unit.
This is a seminar course which provides a forum within which students performing undergraduate research, or who have done so previously, can present and discuss their projects. Discussions will cover all aspects of the students' research projects: background material, experimental design and methods, results and their analysis and conclusions. At the beginning of the semester, each student will briefly outline his or her project and distribute a few key papers to provide background reading for all participants. After this introductory phase, each student will make a presentation of his/her own research. Graded as pass/fail, based upon attendance and participation. Prereq: BIOL 388. Prereq or coreq: BIOL 390.

BIOL 396. Undergraduate Research in Evolutionary Biology. 3 Units.
Students propose and conduct guided research on an aspect of evolutionary biology. The research will be sponsored and supervised by a member of the CASE faculty or other qualified professional. A written report must be submitted to the Evolutionary Biology Steering Committee before credit is granted. Offered as ANTH 396, BIOL 396, EEPS 396, and PHIL 396.

BIOL 401. Biotechnology Laboratory: Genes and Genetic Engineering. 3 Units.
Laboratory training in recombinant DNA techniques. Basic microbiology, growth, and manipulation of bacteriophage, bacteria and yeast. Students isolate and characterize DNA, construct recombinant DNA molecules, and reintroduce them into eukaryotic cells (yeast, plant, animal) to assess their viability and function. Two laboratories per week. Offered as BIOL 301 and BIOL 401.

BIOL 402. Principles of Neural Science. 3 Units.
Lecture/discussion course covering concepts in cell and molecular neuroscience, principles of systems neuroscience as demonstrated in the somatosensory system, and fundamentals of the development of the nervous system. This course will prepare students for upper level Neuroscience courses and is also suitable for students in other programs who desire an understanding of neurosciences. Recommended preparation: CBIO 453. Offered as BIOL 402 and NEUR 402.

BIOL 404. Fitting Models to Data: Maximum Likelihood Methods and Model Selection. 3 Units.
This course will introduce students to maximum likelihood methods for fitting models to data and to ways of deciding which model is best supported by the data (model selection). Along the way, students will learn some basic tenets of probability and develop competency in R, a commonly used statistical package. Examples will be drawn from ecology, epidemiology, and potentially other areas of biology. The second half of the course is devoted to in-class projects, and students are encouraged to bring their own data. Offered as BIOL 304 and BIOL 404. Prereq: MATH 121 & 122 OR MATH 125 &126 or consent of instructor.

BIOL 407. General Biochemistry. 4 Units.
Overview of the macromolecules and small molecules key to all living systems. Topics include: protein structure and function; enzyme mechanisms, kinetics and regulation; membrane structure and function; bioenergetics; hormone action; intermediary metabolism, including pathways and regulation of carbohydrate, lipid, amino acid, and nucleotide biosynthesis and breakdown. One semester of biology is recommended. Offered as BIOC 307, BIOC 407, and BIOL 407.

BIOL 408. Molecular Biology: Genes and Genetic Engineering. 4 Units.
An examination of the flow of genetic information from DNA to RNA to protein. Topics include: nucleic acid structure; mechanisms and control of DNA, RNA, and protein biosynthesis; recombinant DNA; and mRNA processing and modification. Where possible, eukaryotic and prokaryotic systems are compared. Special topics include yeast as a model organism, molecular biology of cancer, and molecular biology of the cell cycle. Current literature is discussed briefly as an introduction to techniques of genetic engineering. Recommended preparation for BIOC 408 and BIOL 408: BIOC 307 or BIOL 214. Offered as BIOC 308, BIOL 308, BIOC 408, and BIOL 408. Prereq: BIOL 215 or BIOC 307.
BiOL 415. Quantitative Biology Laboratory. 3 Units.
This course will apply a range of quantitative techniques to explore structure-function relations in biological systems. Using a case study approach, students will explore causes of impairments of normal function, will assemble diverse sets of information into a database format for the analysis of causes of impairment, will analyze the data with appropriate statistical and other quantitative tools, and be able to communicate their results to both technical and non-technical audiences. The course has one lecture and one lab per week. Students will be required to maintain a journal of course activities and demonstrate mastery of quantitative tools and statistical techniques. Graduate students will have a final project that applies these techniques to a problem of their choice. Offered as BiOL 315 and BiOL 415.

BiOL 416. Fundamental Immunology. 4 Units.
Introductory immunology providing an overview of the immune system, including activation, effector mechanisms, and regulation. Topics include antigen-antibody reactions, immunologically important cell surface receptors, cell-cell interactions, cell-mediated immunity, innate versus adaptive immunity, cytokines, and basic molecular biology and signal transduction in B and T lymphocytes, and immunopathology. Three weekly lectures emphasize experimental findings leading to the concepts of modern immunology. An additional recitation hour is required to integrate the core material with experimental data and known immune mediated diseases. Five mandatory 90 minute group problem sets per semester will be administered outside of lecture and recitation meeting times. Graduate students will be graded separately from undergraduates, and 22 percent of the grade will be based on a critical analysis of a recently published, landmark scientific article. Offered as BiOL 316, BiOL 416, CLBY 416, and PATH 416. Prereq: Graduate standing.

BiOL 417. Cytokines: Function, Structure, and Signaling. 3 Units.
Regulation of immune responses and differentiation of leukocytes is modulated by proteins (cytokines) secreted and/or expressed by both immune and non-immune cells. Course examines the function, expression, gene organization, structure, receptors, and intracellular signaling of cytokines. Topic include regulatory and inflammatory cytokines, colony stimulating factors, chemokines, cytokine and cytokine receptor gene families, intracellular signaling through STAT proteins and tyrosine phosphorylation, clinical potential, and genetic defects. Lecture format using texts, scientific reviews and research articles. Recommended preparation: PATH 416 or equivalent. Offered as BiOL 417, CLBY 417, and PATH 417.

BiOL 418. Introductory Entomology. 4 Units.
The goal of this course is to discover that, for the most part, insects are not aliens from another planet. Class meetings will alternate; with some structured as lectures, while others are laboratory exercises. Sometimes we will meet at the Cleveland Museum of Natural History, or in the field to collect and observe insects. The 50 minute discussion meeting once a week will serve to address questions from both lectures and lab exercises. The students will be required to make a small but comprehensive insect collection. Early in the semester we will focus on collecting the insects, and later, when insects are gone for the winter, we will work to identify the specimens collected earlier. Students will be graded based on exams, class participation and their insect collections. Offered as BiOL 318 and BiOL 418. Prereq: BiOL 214, and BiOL 215, and BiOL 216.

BiOL 419. Applied Probability and Stochastic Processes for Biology. 3 Units.
Applications of probability and stochastic processes to biological systems. Mathematical topics will include: introduction to discrete and continuous probability spaces (including numerical generation of pseudo random samples from specified probability distributions), Markov processes in discrete and continuous time with discrete and continuous sample spaces, point processes including homogeneous and inhomogeneous Poisson processes and Markov chains on graphs, and diffusion processes including Brownian motion and the Ornstein-Uhlenbeck process. Biological topics will be determined by the interests of the students and the instructor. Likely topics include: stochastic ion channels, molecular motors and stochastic ratchets, actin and tubulin polymerization, random walk models for neural spike trains, bacterial chemotaxis, signaling and genetic regulatory networks, and stochastic predator-prey dynamics. The emphasis will be on practical simulation and analysis of stochastic phenomena in biological systems. Numerical methods will be developed using both MATLAB and the R statistical package. Student projects will comprise a major part of the course. Offered as BiOL 319, EECS 319, MATH 319, BiOL 419, EBME 419, and PHOL 419.

BiOL 424. Introduction to Stem Cell Biology. 3 Units.
This discussion-based course will introduce students to the exciting field of stem cell research. Students will first analyze basic concepts of stem cell biology, including stem cell niche, cell quiescence, asymmetric cell division, cell proliferation and differentiation, and signaling pathways involved in these processes. This first part of the course will focus on invertebrate genetic models for the study of stem cells. In the second part of the course, students will search for primary research papers on vertebrate and human stem cells, and application of stem cell research in regenerative medicine and cancer. Finally, students will have the opportunity to discuss about ethical controversies in the field. Students will rotate in weekly presentations, and will write two papers during the semester. Students will improve skills on searching and reading primary research papers, gain presentation skills, and further their knowledge in related subjects in the fields of cell biology, genetics and developmental biology. This course may be used as a cell/molecular subject area elective for the B.A. and B.S. Biology degrees. Offered as BiOL 324 and BiOL 424. Prereq: Graduate standing.

BiOL 426. Genetics. 3 Units.
Transmission genetics, nature of mutation, microbial genetics, somatic cell genetics, recombinant DNA techniques and their application to genetics, human genome mapping, plant breeding, transgenic plants and animals, uniparental inheritance, evolution, and quantitative genetics. Offered as BiOL 326 and BiOL 426.

BiOL 427. Neural Development. 3 Units.
Topics include cell commitment, regulation of proliferation and differentiation, cell death and trophic factors, pathfinding by the outgrowing nerve fiber, synapse formation, relationships between center and periphery in development and the role of activity. Offered as BiOL 427 and NEUR 427.
BIOL 428. Plant Genomics and Proteomics. 3 Units.
The development of molecular tools has impacted agriculture as much as human health. The application of new techniques to improve food crops, including the development of genetically modified crops, has also become controversial. This course covers the nature of the plant genome and the role of sequenced-based methods in the identification of the genes. The application of the whole suite of modern molecular tools to understand plant growth and development, with specific examples related agronomically important responses to biotic and abiotic stresses, is included. The impact of the enormous amounts of data generated by these methods and their storage and analysis (bioinformatics) is also considered. Finally, the impact on both the developed and developing world of the generation and release of genetically modified food crops will be covered. Recommended preparation: BIOL 326. Offered as BIOL 328 and BIOL 428.

BIOL 431. Statistical Methods I. 3 Units.
Application of statistical techniques with particular emphasis on problems in the biomedical sciences. Basic probability theory, random variables, and distribution functions. Point and interval estimation, regression, and correlation. Problems whose solution involves using packaged statistical programs. First part of year-long sequence. Offered as ANAT 431, BIOL 431, CRSP 431, EPBI 431, and MPHP 431.

BIOL 432. Statistical Methods II. 3 Units.
Methods of analysis of variance, regression and analysis of quantitative data. Emphasis on computer solution of problems drawn from the biomedical sciences. Design of experiments, power of tests, and adequacy of models. Offered as BIOL 432, CRSP 432, EPBI 432, and MPHP 432. Prereq: EPBI 431 or equivalent.

BIOL 434. Structural Biology. 3 Units.
Introduces basic chemical properties of proteins and discusses the physical forces that determine protein structure. Topics include: the elucidation of protein structure by NMR and by X-ray crystallographic methods; the acquisition of protein structures from data bases; and simple modeling experiments based on protein structures. Offered as BIOC 334, BIOL 334, BIOC 434, and BIOL 434.

BIOL 438. Ichthyology. 3 Units.
Biology of fishes. Students will first develop fundamental understanding of the evolutionary history and systematics of fishes to provide a context within which they can address diverse aspects of biology including anatomy, physiology (e.g., in species that change sex; osmoregulation in freshwater vs. saltwater), and behavior (e.g. visual, auditory, chemical, electric communication; social structures). Finally, this knowledge will be used to explore the biodiversity of fishes around the world, with emphasis on Ohio species, by examining preserved specimens in class and making two local field trips to (1) observe captive living specimens, and (2) to observe, capture, and identify wild fishes in their natural habitats. The course will conclude with an analysis of the current global fisheries crisis that has resulted from human activities. Fishes will be used to address broad topics in ecology and evolutionary biology that transcend the pure study of ichthyology. Recommended preparation for BIOL 438: BIOL 216. Offered as BIOL 338 and BIOL 438.

BIOL 442. Parasitology. 3 Units.
This course will introduce students to classical and current parasitology. Students will discuss basic principles of parasitology, parasite life cycles, host-parasite interaction, therapeutic and control programs, epidemiology, and ecological and societal considerations. The course will explore diverse classes of parasitic organisms with emphasis on protozoan and helminthic diseases and the parasites’ molecular biology. Group discussion and selected reading will facilitate further integrative learning and appreciation for parasite biology. This course counts as an elective in the cell/molecular biology subject area for the Biology BA and BS degrees. Offered as BIOL 342 and BIOL 442. Prereq: Graduate standing and consent of instructor.

BIOL 443. Advanced Microbiology. 3 Units.
The physiology, genetics, biochemistry, and diversity of microorganisms. The subject will be approached both as a basic biological science that studies the molecular and biochemical processes of cells and viruses, and as an applied science that examines the involvement of microorganisms in human disease as well as in the workings of ecosystems, plant symbioses, and industrial processes. The course is divided into four major areas: bacteria, viruses, medical microbiology, and environmental and applied microbiology. Recommended preparation: BIOL 215 or consent of instructor.

BIOL 445. Mammal Diversity and Evolution. 3 Units.
This course focuses on the morphologic and taxonomic diversity of mammals in a phylogenetic context. By the end of the course, students will be able to (1) describe the key morphological and physiological features of mammals; (2) identify the main anatomical characteristics of all orders and most families of extant, non-volant mammals; (3) interpret a phylogenetic tree and the data used to generate it; (4) appreciate major historical patterns in mammal diversity and biogeography. Two lectures and one lab each week; most labs will be specimen-based and will take place at the Cleveland Museum of Natural History. One weekend field trip to Cleveland Metroparks Zoo. This course satisfies a laboratory requirement for the biology major. Offered as ANAT 445, BIOL 345, and BIOL 445. Prereq: BIOL 214.

BIOL 448. Human Anatomy and Physiology. 4 - 5 Units.
The anatomy and physiology of the human body. Enrollment is restricted to students majoring in nutrition. Four lectures and one laboratory per week. Offered as BIOL 348 and BIOL 448.

BIOL 451. Principles of Ecology. 3 Units.
This lecture course explores spatial and temporal relationships involving organisms and the environment at individual, population, and community levels. An underlying theme of the course will be neo-Darwinian evolution through natural selection with an emphasis on organismal adaptations to abiotic and biotic environments. Studies and models will illustrate ecological principles, and there will be some emphasis on the applicability of these principles to ecosystem conservation. Students taking the graduate level course will prepare a grant proposal in which hypotheses will be based on some aspect of ecological theory. Offered as BIOL 351 and BIOL 451.
BIOL 451L. Principles of Ecology Laboratory. 2 Units.
Students in this laboratory course will conduct a variety of ecological investigations that are designed to examine relationships involving organisms and the environment at individual, population, and community levels. Descriptive and hypothesis-driven investigations will take place at Case Western Reserve University's Squire Valley Farm, in both field and greenhouse settings. The course is designed to explore as well as test a variety of ecological paradigms. Students taking the graduate level course will prepare a grant proposal in which hypotheses will be based on a select number of lab investigations. This course satisfies a laboratory requirement for biology majors. Recommended preparation for BIOL 451L: prior or concurrent enrollment in BIOL 451. Offered as BIOL 351L and BIOL 451L.

BIOL 453. Ecophysiology of Global Change. 3 Units.
Climate changes and natural selection, prior to human activities, have pre-equipped autotrophic organisms with a suite of adaptations to natural abiotic stress. Whether these adaptations are capable of dealing with current and future levels (magnitude, speed) of nonnatural abiotic change is of great interest. This course will examine, in detail, the tight physiological interactions between plants and their variable environment. Emphasizing major aspects of indirect (UV-B, global warming, altered precipitation) and direct (CO2, O3, SOx, NOx) anthropogenic pollution, relevant plant cellular processes, and responses of plants to abiotic stress, will be examined. With this foundation, class discussions will explore scaled collective consequences of global change to plant-dominated terrestrial and aquatic ecosystems. Offered as BIOL 353 and BIOL 453.

BIOL 454. Coadaptation of Organisms. 3 Units.
This graduate level course will examine biological interactions that result in organismal coadaptation and its ecological implications. Darwin was an avid observer of biological interactions that result in organismal coadaptation and its ecological implications. Darwin was an avid observer of biological interactions and his theory of evolution by natural selection focused primarily on one type of interaction: competition between individuals especially those of the same species. However, Darwin did not explicitly consider the role of cooperation in biological evolution. Nonetheless, cooperation can be a key agent in the coadaptation of organisms and in fact may have led to the evolution of eukaryotes. Three broad types of interactions will be examined in this course: competition, parasitism and cooperation. A particular focus of the course will be on biological cooperation or mutualism. Case studies will be presented to highlight the possible range of biological coadaptation. Lectures will be supplemented by discussion of the relevant literature.

BIOL 457. Proteins and Nucleic Acids. 3 Units.
The goal of this course is to provide a basic working knowledge of protein structure/function and molecular biology. The course begins with a discussion of protein structure and enzyme catalysis followed by protein purification and characterization. The course then addresses concepts relating to the application of modern molecular biology techniques. Students are taught how to clone genes and use these clones in animal and cell-based studies. The overall goal is to provide students with an understanding of proteins and genetic approaches that can be used in experimental work and to facilitate comprehension of the scientific literature. Offered as BIOL 457 and PHOL 456.

BIOL 458. Animal Behavior. 4 Units.
Ultimately the success or failure (i.e., life or death) of any individual animal is determined by its behavior. The ability to locate and capture food, avoid being food, acquiring and defending territory, and successfully passing your genes to the next generation, are all dependent on complex interactions between an animal's design, environment and behavior. This course will be an integrative approach emphasizing experimental studies of animal behavior. You will be introduced to state-of-the-art approaches to the study of animal behavior, including neural and hormonal mechanisms, genetic and developmental mechanisms and ecological and evolutionary approaches. We will learn to critique examples of current scientific papers, and learn how to conduct observations and experiments with real animals. We will feature guest appearances by the Curator of Research from the Cleveland MetroParks Zoo and visits to working animal behavior research labs here at CWRU. Group discussions and writing will be emphasized. This course satisfies a laboratory requirement for biology majors. Offered as BIOL 358 and BIOL 458.

BIOL 459. Genetic Basis of Behavior. 3 Units.
In this course, students will discuss scientific papers on Drosophila behavior. Emphasis will be given to studies that employ the powerful genetic tools available in Drosophila to the study of behavior. The topics covered will include: innate behaviors (e.g. sexual behavior); learning and memory; sensory information processing; anatomy of the Drosophila adult brain; genetic screenings for behavioral mutants; genetic tools to interfere with behavioral response. Students will be required to write and develop an objective project that combines genetics with behavioral tests. Students will be graded in presentations as well as a final grant proposal. Lab component will consist of experimentation in flies using genetics and behavioral analyses, to be carried out in the last 6 weeks of the course. Counts as a Biology laboratory course for the B.A. and B.S. Biology degrees. Offered as BIOL 359 and BIOL 459. Prereq: BIOL 216 or BIOL 251.

BIOL 462. Advanced Principles of Developmental Biology. 3 Units.
Same as BIOL 362 except the required term paper is an NIH-format research proposal. Recommended preparation: BIOL 216. Offered as ANAT 462 and BIOL 462.

BIOL 463. Experimental Developmental Biology. 3 Units.
This laboratory course will teach concepts and techniques in developmental biology. Emphasis will be on the mechanisms that pattern the embryo during development and how these mechanisms are explored using molecular, cellular, and genetic approaches. A term research paper is required. Students taking the graduate level course will prepare a grant proposal. One laboratory and one lecture per week. Offered as BIOL 363 and BIOL 463.
BIOL 464. Research Methods in Evolutionary Biology. 3 Units.
The process of evolution explains not only how the present diversity of life on earth has formed, but also provides insights into current pressing issues today, including the spread of antibiotic resistance, the causes of geographic variation in genetic diseases, and explanations for modern patterns of extinction risk. Students in Research Methods in Evolutionary Biology will be introduced to several of the major research approaches of evolutionary biology, including methods of measuring natural selection on the phenotypic and genotypic levels, quantifying the rate of evolution, reconstructing evolutionary relationships, and assessing the factors that affect rates of speciation and extinction. The course will consist of a combination of interactive lectures, in-class problem solving and data analysis, and the discussion of peer-reviewed scientific papers. Grades are based on participation in class, discussions and written summaries of published papers, in-class presentations, and two writing assignments. Offered as BIOL 364 and BIOL 464. Prereq: BIOL 214, BIOL 216, BIOL 251.

BIOL 465. Evo-Devo: Evolution of Body Plans. 3 Units.
This discussion-based course offers a detailed introduction to Evolutionary Developmental Biology. The field seeks to explain evolutionary events through the mechanisms of Developmental Biology and Genetics. The course is structured into different modules. First we will look at the developmental genetic mechanisms that can cause variation. Then we focus on how alterations of these mechanisms can generate novel structural changes. We will then examine a few areas of active debate, where Evo-Devo is attempting to solve major problems in evolutionary biology. We will conclude with two writing assignments. Students will be required to present, read, and discuss primary literature in each module. Offered as BIOL 365 and BIOL 465.

BIOL 467. Biobotics Team Research. 3 Units.
Many exciting research opportunities cross disciplinary lines. To participate in such projects, researchers must operate in multi-disciplinary teams. The Biobotics Team Research course offers a unique capstone opportunity for undergraduate students to utilize skills they developed during their undergraduate experience while acquiring new teaming skills. A group of eight students form a research team under the direction of two faculty leaders. Team members are chosen from appropriate majors through interviews with the faculty. They will research a biological mechanism or principle and develop a robotic device that captures the actions of that mechanism. Although each student will cooperate on the team, they each have a specific role, and must develop a final paper that describes the research generated on their aspect of the project. Students meet for one class period per week and two 2-hour lab periods. Initially students brainstorm ideas and identify the project to be pursued. They then acquire biological data and generate robotic designs. Both are further developed during team meetings and reports. Final oral reports and a demonstration of the robotic device occur in week 15. Offered as BIOL 377, EMAE 377, BIOL 477, and EMAE 477.

BIOL 468. Topics in Evolutionary Biology. 3 Units.
The focus for this course on a special topic of interest in evolutionary biology will vary from one offering to the next. Examples of possible topics include theories of speciation, the evolution of language, the evolution of sex, evolution and biodiversity, molecular evolution. ANAT/ANTH/EEPS/PHIL/PHOL 467/BIOL 468 will require a longer, more sophisticated term paper, and additional class presentation. Offered as ANTH 367, BIOL 368, EEPS 367, PHIL 367, ANAT 467, ANTH 467, BIOL 468, EEPS 467, PHIL 467 and PHOL 467.
BIOL 480. Physiology of Organ Systems. 4 Units.
Our intent is to expand the course from the current 3 hours per week (1.5 hour on Monday and Wednesday) to 4 hours per week (1.5 hours on Monday and Wednesday plus 1 hour on Friday). Muscle structure and function, Myasthenia gravis and Sarcopenia; Central Nervous System, (Synaptic Transmission, Sensory System, Autonomic Nervous System, CNS circuits, Motor System, Neurodegenerative Diseases, Paraplegia and Nerve Compression); Cardiovascular Physiology (Regulation of Pressure and flow; Circulation, Cardiac Cycle, Electrophysiology, Cardiac Function, Control of Cardiovascular function, Hypertension); Hemorrhage, Cardiac Hypertrophy and Fibrillation; Respiration Physiology (Gas Transport and Exchange, Control of Breathing, Acid/base regulation, Cor Pulmonaris and Cystic Fibrosis, Sleeping apnea and Emphysema); Renal Physiology (Glomerular Filtration, Tubular Function/transport, Glomerulonephritis, Tubulopathies); Gastro-Intestinal Physiology (Gastric motility, gastric function, pancreas and bile function, digestion and absorption, Liver Physiology; Pancreatitis, Liver Disease and cirrhosis); Endocrine Physiology (Thyroid, Adrenal glands, endocrine pancreas, Parathyroid, calcium sensing receptor, Cushing and diabetes, Reproductive hormones, eclampsia); Integrative Physiology (Response to exercise, fasting and feeding, aging). For all the classes, the students will receive a series of learning objectives by the instructor to help the students address and focus their attention to the key aspects of the organ physiology (and physiopathology). The evaluation of the students will continue to be based upon the students’ participation in class (60% of the grade) complemented by a mid-term and a final exam (each one accounting for 20% of the final grade). Offered as BIOL 480 and PHOL 480.

BIOL 482. Drugs, Brain, and Behavior. 3 Units.
This course is concerned with the mechanisms underlying neurochemical signaling and the impact of drugs on those mechanisms. The first half of the course emphasizes the fundamental mechanisms underlying intra- and extracellular communication of neurons and the basic principles of how drugs interact with the nervous system. The second half of the course emphasizes understanding the neural substrates of disorders of the nervous system, and the mechanisms underlying the therapeutic effects of drugs at the cellular and behavioral levels. This course will consist of lectures designed to give the student necessary background for understanding these basic principles and class discussion. The class discussion will include viewing video examples of behavioral effects of disorders of the nervous system, and analysis of research papers. The goal of the class discussions is to enhance the critical thinking skills of the student and expose the student to contemporary research techniques. Offered as BIOL 382, BIOL 482, and NEUR 482.

BIOL 491. Contemporary Biology and Biotechnology for Innovation I. 3 Units.
The first half of a two-semester sequence providing an understanding of biology as a basis for successfully launching new high-tech ventures. The course will examine physical limitations to present technologies and the use of biology to identify potential opportunities for new venture creation. The course will provide experience in using biology in both identification of incremental improvements and as the basis for alternative technologies. Case studies will be used to illustrate recent commercially successful (and unsuccessful) biotechnology-based venture creation and will illustrate characteristics for success.

BIOL 492. Contemporary Biology and Biotechnology for Innovation II. 3 Units.
Continuation of BIOL 491 with an emphasis on current and prospective opportunities for Biotechnology Entrepreneurship. Longer term opportunities for Biotechnology Entrepreneurship in emerging areas including (but not limited to) applications of DNA sequence information in medicine and agriculture; energy and the environment; biologically-inspired robots. Recommended preparation: BIOL 491 or consent of department.

BIOL 493. Feasibility and Technology Analysis. 3 Units.
This course provides the tools scientists need to determine whether a technology is ready for commercialization. These tools include (but are not limited to): financial analysis, market analysis, industry analysis, technology analysis, intellectual property protection, the entrepreneurial process and culture, an introduction to entrepreneurial strategy and new venture financing. Deliverables will include a technology feasibility analysis on a possible application in the student’s scientific area. Offered as BIOL 493, CHEM 493, and PHYS 493.

BIOL 494. Seminar in Evolutionary Biology. 3 Units.
This seminar investigates 20th-century evolutionary theory, especially the Modern Evolutionary synthesis and subsequent expansions of and challenges to that synthesis. The course encompasses the multidisciplinary nature of the science of evolution, demonstrating how disciplinary background influences practitioners’ conceptualizations of pattern and process. This course emphasizes practical writing and research skills, including formulation of testable theses, grant proposal techniques, and the implementation of original research using the facilities on campus and at the Cleveland Museum of Natural History. Offered as ANTH 394, BIOL 394, EEPS 394, HSTY 394, PHIL 394, ANTH 494, BIOL 494, EEPS 494, HSTY 494, and PHIL 494.

BIOL 530. Seminar in the Rhizosphere. 1 - 2 Unit.
The rhizosphere is the dynamic zone of soil that surrounds plant roots. Chemical and physical processes in the rhizosphere are controlled by the interaction between plants and a diverse soil microflora. This graduate-level seminar course will explore these processes and interactions as they affect nutrient cycling and the fertility of natural systems. Each week one student will present and lead the discussion on a seminal or current key scientific article dealing with one of the following general topics: Rhizosphere biogeochemistry, diversity and function of the rhizosphere biota, interaction of organisms inhabiting the rhizosphere, influence of rhizospheric processes in plant fitness and ecosystem function.

BIOL 531. Seminar in Experimental Ecology. 1 - 3 Unit.

BIOL 541. Topics in Integrative Biology. 1 - 3 Unit.
The goal of this course is to encourage graduate students to think about any question in biology from a broad-based perspective, focusing on the integration of three major themes: 1) evolution and its effects, 2) the cellular basis of life, and 3) systems level control. Each semester, the course may focus on a different topic, but it will be examined from the perspectives of these three focus areas. One faculty instructor with strength in each of these areas will present a few introductory lectures to provide the class with a basic understanding of the topic as it is studied in their area. Then, each student will research a subject covered that semester and develop and present this subject to the class with an explicit evolutionary, cellular or systems level approach. Students will be graded on the quality of their presentations and the overall level of their participation in class.
BIOL 549. Mathematical Life Sciences Seminar. 1 - 3 Unit.
Continuing seminar on areas of current interest in the applications of mathematics to the life sciences. Allows graduate and advanced undergraduate students to become involved in research. Topics will reflect interests and expertise of the faculty and may include topics in mathematical biology, computational neuroscience, mathematical modeling of biological systems, models of infectious diseases, computational cell biology, mathematical ecology and mathematical biomedicine broadly construed. May be taken more than once for credit.

BIOL 550C. Seminar: Experimental Biology. 1 - 3 Unit.

BIOL 561. Statistical Methods for Scientific Research. 3 Units.
This course will introduce students to traditional and novel statistical methods useful for experimental scientists. The emphasis will be on understanding theory and techniques that are used in research. We shall consider problems from astronomy, biology and particle-astro physics. The course will also cover topics of interest to engineers. Current collaborative research problems of the instructor will motivate some of the advanced statistical techniques. Topics to be covered include: Measuring uncertainty and probability distributions (low and high dimensional); point and interval estimation; curve fitting; likelihood and score type tests required for an experiment; posterior probabilities; dealing with small samples (which arise in search experiments); over- and under-coverage using confidence belts; and Monte Carlo simulation methods for planning experiments and evaluating the statistical significance of the results. "GGobi" and "R" open source software will be used for visualization (via dynamic and interactive graphics) and exploring high-dimensional data. Offered as BIOL 561 and PHYS 561.

BIOL 599. Advanced Independent Study for Graduate Students. 1 - 3 Unit.
Independent study of advanced topics in biology under the supervision of a biology faculty member. Registration requires submission of a proposal for a project or study and approval of the department.

BIOL 601. Research. 1 - 9 Unit.

BIOL 651. Thesis M.S.. 1 - 9 Unit.
Prereq: Predoctoral research consent or advanced to Ph.D. candidacy milestone.

BIOL 701. Dissertation Ph.D.. 1 - 9 Unit.
Prereq: Predoctoral research consent or advanced to Ph.D. candidacy milestone.
**Department of Chemistry**

The Department of Chemistry is the largest department representing the chemical sciences at Case Western Reserve University. It consists of 21 faculty members, 10 associated faculty, about 10 postdoctoral associates, approximately 90 graduate students, and over 100 undergraduate students majoring in chemistry. The department offers undergraduate and graduate degree programs leading to the Bachelor of Arts, Bachelor of Science, Master of Science, and Doctor of Philosophy.

The general focus of chemistry is on (1) understanding the basic properties of matter, and (2) employing this knowledge in the design, synthesis, and characterization of materials with novel and useful properties. The various degree programs strive to develop all aspects of the student’s chemical knowledge through a broad range of lecture and laboratory courses.

Chemical research is an integral part of the department’s activities: over $3 million of federal, state, and private research support flows into the department each year. State-of-the-art research facilities are available to both graduate and undergraduate students. Undergraduates are encouraged to participate in research projects with individual faculty members in order to expand their hands-on training, problem-solving skills, and understanding of the scientific method as applied in chemical research. These research projects typically involve interchange and collaboration across all levels of experience and may also involve scientists from other departments and institutions.

Chemistry is often referred to as “the central science” because of its key role in interdisciplinary studies. Correspondingly, a degree in chemistry affords a broad range of employment opportunities. Chemists can direct their talents to specialized problems of applied research, or they can choose to delve into fundamental investigations. A degree in chemistry can cover the spectrum of chemical specialties, from biochemistry to interstellar chemistry. The degree also provides valuable preparation for other professions, such as medicine, dentistry, and law.

The American Chemical Society ([http://bulletin.case.edu/collegeofartsandsciences/chemistry](http://bulletin.case.edu/collegeofartsandsciences/chemistry) or [www.acs.org](http://www.acs.org)), with more than 160,000 members, is the major professional society in the United States for practicing chemists. Both undergraduate and graduate students may join the society.

**Facilities**

The department’s facilities for experimental and theoretical research are modern and extensive. They include diverse major instruments for use by faculty and students, as well as specialized equipment serving individual research groups. Shared instrumentation includes 400- and 600-MHz NMR spectrometers, ultrafast laser systems in the Center for Chemical Dynamics, and a cyber-enabled X-ray crystallographic facility.

Other departmental instrumentation includes equipment for laser Raman spectroscopy, GC-MS and LC-MS/MS mass spectrometers, stopped-flow kinetics instrumentation, a circular dichroism spectrometer, an analytical ultracentrifuge, and equipment for electrochemical measurements. Access to very high-field NMR instrumentation is available on campus at the Cleveland Center for Membrane Structural Biology (CCMSB), which is equipped with numerous 500- to 900-MHz NMR spectrometers for solution and solid-state measurements. The chemistry department’s computers are part of the campus-wide fiber optic communications network operated by Information Technology Services, and the entire University Circle area offers wireless access. In addition to the full complement of software, Internet, and library database services offered by the university, connections to off-site databases, such as SciFinder and Ohio Supercomputer Center, are available to departmental users.

The department uses some of the foremost equipment available in high-resolution nuclear magnetic resonance spectroscopy and in tunable laser spectroscopy. Work on various aspects of chemistry as studied by these techniques is recognized throughout the world.

**BS Chemistry | BA Chemistry | Teacher Licensure | Minor**

**Undergraduate Programs**

**Majors**

The Department of Chemistry offers two curricula for undergraduate chemistry majors, leading to a Bachelor of Science (BS) or Bachelor of Arts (BA) degree.

**Bachelor of Science Program**

The BS program is designed for students who seek professional careers in the chemical sciences and is certified by the American Chemical Society. The BS curriculum provides a rigorous background in chemistry, yet offers considerable flexibility in the senior year in the choice of electives, allowing BS majors to pursue areas of chemistry of particular interest to them in greater depth. At least three units of research (CHEM 397 / CHEM 398) are required, and up to nine units of research may be credited toward the degree.

**Total Units Required for Graduation: 120**

**CHEM BS - Required Chemistry Courses**

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<thead>
<tr>
<th>First Year</th>
<th>Units</th>
<th>Fall</th>
<th>Spring</th>
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<tbody>
<tr>
<td>Principles of Chemistry I (CHEM 105)</td>
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<tr>
<td>Principles of Chemistry Laboratory (CHEM 113)</td>
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<td>Principles of Chemistry II (CHEM 106)</td>
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<td>Chemistry Frontiers Laboratory (CHEM 114)</td>
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<td>Organic Chemistry I (CHEM 323)</td>
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<td>Laboratory Methods in Organic Chemistry (CHEM 322)</td>
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<td>Quantitative Analysis Laboratory (CHEM 304)</td>
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<td>Foundations of Analytical Chemistry (CHEM 310)</td>
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<td>Physical Chemistry I (CHEM 335)</td>
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<td>Laboratory Methods in Physical Chemistry (CHEM 332)</td>
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<td>One of the following courses:</td>
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<td>Introductory Biochemistry (CHEM 328) (spring, 3 units)</td>
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<td>Chemical Aspects of Living Systems (CHEM 329) (fall, 3 units)</td>
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<tr>
<td>Evolutionary Biology of the Invertebrates (BIOL 307) (fall, 4 units)</td>
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<td>Laboratory Methods in Inorganic Chemistry (CHEM 331)</td>
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<td>Undergraduate Research (CHEM 397)</td>
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The American Chemical Society is the major professional society in the United States and has over 160,000 members. Its roles include promotion of chemistry and the advancement of the chemical sciences at Case Western Reserve University. It consists of 21 faculty members, 10 associated faculty, about 10 postdoctoral associates, approximately 90 graduate students, and over 100 undergraduate students majoring in chemistry.
The Bachelor of Arts Program

The BA program is intended for pre-professional students who plan careers in medicine, dentistry, veterinary medicine, and pharmacy or in other fields for which a baccalaureate degree in chemistry provides appropriate training. BA majors may supplement their required courses with additional chemistry courses or may utilize the curriculum’s flexibility to develop an interdisciplinary program of their choice. Many BA majors participate in undergraduate research within the Department of Chemistry (CHEM 397 / CHEM 398) or in other science departments, including those in the medical school.

Total Units Required for Graduation: 120

CHEM BA - Required Chemistry Courses

First Year

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<tr>
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<td>Introduction to Modern Physics</td>
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Second Year

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Third Year

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<tr>
<td>Introductory Physical Chemistry I (CHEM 301)  or Physical Chemistry I (CHEM 335)</td>
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<td>Foundations of Analytical Chemistry (CHEM 310)</td>
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Fourth Year

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Total Units in Sequence: 32-33

CHEM BA - Additional Required Courses

Course List

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<td>PHYS 115  (Introductory Physics I)</td>
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<td>PHYS 116  (Introductory Physics II)</td>
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<td>MATH 125  (Math and Calculus Applications for Life, Managerial, and Social Sci I)</td>
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<td>or MATH 121  (Calculus for Science and Engineering I)</td>
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<td>MATH 126  (Math and Calculus Applications for Life, Managerial, and Social Sci II)</td>
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<td>or MATH 122  (Calculus for Science and Engineering II)</td>
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Departmental Honors
Chemistry majors who have excellent academic records may participate in the Honors in Chemistry program. To graduate with honors in chemistry, a student must satisfy the following requirements:

1. A combined grade point average of 3.50 in chemistry, physics, and mathematics and an overall grade point average of 3.20
2. A minimum of six units of Undergraduate Research (CHEM 397), or chemical research done under another course number with departmental approval
3. A thesis approved by the department’s undergraduate affairs committee based on the level of research, quality of the manuscript, and chemical content

Teacher Licensure in Physical Science (Chemistry and Physics)
An option is available within the BA program for students to become eligible for licensure as teachers of physical science (chemistry and physics) in secondary schools (grades 9–12). Students interested in this option should contact Professor Michael Kenney. A total of 57 units in the subject area are required for teacher licensure, as well as a 35-unit sequence in professional education (including student teaching) taken here and at John Carroll University. For more information, see the program description for Teacher Licensure (p. 437) elsewhere in this bulletin.

Subject area requirements for students majoring in chemistry:

Course List

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<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
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<tbody>
<tr>
<td>ASTR 201</td>
<td>The Sun and its Planets</td>
<td>3</td>
</tr>
<tr>
<td>or EEPS 110</td>
<td>Physical Geology</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 121</td>
<td>General Physics I - Mechanics</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 122</td>
<td>General Physics II - Electricity and Magnetism</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 221</td>
<td>Introduction to Modern Physics</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 105</td>
<td>Principles of Chemistry I</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 106</td>
<td>Principles of Chemistry II</td>
<td>3</td>
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<tr>
<td>CHEM 113</td>
<td>Principles of Chemistry Laboratory</td>
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<tr>
<td>CHEM 223</td>
<td>Introductory Organic Chemistry I</td>
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<tr>
<td>or CHEM 323</td>
<td>Organic Chemistry I</td>
<td>3</td>
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<tr>
<td>CHEM 224</td>
<td>Introductory Organic Chemistry II</td>
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<tr>
<td>or CHEM 324</td>
<td>Organic Chemistry II</td>
<td>3</td>
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<tr>
<td>PHYS 331</td>
<td>Introduction to Quantum Mechanics I</td>
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<tr>
<td>ENGR 131</td>
<td>Elementary Computer Programming</td>
<td>3</td>
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<tr>
<td>MATH 125</td>
<td>Math and Calculus Applications for Life, Managerial, and Social Sci</td>
<td>3</td>
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<tr>
<td>MATH 126</td>
<td>Math and Calculus Applications for Life, Managerial, and Social Sci</td>
<td>3</td>
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<tr>
<td>CHEM 301</td>
<td>Introductory Physical Chemistry I</td>
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<tr>
<td>CHEM 302</td>
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<tr>
<td>CHEM 304</td>
<td>Quantitative Analysis Laboratory</td>
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<td>CHEM 305</td>
<td>Introductory Physical Chemistry Laboratory</td>
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<tr>
<td>PHYS 310</td>
<td>Classical Mechanics</td>
<td>3</td>
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<tr>
<td>PHYS 324</td>
<td>Electricity and Magnetism I</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 315</td>
<td>Introduction to Solid State Physics</td>
<td>3</td>
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<tr>
<td>or PHYS 316</td>
<td>Introduction to Nuclear and Particle Physics</td>
<td>3</td>
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</table>

Course requirements for students majoring in physics and seeking physical science teacher licensure are listed under the Department of Physics.

Minor

Students may complete a minor in chemistry, defined as one year of freshman chemistry (including laboratory); two additional three-unit lecture courses; and two additional laboratory or approved courses. A recommended sequence would include:

Course List

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<tr>
<th>Course</th>
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<th>Units</th>
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<tbody>
<tr>
<td>CHEM 105</td>
<td>Principles of Chemistry I</td>
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<tr>
<td>CHEM 106</td>
<td>Principles of Chemistry II</td>
<td>3</td>
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<tr>
<td>CHEM 113</td>
<td>Principles of Chemistry Laboratory</td>
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<tr>
<td>CHEM 223</td>
<td>Introductory Organic Chemistry I</td>
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<td>CHEM 224</td>
<td>Introductory Organic Chemistry II</td>
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<tr>
<td>or CHEM 324</td>
<td>Organic Chemistry II</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 233</td>
<td>Introductory Organic Chemistry Laboratory I</td>
<td>2</td>
</tr>
<tr>
<td>CHEM 234</td>
<td>Introductory Organic Chemistry Laboratory II</td>
<td>2</td>
</tr>
</tbody>
</table>

Total Units: 18

Other sequences may be followed after consultation with the Department of Chemistry.

BS Chemistry | BA Chemistry | Teacher Licensure | Minor

Graduate Programs

Master of Science Programs

The MS degree in chemistry may be obtained by completing (1) a program that includes the preparation of a master’s thesis, or (2) a program involving only course work. Both programs require a minimum of 27 units, of which up to six units may be for the master’s thesis. Course work for the master’s degree may be taken on a part-time basis, but thesis research can be undertaken only by full-time graduate students. Thus, only the master’s degree without thesis can be earned entirely on a part-time basis.

The Science and Technology Entrepreneurship Program (STEP) is a three- or four-semester professional MS degree offered in chemistry as well as in biotechnology and physics. Students enter the Chemistry Entrepreneurship program with a bachelor’s, master’s, or doctoral degree in a chemistry-related field. The program consists of advanced courses in chemistry, business, and technology innovation and an entrepreneurial project with technical content in an existing company or new venture.

Doctor of Philosophy Program

The PhD degree in chemistry is granted to those students who have shown an extensive knowledge of advanced chemistry and the ability to do original research. The program usually requires four years of full-time study after the bachelor’s degree. Besides advanced courses, the program consists of cumulative and oral examinations, seminars and colloquia, and an original research project. At least twelve months must be spent in residence on campus while fulfilling the PhD thesis research requirement.

Full-time graduate students who maintain satisfactory academic performance while pursuing the PhD degree in chemistry normally receive a stipend for teaching and/or research, which includes full tuition and a monthly amount sufficient to cover living expenses.

Research

The Department of Chemistry is noted for research programs in (1) chemical biology and (2) energy and materials. Projects range from...
synthetic studies of important bioactive substances, including antibiotics and DNA-binding substances, to detailed examination of the surface properties of materials used in batteries and electrolytic cells. Studies are being performed with molecules as simple as oxygen and as complicated as those which describe the active centers of enzymes or the protein core of insoluble aggregates that deposit in neurodegenerative disease. Efforts are being made to understand the basic chemical properties leading to reactive mediators generated from physiological lipids.

Other research is aimed at developing new drugs for photodynamic therapy and at understanding the mechanism of action of drugs for antiretroviral therapy. The influence of metal ions in modifying reactivity is a common interest of several members of the faculty, as is the development of organometallic compounds for materials and catalysis. Chemical surfaces are being studied, as are various applications of nanoparticles, from cells to the environment. Studies designed to characterize electrode–electrolyte interfaces, the electrochemical properties of new semiconductors, and single-cell microelectrodes are also ongoing. These efforts are complemented by theoretical studies on the interfacial structure and bonding of composite materials.

Case Western Reserve University ranks among the leading universities internationally in its strengths in electrochemistry and has brought these strengths together in the Yeager Center for Electrochemical Studies (YCES) (http://electrochem.cwru.edu). The interdisciplinary nature of electrochemistry involves the interaction of electrochemists in the chemistry and chemical engineering departments with metallurgists, surface physicists, inorganic and organic chemists, polymer chemists, and electrical engineers. Such interactions, lacking on most campuses, are promoted at Case Western Reserve University through YCES. Graduate students in the chemistry department have the opportunity to specialize in electrochemistry in one of the most extensive course and research programs in the United States.

Colloquia and Seminars
The department sponsors a rich program of colloquia and seminars on recent advances in chemical research. Most notable among these is the Frontiers in Chemistry Lecture Series, in which scientists of international distinction lecture on major discoveries and developments in chemistry. In addition, a weekly colloquium series provides lectures by invited speakers in a variety of fields of chemical investigation. Both of these programs are addressed to an audience of faculty, graduate students, and other chemical scientists in the university and the Cleveland area, and are a vital means to broaden current knowledge. Numerous other seminars and meetings are held on a more specialized and informal level. Most individual research groups conduct weekly discussions to evaluate their progress.

Department Faculty
Mary D. Barkley, PhD
(University of California, San Diego)

M. Roger Clapp University Professor of Arts and Sciences and Chair
Biophysical chemistry; fluorescence spectroscopy; tryptophan fluorescence; HIV reverse transcriptase

Alfred B. Anderson, PhD
(Johns Hopkins University)
Professordoctor
Pure and applied theoretical chemistry: surface science, catalysis, electrocatalysis and properties of doped diamond

Clemens Burda, PhD
(University of Basel, Switzerland)
Professor

Physical chemistry of nanostructures; molecular electronics; femtosecond laser spectroscopy
James D. Burgess, PhD
(Virginia Commonwealth University)
Associate Professor
Physical chemistry of platinum-based anticancer drugs; electrode-supported bilayer membranes; electron transfer enzymes
Carlos E. Crespo-Hernández, PhD
(University of Puerto Rico)
Assistant Professor
Ultrafast spectroscopy; organic photochemistry and photophysics; environmental chemistry; computational chemistry

Thomas G. Gray, PhD
(Harvard University)
Professor
Hurlbut Professor of Chemistry
Photodynamic therapy; porphyrin-like compounds; organosilicon compounds; flue gas desulfurization

Michael J. Kenney, PhD
(Iowa State University)
Senior Instructor and John Teagle Professorial Fellow in Chemistry
Chemical education

Irene Lee, PhD
(Pennsylvania State University)
Professor
Biochemistry; enzymology

Anthony J. Pearson, PhD
(University of Aston, Birmingham, England)
Rudolph and Susan Rense Professor of Chemistry
Natural products; organometallics; organic synthesis

John D. Protasiewicz, PhD
(Cornell University)
Professor and Associate Chair
Inorganic chemistry; organometallic reaction mechanisms; catalyzed oxidations

Robert G. Salomon, PhD
(University of Wisconsin, Madison)
Charles Frederic Mabery Professor of Research in Chemistry
Chemical biology; lipid oxidation and disease; organic synthesis and reaction mechanisms

Anna C. Samia, PhD
(Georgia Institute of Technology)
Assistant Professor
Analytical chemistry; inorganic chemistry; materials and energy; bio-inorganic chemistry; functional nanomaterials; nanotheranostics

Genevieve Sauve, PhD
(California Institute of Technology)
Assistant Professor
Organic electronics; alternative energy; synthesis of polymers and inorganic complexes; transistor and solar cell devices

Daniel A. Scherson, PhD
(University of California, Davis)
Case Western Reserve University

Frank Hovorka Professor of Chemistry
Electrochemistry; electrode kinetics; electrocatalysis; in-situ spectroscopic methods in electrochemistry
Rekha Srinivasan, PhD
(Case Western Reserve University)
Instructor
Chemical education
John E. Stuehr, PhD
(Case Western Reserve University)
Professor
Physical chemistry, chemical education
Gregory P. Tochtrop, PhD
(Washington University Medical School)
Associate Professor
Chemical biology; molecular recognition; NMR; diversity-oriented synthesis
Blanton S. Tolbert, PhD
(University of Rochester)
Assistant Professor
Biochemistry; Structural Biophysics; Viral RNA metabolism; HIV
Rajesh Viswanathan, PhD
(University of Indiana)
Assistant Professor
Chemical biology; microarrays; biosynthesis and biomimetic synthesis; total synthesis of natural products
Michael G. Zagorski, PhD
(Case Western Reserve University)
Professor
Organic chemistry; nuclear magnetic resonance; structure of peptides

Professor, Department of Macromolecular Science and Engineering, Case School of Engineering
Synthetic chemistry; supramolecular polymerization; reversible “dynamic” chemistry; chemical sensors; biomaterials; nanotechnology
Witold K. Surewicz, PhD
(University of Lodz, Poland)
Professor, Department of Physiology and Biophysics, School of Medicine
Protein aggregation and the pathogenesis of aging-related diseases; prion protein; protein folding and protein-membrane interaction
Yanming Wang, PhD
(ETH Zürich, Switzerland)
Associate Professor of Radiology; Director of Radiopharmaceutical Division, Case Center for Imaging Research, School of Medicine
Organic synthesis; molecular probes for in vivo imaging

Adjunct Faculty
M. Cather Simpson, PhD
(University of New Mexico)
Senior Lecturer in Chemistry and Physics; Associate Director, Dan Walls Centre for Pure and Applied Optics, University of Auckland, New Zealand
Biophysical chemistry; spectroscopic studies of biologically significant processes

Research Professors
Mikhail D. Linetsky, PhD
(Academy of Science of Ukraine)
Research Associate Professor
Biochemistry; chemical biology; protein chemistry; post-translational protein modification; proteomics

Courses
CHEM 102. The Molecules of Medicine. 1 Unit.
The central tenet of CHEM 102 is the identification and presentation of concrete examples to illustrate how basic scientific principles impact medicine in a substantive way. Several topics will be addressed that include medical diagnostics, medical instrument design, and drug development. An emphasis of this class will be to convey how topics being presented in other classes in the pre-medical curriculum have a direct and substantive impact on the practice of medicine.

CHEM 105. Principles of Chemistry I. 3 Units.
Atomic structure; thermochemistry; periodicity, bonding and molecular structure; intermolecular forces; properties of solids; liquids, gases and solutions. Recommended preparation: One year of high school chemistry.

CHEM 106. Principles of Chemistry II. 3 Units.
Thermodynamics, chemical equilibrium; acid/base chemistry; oxidation and reduction; kinetics; spectroscopy; introduction to nuclear, organic, inorganic, and polymer chemistry. Prereq: CHEM 105 or equivalent.

Secondary Faculty
Paul Carey, PhD
(University of Sussex, UK)
Professor, Department of Biochemistry, School of Medicine
Raman spectroscopy; proteins and protein-ligand interactions
John W. Crabb, PhD
(University of Kansas Medical Center)
Professor of Molecular Medicine, Cleveland Clinic Lerner College of Medicine, Case Western Reserve University
Proteomics of the visual cycle and age-related ocular diseases
Thomas Gerken, PhD
(Case Western Reserve University)
Professor, Department of Pediatrics, School of Medicine
Biochemistry of glycoproteins; NMR
Thomas Kelley, PhD
(University of Notre Dame)
Associate Professor, Department of Pediatrics, School of Medicine
Biochemistry; cell signaling and cholesterol processing in cystic fibrosis
John J. Mieyal, PhD
(Case Western Reserve University)
Professor, Department of Pharmacology, School of Medicine
Reactive oxygen species and sulfur biochemistry; enzymatic reaction mechanisms of intracellular sulfhydryl homeostasis and redox signal transduction
Stuart J. Rowan, PhD
(University of Glasgow, UK)
CHEM 111. Principles of Chemistry for Engineers. 4 Units.
A first course in university chemistry emphasizing chemistry of materials for engineering students. Atomic theory and quantitative relationships; gas laws and kinetic theory; solutions, acid-base properties and pH; thermodynamics and equilibrium; kinetics, catalysis, and mechanisms; molecular structure and bonding. Recommended preparation: One year of high school chemistry or permission of department.

CHEM 113. Principles of Chemistry Laboratory. 2 Units.
A one semester laboratory based on quantitative chemical measurements. Experiments include analysis, synthesis and characterization, thermochemistry and chemical kinetics. Computer analysis of data is a key part of all experiments. Prereq or Coreq: CHEM 105 or CHEM 111 and ENGR 145.

CHEM 114. Chemistry Frontiers Laboratory. 2 Units.
An introduction to laboratory techniques and computer-based methods for chemical research for the chemistry major. Scientific information databases, structural chemistry, experimental design and data handling, chemical synthesis and characterization. Prereq: CHEM 105 or CHEM 111, and CHEM 113. Coreq: CHEM 106.

CHEM 223. Introductory Organic Chemistry I. 3 Units.
Introductory course for science majors and engineering students. Develops themes of structure and bonding along with elementary reaction mechanisms. Includes treatment of hydrocarbons, alkyl halides, alcohols, and ethers as well as an introduction to spectroscopy. Prereq: CHEM 106 or CHEM 111.

CHEM 224. Introductory Organic Chemistry II. 3 Units.
Continues and extends themes of structure and bonding from CHEM 223 and continues spectroscopy and more complex reaction mechanisms. Includes treatment of aromatic rings, carbonyl compounds, amines, and selected special topics. Prereq: CHEM 223 or CHEM 323.

CHEM 223. Introductory Organic Chemistry Laboratory I. 2 Units.
An introductory organic laboratory course emphasizing microscale operations. Synthesis and purification of organic compounds, isolation of natural products, and systematic identification of organic compounds by physical and chemical methods. Prereq: CHEM 106 or CHEM 111 and CHEM 113 or equivalent. Coreq: CHEM 223 or CHEM 323.

CHEM 224. Introductory Organic Chemistry Laboratory II. 2 Units.
A continuation of CHEM 223, involving multi-step organic synthesis, peptide synthesis, product purification and analysis using sophisticated analytical techniques such as chromatography and magnetic resonance spectroscopy. Prereq: CHEM 223. Coreq: CHEM 224

CHEM 290. Chemical Laboratory Methods for Engineers. 3 Units.
Techniques of chemical synthesis, analysis, and characterization. Uses students' backgrounds in general and organic chemistry, but requires no background in chemical laboratory operations. Prereq or Coreq: CHEM 223 or CHEM 323.

CHEM 301. Introductory Physical Chemistry I. 3 Units.
First of a two-semester sequence covering principles and applications of physical chemistry, intended for chemistry and engineering majors and other students having primary interests in biochemical, biological or life-science areas. States and properties of matter. Thermodynamics and its application to chemical and biochemical systems. Chemical equilibrium. Electrochemistry. Recommended preparation: One year each of undergraduate physics and calculus, preferably including partial derivatives. Prereq: CHEM 106 or equivalent.

CHEM 302. Introductory Physical Chemistry II. 3 Units.

CHEM 304. Quantitative Analysis Laboratory. 2 Units.
A one-semester laboratory course providing practical experience in the analytical process. Focus is on statistical error analysis of measurements, method validation and instrument calibration, and reporting. Basic laboratory skills are developed and evaluated based on accuracy and precision of measurements. Experiments using titration, spectroscopy, electrochemistry, liquid and gas chromatography, and mass spectrometry are conducted. Prereq: CHEM 106 and CHEM 113. Coreq: CHEM 310.

CHEM 305. Introductory Physical Chemistry Laboratory. 3 Units.
A one-semester laboratory course focusing on the principles and quantitative characterization of chemical and biochemical systems. Experiments include chemical equilibrium kinetics, electrochemistry, spectroscopy and the use of computers for the statistical analysis of experimental data. Seminar discussions and disciplinary writing of results. Prereq: CHEM 301 and CHEM 304 or CHEM 335. Or Prereq or Coreq: CHEM 302 or CHEM 336.

CHEM 310. Foundations of Analytical Chemistry. 3 Units.
A one-semester lecture covering classical and modern aspects of the analytical process; analysis requirements, method selection including capabilities and limitations, sampling and sample processing, measurement data statistics for evaluation of precision and accuracy, method validation, and reporting. Fundamental concepts in equilibrium thermodynamics are covered in the context of chemical analysis. Methods based on titration, spectroscopy, electrochemistry, chromatography, and mass spectrometry are emphasized. Prereq: CHEM 106 and CHEM 113. Coreq: CHEM 304.

CHEM 311. Inorganic Chemistry I. 3 Units.
Fundamentals of inorganic chemistry. Topics include molecular structure, molecular shape and symmetry, structure of solids, d-metal complexes, oxidation and reduction, and acids and bases. Prereq or Coreq: CHEM 301 or CHEM 335.

CHEM 312. Inorganic Chemistry II. 3 Units.
Continuation of CHEM 311. Fundamentals of inorganic chemistry. Topics include electronic spectra of complexes, structures and properties of solids, organometallic compounds, and descriptive chemistry of representative elements. Prereq: CHEM 311.

CHEM 322. Laboratory Methods in Organic Chemistry. 3 Units.
Experimental approach to the synthesis, purification and characterization of organic compounds. Nuclear magnetic resonance (NMR) and infrared (IR) spectroscopies; chromatographic techniques. Prereq: CHEM 304 and CHEM 223 or CHEM 323. Prereq or Coreq: CHEM 224 or CHEM 324.
CHEM 323. Organic Chemistry I. 3 Units.
Relationships between molecular structure and chemical reactivity and development of sophisticated problem-solving skills in the context of organic reaction mechanisms and multi-step synthesis. Homolytic and heterolytic substitution, elimination, oxidation and reduction reactions; topics in stereochemistry and spectroscopy. Recommended for chemistry, biochemistry, and related majors. Prereq: CHEM 106 or equivalent.

CHEM 324. Organic Chemistry II. 3 Units.
Continuation of CHEM 323. Introduces the chemistry of carbonyl, aromatic and amino functional groups, and develops the concepts of conjugation and resonance, molecular orbital theory and pericyclic reactions. Prereq: CHEM 223 or CHEM 323.

CHEM 325. Physical Methods for Determining Organic Structure. 3 Units.
Structure determination of organic compounds using mass spectrometry and modern instrumental techniques such as infrared, ultraviolet, visible, and nuclear magnetic resonance spectroscopy. Recommended preparation: Two semesters of undergraduate organic chemistry. Offered as CHEM 325 and CHEM 425.

CHEM 328. Introductory Biochemistry. 3 Units.
A survey of biochemistry with a strong emphasis on the chemical logic underlying metabolic pathways and the evolution of biomolecules. Cellular architecture. Amino acids and protein structure, purification, analysis, and synthesis. DNA, RNA, the flow of genetic information, and molecular biological technology. Enzyme kinetics, catalytic, and regulatory strategies. Sugars, complex carbohydrates, and glycoproteins. Lipids and cell membranes. Glycolysis, gluconeogenesis, carbon fixation through the "dark reactions" of photosynthesis, aerobic catabolism through the citric acid cycle, and glycogen metabolism. Biosynthesis and degradation of fatty acids, amino acids, and proteins. Offered as CHEM 328 and CHEM 428. Prereq: CHEM 224 or CHEM 324.

CHEM 329. Chemical Aspects of Living Systems. 3 Units.

CHEM 331. Laboratory Methods in Inorganic Chemistry. 3 Units.
Synthesis, separation techniques, physical properties, and analysis. Advanced techniques of chemical synthesis, leading the student to the preparation of interesting inorganic and organometallic compounds. Prereq: CHEM 322.

CHEM 332. Laboratory Methods in Physical Chemistry. 3 Units.
Modern techniques of physicochemical measurement, including, kinetics, spectroscopy, and electrochemistry and the use of statistical methods for the analysis of experimental data. Seminar discussions and disciplinary writing of results. Prereq: CHEM 304. Prereq or Coreq: CHEM 336.

CHEM 333. Medicinal Chemistry and Drug Development. 3 Units.
This course provides an overview on how principles in chemistry and biology are integrated to facilitate drug development. Primary emphasis will be placed on the development of organic molecules as drugs and metabolic enzymes as drug targets. Subjects pertinent to the introduction of medicinal chemistry, evaluation of drug efficacies in vitro and in vivo, and drug metabolism will be covered. Offered as CHEM 333 and CHEM 433. Prereq: CHEM 223 or CHEM 323 and BIOL 215. Coreq: CHEM 224 or CHEM 324.

CHEM 335. Physical Chemistry I. 3 Units.

CHEM 336. Physical Chemistry II. 3 Units.

CHEM 337. Quantum Mechanics I. 3 Units.
Introduction to quantization, measurement and the Schrodinger equation; angular momentum and states of molecules. Perturbation theory, spectroscopy and chemical bonding. Variational theory and calculations of molecular properties. Offered as CHEM 337 and CHEM 446. Prereq: CHEM 336.

CHEM 339. Bioinorganic Chemistry. 3 Units.
An introduction to metal ions in biology and medicine. Topics of emphasis include metalloenzymes, inorganic elements in pharmaceuticals, and physical methods of characterization in biology. Course material will be presented through a seminar format, and will involve extensive class participation, student presentations, and literature research reports. Offered as CHEM 339 and CHEM 439. Prereq: CHEM 224 or CHEM 324.

CHEM 395. Chemistry Colloquium Series. 1 Unit.
Course content provided by Thursday chemistry department colloquia (or Frontiers in Chemistry lectures). Discussion sessions review previous lectures and lay foundation for forthcoming lectures.

CHEM 397. Undergraduate Research. 1 - 6 Unit.
Independent research project within a research group in the chemistry department or, by petition, within a research group in another Case department. Arrangements should be made with the faculty member selected. Open to all chemistry majors and other qualified students; required for Honors in Chemistry. A written report is required each semester.
CHEM 398. Undergraduate Research/Senior Capstone Project. 3 - 6 Units.
Independent research project within a research group in the chemistry department or, by petition, within a research group in another Case department. Arrangements should be made by consultation with the faculty member selected and the Senior Capstone Committee of the chemistry department. Open to all chemistry majors and other qualified students. Satisfies the research requirement for Honors in Chemistry. A written report and public oral presentations are required.

CHEM 406. Chemical Kinetics. 3 Units.
Theory and characterization of chemical rate processes. Recommended preparation: Two semesters of undergraduate physical chemistry.

CHEM 407. Chemical Thermodynamics. 3 Units.
Thermodynamics and statistical thermodynamics and their application to chemical problems. Recommended preparation: Two semesters of undergraduate physical chemistry.

CHEM 408. Advanced Physical Chemistry. 3 Units.
Topics in physical chemistry, intended for entering graduate students, giving background tools appropriate for graduate research in areas of chemistry other than physical chemistry. Illustrations from the contemporary chemical research literature will be emphasized. Thermodynamics and statistical mechanics, quantum chemistry and computation, spectroscopy, and chemical kinetics and dynamics. Recommended preparation: One year of undergraduate physical chemistry.

CHEM 412. Advanced Inorganic Chemistry I. 3 Units.
Chemistry of inorganic systems. Spectroscopy, magnetism, and stereochemistry of transition metal compounds. Recommended preparation: One semester of undergraduate inorganic chemistry and two semesters of undergraduate physical chemistry.

CHEM 414. Organometallic Reactions and Structures. 3 Units.
Bonding, structure, and mechanistic aspects of organometallic chemistry and the relevance of organometallic species to chemical catalysis. Recommended preparation: One semester of undergraduate inorganic chemistry.

CHEM 421. Advanced Organic Chemistry I. 3 Units.

CHEM 422. Advanced Organic Chemistry II. 3 Units.

CHEM 425. Physical Methods for Determining Organic Structure. 3 Units.
Structure determination of organic compounds using mass spectrometry and modern instrumental techniques such as infrared, ultraviolet, visible, and nuclear magnetic resonance spectroscopy. Recommended preparation: Two semesters of undergraduate organic chemistry. Offered as CHEM 325 and CHEM 425.

CHEM 428. Introductory Biochemistry. 3 Units.
A survey of biochemistry with a strong emphasis on the chemical logic underlying metabolic pathways and the evolution of biomolecules. Cellular architecture. Amino acids and protein structure, purification, analysis, and synthesis. DNA, RNA, the flow of genetic information, and molecular biological technology. Enzyme kinetics, catalytic, and regulatory strategies. Sugars, complex carbohydrates, and glycoproteins. Lipids and cell membranes. Glycolysis, gluconeogenesis, carbon fixation through the "dark reactions" of photosynthesis, aerobic catabolism through the citric acid cycle, and glycogen metabolism. Biosynthesis and degradation of fatty acids, amino acids, and proteins. Offered as CHEM 328 and CHEM 428.

CHEM 429. Chemical Aspects of Living Systems. 3 Units.

CHEM 430. Advanced Methods in Structural Biology. 1 - 6 Unit.
The course is designed for graduate students who will be focusing on one or more methods of structural biology in their thesis project. This course is divided into 3-6 sections (depending on demand). The topics offered will include X-ray crystallography, nuclear magnetic resonance spectroscopy, optical spectroscopy, mass spectrometry, cryo-electron microscopy, and computational and design methods. Students can select one or more modules. Modules will be scheduled so that students can take all the offered modules in one semester. Each section is given in 5 weeks and is worth 1 credit. Each section covers one area of structural biology at an advanced level such that the student is prepared for graduate level research in that topic. Offered as BIOC 430, CHEM 430, PHOL 430, and PHRM 430.

CHEM 433. Medicinal Chemistry and Drug Development. 3 Units.
This course provides an overview on how principles in chemistry and biology are integrated to facilitate drug development. Primary emphasis will be placed on the development of organic molecules as drugs and metabolic enzymes as drug targets. Subjects pertinent to the introduction of medicinal chemistry, evaluation of drug efficacies in vitro and in vivo, and drug metabolism will be covered. Offered as CHEM 333 and CHEM 433.

CHEM 435. Synthetic Methods in Organic Chemistry. 3 Units.

CHEM 436. Complex Molecular Synthesis. 3 Units.
An advanced organic chemistry course providing students with an in-depth examination of the art of total synthesis drawing from both classical and recent examples. Recommended preparation: Two semesters of undergraduate organic chemistry.
CHEM 439. Bioinorganic Chemistry. 3 Units.
An introduction to metal ions in biology and medicine. Topics of emphasis include metalloenzymes, inorganic elements in pharmaceuticals, and physical methods of characterization in biology. Course material will be presented through a seminar format, and will involve extensive class participation, student presentations, and literature research reports. Offered as CHEM 339 and CHEM 439. Prereq: Graduate standing.

CHEM 445. Electrochemistry I. 3 Units.
Electrochemical properties and processes of electrode/electrolyte interfaces. Fundamental background for work in corrosion, electrodeposition, industrial electrolysis, electro-organic synthesis, batteries, fuel cells, and photoelectrochemical energy conversion. Recommended preparation: One semester of undergraduate physical chemistry.

CHEM 446. Quantum Mechanics I. 3 Units.
Introduction to quantization, measurement and the Schrodinger equation; angular momentum and states of molecules. Perturbation theory, spectroscopy and chemical bonding. Variational theory and calculations of molecular properties. Recommended preparation: Two semesters of undergraduate physical chemistry. Offered as CHEM 335 and CHEM 446.

CHEM 447. Quantum Mechanics II. 3 Units.
Continuation of CHEM 446. Ab initio and semi-empirical methods, configuration interactions, time dependent phenomena, and introduction to band theory of solids. Prereq: CHEM 446.

CHEM 450. Molecular Spectroscopy. 3 Units.
Translation, rotation, vibration, and electronic transitions of molecules. Prereq: CHEM 446.

CHEM 475. Protein Biophysics. 3 Units.
This course focuses on in-depth understanding of the molecular biophysics of proteins. Structural, thermodynamic and kinetic aspects of protein function and structure-function relationships will be considered at the advanced conceptual level. The application of these theoretical frameworks will be illustrated with examples from the literature and integration of biophysical knowledge with description at the cellular and systems level. The format consists of lectures, problem sets, and student presentations. A special emphasis will be placed on discussion of original publications. Offered as BIOC 475, CHEM 475, PHOL 475, PHRM 475, and NEUR 475.

CHEM 491. Modern Chemistry for Innovation I. 3 Units.
The first half of a two-semester sequence providing an understanding of chemistry as a basis for successfully launching new high-tech ventures. The course will examine physical limitations to present technologies and the use of chemistry to identify potential opportunities for new venture creation. The course will provide experience in using chemistry for both identification of incremental improvements and as the basis for alternative technologies. Case studies will be used to illustrate recent commercially successful (and unsuccessful) venture creation and will illustrate characteristics for success. Admission to this course requires consent of the department.

CHEM 492. Modern Chemistry for Innovation II. 3 Units.
Continuation of CHEM 491, with an emphasis on current and prospective opportunities for Chemistry Entrepreneurship. Longer term opportunities for Chemistry Entrepreneurship in emerging areas, including (but not be limited to) biomaterials, pharmacogenomics, biocatalysis, and drug discovery. Prereq: CHEM 491.

CHEM 493. Feasibility and Technology Analysis. 3 Units.
This course provides the tools scientists need to determine whether a technology is ready for commercialization. These tools include (but are not limited to): financial analysis, market analysis, industry analysis, technology analysis, intellectual property protection, the entrepreneurial process and culture, an introduction to entrepreneurial strategy and new venture financing. Deliverables will include a technology feasibility analysis on a possible application in the student’s scientific area. Offered as BIOL 493, CHEM 493, and PHYS 493.

CHEM 501. Special Topics in Inorganic Chemistry. 1 - 6 Unit.
(Credit as arranged.) Lectures on advanced topics in inorganic chemistry presented by staff or visiting lecturers. Course title, content, and credit change from year to year.

CHEM 502. Special Topics in Inorganic Chemistry. 1 - 6 Unit.
(Credit as arranged.) Lectures on advanced topics in inorganic chemistry presented by staff or visiting lecturers. Course title, content, and credit change from year to year.

CHEM 504. Special Topics in Organic Chemistry. 1 - 6 Unit.
(Credit as arranged.) Lectures on advanced topics in organic chemistry presented by staff or visiting lecturers. Course title, content, and credit change from year to year.

CHEM 506. Special Topics in Physical Chemistry. 1 - 6 Unit.
(Credit as arranged.) Lectures on advanced topics in physical chemistry presented by staff or visiting lecturers. Course title, content, and credit change from year to year.

CHEM 507. Special Readings in Chemistry. 1 - 6 Unit.
Detailed study of a special topic in chemistry under the guidance of a faculty member.

CHEM 508. Special Readings in Chemistry. 1 - 6 Unit.
Detailed study of a special topic in chemistry under the guidance of a faculty member.

CHEM 509. Special Topics in Analytical Chemistry. 1 - 6 Unit.

CHEM 601. Research. 1 - 18 Unit.
(Credit as arranged.) Special research in an area of chemistry under the guidance of a faculty member.

CHEM 605. Chemistry Colloquium Series. 1 Unit.
Course content provided by Thursday chemistry department colloquia (or Frontiers in Chemistry lectures). Discussion sessions review previous lectures and lay foundation for forthcoming lectures.

CHEM 651. Thesis M.S.. 1 - 18 Unit.
(Credit as arranged.)

(Credit as arranged.) Prereq: Predoctoral research consent or advanced to Ph.D. candidacy milestone.
Department of Classics

The Department of Classics introduces students to the culture, life, and legacy of ancient Greece and Rome through courses in the Greek and Latin languages and literatures, in ancient history and archaeology, and in the visual and material cultures of the ancient Mediterranean world. When justified by enrollment, the department offers courses in Sanskrit and in ancient Indian religious texts. A relatively recent development is a focus on the classical tradition in Europe and beyond. The department faculty represents a range of academic disciplines and is committed, where appropriate, to an interdisciplinary approach in teaching and research.

The core purpose of the department is to offer the opportunity for study of the ancient classical languages, as a crucial point of entry into the conceptual worlds of Greece and Rome. Students are also exposed to the various facets of antiquity that made the ancient Mediterranean world the progenitor of the modern West, not least in its mingling of cultures and belief systems. The different sub-disciplines and methodologies represented in the department involve multiple ways of exploring and understanding antiquity. Our students explore the philological, literary, and philosophical dimensions of ancient texts, and they engage with material and visual culture and city form through archaeology, epigraphy, and art and architectural history. Further, they study major moments of the revival of antiquity and the various lenses through which subsequent eras understood or appropriated the past.

Knowledge of classical antiquity constitutes the backbone of a liberal education. It also provides an excellent basis for further professional training in whatever field a student may ultimately pursue; for informed engagement with the political, social, and cultural issues of our turbulent times; and for the appreciation and enjoyment of artistic and cultural achievement. A major in classics, or even a minor, may be (as it often has been) profitably combined with programs aimed toward law, medicine, management, diplomatic service, banking, journalism, library science, or politics; religious, philosophic, literary, or historical studies; careers in the fine arts (visual or performing); or museum or archival work.

Undergraduate Programs

Major

The core of the classics major is the study of the languages and literatures of ancient Greece and Rome and the societies that spoke Greek and Latin until the end of the ancient world (usually taken as the 5th century of the Common Era). The major uniquely offers exposure to a range of approaches: literary, philological, historical, archaeological, art historical, philosophical, and anthropological. Further, the scope of the department has expanded to embrace the classical tradition in and even beyond Europe, with courses on literature and art and architecture up to the 20th century.

Concentrations

There are three separate tracks in the classics major. Philology (Track A) is devoted to ancient languages and their associated literatures in the original languages (Greek, Latin, or Greek and Latin). Classical Civilization (Track B) focuses on ancient history, literature in translation, and archaeology. Classical Tradition (Track C) explores the legacy of antiquity from the European Middle Ages to the contemporary world. The relevant courses examine the various ways that subsequent civilizations and movements have drawn on the classical world, for a wide range of purposes (some good, some nefarious), and with an equally wide range of effects. Please note that for Tracks B and C, students must complete study of either Greek or Latin to at least the intermediate level.

Each track requires 10 courses (30 hours), and at least two of these courses must be at the 300 level. For students who elect to complete their junior and senior year SAGES requirements in classics, two additional courses (6 hours) are required. CLSC 320 Departmental Seminar: Alexander the Great and CLSC 381 Classics Senior Capstone. (CLSC 320 may count as one of the classics 300-level courses, provided the student takes his or her junior SAGES requirements outside of classics.)

In the Philology Concentration (Track A), students can earn one of three degrees: BA in Classics: Greek; BA in Classics: Latin; or BA in Classics: Greek and Latin. Students in Track A are required to take CLSC 231 Greek Civilization and CLSC 232 Roman Civilization, then any combination of eight GREK or LATN courses, at least two of which (6 hours) must be at the 300-level. To receive the BA in Classics: Greek and Latin, students must complete at least one year of their second language.

In the Classical Civilization Concentration (Track B), students are required to take CLSC 231 Greek Civilization and CLSC 232 Roman Civilization; at least one 200-level or higher GREK or LATN course (for most students, this will mean taking GREK or LATN 101, 102 and 201); and any combination of GREK, LATN, or CLSC courses to bring their course total to 10 (30 hours), at least two of which must be at the 300 level. The elective CLSC courses should consist of courses that focus on the period before the 6th century of the Common Era and not the Classical Tradition (Track C).

In the Classical Tradition Concentration (Track C), students are required to take and CLSC 232 Roman Civilization and at least one course in Greek or Latin at the intermediate level or higher. (Students who enter the program without any Greek or Latin are required to take the introductory sequence in either language.) The department offers four 200-level courses in Classical Tradition, focusing respectively on the Renaissance and Baroque, the Enlightenment, Architecture and Urbanism from the Renaissance to the 20th Century, and Classics in Film (see list below). Students are required to take at least two of these courses.

<table>
<thead>
<tr>
<th>Students in the Classical Tradition Concentration must take two of the following four 200-level courses:</th>
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<tbody>
<tr>
<td>CLSC/ARTH 311 Roman: City and Image</td>
</tr>
<tr>
<td>CLSC 313/COGS 318 Thinking Communication in Ancient and Medieval Literature</td>
</tr>
<tr>
<td>CLSC 315 Erotic Literature Ancient to Modern</td>
</tr>
<tr>
<td>CLSC 319/ARTH 320 Epic: The Sublime and Terrible in Literature</td>
</tr>
<tr>
<td>CLSC/COGS 340 Seminar in Enlightenment Art and Literature: Piranesi and Vico</td>
</tr>
</tbody>
</table>

Keeping in mind that the student should have at least two 300-level courses out of ten, the remaining courses (two to four, depending on whether the student is required to take the beginning language sequence) may be chosen from the above lists or, subject to advisor’s approval, from the classics, Greek, or Latin courses in general.
Study in Related Fields
Each student completing the classics major is strongly advised to choose a related minor, selected in consultation with and approved by the departmental advisor, in such closely related fields as anthropology, art history, philosophy, comparative literature, history, theater, or English. The association between the department and the World Literature Program is especially close.

Departmental Honors
Departmental honors are given to students who earn the grade of A for their senior dissertation in CLSC 382 Senior Honors Thesis and maintain a GPA in the major of 3.5.

The Minor
A minor in classics is designed to acquaint the student with aspects of the ancient civilizations of Greece and Rome by means of 15 hours of course work. These 15 hours may be any combination of Greek, Latin, and classics courses, at least 3 hours of which must be at or above the 300 level. While the study of either Greek or Latin is encouraged, neither is required for the minor.

Graduate Study

Post-Baccalaureate
The department is about to launch a Classics Post-Bac program in which existing courses will be offered at the 400 level. Interested, qualified students should contact the chair.

World Literature MA: Classics Track
Qualified students may pursue graduate work in classics through the MA in the World Literature Program (p. 446) (WLIT). Classics courses at the 300 level may be taken for graduate credit in this way.

Department Faculty
Charles Burroughs, PhD  
(Warburg Institute, University of London)  
Elsie B. Smith Professor in the Liberal Arts and Chair  
Art and architecture in the classical tradition; Italian Renaissance; early modern urbanism; landscapes in Europe and the Americas

Ricardo A. Apostol, PhD  
(University of Michigan)  
Assistant Professor  
Augustan poetry and culture; Hellenistic poetry; material culture

Florin Berindeanu, PhD  
(University of Georgia)  
Instructor; Director, World Literature Program; Secondary Appointment, Department of Cognitive Science  
European literature; literary and semiotic theory; mysticism

Paul A. Iversen, PhD  
(Ohio State University)  
Associate Professor  
Greek and Roman New Comedy; Greek and Latin epigraphy; Hellenistic culture and society

Rachel Hall Sternberg, PhD  
(Bryn Mawr College)  
Associate Professor  
Greek language and literature; Greek social history; history of emotion; reception of the classical tradition in the age of Jefferson

Visiting Faculty
Timothy Wutrich, PhD  
(Tufts University)  
Visiting Assistant Professor  
Greek and Roman drama; classical tradition in literature and art; philosophical approaches to literature and art; Roman civilization; Vergil

Secondary Faculty
Jenifer Neils, PhD  
(Princeton University)  
Ruth Coulter Heede Professor of Art History; Department of Art History and Art  
Ancient art and classical archaeology

Deepak Sarma, PhD  
(University of Chicago)  
Associate Professor, Department of Religious Studies  
Hinduism; Indian philosophy; method and theory in the study of religion

Adjunct Faculty
Ramaswamy Sharma, PhD  
(Bharathidasan University, Trichy, India)  
Adjunct Instructor  
Sanskrit language and literature

CLSC Courses
CLSC 193. The Ancient World. 3 Units.  
Ancient Western history from the origins of civilization in Mesopotamia to the dissolution of the Roman Empire in the West. Offered as CLSC 193 and HSTY 193.

CLSC 199. Athens: Environment and Ethics. 3 Units.  
Students selected for their strong background or interest in Greek Civilization spend Spring Break in Athens, Greece (thanks to a collaboration between CWRU’s Department of Classics and the Athens Centre). They follow an intensive seven-day itinerary of travel, visiting major monuments and museums including the Acropolis, Delphi, Epidaurus, and Aegina. Two class sessions of instruction in modern Greek help them to interact with people they meet; but the overwhelming emphasis lies on Classical Athens, the historical-cultural setting for the emergence of Western moral philosophy. The focus of this mini-course is on the figure of Socrates and the agenda of moral philosophy that the Athenian sage established. Readings from Plato, Aristophanes, and Aristotle. Via the Socratic method, students will also study Aristotle’s Ethics and test the applicability of that foundational text to their own lives.

CLSC 202. Classical Mythology. 3 Units.  
The myths of Classical Greece and Rome, their interpretation and influence.

CLSC 203. Gods and Heroes in Greek Literature. 3 Units.  
This course examines major works of Greek literature and sets them in their historical and cultural context. Constant themes are war, wandering, tyranny, freedom, community, family, and the role of men and women within the household and the ancient city-state. Parallels with modern life and politics will be explored. Lectures and discussions. Offered as CLSC 203 and WLIT 203.
CLSC 204. Heroes and Hustlers in Latin Literature. 3 Units.
This course constitutes the second half of a sequence on Classical literature. Its main themes are heroism vs. self-promotion, love vs. lust, and the struggle between democracy and tyranny. These topics are traced in a variety of literary genres from the period of the Roman republic well into the empire. Parallels with modern life and politics will be drawn. Offered as CLSC 204 and WLIT 204.

CLSC 206. Ancient and Medieval Spain: Prehistory to 1492. 3 Units.
This course focuses on the history of the Iberian peninsula from before the Roman conquest from the Iberians, Greek, and Carthaginian settlements, through Roman, Visigothic, and Muslim rule to the conquest of Ferdinand and Isabella of the last non-Christian territory on the peninsula in 1492. The issues of conquest, frontier, cultural diversity, and change, tolerance, and intolerance will be examined. Offered as CLSC 206, HSTY 206.

CLSC 210. Byzantine World 300-1453. 3 Units.
Development of the Byzantine empire from the emperor Constantine’s conversion to Christianity and founding of the eastern capital at Constantinople to the fall of Constantinople to Turkish forces in 1453. Offered as CLSC 210 and HSTY 210.

CLSC 220. Art & Literature in the Classical Tradition, Pt 1: Renaissance and Baroque (14th to 17th centuries). 3 Units.
Through lectures, varied assignments, and visits to the Cleveland Museum of Art this course will introduce students to the major issues in the study of early modern art and literatures. The emphasis will inevitably be on Italy, as the place where the physical remains of ancient Rome confronted and inspired such remarkable masters as Michelangelo (as poet and artist), Palladio, Gian Lorenzo Bernini, Nicholas Poussin (Bernini and Poussin are represented in the CMAI), though some artists -- notably Leonardo -- resisted the lure of the classical past. From Italy new ideas spread to the rest of Europe and beyond. We will not have much time to study Shakespeare in the course, but we will not be able to ignore the greatest author of the Renaissance period. Like Shakespeare, we will move between the court and the city, between scenes of often-endangered order and scenes of sometimes-productive disorder, in which classical models provided a key cultural and even psychological resource in challenging times. Recommended preparation: CLSC 112. Offered as CLSC 220 and WLIT 220.

CLSC 221. Building on Antiquity. 3 Units.
Beginning with Ancient Greece and Rome and ending in Cleveland, the course will provide orientation in the architectural orders and in most periods of European and Euro-American architectural history, as well as, to an extent, architectural criticism. The issue of how architecture has meaning will be central, not least in connection with the formalized "language" of classicism and the emergence of development of building types (temple, museum, civic hall, transportation buildings, etc.). We will also review more subtle ways in which architecture conveys meaning or mood, and the assignment of gendered associations to certain architectural elements. The course will consider more or less blatant political uses of architecture and architectural imagery, but also more elusive and/or ambiguous cases, as well as the phenomenon of the shifting meanings of architecture through changes of era, owner, audience, etc. Offered as ARTH 221 and CLSC 221.

CLSC 222. Classical Tradition 2: Birth of Archaeology. 3 Units.
The course will focus on the history of diverse methods for studying societies remote in time and space; i.e., on the formation of the distinct disciplines of archaeology and anthropology, and the interest in the origins of human society and cultural practices. The birth of archaeology occurred in the context of the profound transformation of European cultural life in the eighteenth century, the era of the Enlightenment. On the basis of a range of cultural productions (literary and historical texts, objects of luxury and use, etc.), we will study visual and literary works and consider the relationship between different modes of artistic production and expression, as well as the marketing and display of prestigious objects, whether ancient or modern. We will consider the eighteenth-century model of experiential education, the "Grand Tour," and the formation of private and public collections, as well as the emergence of the museum as institution. Finally, we will also consider important recent work on the relationship between the production of luxury commodities (sugar, coffee, tea, etc.) through the plantation economy in the Americas and beyond and the development of attitudes and ideas in Europe. Offered as CLSC 222 and WLIT 222.

CLSC 224. Sword and Sandal: The Classics in Film. 3 Units.
Gladiator. Alexander. The 300. Contemporary society’s continuing fascination with putting the ancient world on the big screen is undeniable; and yet the causes underlying this phenomenon are not quite so readily apparent. In this course we will watch and discuss a number of movies about the ancient world, running the gamut from Hollywood classics such as Ben-Hur and Spartacus to more recent treatments (the aforementioned 300 and Gladiator, for starters), and from the mainstream and conventional (Clash of the Titans, Disney's Hercules) to the far-out and avant-garde (Fellini’s Satyricon, anyone?). As we do so we’ll learn quite a bit about the art and economics of film, on one hand, and the ancient world, on the other. And yet what we’ll keep coming back to are the big questions: what does our fascination with the ancient Mediterranean tell us about ourselves as a society? Why do such movies get made, and what kinds of agendas do they serve? To what extent can we recapture the past accurately? And if we can’t, are we doomed to just endlessly projecting our own concerns and desires onto a screen, and dressing them in togas? No knowledge of ancient languages is required for this course. Offered as CLSC 224 and WLIT 224.

CLSC 227. Ancient Cities and Sanctuaries. 3 Units.
A selection of cities and sanctuaries from the ancient Near East, Egypt, the Aegean, Greece, Etruria, and Rome; their political and religious institutions and the relationship to contemporary art forms. Offered as ARTH 227 and CLSC 227.

CLSC 228. Ancient Greek Athletics. 3 Units.
Exploration of the role of athletics in the ancient, primarily Greek world, and their reflection in the art of the period. Offered as ARTH 228 and CLSC 228.

CLSC 231. Greek Civilization. 3 Units.
This course constitutes the first half of a year-long sequence on classical civilization. It examines the enduring significance of the Greeks studied through their history, literature, art, and philosophy. Lectures and discussion. (For the second course in the sequence, see CLSC 232 and HSTY 232.) Offered as CLSC 231 and HSTY 231.

CLSC 232. Roman Civilization. 3 Units.
The enduring significance of the Romans studied through their history, literature, art, and philosophy. Lectures and discussion. Offered as CLSC 232 and HSTY 232.
CLSC 295A. Greek and Latin Elements in English: The Basic Course. 1.5 Unit.
A self-paced, computer-assisted course in the classical foundations of modern English in which the student learns the basic principles on which roots, prefixes, and suffixes combine to give precise meanings to composite words.

CLSC 295B. Greek and Latin Elements in English: Biomedical Terminology. 1.5 Unit.
(See CLSC 295A.) Advanced section that is oriented especially toward scientific and medical terminology. Prereq or Coreq: CLSC 295A.

CLSC 301. Ancient Philosophy. 3 Units.
Western philosophy from the early Greeks to the Skeptics. Emphasis on the pre-Socratics, Plato and Aristotle. Recommended preparation: PHIL 101 and consent of department. Offered as CLSC 301 and PHIL 301.

CLSC 302. Ancient Greece: Archaic, Classical, and Hellenistic Periods. 3 Units.
The rise of Hellenic thought and institutions from the eighth to the third centuries B.C., the rise of the polis, the evolution of democracy at Athens, the crises of the Persian and Peloponnesian Wars, fifth-century historiography, the growth of individualism, and the revival of monarchy in the Hellenistic period. Offered as CLSC 302 and HSTY 302.

CLSC 304. Ancient Rome: Republic and Empire. 3 Units.
Growth and development of the Roman state from the unification of Italy in the early third century B.C. to the establishment of the oriental despotism under Diocletian and Constantine. The rise of empire in the Punic Wars, the uncertain steps toward an eastern hegemony, the crisis in the Republic from the Gracchi to Caesar, the new regime of Augustus, the transformation of the leadership class in the early Empire, and the increasing dominance of the military over the civil structure. Offered as CLSC 304 and HSTY 304.

CLSC 305. Sanskrit Religious Texts. 3 Units.
Introduction to the Sanskrit language and culture through the reading of selected texts taken from the ancient religions of South Asia. Offered as CLSC 305 and RLGN 305.

CLSC 309. Advanced Sanskrit Religious Texts. 3 Units.
This class is a continuation of RLGN 305/CLSC 305, the introduction to the Sanskrit language and culture. In RLGN 309/CLSC 309 students will learn advanced Sanskrit grammar and syntax. Previous knowledge of Sanskrit is required. We will finish the lessons from Devavanipravesika that we began in the introductory course. We will then translate sections for the Bhagavad Gita. Offered as CLSC 309 and RLGN 309.

CLSC 311. Rome: City and Image. 3 Units.
This course studies the architectural and urban history of Rome from the republican era of the ancient city up to the eighteenth century using the city itself as the major “text.” The emphasis will be placed on the extraordinary transformations wrought in the city, or at least in key districts, by powerful rulers and/or elites, especially in the ancient empire and in the Renaissance and baroque eras. In a larger perspective, the great construction projects exerted a far-reaching effect within and beyond Europe, but we will study them in relation to their topographical situation, their functions, and their place in a long history of variations on prestigious themes since many of the artworks and the urban settings featured in the course carry the mark of the Long history of the city itself. Recommended preparation: At least one 200-level course in ANTH, ARTH, CLSC, ENGL, HSTY, or RLGN. Offered as ARTH311/411 and CLSC 311.

CLSC 312. Women in the Ancient World. 3 Units.
The course offers a chronological survey of women’s lives in Greece, Hellenistic Egypt, and Rome. It focuses on primary sources as well as scholarly interpretations of the ancient record with a view to defining the construction of gender and sexuality according to the Greco-Roman model. Additionally, the course aims to demonstrate how various methodological approaches have yielded significant insights into our own perception of sex and gender. Specific topics include matriarchy and patriarchy; the antagonism between male and female in myth; the legal, social, economic, and political status of women; the ancient family; women’s role in religion and cult; ancient theories of medicine regarding women; pederasty and homosexuality. Offered as CLSC 312 and WGST 312.

CLSC 313. Thinking Communication in Ancient and Medieval Literature. 3 Units.
The ancients were much concerned with the nature and validity of signs: Important decisions depended on the flight of birds or the coloration of the liver of a sacrificial victim. The relationship of language to truth, i.e., a reality beyond the contingent, was a crucial issue, not least because of the rise of sophist rhetoric: for an orator, language was a tool in a contest rather than a means to true understanding. The discipline of medicine, developed by such important figures as Galen and Hippocrates, depended on the interpretation of physical signs to diagnose and treat ailments of mind and body. The term for the theory of signs - semiotics - is derived from the Greek term "semeiotike", and for many Greek philosophers and their Roman and medieval successors the sign was a key issue. For Christians especially, new forms of vision and discerning truth presented particular problems: after all, the Christian God revealed his intentions through "portents" that had to be read and interpreted. And even if sacred scripture was in some way understood as encapsulating the whole word, there were countless passages requiring clarification or adaptation to contemporary situations. In other words, the concern was with the relationship between a universe of structured signs (the subject of semiotics) and structures of interpersonal communication (pragmatics). Offered as CLSC 313 and COGS 318. Prereq: WLIT 211 or WLIT 212.

CLSC 314. Love Poetry from Sappho to Shakespeare. 3 Units.
Introduction to the love poetry of ancient Greece and Rome and its impact on the later European tradition in such poets as Petrarch, Chaucer, and Shakespeare. Readings will focus especially on questions of generic convention, audience expectation, and the social setting of love poetry in the different ages under consideration. No knowledge of the original languages required. Offered as CLSC 314 and WLIT 314.
CLSC 315. Erotic Literature Ancient to Modern. 3 Units.
The erotic drive is a fundamental impulse in human beings, indeed in the animal world in general. Primordially, the erotic find expression in sexual desire and in associated behaviors, which in antiquity -- as in other myth-oriented cultures -- amounts to a production of poetry to aid in seduction, to praise an object of desire, or simply reflect the nature of love and/or sexual desire in general. Highly sexualized language appears in both ancient and modern texts that take into account a variety of foundational texts in Western culture. From Plato, who wrote a whole dialogue (Symposium) describing different kinds of love, to Christian interpreters of sacred texts, eroticism was a term that defined both pagan and religious experiences. This course will explore fictional as well as theoretical inquiries into the nature and purpose of erotic desire and its evaluation as aesthetic phenomenon. It will focus on texts such as Longus's Daphnis and Chloe, Abelard's Letters, Aucassin and Nicolette, mystical voices, Freudian theory and modern contribution such as Roland Barthes and Georges Bataille. Modern theoreticians as those mentioned here illustrate how the libidinal (whether understood as subjective drive or in Freudian terms) is inseparable from the aesthetic. Offered as: CLSC 315 and WLIT 317. Prereq: WLIT 211 and WLIT 212.

CLSC 316. Greek Tragedy. 3 Units.
This course provides students the opportunity to read a significant number of ancient Greek tragedies in modern English translations. We shall read, study, and discuss selected works by Aeschylus, Sophocles, and Euripides, and attempt to understand the plays as literature composed for performance. We shall study literary elements within the plays and theatrical possibilities inherent in the texts. As we read the plays, we shall pay close attention to the historical context and look for what each play can tell us about myth, religion, and society in ancient Athens. Finally, we shall give occasional attention to the way these tragic dramas and the theater in which they were performed have continued to inspire literature and theater for thousands of years. Lectures will provide historical background on the playwrights, the plays, the mythic and historical background, and possible interpretation of the texts as literature and as performance pieces. Students will discuss in class the plays that they read. The course has three examinations and a final project that includes a short essay and a group presentation. Offered as CLSC 316, WLIT 316, WLIT 416.

CLSC 317. Inspiration: The Topic of Creativity in Art and Literature--Ancient to Medieval. 3 Units.
Inspiration is an inextricably essential part of the aesthetic genesis, and it has instantly become one of the most frequented themes of artistic creation. Where does inspiration come from? Are artists "chosen ones" that implicitly stand out from the "non-inspired" rest? Trying to answer these questions and others related to the phenomenon of creativity, one direction that this course should take and focus on is the theme of "divine" or "transcendent" as a source of inspiration in art and literature. The course will start with the mystical teaching and theories of Pythagoras that influenced Plato and the Neo-Platists that will be carried on further in the general tradition of Christian literature. In this respect, the course will examine creativity in readings that include both Ancient and Medieval writers whose writings place the subject of inspiration at the center of their own aesthetic invention. Among the authors included in the course will be Pseudo-Dyonisius, Gregory Palamas, Jacopone da Todi, Caterina da Siena, Dante, Petrarch, and Meister Eckhart. Offered as: CLSC 317 and WLIT 319.

CLSC 318. Landscape Archaeology and Epigraphy. 3 Units.
Landscape archaeology addresses the complex ways that people have consciously and unconsciously shaped the land around them. As by-products of the interaction between people and place, landscapes designate spaces occupied by specific social groups whose members draw from their environs a shared identity and who situate their actions within specific normative frameworks. The landscapes of the Greek and Roman East are no exception to this. As "cultural landscapes," they were the scene of thousands of years of actions, including the organizing of space or the altering of the land for diverse purposes such as subsistence, or for economic, social, political, religious and military concerns. As such they offer us the possibility to investigate the agencies, actions, and negotiations between particular communities and the various greater powers that exercised control over them. This course will, therefore, introduce students to the study of Landscape Archaeology/Intensive Surveying through five weeks of hands-on fieldwork in the region of Isparta, Turkey, the locus of an ancient landscape called Northwestern Pisidia about which little is known. This landscape has a long storied past, lying as it did along a fault line between earthshaking empires, including the Hittites, Lydians and Persians to North and to the East, and the Greeks, Macedonians and Romans to the West. As such it was a contested space, not only in terms of the physical control of the land, but also the culture. This course will investigate this cultural landscape through the analysis of the archaeological material found. There will also be an opportunity to work with the archaeological material in the Isparta Museum, especially the epigraphical material there. We will also take field trips to important ancient sites and museums in the area to better grasp the region's ancient cultural profile and context. In addition, we will discuss archaeological ethics, issues of cultural patrimony, the importance of teamwork, and the need to work side by side with the local community. Offered as CLSC 318 and CLSC 418.

CLSC 319. Epic: The Sublime and Terrible in Literature. 3 Units.
The course focuses on the epic genre that dominates the dawn of Western literature as well as the literary traditions of much of the rest of the world. From the Homeric epic to the Middle Ages and deep into the Renaissance, there was a collective urge to record both in verse and in prose extraordinary adventures with exceptional heroes as central figures. Thus, the epic genre typically encouraged variations in the aesthetic treatment of the hero that eventually came to define distinct categories within the genre. "Sublime" and "terrible" are common notions in the aesthetics of classicism, from antiquity to the early modern period. Authors studied in the course include such key figures in the creation and development of epic as Homer, Virgil, Ovid, Gottfried von Strassburg, Dante, and Cervantes. The works of these authors exemplify, on the one hand, the aesthetic directions mentioned above and, on the other hand, provide opportunities for using the close engagement with particular texts to illuminate wider cultural fields, in which various aesthetic perceptions of social, political, and religious reality coexist and therefore stimulate remarkable innovations in the standard epic narrative. Offered as CLSC 319, CLSC 419, WLIT 320 and WLIT 420.
CLSC 320. Departmental Seminar: Alexander the Great. 3 Units.
This course is the Classics Departmental Seminar in the SAGES sequence, though it can also be taken for regular credit in Classics or History. The seminar on Alexander the Great is normally taken in the Spring semester of junior year, and offers students a firm grounding in the diverse materials, methods, and approaches that can be brought to bear on the study of Greco-Roman antiquity and of its legacy up to today. Alexander’s career is urgently relevant today for two primary reasons: the establishment of new forms of interaction between European/"western" and Asian/"eastern" civilizations; and the idea of global domination, wedding Greek and Asian as well as African (Egyptian) conceptions of rule and governance. Beyond the exploration of the ancient world of, or shaped by, Alexander, we will focus also on the reception of the historical figure, i.e., on the sometimes fantastic image of Alexander diffused in later epochs (Islamic, medieval) as well as on the more critical but often ideologically slanted early modern approach. Because of the expansion of the scope of the seminar (as of Alexander himself) beyond Europe and the critical examination of the traditional separation of East and West--or the three continents (Europe, Africa, and Asia) distinguished in antiquity--this course qualifies as a Global and Cultural Diversity course. Offered as CLSC 320 and HSTY 320.

CLSC 330. Topics in Classical Tradition. 3 Units.
This course will examine facets and tendencies of cultural development in modern Europe and beyond which involve the engagement of historians, philosophers, literary authors and critics, artists, architects, and/or society in general with the classical world and its legacy. In some cases courses will be programmatically associated with special events, e.g., exhibitions in The Cleveland Museum of Art. No prerequisites have been included, but students taking this course should have completed intermediate humanities courses, preferably in CLSC/LATN/GREK as well as WLIT. Offered as CLSC 330 and CLSC 430.

CLSC 332. Art and Archaeology of Ancient Italy. 3 Units.
The arts of the Italian peninsula from the 8th century B.C. to the 4th century A.D., with emphasis on recent archaeological discoveries. Lectures deal with architecture, sculpture, painting, and the decorative arts, supplemented by gallery tours at the Cleveland Museum of Art. Offered as ARTH 332, CLSC 332, and ARTH 432.

CLSC 333. Greek and Roman Painting. 3 Units.
Greek vase painting. Etruscan tomb painting and Roman wall painting. The development of monumental painting in antiquity. Offered as ARTH 333, CLSC 333, and ARTH 433.

CLSC 334. Art and Archaeology of Greece. 3 Units.
A survey of the art and architecture of Greece from the beginning of the Bronze Age (3000 B.C.) to the Roman conquest (100 B.C.) with emphasis on recent archaeological discoveries. Lectures deal with architecture, sculpture, painting, and the decorative arts, supplemented by gallery tours at the Cleveland Museum of Art. Offered as ARTH 334, CLSC 334, and ARTH 434.

CLSC 340. Seminar in Enlightenment Art and Literature: Piranesi and Vico. 3 Units.
This course explores aspects of the European eighteenth century as a transformative epoch in the history of western culture. Though the Enlightenment is usually associated especially with France, in this course we will focus on Italy, as the irresistible goal of travelers taking part in the "Grand Tour," and as a landscape of powerful ancient and modern architecture and artworks universally recognized as exemplary. In particular we will study one of the strangest and most fascinating visual artists of the period, the self-proclaimed architect Giovanni Battista Piranesi (1720-1778) famous no less now than in his own time for his fantastic prison engravings as well as his views of Rome, involving a radical rethink of the city as a particular kind of inhabited as well as imagined space. Piranesi’s polemical response to the advocates of the Greek revival, then coming into fashion, will lead into discussion of the key philosophical debates and aesthetic shifts of the time, notably the emergence of the notion of the sublime as a category eventually subversive of western ideals of rationality and still present -- and potent -- in our own culture. Finally we will place Piranesi within a current of discussion of the origins and nature of language and of human society in general, not least as manifested in architecture and other symbolic practices. The leading figure here is the Neapolitan G.B. Vico, whose New Science of 1725 remains one of the most stimulating texts in the western intellectual tradition. Offered as CLSC 340, COGS 340, WLIT 340, CLSC 440, and WLIT 440.

CLSC 381. Classics Senior Capstone. 3 Units.
The capstone is the final requirement of the SAGES program and is normally taken in the fall semester of senior year. It involves an independent study paper resulting from exploration of a topic chosen in consultation with the student's capstone advisor, who will regularly review progress on the project. In the capstone students employ, integrate, and demonstrate analytical, rhetorical, and practical skills developed and honed through the SAGES curriculum as well as their major or minor studies. The Capstone Project has both a written and an oral component: oral presentation and argumentation will be stressed. The product of the capstone may take different forms: there will always be a written component, but other forms of expression are also encouraged, such as a webpage or poster for a poster session. As for the kind of project that might be done: students interested in literature might work on an annotated translation of a classical text; archaeology students might produce a virtual exhibit centered on a specific site or problem. Prereq: CLSC 111 and CLSC 112, plus courses prescribed for each track of the major.

CLSC 382. Senior Honors Thesis. 3 Units.
A course of independent study and research culminating in the preparation of a thesis on a topic approved by the supervising faculty member. Enrollment in this course must be approved by the Chair of the Department. Prereq: CLSC 381.

CLSC 395. Directed Readings. 1 - 3 Unit.
Readings in English on a topic of interest to the student and acceptable to the instructor. Designed and completed under the supervision of the instructor with whom the student wishes to work.
CLSC 416. Greek Tragedy. 3 Units.
This course provides students the opportunity to read a significant number of ancient Greek tragedies in modern English translations. We shall read, study, and discuss selected works by Aeschylus, Sophocles, and Euripides, and attempt to understand the plays as literature composed for performance. We shall study literary elements within the plays and theatrical possibilities inherent in the texts. As we read the plays, we shall pay close attention to the historical context and look for what each play can tell us about myth, religion, and society in ancient Athens. Finally, we shall give occasional attention to the way these tragic dramas and the theater in which they were performed have continued to inspire literature and theater for thousands of years. Lectures will provide historical background on the playwrights, the plays, the mythic and historical background, and possible interpretation of the texts as literature and as performance pieces. Students will discuss in class the plays that they read. The course has three examinations and a final presentation. Offered as CLSC 316, WLIT 316, WLIT 416.

CLSC 418. Landscape Archaeology and Epigraphy. 3 Units.
Landscape archaeology addresses the complex ways that people have consciously and unconsciously shaped the land around them. As byproducts of the interaction between people and place, landscapes designate spaces occupied by specific social groups whose members draw from their environs a shared identity and who situate their actions within specific normative frameworks. The landscapes of the Greek and Roman East are no exception to this. As "cultural landscapes," they were the scene of thousands of years of actions, including the organizing of space or the altering of the land for diverse purposes such as subsistence, or for economic, social, political, religious and military concerns. As such they offer us the possibility to investigate the agencies, actions, and negotiations between particular communities and the various greater powers that exercised control over them. This course will, therefore, introduce students to the study of Landscape Archaeology/ Intensive Surveying through five weeks of hands-on fieldwork in the region of Isparta, Turkey, the locus of an ancient landscape called Northwestern Pisidia about which little is known. This landscape has a long storied past, lying as it did along a fault line between earthshaking empires, including the Hittites, Lydians and Persians to North and to the East, and the Greeks, Macedonians and Romans to the West. As such it was a contested space, not only in terms of the physical control of the land, but also the culture. This course will investigate this cultural landscape through the analysis of the archaeological material found.
There will also be an opportunity to work with the archaeological material in the Isparta Museum, especially the epigraphical material there. We will also take field trips to important ancient sites and museums in the area to better grasp the region's ancient cultural profile and context. In addition, we will discuss archaeological ethics, issues of cultural patrimony, the importance of teamwork, and the need to work side by side with the local community. Offered as CLSC 318 and CLSC 418.

CLSC 419. Epic: The Sublime and Terrible in Literature. 3 Units.
The course focuses on the epic genre that dominates the dawn of Western literature as well as the literary traditions of much of the rest of the world. From the Homeric epic to the Middle Ages and deep into the Renaissance, there was a collective urge to record both in verse and in prose extraordinary adventures with exceptional heroes as central figures. Thus, the epic genre typically encouraged variations in the aesthetic treatment of the hero that eventually came to define distinct categories within the genre. "Sublime" and "terrible" are common notions in the aesthetics of classicism, from antiquity to the early modern period. Authors studied in the course include such key figures in the creation and development of epic as Homer, Virgil, Ovid, Gottfried von Strassburg, Dante, and Cervantes. The works of these authors exemplify, on the one hand, the aesthetic directions mentioned above and, on the other hand, provide opportunities for using the close engagement with particular texts to illuminate wider cultural fields, in which various aesthetic perceptions of social, political, and religious reality coexist and therefore stimulate remarkable innovations in the standard epic narrative. Offered as CLSC 319, CLSC 419, WLIT 320 and WLIT 420.

CLSC 430. Topics in Classical Tradition. 3 Units.
This course will examine facets and tendencies of cultural development in modern Europe and beyond which involve the engagement of historians, philosophers, literary authors and critics, artists, architects, and/or society in general with the classical world and its legacy. In some cases courses will be programmatically associated with special events, e.g., exhibitions in The Cleveland Museum of Art. No prerequisites have been included, but students taking this course should have completed intermediate humanities courses, preferably in CLSC/LATN/GREK as well as WLIT. Offered as CLSC 330 and CLSC 430.

CLSC 440. Seminar in Enlightenment Art and Literature: Piranesi and Vico. 3 Units.
This course explores aspects of the European eighteenth century as a transformative epoch in the history of western culture. Though the Enlightenment is usually associated especially with France, in this course we will focus on Italy, as the irresistible goal of travelers taking part in the "Grand Tour," and as a landscape of powerful ancient and modern architecture and artworks universally recognized as exemplary. In particular we will study one of the strangest and most fascinating visual artists of the period, the self-proclaimed architect Giovanni Battista Piranesi (1720-1778) famous no less now than in his own time for his fantastic prison engravings as well as his views of Rome, involving a radical rethinking of the city as a particular kind of inhabited as well as imagined space. Piranesi's polemical response to the advocates of the Greek revival, then coming into fashion, will lead into discussion of the key philosophical debates and aesthetic shifts of the time, notably the emergence of the notion of the sublime as a category eventually subversive of western ideals of rationality and still present -- and potent -- in our own culture. Finally we will place Piranesi within a current of discussion of the origins and nature of language and of human society in general, not least as manifested in architecture and other symbolic practices. The leading figure here is the Neapolitan G.B. Vico, whose New Science of 1725 remains one of the most stimulating texts in the western intellectual tradition. Offered as CLSC 340, COGS 340, WLIT 340, CLSC 440, and WLIT 440.

CLSC 481. Special Studies. 1 - 6 Units.
Subject matter varies according to need.
GREK Courses

GREK 101. Elementary Greek I. 3 Units.
Beginning course in Greek language, covering grammar (forms and syntax) and the reading of elementary selections from ancient sources. Makes a start toward reading Greek authors.

GREK 102. Elementary Greek II. 3 Units.
Beginning course in Greek language, covering grammar (forms and syntax) and the reading of elementary selections from ancient sources. Makes a start toward reading Greek authors. Prereq: GREK 101 or equivalent.

GREK 201. Greek Prose Authors. 3 Units.
Readings from authors such as Plato, Lysias, Xenophon, and Herodotus. Prereq: GREK 102 or equivalent.

GREK 202. Introduction to Greek Poetry. 3 Units.
Primarily readings from Homer, Hesiod, and Theocritus. Selections from Greek lyric may be introduced at the instructor’s discretion. Prereq: GREK 201 or equivalent.

GREK 306. Tragedy. 3 Units.
Reading and interpretation of selected plays of Aeschylus, Euripides, and Sophocles. Prereq: GREK 202 or equivalent.

GREK 307. History. 3 Units.
Extensive reading in Thucydides’ History of the Peloponnesian War, especially Books VI and VII, the expedition against Syracuse. Prereq: GREK 202 or equivalent.

GREK 308. Comedy. 3 Units.
Origin, ambiance, and development of Greek Old Comedy and persisting characteristics of the genre. Translation of selected plays from Greek into English. Prereq: GREK 202 or equivalent.

GREK 311. Homer. 3 Units.
Reading and translation of extensive selections from the Odyssey. Introduction to epic meter, to Homeric Greek, and to the poet’s style. Consideration of evidences of oral composition and discussion of the heroic tradition. Prereq: GREK 202 or equivalent.

GREK 370. Greek Prose Composition. 3 Units.
This course introduces students to the principles and practice of composing continuous passages of Greek prose. It is designed to review and to strengthen students’ command of Attic forms while becoming more aware of the ways Greek syntax was employed to express thought. Via practice at writing Greek prose, the ultimate goal is for the students to become more proficient and sensitive readers of ancient Greek. Prereq: GREK 202.

GREK 380. Advanced Topics in Greek Literature. 3 Units.
Study and discussion of important authors, works, and topics not covered regularly. Content will reflect particular interests of students and faculty and timeliness of the topics. Prereq: GREK 202 or equivalent.

GREK 395. Directed Readings. 1 - 3 Unit.
Readings in Greek of authors selected to serve the individual interests and needs of undergraduate students. Each program planned and completed under the supervision of the instructor with whom the student wishes to work.

LATN Courses

LATN 101. Elementary Latin I. 3 Units.
An introduction to the elements of Latin: pronunciation, forms, syntax, vocabulary, and reading.

LATN 102. Elementary Latin II. 3 Units.
An introduction to the elements of Latin: pronunciation, forms, syntax, vocabulary, and reading. Prereq: LATN 101 or equivalent.

LATN 201. Latin Prose Authors. 3 Units.
Reading and discussion of such prose authors as Cicero, Caesar, Livy or Pliny. Prereq: LATN 102 or equivalent.

LATN 202. Vergil. 3 Units.
Primarily readings from The Aeneid; selections from Vergil’s other work may be introduced at instructor’s discretion. Recommended preparation: LATN 201 or equivalent.

LATN 305. Literature of the Republic. 3 Units.
A reading course in prose and poetry of the Roman Republic. Extensive selections from Cicero and Catullus, and one comedy of Terence. Prereq: LATN 202 or equivalent.

LATN 306. Survey of Latin Literature. 3 Units.
Reading and discussion of selections from the various genres of Latin literature of the Roman Republic and Empire such as historical narrative, lyric and elegiac poetry, comic drama, forensic rhetoric, philosophical dialogue, didactic literature, letters, and epigrams. Prereq: LATN 202 or equivalent.

LATN 307. Livy. 3 Units.
Readings in Books I and XXI, with other selections from this major Augustan historian. Prereq: LATN 202 or equivalent.

LATN 308. Horace: Odes and Epodes. 3 Units.
Readings and discussion of extensive selections from the poetry of Horace; consideration of Horace as exemplifying the spirit of the Augustan Age. Prereq: LATN 202 or equivalent.

LATN 309. Medieval Latin. 3 Units.
Reading and interpretation of Latin texts from the Middle Ages. Material selected according to the needs and interests of students. Prereq: LATN 202 or equivalent.

LATN 351. Latin Didactic Literature. 3 Units.
Readings from didactic poetry such as Lucretius and Vergil’s Georgics. Parodies like Ovid’s Ars Amatoria or prose treatises may also be introduced. Prereq: LATN 202 or equivalent.

LATN 354. Drama. 3 Units.
Reading of at least one play each by Plautus and Terence. Attention to the history of Latin and Greek New Comedy, and the contrasting styles of the two authors. Prereq: LATN 202 or equivalent.

LATN 370. Latin Prose Composition. 3 Units.
This course is designed to strengthen students’ active command of Latin grammar and idiomatic prose style. At a basic level, students are trained to pay attention to details and thus write grammatically correct. Going beyond this, the course teaches Latin Idioms. Finally, it aims to develop students’ intuitive feeling for the Latin language. The ultimate goal is to write in a Ciceronian prose style. Prereq: LATN 202.
LATN 380. Advanced Topics in Latin Literature. 3 Units.
Study and discussion of important authors, works, and topics not covered regularly. Content will reflect particular interests of students and faculty and timeliness of topics. Prereq: LATN 202 or equivalent.

LATN 395. Directed Readings. 1 - 3 Unit.
Directed readings in Latin of authors selected to serve the individual interests and needs of undergraduate students. Each program planned and completed under the supervision of the instructor with whom the student wishes to work.
Department of Cognitive Science

Cognitive science is the scientific study of the mind in a transdisciplinary framework. The Department of Cognitive Science at Case Western Reserve University is specifically dedicated to the study of human higher cognition, including language, gesture, advanced social cognition, mathematical invention, scientific discovery, art, religion, music, literature, advanced tool use and advanced technology, theater and dance, fashions of dress, sign systems, creativity, and culture. The department draws on methods of research in the biological sciences, the social sciences, and the humanities. Its educational mission is to provide students with the best possible opportunity to integrate a wide variety of approaches and apply them to the study of human higher cognition.

The department provides basic training in core disciplines, as well as in a range of philosophical, evolutionary, linguistic, and computational issues bearing on cognitive science. It seeks to place cognitive science in a wider, more ecologically valid context than traditional programs in this field have typically allowed, so as to broaden our theories of those high-end cognitive capacities that mark human beings as distinctive.

The department offers an undergraduate major and minor in cognitive science and a master’s degree in cognitive linguistics. By developing wide-ranging expertise in at least two or three relevant disciplines, our students can prepare for a variety of career options. Training in several disciplines will also provide increased choices for postgraduate study.

Undergraduate Programs

Major

In addition to meeting general education requirements, cognitive science majors must complete a minimum of 30 semester hours in cognitive science and approved related course work: 15 hours in the foundation component and 15 hours of elective course work. The foundation courses provide all students with a common basis for further study. They consist of:

- COGS 101 Introduction to Cognitive Science 3
- COGS 201 Human Cognition in Evolution and Development 3
- COGS 202 Human Cognition Viewed from a Cultural Perspective 3
- One of the following quantitative methods courses: 3
  - ANTH 319 Introduction to Statistical Analysis in the Social Sciences
  - PSCL 282 Quantitative Methods in Psychology
  - STAT 201 Basic Statistics for Social and Life Sciences
- Five elective courses (three must be at the 200 or 300 level) 15

Total Units 30

Minor

The minor requires students to take the following:

- COGS 101 Introduction to Cognitive Science 3
- One of the following: 3
  - COGS 102 Introduction to Cognitive Neuroscience
  - COGS 201 Human Cognition in Evolution and Development
  - COGS 202 Human Cognition Viewed from a Cultural Perspective
- Three COGS courses at the 200 or 300 level 9

Total Units 15

The minor provides a good basic grounding in cognitive science, and allows students to narrow their exposure to those aspects of the field most relevant to their other academic interests. Individual programs can be developed in consultation with the chair of the department.

Graduate Program

MA in Cognitive Linguistics

“Cognitive linguistics goes beyond the visible structure of language and investigates the considerably more complex backstage operations of cognition that create grammar, conceptualization, discourse, and thought itself. The theoretical insights of cognitive linguistics are based on extensive empirical observation in multiple contexts, and on experimental work in psychology and neuroscience. Results of cognitive linguistics, especially from metaphor theory and conceptual integration theory, have been applied to wide ranges of nonlinguistic phenomena.”


Candidates may apply for admission to the degree program in cognitive linguistics with the purpose of pursuing the MA, or for non-degree status with the purpose of taking courses for credit that can be transferred to other institutions. The MA follows Plan A as described in the School of Graduate Studies (p. 662) section of this bulletin. Accordingly, it requires 30 credit hours and a written MA thesis.

Department Faculty

Todd Oakley, PhD
(University of Maryland)
Professor and Chair
Cognitive linguistics; discourse analysis; attention

Anthony Jack, PhD
(University College London)
Assistant Professor
Cognitive neuroscience; social cognition; consciousness; neuroimaging

Fey Parrill, PhD
(University of Chicago)
Assistant Professor
Cognitive aesthetics and poetics; narratology; embodiment and performance

Vera Tobin, PhD
(Oxford University)
Assistant Professor
Cognitive linguistics; discourse analysis; attention

Mark Turner, PhD
(University of California, Berkeley)
Institute Professor
Higher-order cognition and creativity; conceptual integration

Secondary Faculty

Florin Berindeanu, PhD
(University of Georgia)
Instructor, Department of Classics

Richard J. Boland, Jr., PhD
(Case Western Reserve University)
Professor of Information Systems, Weatherhead School of Management

Patrizia Bonaventura, PhD
(Ohio State University)
Courses

COGS 101. Introduction to Cognitive Science. 3 Units.
This course introduces students to the field of cognitive science. Cognitive scientists are interested in the nature of the human mind--basically, we ask how humans think. This is a huge question, and has been addressed in one way or another by pretty much every academic field. Cognitive science tries to unite work from many different fields, including computer science, neuroscience, psychology, linguistics, philosophy, music, art, and literary theory. In this course, you'll get a basic introduction to some of the topics that are central to human cognition, such as intelligence, categorization, language, and creativity. We'll ask what can be gained by taking an integrated, cognitive scientific approach to these topics.

COGS 102. Introduction to Cognitive Neuroscience. 3 Units.
A survey of the fundamental methods, findings, and theories that attempt to understand the human mind from a neuroscientific standpoint. The course provides the student with background knowledge of brain processes underlying such psychological phenomena as consciousness, sensation, perception, thought, language, and voluntary action. Since many fields of neuroscience have contributed to cognitive neuroscience, the approach of this course is cross-disciplinary. It introduces theories and data from clinical and experimental neuropsychology, brain imaging, neuroelectric and neuromagnetic brain activity, the neuroscience of language, and behavioral neuroscience, among other fields.

COGS 201. Human Cognition in Evolution and Development. 3 Units.
COGS 201 covers mind unfolding in time, including the fundamental methods, findings, and theories of human mental phylo- and ontogenesis. It provides the student with background knowledge about the unfolding of cognitive structures and functions over time, in both the deep temporal perspective of evolution (measured across many lifetimes) and the shorter one of development (measured within single lifetimes). The approach of the course is cross-disciplinary, including approaches that come from anthropology, archaeology, philosophy, computing science, comparative psychology, primatology, and comparative linguistics, among others.

COGS 202. Human Cognition Viewed from a Cultural Perspective. 3 Units.
This course studies the human mind in its natural environment: culture. It covers the fundamental methods, findings, and theories that attempt to understand the growth and evolution of cognition from either a social science or humanistic standpoint. It provides the student with background knowledge of theories of human cultural evolution and change, of the relationship between the cognizing individual and larger social-cognitive structures, and of such phenomena as distributed networks, cooperative mental work, and the phenomenology of human experience. Many disciplines have contributed to this knowledge; hence the approach of this course is cross-disciplinary, including ideas from cultural anthropology, literary studies, art and art history, musicology, philosophy, and the history of technology, among others.
COGS 204. Cognition and Computation. 3 Units.
This course explores possible uses of computational technology in the study of cognition. (1) The human or animal mind-supporting brain is not in any technical sense "just" a computer, but it is relevant to stimulate various cognitive phenomena by computation in order to model their formal properties. From perception to conception, images schemas, categories, and meanings found in linguistic semantics and syntax, and from bodily motion to the processes of abstraction, intentional orientation, and spatial navigation, computational modeling can help us understand mental architecture, the interrelations between iconicity and symbolization in mental representations, and the constraints and indeterminacies at work in social cognitive networks (distributed cognition). (2) It also is relevant in this course to analyze the cognitive roles of actual computation as a social and communicational technology, mirroring certain of our mental routines on the screens we interact with and program to manifest symbolic and iconic behaviors in ever-changing patterns of "Interface" communication, while the underlying systems control our social and technical environment. (3) Recent developments in Cognitive Robotics finally invite for an integration of semantic stimulation and the elaboration and implementation of language-based and motion-based competencies in mobile robots. Computation serves, in this perspective, the construction of a dynamic model of meaning linked to interaction (human-machine, machine-machine, and machine to human).

COGS 205. Cognition and Design. 3 Units.
Urbanism is design; architecture is design; of course, the aesthetic shaping of artifacts (such as computers, cars, and coffee machines) is design. Configuring surfaces, volumes, and portions of space in special ways, creating and changing formats for things and places that allow cultural practices to unfold while delimiting them, are essential "designing" endeavors of human civilization and are, necessarily, activities based on the cognitive capacities and constraints of our species. We 'cognize' the human world in terms and frames of 'designed' surroundings. Design is a basic expressive activity, by which we interact with our artificial and natural surroundings and create 'interfaces' between mind and reality, thus upholding and interpretable world. Landscapes and citiescapes, workspaces of all sorts, buildings and parks, exteriors and interiors of homes, factories, institutions, and temples; furniture, artifacts such as machines, tools, weapons, symbolic objects, even the configuration ('building') of our own bodies, are design. An inquiry into cultural cognition, aiming to understand how humans as socio-cultural beings think and feel, therefore needs to explore this dimension of spatial expressivity and to acknowledge it as a constitutive fact of human meaning production; it needs to study the aesthetic and pragmatic, political and historical, philosophical and religious, and simply everyday practical, semiotic aspects of this basic form of human creativity. This course will focus on spatial expressivity--design--in several primary keys and scales, including design for learning; design for verbal and technical communication, interaction, and commerce; design for expressions of authority and deliberation; and design for emotional display.

COGS 272. Morality and Mind. 3 Units.
Recent research in cognitive science challenges ethical perspectives founded on the assumption that rationality is key to moral knowledge or that morality is the product of divine revelation. Bedrock moral concepts like free will, rights, and moral agency also have been questioned. In light of such critiques, how can we best understand moral philosophy and religious ethics? Is ethics primarily informed by nature or by culture? Or is ethics informed by both? This course examines 1) ways in which cognitive science--and related fields such as evolutionary biology--impact traditional moral perspectives, and 2) how the study of moral philosophy and comparative ethics forces reconsideration of broad cognitive science theories about the nature of ethics. The course examines the concept of free will as a case study in applying these interpretive viewpoints. Interdisciplinary readings include literature from moral philosophy, religious ethics, cognitive science, and evolutionary biology. Offered as COGS 272, RLGN 272.

COGS 301. Special Topics in Cognitive Science. 3 Units.
This course offers instructors the opportunity to cover a more advanced and specialized topic in the field of cognitive science for third and fourth year students. Topics will vary from year to year.

COGS 302. SAGES Departmental Seminar: Methods and Theories in Cognitive Science. 3 Units.
This course takes a look at the discipline of cognitive science by exploring the methods that cognitive scientists use in their research. We'll discuss how different methods reflect different approaches and traditions of thought and how they provide different answers to particular questions. We'll also discuss the process of translating research into writing and talk about how different kinds of writing reflect the many different methods used in cognitive science. Recommended preparation: COGS 101, COGS 102, COGS 201, COGS 202.

COGS 303. SAGES Departmental Seminar: Current Controversies in Cognitive Science. 3 Units.
This course takes a look at the discipline of cognitive science by exploring the current controversies that impact cognitive scientists in their research. We'll discuss how different controversies effect different approaches and traditions of thought and how they elicit different answers to particular questions. We'll also discuss the process of translating research into writing and talk about how different kinds of writing reflect the many different controversial issues presented in cognitive science. Recommended preparation: COGS 101, COGS 102, COGS 201, and COGS 202.

COGS 304. Conceptual Integration. 3 Units.
Conceptual Integration, otherwise known as "blending", is a defining feature of higher-order human cognition, indispensable for all behaviors typically taken as distinctive to human beings. This course presents the cognitive mechanisms of conceptual integration, the constraints on its operation, and its deployment and expression in a range of human behaviors such as learning, invention, mathematical and scientific discovery, language, art music, gesture, social understanding, institutional performance, reasoning, decision, judgment, choice, design, and engineering. A student in the class will work on an individual research project in any of a variety of fields, including engineering (e.g. designing with blends), computer science, the arts, the humanities, the social sciences, cognitive neuroscience, and linguistics. Only one of COGS 304 and COGS 404 can be taken for credit within any degree program. Offered as COGS 304 and COGS 404.
COGS 305. Departmental Seminar: Moral Boundaries and Limits of Science. 3 Units.
Cognitive Science is essentially interdisciplinary, and this seminar will focus on deep issues that lie at the intersection between science and philosophy. The class will explore how, and to what extent, science might both shape our ethical judgments and help us to understand them. We will also consider what, if anything, our deep moral intuitions, as evidenced by strong sentiments such as disgust or repugnance, tell us about the nature of morality. Current scholarship in moral psychology, moral neuroscience, and moral philosophy are shedding new light on these issues. We will focus on moral boundaries: distinctions between things that have powerful ethical and emotional significance, at least for some people. We will consider the following boundaries: -Male/ female and moral responses to homosexuality; -Human/animal and moral responses to bestiality and stem cell research that inserts human stem cells into animals; -Life/death and moral responses to euthanasia; -Human/machine and the moral responses to artificial intelligence, robots, and the use of steroids to enhance athletes and warfighters. In addition to learning and writing about relevant psychological and neuroscientific research, the course contains two other essential aspects. First, students will engage with relevant philosophical issues and arguments. Are there moral facts? If so, what is their basis? Second, the course will include experiential aspects—students will be asked to examine their own ethical responses, and to reexamine them in light of what they are learning. Recommended Preparation: (any two of following pre-requisites) COGS 101, COGS 102, COGS 201, COGS 202.

COGS 313. Special Topics in Cognitive Linguistics. 3 Units.
This course covers special topics in the field of cognitive linguistics. Topics will vary from semester to semester. Offered as COGS 313 and COGS 413.

COGS 314. Animal Cognition and Consciousness. 4 Units.
This course examines the notions of intelligence, cognition, reasoning, consciousness, and mental content as they appear in the philosophical views and empirical studies of animals in individual and social contexts. We will review scientific findings that suggest striking likenesses and intriguing differences in the (apparent) thought processes of humans and animals, and ask whether the research techniques that brought us these results are fully adequate to measuring such unobservable entities as conscious experience and thought. Techniques of measurement range from naturalistic observation, to the processing of vocalizations, to memory and problem solving tasks, and the imaging of brain processes through fMRI scans, etc. Students will face the challenges and rewards of practicing these techniques and reworking philosophical theories in the service component of the course. Students will participate in veterinary or shelter work to provide needed animal care while studying animal behavior using cognitive ethological methods. We will compare methods for measuring consciousness and intelligence in animals to those used for human beings, and ask questions about the possibility of machine consciousness and the emergent property of group consciousness. Offered as BIOL 314, COGS 314, PHIL 314 and PHIL 414.

COGS 315. Mental Space Theory. 3 Units.
This course covers theory of mental spaces and methodology of mental space analysis, with special emphasis on the use of mental space theory to analyze human performance in various areas of cognition, including reasoning, judgment, decision, counterfactual thought, inference, planning, communication and language, gesture, social cognition, cognitive design and engineering, representation, learning, humor, symbol systems, and invention. It includes a consideration of experimental methods that have arisen under the influence of mental space theory. A student may earn credit for either COGS 315 or COGS 415, but not both. Offered as COGS 315 and COGS 415.

COGS 316. Decision-Making. 3 Units.
This course is a topical introduction to decision-making, a major area of cognitive social science, with connections to economics, law, political science, business, policy, and related fields. Topics include game theory and rational calculation, equilibrium, kinds of choice, heuristics, the role of affect in decision, framing, bounded rationality, mechanisms of choice such as heuristics, the role of social cognition in choice, concepts of self and other, and computer modeling of choice. The course also includes an introduction to the design of empirical behavioral research. Offered as COGS 316 and COGS 416.

COGS 318. Thinking Communication in Ancient and Medieval Literature. 3 Units.
The ancients were much concerned with the nature and validity of signs: Important decisions depended on the flight of birds or the coloration of the liver of a sacrificial victim. The relationship of language to truth, i.e., a reality beyond the contingent, was a crucial issue, not least because of the rise of sophistic rhetoric: for an orator, language was a tool in a contest rather than a means to true understanding. The discipline of medicine, developed by such important figures as Galen and Hippocrates, depended on the interpretation of physical signs to diagnose and treat ailments of mind and body. The term for the theory of signs - semiotics - is derived from the Greek term "semeiotike", and for many Greek philosophers and their Roman and medieval successors the sign was a key issue. For Christians especially, new forms of vision and discerning truth presented particular problems: after all, the Christian God revealed his intentions through "portents" that had to be read and interpreted. And even if sacred scripture was in some way understood as encapsulating the whole word, there were countless passages requiring clarification or adaptation to contemporary situations. In other words, the concern was with the relationship between a universe of structured signs (the subject of semiotics) and structures of interpersonal communication (pragmatics). Offered as CLSC 313 and COGS 318. Prereq: WLIT 211 or WLIT 212.

COGS 322. Human Learning and the Brain. 3 Units.
This course focuses on the question, "How does the human brain learn?" Through assigned readings, extensive class discussions, and a major paper, each student will explore personal perspectives on learning. Specific topics include, but are not limited to: the brain's cycle of learning; neocortex structure and function; emotion and limbic brain; synapse dynamics and changes in learning; images in cognition; symbolic brain (language, mathematics, music); memory formation; and creative thought and brain mechanisms. The major paper will be added to each student's SAGES writing portfolio. In addition, near the end of the semester, each student will make an oral presentation on a chosen topic. Offered as BIOL 302 and COGS 322.
COGS 324. Discourse and Cognition. 3 Units.
This course explores discourse and interaction from a cognitive linguistic perspective, with special emphasis on mental space, conceptual integration, and cognitive grammar. Cognitive linguistics is a paradigm of language study that seeks to understand language structure, acquisition, and use as a function of embodied conceptualization. This means that it seeks to describe and explain language as a symbolic activity involving general cognitive processes, such as perception, attention, memory, categorization, framing and sensory-motor activities. Another burgeoning area of interest among cognitive linguists is social-cognition, gesture, and interaction. In each of these endeavors, the goal is to explain as much about language without having to posit autonomous and language-specific faculties. While cognitive linguists have always been seen discourse as a legitimate object of study, many still take the sentence, clause, and phrase as their primary unit of analysis. In this course, we shall focus on the relationship between discourse and relevant cognitive processes such as attention, memory, categorization, framing, and kinesthetic experience, with the intention of exploring who these cognitive processes shape discourse in English and other languages. We will subsequently reverse our orientation and explore how discourse (in text as well as embodied/face-to-face) in turn shapes how we pay attention, remember, categorize, frame, and even experience the world. The readings, discussion, and/or research projects for this course may include the following topics: interactional conduct, intersubjectivity, consciousness, co-speech gesture, mental spaces, prosody, time and temporality, and working memory. The international structure of this course will likely lead to focused discussion and research projects on English as a Second & Foreign Language. Offered as COGS 324 and COGS 424.

COGS 325. Cognitive Approaches to Literature. 3 Units.
This course approaches literature as a window into language, in which cognition is characterized by the same imaging and imaginary properties as artistic literature. It is an attempt to identify and analyze procedures as aesthetically interesting and generally relevant forms of human thinking, feeling, imagining, fantasizing, and conceptualizing. The course introduces current theories of literature in relation to language and mind, and it presents and discusses practical applications in critical reading and text analysis, using examples from modern literature in the main genres. A student may earn credit for either COGS 325 or COGS 425 but not both. Recommended preparation: COGS 101, COGS 202. Offered as COGS 325 and COGS 425.

COGS 326. Cognitive Approaches to Music. 3 Units.
This course will study the ways in which the presence of music relates to cognition and the semiotics of inter-subjective communication at large—the emergence of language, gesture, and symbolization of time. Topics of interests include: the ways that specific works of musical art invite semantic interpretation; how intelligible musical structure relates to meaning; how musical activities correspond to brain activity; and how music relates to and/or induces emotion. Recommended preparation: COGS 101, COGS 202. Offered as COGS 326 and COGS 426.

COGS 327. Gesture in Cognition and Communication. 3 Units.
Most people never notice that when they are talking, they’re also gesturing. Why do we produce these gestures? What can studying them tell us about the human mind? This course surveys scientific research on gesture, exploring topics such as the role of gesture in communication, cross-cultural differences in gesture, and the relationship between gesture and signed languages. The course will focus on gestures produced with speech, but will cover symbolic and ritualized gesture in the visual arts and in dance. Offered as COGS 327 and COGS 427 and MLIT 327.

COGS 328. Cognition and Visual Aesthetic Experience. 3 Units.
This course is offered as a reciprocal exchange between new research on the mind/brain and existing theories of visual aesthetics. It would appeal to students from diverse majors, ranging from art, language or philosophy, to psychology, computer science or pre-medicine. The material covered links a traditional approach to philosophical aesthetics with a most up-to-date research on visual perception and brain functioning. Recommended preparation: COGS 101, COGS 202.

COGS 329. Performance and the Embodied Mind. 3 Units.
In the past twenty years cognitive scientists working in neuroscience, psychology, linguistics, philosophy, and related fields have made great progress in understanding perception, empathy, the human mind’s sense of space and movement, emotions, meaning-making, and many other cognitive areas that are crucial to producing, enacting, and responding to performances on stage. This course will look at ways of incorporating many of the insights of cognitive science into the existing work of theatre and performance scholarship. The course will thus link a more traditional approach to the body in theatre and dance studies, where it has commonly been considered one of the main means of communication, to a most up-to-date research on embodied cognition. Observation of live and pre-recorded dance and theatre performances will regularly be used to supplement the theoretical discussion. Recommended preparation: COGS 101, COGS 202.

COGS 340. Seminar in Enlightenment Art and Literature: Piranesi and Vico. 3 Units.
This course explores aspects of the European eighteenth century as a transformative epoch in the history of western culture. Though the Enlightenment is usually associated especially with France, in this course we will focus on Italy, as the irresistible goal of travelers taking part in the “Grand Tour,” and as a landscape of powerful ancient and modern architecture and artworks universally recognized as exemplary. In particular we will study one of the strangest and most fascinating visual artists of the period, the self-proclaimed architect Giovanni Battista Piranesi (1720-1778) famous no less now than in his own time for his fantastic prison engravings as well as his views of Rome, involving a radical rethinking of the city as a particular kind of inhabited as well as imagined space. Piranesi’s polemical response to the advocates of the Greek revival, then coming into fashion, will lead into discussion of the key philosophical debates and aesthetic shifts of the time, notably the emergence of the notion of the sublime as a category eventually subversive of western ideals of rationality and still present -- and potent -- in our own culture. Finally we will place Piranesi within a current of discussion of the origins and nature of language and of human society in general, not least as manifested in architecture and other symbolic practices. The leading figure here is the Neapolitan G.B. Vico, whose New Science of 1725 remains one of the most stimulating texts in the western intellectual tradition. Offered as CLSC 340, COGS 340, WLIT 340, CLSC 440, and WLIT 440.
COGS 349. Biocultural Approaches to Religion. 3 Units.
This course studies religious beliefs and rituals from a biocultural perspective. A biocultural approach to religion is based on the idea that human religiosity is informed by both our evolutionary biological makeup and by our ability to construct culture to adapt to variable social worlds and environments. According to a biocultural view, humans are biologically constrained but have the cultural capacity to adapt to the world in a variety of ways. Thus, a biocultural approach to religion asserts that biology and culture operate in tandem and that both biological and cultural insights are required in order to understand and explain religious beliefs and practices. This course explores these assumptions and examines them against specific religious data. This course introduces students to major ideas, concepts, and questions that motivate biocultural approaches to religion. The course requires students to apply course material to a final research project that explores particular religious beliefs and/or practices in terms of the intersection of cultural choices and biological constraints. Students will present their research findings to the class. Students who take this course under the COGS designation are expected to engage substantively with the contemporary scientific study of the human mind in their research project and other course work. Offered as RLGN 349, RLGN 449 and COGS 349.

COGS 352. Language, Cognition, and Religion. 3 Units.
This course utilizes theoretical approaches found in cognitive semantics -- a branch of cognitive linguistics -- to study the conceptual structures and meanings of religious language. Cognitive semantics, guided by the notion that conceptual structures are embodied, examines the relationship between conceptual systems and the construction of meaning. We consider such ideas as conceptual metaphor theory, conceptual blending, Image schemas, cross-domain mappings, metonymy, mental spaces, and idealized cognitive models. We apply these ideas to selected Christian, Buddhist, and Chinese religious texts in order to understand ways in which religious language categorizes and conceptualizes the world. We examine both the universality of cognitive linguistic processes and the culturally specific metaphors, conceptual blends, image schemas, and other cognitive operations that particular texts and traditions utilize. Offered as RLGN 352, RLGN 452, COGS 352 and COGS 452.

COGS 363. Philosophy and Social Neuroscience. 3 Units.
A philosophical examination of recent research in human cognition and emotion at the intersection of the social sciences and neurological sciences. The course provides the student with background knowledge of brain processes underlying such social and cultural phenomena as bonding, aggression, imitation, mind-attribution, language, sexual behavior, moral action, and creativity. The approach of this course is at once scientific (comparing methods, findings and questions as they arise in clinical and experimental neuropsychology, brain imaging, neurolinguistics, and behavioral neuroscience) and humanistic, asking critical questions about the nature and methods of a science of cognition, and surveying moral responses from a neurologic and philosophic perspective. Recommended preparation: PHIL 101 or COGS 201. Offered as COGS 363 and PHIL 363.

COGS 365. Advanced Topics in Cognitive Neuroscience. 3 Units.
This course focuses on specific areas of research in cognitive neuroscience in some depth. The first half of the semester covers basics and fundamental research areas (e.g., perception, attention) and examines the (sometimes controversial) theoretical issue of what cognitive neuroscience techniques tell us about the mind. The second half of the semester is dedicated to examining selected research topics of interest to students. Students research and write 'grant proposals' for cognitive neuroscience experiments. The class culminates with students and invited faculty simulating a funding panel, and deciding which grants to 'fund' from a limited budget. Prereq: COGS 102.

COGS 366. Functional Magnetic Resonance Imaging. 3 Units.
fMRI is the workhorse of cognitive neuroscience research. This course will take an in-depth look at this methodology, including hands-on experience analyzing imaging data. The course will address the following issues: How do MRI and fMRI work? What does fMRI actually measure and how does that relate to cognition? What are the standard steps involved in processing and analyzing fMRI data to help answer specific questions? The course culminates in the production of a report of a novel analysis of imagining data that the students have performed (in small groups), including a broader description of what that analysis reveals about the neural basis of cognition. Prereq: COGS 102.

COGS 373. Intelligence and Cognition. 3 Units.
This course will focus on the notion and meaning of intelligence. What is intelligence? How is it measured, and are these measures adequate to the task? Is there more than one kind of intelligence? What is the relationship between individuals, genetic factors, biological factors, and socio-cultural-economic factors in the development of intelligence? How are language and thought related to intelligence? What is the difference between intelligence and talent? Intelligence seems to be necessary for culture, art, religious belief, the creation of theories and the quest for knowledge, truth and morality; thus intelligence is a necessary condition for the study of itself. To attempt to understand intelligence is an undertaking in which we will ask questions about the self and the common nature of humanity, while simultaneously examining the abilities of animals and machines. What is the mark of intelligence? Recommended preparation: PHIL 101 or COGS 201. Offered as COGS 373 and PHIL 373.

COGS 378. Computational Neuroscience. 3 Units.
Computer simulations and mathematical analysis of neurons and neural circuits, and the computational properties of nervous systems. Students are taught a range of models for neurons and neural circuits, and are asked to implement and explore the computational and dynamic properties of these models. The course introduces students to dynamical systems theory for the analysis of neurons and neural learning, models of brain systems, and their relationship to artificial and neural networks. Term project required. Students enrolled in MATH 478 will make arrangements with the instructor to attend additional lectures and complete additional assignments addressing mathematical topics related to the course. Recommended preparation: MATH 223 and MATH 224 or BIOL 300 and BIOL 306. Offered as BIOL 378, COGS 378, MATH 378, BIOL 478, EBME 478, EECS 478, MATH 478 and NEUR 478.
COGS 381. Philosophy and Cognitive Neuroscience. 3 Units.
This course will focus on the various methodologies used in the cognitive neurosciences, and explore their strengths and weaknesses from scientific and philosophical standpoints. We will begin by examining baseline measures (including IQ tests, tasks of cognitive flexibility, verbal and visual memory, causal/sequential thinking and narrative tasks) and their experimental design. Lesion methods will follow, with an eye toward understanding the strength of inferences that can be drawn from such data. The course will also focus on imaging techniques (CAT, PET, SPECT, FMRI, TMS, etc.) as well as measures of electrical activity such as EEG and single-cell recordings. Students will become familiar with many fundamental assumptions necessary for the implementation of each method, and philosophical questions associated with these endeavors and their potential impact on our knowledge and society. Recommend preparation: PHIL 101 or COGS 201. Offered as COGS 381 and PHIL 381.

COGS 383L. Vocalization and Cognition Lab. 1 Unit.
This is a laboratory section intended to provide hands-on training and experience with sound processing and analysis of animal vocalizations in the context of cognitive science, philosophy, and biology. Students will ask and answer questions surrounding language, meaning, mind, mental states, animal and human cognition. How does a science of content and language actually proceed? How do we measure behavior for use as an indicator of cognition? What pragmatic constraints are found when we explore the natural world? What causes us to interpret certain symbols as systematic? The laboratory work begins with an understanding of different software for sound analysis with an emphasis on the bioacoustic experimental method. Frog vocalization exercises will familiarize students with the process of data categorization, analysis and comparison, and will be the foundation for understanding hypothesis testing within a Darwinian theoretical backdrop. Cetacean vocalization analysis will press students to move beyond comparison and analysis to consider and evaluate the standard evidence types used in cognitive science to measure the mind. Recommended preparation: PHIL 101 or COGS 201. Offered as COGS 383L and PHIL 383L.

COGS 390. Introduction to General Semiotics. 3 Units.
Semiotics, the study of meaning and signs conveying meaning, is a central part of cognitive semiotics, or ‘high level’ cognitive semantics. This discipline is typically taught in departments of linguistics, cognitive science, philosophy, or cultural studies. The domain of semiotics is in fact widely intersecting with other disciplines (general linguistics, philosophy, neuroscience, anthropology, music, literature, architecture, and the arts). Sign theory, text theory, studies of narrative structure, enunciation, natural logic, rhetoric and poetics, speech act forms, are important components in this field.

COGS 391. Introduction to Text Semiotics. 3 Units.
Introduction to Text Semiotics addresses both students of Literature and students in Cognitive Science. Most of the authors included in the reading list extend their linguistic approach towards fields that intersect literature, psychology, philosophy, aesthetics, and anthropology. The scholarly traditions of text analysis and structural theory of meaning, including authors from classical formalism, structuralism, structural semiotics, and new criticism will be connected to cognitive theories of meaning construction in text, discourse, and cultural expressions in general. The focus of this course, taught as a seminar, is on empirical studies, specific text analyses, discourse analyses, speech act analyses, and other studies of speech, writing, and uses of language in cultural contexts. This course thus introduces to a study of literature and cultural expressions based on cognitive science and modern semiotics—the new view that has been coined Cognitive Semiotics. Offered as COGS 391 and WLIT 391.

COGS 397. SAGES Capstone in Cognitive Science. 3 Units.
Supervised original research on a topic in cognitive science, culminating in a public presentation. The research may be in the form of an independent research project, a literature review, or some other form approved by the department.

This course is for students with special interests and commitments that are not fully addressed in regular courses, and who wish to work independently.

COGS 401. Special Topics in Cognitive Science. 3 Units.
Special Topics in Cognitive Science at the 400-level. Topics vary. Permission of department is required.

COGS 404. Conceptual Integration. 3 Units.
Conceptual Integration, otherwise known as “blending”, is a defining feature of higher-order human cognition, indispensable for all behaviors typically taken as distinctive to human beings. This course presents the cognitive mechanisms of conceptual integration, the constraints on its operation, and its deployment and expression in a range of human behaviors such as learning, invention, mathematical and scientific discovery, language, art music, gesture, social understanding, institutional performance, reasoning, decision, judgment, choice, design, and engineering. A student in the class will work on an individual research project in any of a variety of fields, including engineering (e.g. designing with blends), computer science, the arts, the humanities, the social sciences, cognitive neuroscience, and linguistics. Only one of COGS 304 and COGS 404 can be taken for credit within any degree program. Offered as COGS 304 and COGS 404.

COGS 406. Theory of Cognitive Linguistics I. 3 Units.
COGS 406 is the first course in a two-course sequence designed to provide an introduction to cognitive linguistics at the M.A. level. It supports student work in COGS 408 and 409; the Workshop courses. This course begins with a discussion of major theoretical questions in linguistics. We first ask how these questions have been approached within theoretical frameworks which view language and general cognition as being separate from one another. The course then focuses on the methods that have been developed in cognitive linguistics in the last ten to twenty years for the study of phonology, syntax, semantics, and pragmatics. We ask how approaches that relate language to general cognitive processes (perception, memory, categorization, etc.) can lead to a deeper understanding both of language and of the human mind.
COGS 407. Theory of Cognitive Linguistics II. 3 Units.
COGS 407 is the second course in a two-course sequence designed to provide an introduction to theory of cognitive linguistics at the MA level. It covers contemporary theory in cognitive linguistics in greater detail and supports student work in COGS 408 and 409, the Workshop courses. Prereq: COGS 406 or consent of instructor.

COGS 408. Workshop on Cognitive Linguistics I. 3 Units.
This is the first in a two-course sequence (408 & 409) designed to provide experience in research methods in cognitive linguistics at the MA level. A workshop in which students read examples of cognitive linguistics research, develop their own topics (theoretical or empirical), and work on them to produce a final paper.

COGS 409. Workshop in Cognitive Linguistics II. 3 Units.
The second course in a two-course sequence (408 & 409) designed to provide experience in research methods in cognitive linguistics at the MA level. A workshop in which students read examples of cognitive linguistics research, develop their own topics (theoretical or empirical), and work on them to produce a final paper. Prereq: COGS 408 or consent of instructor.

COGS 413. Special Topics in Cognitive Linguistics. 3 Units.
This course covers special topics in the field of cognitive linguistics. Topics will vary from semester to semester. Offered as COGS 313 and COGS 413.

COGS 415. Mental Space Theory. 3 Units.
This course covers theory of mental spaces and methodology of mental space analysis, with special emphasis on the use of mental space theory to analyze human performance in various areas of cognition, including reasoning, judgment, decision, counterfactual thought, inference, planning, communication and language, gesture, social cognition, cognitive design and engineering, representation, learning, humor, symbol systems, and invention. It includes a consideration of experimental methods that have arisen under the influence of mental space theory. A student may earn credit for either COGS 315 or COGS 415, but not both. Offered as COGS 315 and COGS 415.

COGS 416. Decision-Making. 3 Units.
This course is a topical introduction to decision-making, a major area of cognitive social science, with connections to economics, law, political science, business, policy, and related fields. Topics include game theory and rational calculation, equilibria, kinds of choice, heuristics, the role of affect in decision, framing, bounded rationality, mechanisms of choice such as heuristics, the role of social cognition in choice, concepts of self and other, and computer modeling of choice. The course also includes an introduction to the design of empirical behavioral research. Offered as COGS 316 and COGS 416.

COGS 424. Discourse and Cognition. 3 Units.
This course explores discourse and interaction from a cognitive linguistic perspective, with special emphasis on mental space, conceptual integration, and cognitive grammar. Cognitive linguistics is a paradigm of language study that seeks to understand language structure, acquisition, and use as a function of embodied conceptualization. This means that it seeks to describe and explain language as a symbolic activity involving general cognitive processes, such as perception, attention, memory, categorization, framing and sensory-motor activities. Another burgeoning area of interest among cognitive linguists is social-cognition, gesture, and interaction. In each of these endeavors, the goal is to explain as much about language without having to posit autonomous and language-specific faculties. While cognitive linguists have always been seen discourse as a legitimate object of study, many still take the sentence, clause, and phrase as their primary unit of analysis. In this course, we shall focus on the relationship between discourse and relevant cognitive processes such as attention, memory, categorization, framing, and kinesthetic experience, with the intention of exploring who these cognitive processes shape discourse in English and other languages. We will subsequently reverse our orientation and explore how discourse (in text as well as embodied/face-to-face) in turn shapes how we pay attention, remember, categorize, frame, and even experience the world. The readings, discussion, and/or research projects for this course may include the following topics: interactional conduct, intersubjectivity, consciousness, co-speech gesture, mental spaces, prosody, time and temporality, and working memory. The international structure of this course will likely lead to focused discussion and research projects on English as a Second & Foreign Language. Offered as COGS 324 and COGS 424.

COGS 425. Cognitive Approaches to Literature. 3 Units.
This course approaches literature as a window into language, in which cognition is characterized by the same imaging and imaginary properties as artistic literature. It is an attempt to identify and analyze procedures as aesthetically interesting and generally relevant forms of human thinking, feeling, imagining, fantasizing, and conceptualizing. The course introduces current theories of literature in relation to language and mind, and it presents and discusses practical applications in critical reading and text analysis, using examples from modern literature in the main genres. A student may earn credit for either COGS 325 or COGS 425 but not both. Recommended preparation: COGS 101, COGS 202. Offered as COGS 325 and COGS 425.

COGS 426. Cognitive Approaches to Music. 3 Units.
This course will study the ways in which the presence of music relates to cognition and the semiotics of inter-subjective communication at large—the emergence of language, gesture, and symbolization of time. Topics of interests include: the ways that specific works of musical art invite semantic interpretation; how intelligible musical structure relates to meaning; how musical activities correspond to brain activity; and how music relates to and/or induces emotion. Recommended preparation: COGS 101, COGS 202. Offered as COGS 326 and COGS 426.
COGS 427. Gesture in Cognition and Communication. 3 Units.
Most people never notice that when they are talking, they’re also gesturing. Why do we produce these gestures? What can studying them tell us about the human mind? This course surveys scientific research on gesture, exploring topics such as the role of gesture in communication, cross-cultural differences in gesture, and the relationship between gesture and signed languages. The course will focus on gestures produced with speech, but will cover symbolic and ritualized gesture in the visual arts and in dance. Offered as COGS 327 and COGS 427 and MLIT 327.

COGS 452. Language, Cognition, and Religion. 3 Units.
This course utilizes theoretical approaches found in cognitive semantics -- a branch of cognitive linguistics -- to study the conceptual structures and meanings of religious language. Cognitive semantics, guided by the notion that conceptual structures are embodied, examines the relationship between conceptual systems and the construction of meaning. We consider such ideas as conceptual metaphor theory, conceptual blending, Image schemas, cross-domain mappings, metonymy, mental spaces, and idealized cognitive models. We apply these ideas to selected Christian, Buddhist, and Chinese religious texts in order to understand ways in which religious language categorizes and conceptualizes the world. We examine both the universality of cognitive linguistic processes and the culturally specific metaphors, conceptual blends, image schemas, and other cognitive operations that particular texts and traditions utilize. Offered as RLGN 352, RLGN 452, COGS 352 and COGS 452.

COGS 499. Independent Studies. 1 - 3 Unit.
This course is a face-to-face seminar between students and instructor, aiming at letting and helping the students independently develop original research on well-defined topics in the field of cognitive linguistics. Themes can vary within the wide area of cognition and culture.

COGS 651. Thesis. 1 - 6 Unit.
Conduct independent research and writing in Cognitive Linguistics under the guidance of a faculty adviser from Cognitive Science. The precise requirements of the course are to be determined by the faculty advisor. Prereq: COGS 406 and COGS 407 and COGS 408. Coreq: COGS 409.
Department of Dance

The Department of Dance offers education and participation in many aspects of dance, with course offerings in modern dance and ballet technique, choreography, kinesiology, history, production and more. Students have the opportunity to perform onstage as well as to serve on the technical crews in dance concerts. The high ratio of faculty to students ensures that students will be able to work closely with highly skilled professionals. The department treats all performances as educational experiences and welcomes the participation of all students, particularly in Mather Dance Collective (MaDaCo), regardless of their academic majors and career goals.

Graduates of the dance program are currently employed as modern dance company members (regionally and nationally), company directors/choreographers, and dance production managers, and as teachers, program directors, and administrators in colleges and universities. Others have transitioned into such disciplines as physical therapy and massage therapy.

Undergraduate Programs

Major

The basic course requirements for all dance majors are as follows:

- **DANC 121** Dance in Culture - Ethnic Forms 3
- **or DANC 122** Dance in Culture - Theatrical Forms
- **DANC 203** Second-Year Modern Dance Techniques I 3
- **DANC 204** Second-Year Modern Dance Techniques II 3
- **THTR 101** Acting I For Minors 3

At least 4 but no more than 8 hours of:

- **DANC 385/386** Rehearsal and Production 4-8
- Six hours from Anatomy, Art, English, Music, or Philosophy at or above the 300 level 6
- **DANC 303** Third-Year Modern Dance Techniques I
- **DANC 304** Third-Year Modern Dance Techniques II
- **DANC 355** History of Modern Dance
- **DANC 403** Fourth-Year Modern Dance Technique I
- **DANC 404** Fourth-Year Modern Dance Technique II
- **DANC 414** The Craft of Choreography
- **DANC 423** Light Design for Theatrical Dance
- **DANC 451** Costume Design and Construction for Dance
- **DANC 460** Ballet Technique for Modern Dance Students I
- **DANC 461** Ballet Technique for Modern Dance Students II

One of the following:

- **DANC 415** Choreography and Music
- **DANC 416** Choreography and Theatrical Elements
- **DANC 426** Advanced Topics in Choreography
- **DANC 445** Kinesiology for Dance
- **DANC 446** Topics in Dance Medicine, Science, and Wellness

Senior Capstone departmental course: 3

**DANC 396** SAGES Senior Capstone in Dance (recommended)

Total Units: 28-32

Total hours, not including DANC 385 Rehearsal and Production/DANC 386 Rehearsal and Performance: 40-43

Departmental Honors

All majors are encouraged to apply for DANC 397 Honors Studies I and DANC 398 Honors Studies II in their final year. This adds 6 hours to the total.

Minor

- **DANC 103** First-Year Modern Dance Techniques I 3
- **DANC 104** First-Year Modern Dance Techniques II 3
- **DANC 203** Second-Year Modern Dance Techniques I 3
- **DANC 204** Second-Year Modern Dance Techniques II 3

One of the following:

- **DANC 460** Ballet Technique for Modern Dance Students I
- **DANC 461** Ballet Technique for Modern Dance Students II
- **DANC 303** Third-Year Modern Dance Techniques I
- **DANC 304** Third-Year Modern Dance Techniques II

Total Units: 13

Graduate Programs

Master of Arts

Although the graduate dance program is geared toward the Master of Fine Arts degree (see below), all graduate students begin in the MA program. Advancement to the MFA program occurs upon faculty recommendation to the Dean of Graduate Studies in the third semester. The course work for the MA may be similar to that for the Master of Fine Arts, enhanced by related studies in theater and other departments. The candidate’s program of study will be designed by the primary dance faculty. As required by the School of Graduate Studies, students must maintain a minimum grade point average of 2.75. The Department of Dance requires an average of 3.0.

MA candidates must complete a minimum of 30 hours, following a program similar to that suggested below. The principal faculty advisor may suggest modifications.

**Technique Classes:** 9-12

- **DANC 417** Advanced Modern Dance Technique I
- **DANC 418** and Advanced Modern Dance Technique II
- **DANC 403** Fourth-Year Modern Dance Technique I
- **DANC 460** and Ballet Technique for Modern Dance Students I
- **DANC 461** Ballet Technique for Modern Dance Students II

**Choreography:** 6-9

- **DANC 414** The Craft of Choreography
- **DANC 415** Choreography and Music
- **DANC 416** Choreography and Theatrical Elements

**Eurhythmics:** 12

- **MUDE 501** Special Reading (M.M. and M.A.)

2-6 hours in Kinesiology and topics in dance medicine, science, and wellness: 2-6

**DANC 445/446** Kinesiology for Dance 3

One of the following suggested advanced electives: 3

- **DANC 535** Modern Dance Pedagogy
- **DANC 455** History of Modern Dance
- **DANC 505** Music Resources for Modern Dance

**Project-oriented seminars:** 2-4

- **DANC 601** Special Projects
- **DANC 423** Light Design for Theatrical Dance
- **DANC 451** Costume Design and Construction for Dance

Total Units: 41-53

The program recommends The School of Graduate Studies’ plan B, with requirements including a non-performance, non-production thesis on a topic approved by the primary program faculty. The thesis must be a substantial contribution to the field, with potential for publication or presentation. The MA thesis must be completed no later than one academic year beyond the completion of the course requirements.
Master of Fine Arts (Contemporary Dance)

The Master of Fine Arts degree, available with emphasis areas in choreography, performance, pedagogy, and complementary courses in dance science, is a terminal pre-professional degree. Candidacy for the MFA program requires an undergraduate degree with (ideally) a major in dance, equivalent training and experience, or demonstrable potential for work at the MFA level. In addition, each candidate must provide evidence of technical skill and creative ability. Participation as a part-time student is not recommended.

At the end of each semester in residence, the student’s skill and creative ability are evaluated in light of his or her work in the department. Only students who have clearly demonstrated growth and excellence are permitted to remain in the program. The award of the MFA degree is contingent upon the student’s academic progress and upon the faculty’s assessment that the candidate possesses the potential to work in the field of dance on a professional level.

Requirements for the MFA degree include:

1. A minimum of 60 semester hours of graduate work beyond the bachelor’s degree
2. A cumulative grade point average of 3.0 for all course work on the graduate level
3. Completion of the course requirements for the MFA Thesis Portfolio
4. Successful completion of the third year in performance in the Mather Dance Center mainstage season

Specific requirements for the MFA degree are as follows:

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<thead>
<tr>
<th>Courses</th>
<th>Total Units</th>
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<tbody>
<tr>
<td>18-24 hours of dance technique</td>
<td>18-24</td>
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<tr>
<td>12 hours of choreography</td>
<td>12</td>
</tr>
<tr>
<td>4 hours (two each) of light and costume design</td>
<td>4</td>
</tr>
<tr>
<td>MUDE 501 Special Reading (M.M. and M.A.)</td>
<td>1</td>
</tr>
<tr>
<td>MUDE 501 Special Reading (M.M. and M.A.) (MUDE 501 is to be taken twice for a total of 2 credit hours)</td>
<td>1</td>
</tr>
<tr>
<td>3 hours of contemporary dance history</td>
<td>3</td>
</tr>
<tr>
<td>3 hours of music resources</td>
<td>3</td>
</tr>
<tr>
<td>12-15 hours of kinesiology, pedagogy, or allied fields, chosen in consultation with advisor</td>
<td>12-15</td>
</tr>
<tr>
<td>6 hours of creative thesis</td>
<td>6</td>
</tr>
<tr>
<td>Total Units</td>
<td>60-69</td>
</tr>
</tbody>
</table>

Department Faculty

Karen Potter, MFA
(Case Western Reserve University)
Associate Professor and Chair
Contemporary dance technique; choreography; pedagogy

Gary Galbraith, MFA
(Case Western Reserve University)
Professor; Artistic Director, Mather Dance Ensemble
Contemporary dance technique; choreography; dance wellness; production and technology

Courses

DANC 103. First-Year Modern Dance Techniques I. 3 Units.
Introduction to modern dance technique, through active participation, to serve individual development of basic movement principles, locomotor and axial skills and dance vocabulary, all in relation to time, space and dynamics and with a broad spectrum of applications, including dance, music, sports and theater. Explorations and investigations, both practical and cognitive, are designed to lay an introductory foundation for participating in and appreciating and understanding creative expressions.

DANC 104. First-Year Modern Dance Techniques II. 3 Units.
Continuation of DANC 103.

DANC 121. Dance in Culture - Ethnic Forms. 3 Units.
A lecture class designed to introduce dance as an art form and the many roles it plays in a variety of cultures. Focus will be on ethnic forms and primal cultures.

DANC 122. Dance in Culture - Theatrical Forms. 3 Units.
Introduction to an historical and cultural overview of many different forms of dance from various cultures specifically selected to encompass geographic diversity and represent different periods in history. Basic craft elements of the structures of dance will be introduced to provide a foundation for viewing dance and developing a personal aesthetic.

DANC 160. Introduction to Ballet Technique I. 3 Units.
This introductory-level course offers the beginning ballet student the basic tenets and principles of ballet technique. Classwork will involve strong emphasis on proper alignment of the body, dynamic timings, and a command of ballet terminology.

DANC 161. Introduction to Ballet Technique II. 3 Units.
Continuation of DANC 160. Prereq: DANC 160 or consent of department.

DANC 203. Second-Year Modern Dance Techniques I. 3 Units.
For the performing arts student, normative movement principles are formally extended in both theory and application to include individual correction, modification of adaptation as foundational preparation for the subsequent specialized training needs of the actor, dancer, and singer. Prereq: DANC 103 and DANC 104.

DANC 204. Second-Year Modern Dance Techniques II. 3 Units.
Continuation of DANC 203. Prereq: DANC 103 and DANC 104.

DANC 237. Religion and Dance in South Asia. 3 Units.
This is an experimental interdisciplinary course in religion, dance, and South Asian studies. We will explore the performance of religion in bharata natyam, one storytelling dance form from South Asia. This dance style draws upon Hindu devotional (bhakti) allegories of sacred and profane love in its choreography. Lover and beloved, as the ideal relationship between God and the human, becomes the model for the performed relationship between heroes and heroines (nayaka-nayaki) danced on stages and, more recently, Bollywood screens. To this end we will examine primary and secondary sources on bharata natyam and aesthetic theory/classical dramatics. We will also observe dance performances in the greater Cleveland area. Offered as RLGN 237 and DANC 237.

DANC 260. Second-Year Ballet Technique I. 3 Units.
In-depth exploration of principles and foundations of ballet technique as preparation for the specialized training needs of dancers.
DANC 261. Second-Year Ballet Technique II. 3 Units.
Continuation of DANC 260. Prereq: DANC 260 or consent of department.

DANC 303. Third-Year Modern Dance Techniques I. 3 Units.
For the dance major and upper level non-major. Formalities of dance technique as a contemporary American art form serve as the basis of the aesthetic and technical challenges explored in the course. Prereq: DANC 204.

DANC 304. Third-Year Modern Dance Techniques II. 3 Units.
Continuation of DANC 303. Recommended preparation: DANC 303 or consent of department.

DANC 314. The Craft of Choreography. 3 Units.
An in-depth investigation of choreographic craft elements is presented through lecture, practical involvement and specified studies. Emphasized are tools to discover primary movement vocabulary, development of vocabulary through permutative investigations and the co-ordering of movement vocabulary into phrases, structural units, and larger sections. Offered as DANC 314 and DANC 414.

DANC 315. Choreography and Music. 3 Units.
Combining craft resources with emphasis on use of music. Music selections, historically categorized, are chosen for the purpose of analyzing metric and structural characteristics in accord with which choreography will be created. Offered as DANC 315 and DANC 415. Prereq: DANC 314 or requisite not met permission.

DANC 317. Advanced Modern Dance Technique I. 1 - 3 Unit.
Emphasis on performing skills enlarged to include rehearsal and performance of full repertory works. Adaptability, versatility, and fidelity to choreographic intention stressed. Offered as DANC 317 and DANC 417. Prereq: DANC 304

DANC 318. Advanced Modern Dance Technique II. 1 - 3 Unit.
Continuation of DANC 317/417. Offered as DANC 318 and DANC 418. Prereq: DANC 317.

DANC 324. Dance Production Resources. 3 Units.
An examination of dance production resources such as costumes construction, lighting design, and management. Exercises include design, construction, and implementation to emphasize practical applications.

DANC 335. Modern Dance Pedagogy. 3 Units.
The study and investigation of the approaches and methods of teaching modern dance. Detailed study is made of kinesthetic, oral, and creative factors in teaching dance. Opportunity to assist and teach under supervision. Offered as DANC 335 and DANC 535.

DANC 345. Kinesiology for Dance. 3 Units.
Seminar and laboratory for assessment of kinesiological and biomechanical principles as related to dance. Assessment of current research will be implemented to affect cross-training protocols. Offered as DANC 345 and DANC 445.

DANC 355. History of Modern Dance. 3 Units.
Origins and development of contemporary dance in its historical context. Prereq: 100 level first year seminar in USFS, FSCC, FSNA, FSSQ, FSSY, or FSCS. Prereq or Coreq: FSTS 100.

DANC 360. Ballet Technique for Modern Dance Students I. 1 - 3 Unit.
Ballet Technique for Dancers will focus on developing the ballet skills required of the Modern Dance major. The technical level of the class will range from intermediate to advanced where applicable in barre work as well as center. Offered as DANC 360 and DANC 460.

DANC 361. Ballet Technique for Modern Dance Students II. 1 - 3 Unit.
Ballet Technique for Dancers will focus on developing the ballet skills required of the Modern Dance major. The technical level of the class will range from intermediate to advanced where applicable in barre work as well as center. Offered as DANC 361 and DANC 461. Prereq: DANC 360.

DANC 385. Rehearsal and Production. 1 - 3 Unit.
Practicum for students participating in production work in the Department of Dance. Supervised laboratory experience in technical theater, construction techniques, scenery, costumes, lighting, and props; production; ticket office operations, promotion, publicity and public relations; house management; wardrobe responsibilities; stage management; assistant directing; and other production positions relating to the mainstage performances in Mather Dance Center. Students are recommended to take one credit hour per production, with a maximum of 8 credit hours allowed during their undergraduate career.

DANC 386. Rehearsal and Performance. 0 Units.
Practicum for students participating in performance in the Department of Dance, relating to the mainstage productions at Mather Dance Center.

DANC 396. SAGES Senior Capstone in Dance. 3 Units.
The course will be centered on creative work in dance, its culmination in public performance, and its extension into a community-based project. Through a review of relevant creative material and building upon skills developed through the dance program curriculum, a capstone project will be developed that represents a culmination of the undergraduate dance experience in the SAGES program. Prereq: DANC 203, DANC 204, DANC 303, DANC 304, DANC 355, DANC 414, DANC 423, or DANC 451.

DANC 397. Honors Studies I. 3 Units.
Individual projects in dance.

DANC 398. Honors Studies II. 3 Units.
Individual projects in dance.

DANC 399. Independent Study in Dance. 1 - 3 Unit.
Independent research and project work in areas of dance and pedagogy.

DANC 403. Fourth-Year Modern Dance Technique I. 1 - 3 Unit.
A logical progression of modern technique, this class is designed for the upper level dance major and graduate student in dance to further develop technical acumen with emphasis on aesthetic and physical challenges. Prereq: DANC 303.

DANC 404. Fourth-Year Modern Dance Technique II. 1 - 3 Unit.
Continuation of DANC 403. Prereq: DANC 403.

DANC 414. The Craft of Choreography. 3 Units.
An in-depth investigation of choreographic craft elements is presented through lecture, practical involvement and specified studies. Emphasized are tools to discover primary movement vocabulary, development of vocabulary through permutative investigations and the co-ordering of movement vocabulary into phrases, structural units, and larger sections. Offered as DANC 314 and DANC 414.
DANC 415. Choreography and Music. 3 Units.
Combining craft resources with emphasis on use of music. Music selections, historically categorized, are chosen for the purpose of analyzing metric and structural characteristics in accord with which choreography will be created. Offered as DANC 315 and DANC 415. Prereq: DANC 414.

DANC 416. Choreography and Theatrical Elements. 3 Units.
Use of properties, costumes, and scenic elements in both "first- and second-function" (Northrop) or "literal" and "abstract" applications challenge the functional and aesthetic appropriateness of conjoined choices. Dance structures fully developed under supervision. Successful results may be programmed for performance and tested for applicability to the Production sequence. Prereq: DANC 414.

DANC 417. Advanced Modern Dance Technique I. 1 - 3 Unit.
Emphasis on performing skills enlarged to include rehearsal and performance of full repertory works. Adaptability, versatility, and fidelity to choreographic intention stressed. Offered as DANC 317 and DANC 417. Prereq: DANC 404.

DANC 418. Advanced Modern Dance Technique II. 1 - 3 Unit.
Continuation of DANC 317/417. Offered as DANC 318 and DANC 418. Prereq: DANC 417.

DANC 423. Light Design for Theatrical Dance. 2 Units.
Elements of stage light design and technology for theatrical dance. Lectures and laboratory experience on color, instruments, and computerized design.

DANC 426. Advanced Topics in Choreography. 3 Units.
Introduction and investigation of advanced topics in choreography including but not limited to dance and technology, directing ensemble dance, and dance and the narrative. This course work is explored in the format of in-studio practicum and lecture, discussion, and peer and instructor review of student generated work. Structured studies will be developed under instructor supervision; students will be required to dedicate time and energy in the studio outside of class meetings to develop choreography studies for in-class presentation and review. Prereq: DANC 414 and DANC 415 and DANC 416.

DANC 445. Kinesiology for Dance. 3 Units.
Seminar and laboratory for assessment of kinesiological and biomechanical principles as related to dance. Assessment of current research will be implemented to affect cross-training protocols. Offered as DANC 345 and DANC 445.

DANC 446. Topics in Dance Medicine, Science, and Wellness. 1 - 3 Unit.
Review and application of continually emerging information from the fields of Dance Medicine and Science that impacts general dancer health and the care and prevention and treatment of dance specific injuries. Participation in the Dancer Wellness Program is encouraged to facilitate continued application of principles developed in DANC 445.

DANC 450. Ballet Technique for Modern Dance Students I. 1 - 3 Unit.
Ballet Technique for Dancers will focus on developing the ballet skills required of the Modern Dance major. The technical level of the class will range from intermediate to advanced where applicable in barre work as well as center. Offered as DANC 360 and DANC 460.

DANC 451. Costume Design and Construction for Dance. 2 Units.
Lecture and studio course in selecting fabrics, draping techniques, construction, and design for concert dance.

DANC 455. History of Modern Dance. 3 Units.
Origin and development of modern dance in its historical context.
Department of Economics

The College of Arts and Sciences awards the Bachelor of Arts degree in economics. The required courses for the major and minor are offered by the Department of Economics in the Weatherhead School of Management.

For details about the department’s undergraduate programs, please consult the Weatherhead School of Management (p. 972) section of this bulletin.
Department of English

The Department of English offers courses of study leading to the Bachelor of Arts, Master of Arts, and Doctor of Philosophy degrees. Included among the department’s offerings are literary and cultural studies, linguistics, film, journalism and new media, creative writing, visual rhetoric, rhetoric, and professional writing.

Combining the intellectual resources of a major research university with a scale and set of values more typical of a liberal arts college, the department puts great stress on class discussion, individual conferences or tutorials, and other opportunities for students and faculty to work closely together. Likewise, the curriculum is deliberately flexible to respond to student needs and interests and to encourage close cooperation with the faculty in planning a course of study.

A major in English prepares one for various sorts of careers. Three paths are common:

- English leads readily to careers that put a premium on writing skills and on the ability to analyze complex human situations. In addition to the fields that have often been of first interest to English majors (writing and publishing, journalism, advertising, the film industry, public relations, and teaching), significant opportunities exist in the corporate world, in government, and in nonprofit organizations such as those devoted to social service, the environment, or the arts.
- The BA in English is usually essential to anyone expecting to do graduate work in English or to pursue a career as a teacher or a scholar in the field.
- The BA in English traditionally has been an important steppingstone to success in professional school, and many of our English majors choose this path. A significant number go on to law school, many to medical or business school, and some to nursing, journalism, social work, or library school, as well as directly into the business world.

Facilities

In addition to manuscript and rare-book holdings in the Special Collections Division, Kelvin Smith Library has strengths in Renaissance literature; 18th-, 19th-, and 20th-century English literature; and American literature. The library also houses an outstanding collection of several thousand films and other audiovisual materials, supported in part by English department endowment funds. In Strosacker Auditorium, the Film Society maintains facilities capable of projecting 35 mm and 16 mm films. In the library’s Freedman Center, students have access to video cameras, state-of-the-art digital editing software, and stations where they can view audiovisual materials from the library collection.

Teacher Licensure in Integrated Language Arts | Integrated Graduate Studies | Minors

Undergraduate Programs

Major

The major in English includes two tracks. The primary track consists of at least 30 semester hours in English above the 100 level (including 15 hours at the 300 level or above). The required courses are:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENGL 300</td>
<td>English Literature to 1800</td>
<td>3</td>
</tr>
<tr>
<td>ENGL 302</td>
<td>English Literature since 1800</td>
<td>3</td>
</tr>
<tr>
<td>or ENGL 308</td>
<td>American Literature</td>
<td></td>
</tr>
<tr>
<td>ENGL 380</td>
<td>Departmental Seminar</td>
<td>3</td>
</tr>
<tr>
<td>ENGL 395</td>
<td>Capstone Seminar</td>
<td>3</td>
</tr>
<tr>
<td>One of the following:</td>
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</tbody>
</table>

Because of the flexibility of departmental requirements and the variety of career paths to which the major may lead, all students should confer frequently and closely with advisors. No courses outside the department are required for the major, but the department recommends courses in comparative literature, history, philosophy, history and criticism of the fine arts, theater, and literature in other languages. Students planning to go to graduate school are reminded of the importance of foreign language study.

Completion of the University composition requirement (ENGL 150 Expository Writing or SAGES First Seminar) is a prerequisite for most English courses at the 200 level and above.

Departmental Honors

To qualify for honors, English majors follow a track consisting of at least 36 hours above the 100 level, including the general requirements for the major (see above); ENGL 387 Literary and Critical Theory, or approved substitute: at least 18 hours of approved electives in literary and cultural studies; and one of the following language courses, or an equivalent in a language for which 300-level literature courses are available:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>FRCH 202</td>
<td>Intermediate French II</td>
<td>4</td>
</tr>
<tr>
<td>GREEK 202</td>
<td>Introduction to Greek Poetry</td>
<td>3</td>
</tr>
<tr>
<td>GRMN 202</td>
<td>Intermediate German II</td>
<td>4</td>
</tr>
<tr>
<td>JAPN 202</td>
<td>Intermediate Japanese II</td>
<td>4</td>
</tr>
<tr>
<td>LATN 202</td>
<td>Vergil</td>
<td>3</td>
</tr>
<tr>
<td>SPAN 202</td>
<td>Intermediate Spanish II</td>
<td>4</td>
</tr>
</tbody>
</table>

The award of honors requires a minimum GPA of 3.5 in courses taken for the honors program.

Teacher Licensure in Integrated Language Arts

A special program is available that leads to the BA and candidacy for licensure by the State of Ohio to teach Integrated Language Arts in grades 7-12 (Adolescents to Young Adults). The teaching credential is valid in Ohio and honored in many other states. The program consists of a more prescriptive form of the normal English major and a series of education courses that includes student teaching in a local school. (See the program description for Teacher Licensure elsewhere in this bulletin.) Because of the student teaching and because some of the education courses must be taken at John Carroll University, early and careful planning is vital. Consult Denise K. Davis for details about this program.

The subject area requirements for teacher licensure (42 credit hours) are as follows:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENGL 150</td>
<td>Expository Writing</td>
<td>3</td>
</tr>
<tr>
<td>ENGL 200</td>
<td>Literature in English</td>
<td>3</td>
</tr>
<tr>
<td>ENGL 202</td>
<td>Advanced Expository Writing</td>
<td>3</td>
</tr>
<tr>
<td>ENGL 204</td>
<td>Introduction to Journalism</td>
<td>3</td>
</tr>
<tr>
<td>ENGL 255</td>
<td>Major British Writers</td>
<td>3</td>
</tr>
</tbody>
</table>
ENGL 256  Major American Writers  3
ENGL 324  Shakespeare: Histories and Tragedies  3
or ENGL 325  Shakespeare: Comedies and Romances
ENGL 380  Departmental Seminar  3

One of the following:

ENGL 301  Linguistic Analysis  3
or ENGL 379  Topics in Language Studies
or COSI 313  Language Development

Two of the following:  6

ENGL 257B  Poetry
ENGL 270  Introduction to Gender Studies
ENGL 363H  African-American Literature
ENGL 365E  The Immigrant Experience
ENGL 365N  Topics in African-American Literature
ENGL 365Q  Post-Colonial Literature

One of the following:  3

ENGL 368B  History of Film
ENGL 368C  Topics in Film

Recommended electives:

ENGL 203  Introduction to Creative Writing
ENGL 213  Introduction to Fiction Writing
ENGL 214  Introduction to Poetry Writing
ENGL 303  Intermediate Writing Workshop: Fiction
ENGL 304  Intermediate Writing Workshop: Poetry
ENGL 310  History of the English Language
ENGL 392  Classroom Teaching

Integrative Graduate Studies

The department participates in the Integrated Graduate Studies Program (p. 549), which makes it possible to complete both a BA and an MA in English in about five years of full-time study. The department particularly recommends the program to qualified students who are interested in seeking admission to highly competitive professional schools or PhD programs. Interested students should note the general requirements and the admission procedures elsewhere in this bulletin.

Minors

Minor in English

The minor in English consists of at least 15 hours above the 100 level. Students who wish to minor in English arrange their sequence of courses in consultation with the department advisor. Minors are strongly advised to take ENGL 200 Literature in English early in the sequence. They should also keep in mind that the flexibility of the department’s requirements often makes it possible to take English as a second major.

Minor in Film Studies

Like the minor in English, the minor in Film Studies requires 15 hours:

ENGL 367  Introduction to Film (Though students are not required to take this course first, it is recommended that they take it first or as early in the sequence as possible.)  3

Up to 12 credits in the following:  3-12

ENGL 368B  History of Film
ENGL 368C  Topics in Film
ENGL 316  Screenwriting

Up to 6 credits of elective courses  0-6

Total Units  6-21

Graduate Programs

The Department of English offers programs in American and English literature and language leading to the Master of Arts and Doctor of Philosophy degrees. At either the MA or PhD level, students may elect a concentration in Writing History and Theory. The department also collaborates with the Department of Modern Languages and Literatures in offering a Master of Arts in world literature.

Candidates for graduate work in English should present an undergraduate major in English or a minimum of 18 semester hours of English (or its equivalent) beyond the freshman level. In some cases, students will be required to make up deficiencies without graduate credit. The department requires all candidates for admission to submit their scores on the aptitude sections of the Graduate Record Examination. Candidates are also required to submit a writing sample, consisting of at least 15 pages of academic writing. Students whose native language is not English are normally admitted only as provisional students. After 12 semester hours of satisfactory work, they are granted regular status.

A maximum of six semester hours of transfer credit will be accepted from another institution, provided they were earned in graduate-level courses, with the approval of the department and the dean of graduate studies. Such courses must have been taken within five years of matriculation at Case Western Reserve University and passed with grades of B or better. The department accommodates part-time students.

Teaching is viewed as an essential part of the education of graduate students aspiring to academic posts, and is required of all students working under assistantships. The department provides opportunities for graduate assistants to gain teaching experience in a variety of courses.

New and continuing graduate students may apply for graduate student assistantships, which are awarded by the dean on recommendation of the department. Applicants with previous teaching experience are preferred. Graduate assistants without previous teaching experience will be required to take ENGL 400 Rhetoric and Teaching of Writing before the first semester in which they teach.

Department Faculty

Mary Grimm, MA  
(Cleveland State University)  
Associate Professor and Chair  
Creative writing (fiction); contemporary literature; graphic novels

Michael Clune, PhD  
(Johns Hopkins University)  
Assistant Professor  
American literature; literature and science; poetry

Kimberly Emmons, PhD  
(University of Washington)  
Associate Professor; Director of Composition  
Rhetoric; composition; gender and language; medical humanities

Christopher Flint, PhD  
(University of Pennsylvania)
Associate Professor
18th-century English literature; print culture
T. Kenneth Fountain, PhD
(University of Minnesota)

Assistant Professor
Scientific and technical communication; visual culture; rhetorical theory
Sarah Gridley, MFA
(University of Montana)

Assistant Professor
Creative writing (poetry); feminist and eco-poetics
Megan Swihart Jewell, PhD
(Duquesne University)

Instructor; Director, Writing Resource Center
American literature; writing studies; poetics
Hee-Seung Kang, PhD
(University of Washington)

Associate Professor; Director of Graduate Studies
19th- and 20th-century British literature; postcolonial literature
James Kuzner, PhD
(Johns Hopkins University)

Assistant Professor
Renaissance literature; Shakespeare
William H. Marling, PhD
(University of California, Santa Barbara)

Professor
American and world literature; modernism; popular culture
Marilyn Sanders Mobley, PhD
(Case Western Reserve University)

Film studies
Gary Lee Stonum, PhD
(Johns Hopkins University)

Oviatt Professor of English
American literature; literary theory
Thrity Umrigar, PhD
(Kent State University)

Professor
Creative writing (fiction and memoir); journalism; African-American literature
Athena Vrettos, PhD
(University of Pennsylvania)

Associate Professor
19th-century British literature; literature and medicine; literature and psychology; women’s and gender studies
Martha Woodmansee, PhD
(Stanford University)

Professor; Professor of Law
Literary theory; 18th- and 19th-century comparative literature; copyright

Courses
ENGL 148. Introduction to Composition. 3 Units.
Practice and training in various modes and genres of writing. Undergraduate CIM students placed into ENGL 148 must complete the course with a grade of C or higher in order to enroll in ENGL 150.

ENGL 150. Expository Writing. 3 Units.
Substantial training and practice in academic writing.

ENGL 180. Writing Tutorial. 1 Unit.
Substantial scheduled tutorial work in writing.

ENGL 181. Reading Tutorial. 1 Unit.
Scheduled tutorial work in reading as well as time management and study strategies for both native and non-native speakers who need work beyond SAGES, or who come to the Writing Resource Center seeking substantial help. May work individually with instructor or in small groups. May be repeated in special instances, but only one semester-hour will count towards the degree.

ENGL 183. Academic Writing Studio. 1 Unit.
Practice and training in various aspects of academic writing in a small group workshop environment. Offered concurrently with First Seminar; provides supplementary instruction to help students meet First Seminar writing objectives. Please note: only one semester hour of English 183 will count toward a degree, but the course may be repeated.

ENGL 184. Research Writing Studio. 1 Unit.
Practice and training in various aspects of research in a small-group workshop environment. Offered concurrently with University Seminar; provides supplementary instruction to help students meet University Seminar writing objectives. Please note: only two semester hours of ENGL 184 will count towards a degree.
ENGL 200. Literature in English. 3 Units.
This course introduces students to the reading of literature in the English language. Through close attention to the practice of reading, students are invited to consider some of the characteristic forms and functions of imaginative literature that have taken place in what and how readers read. Recommended preparation: Concurrent enrollment in ENGL 150 or USFS 100.

ENGL 202. Advanced Expository Writing. 3 Units.
A workshop-style course for students that offers practice and training in genres of nonfiction prose. Special attention paid to style and presentation. Prereq: 100 level first seminar in FSCC, FSNA, FSSO, or FSSY.

ENGL 203. Introduction to Creative Writing. 3 Units.
A course exploring basic issues and techniques of writing narrative prose and verse through exercises, analysis, and experiment. For students who wish to try their abilities across a spectrum of genres. Recommended preparation: ENGL 150 or USFS 100.

ENGL 204. Introduction to Journalism. 3 Units.
Students will learn the basics of reporting and writing news stories, but also the traditions behind the craft and the evolving role of journalism in society. Instruction will include interviewing skills, fact-checking, word choice and story structure—all framed by guidance on making ethically sound decisions. Assignments could include stories from a variety of beats (business, entertainment, government, science), along with deadline stories and breaking news Web updates, profiles and obituaries.

ENGL 213. Introduction to Fiction Writing. 3 Units.
A beginning workshop in fiction writing, introducing such concepts as voice, point of view, plot, characterization, dialogue, description, and the like. May include discussion of literary examples, both classic and contemporary, along with student work. Recommended preparation: ENGL 150 or USFS 100.

ENGL 214. Introduction to Poetry Writing. 3 Units.
A beginning workshop, focusing on such elements of poetry as verse form, syntax, figures, sound, tone. May include discussion of literary examples as well as student work. Recommended preparation: ENGL 150 or USFS 100.

ENGL 217A. Business and Professional Writing. 3 Units.
An introduction to professional communication in theory and practice. Special attention paid to audience analysis, persuasive techniques in written and oral communication, document design strategies, and ethical communication practices. Prereq: ENGL 150 or passing letter grade in a 100 level first year seminar in USFS, FSCC, FSNA, FSSO, FSSY, FSTS, FSCS.

ENGL 217B. Writing for the Health Professions. 3 Units.
This course offers practice and training in the professional and technical writing skills common to health professions (e.g., medicine, nursing, dentistry). Attention will be paid to the writing processes of drafting, revising, and editing. Typical assignments include: letters, resumes, personal essays, professional communication genres (e.g., email, reports, patient charts, and histories), and scholarly genres (e.g., abstracts, articles, and reviews). Recommended preparation: FSCC 100 or equivalent.

ENGL 255. Major British Writers. 3 Units.
Introduction to literary studies and survey of selected English authors from the Medieval period to the present. Recommended preparation: Concurrent enrollment in ENGL 150 or USFS 100.

ENGL 256. Major American Writers. 3 Units.
Introduction to literary studies and survey of literature of United States from colonial times to the present. Recommended preparation: Concurrent enrollment in ENGL 150 or USFS 100.

ENGL 257A. The Novel. 3 Units.
Introductory readings in the novel. May be organized chronologically or thematically. Some attention to the novel as a historically situated genre.

ENGL 257B. Poetry. 3 Units.
Introductory readings in poetry. May be organized chronologically or thematically. Attention to the formal qualities of poetry in relation to meaning, expressivity, etc.

ENGL 270. Introduction to Gender Studies. 3 Units.
This course introduces women and men students to the methods and concepts of gender studies, women’s studies, and feminist theory. An interdisciplinary course, it covers approaches used in literary criticism, history, philosophy, political science, sociology, anthropology, psychology, film studies, cultural studies, art history, and religion. It is the required introductory course for students taking the women’s and gender studies major. Offered as ENGL 270, HSTY 270, PHIL 270, RLGN 270, SOCI 201, and WGST 201. Prereq: ENGL 150 or passing letter grade in a 100 level first year seminar in USFS, FSCC, FSNA, FSSO, FSSY, FSTS, FSCS.

ENGL 285. Special Topics Seminar. 1 Unit.
One-credit seminars on special topics in literature or language; see departmental listings for topics each term. Maximum of 3 credits. Recommended preparation: ENGL 150 or USFS 100.

ENGL 290. Masterpieces of Continental Fiction. 3 Units.
Major works of fiction from the 19th century and earlier. Offered as ENGL 290 and WLIT 290.

ENGL 291. Masterpieces of Modern Fiction. 3 Units.
Major works of fiction of the 20th century. Offered as ENGL 291 and WLIT 291.

ENGL 300. English Literature to 1800. 3 Units.
Introduction to literary studies and survey of selected English authors from the Medieval period to the present. Recommended preparation: Concurrent enrollment in ENGL 150 or USFS 100.

ENGL 301. Linguistic Analysis. 3 Units.
Analysis of modern English from various theoretical perspectives: structural, generative, discourse analytical, sociolinguistic, psycholinguistic, and cognitive linguistic. Some attention to the major dialects of American English. Offered as ENGL 301 and ENGL 401. Prereq: ENGL 150 or passing letter grade in a 100 level first year seminar in USFS, FSCC, FSNA, FSSO, FSSY, FSTS, FSCS.

ENGL 302. English Literature since 1800. 3 Units.
A survey of major British authors from Wordsworth to the present. Prereq: ENGL 150 or passing letter grade in a 100 level first year seminar in USFS, FSCC, FSNA, FSSO, FSSY, FSTS, FSCS.
ENGL 303. Intermediate Writing Workshop: Fiction. 3 Units.
Continues developing the concepts and practice of the introductory course, with reading, writing, and discussion of fiction in various forms, including the short story, the novella and the novel. Maximum 6 credits. Prereq: ENGL 203 or ENGL 213.

ENGL 304. Intermediate Writing Workshop: Poetry. 3 Units.
Continues developing the concepts and practice of the introductory course, with emphasis on experiment and revision as well as consideration of poetic genres through examples from established poets. Maximum 6 credits. Prereq: ENGL 203 or ENGL 214.

ENGL 305. Playwriting. 3 Units.
Theory and practice of dramatic writing, in the context of examples, classic and contemporary. Recommended preparation: ENGL 203 or ENGL 213 or ENGL 214 or ENGL 303 or ENGL 304. Offered as ENGL 305 and THTR 312.

ENGL 306. Intermediate Writing Workshop: Creative Non-Fiction. 3 Units.
A writing workshop that focuses on non-fiction. Students will study and write narrative journalism, the memoir, and the personal essay. Prereq: ENGL 203 or ENGL 213 or ENGL 214.

ENGL 307. Feature/Magazine Writing. 3 Units.
Continues developing the concepts and practices of the introductory course, with emphasis on feature writing for magazines (print and online), story structure, fact-checking, reporting techniques and freelancing. Prereq: ENGL 204 or instructor approval.

ENGL 308. American Literature. 3 Units.
A survey of major American authors from the Puritans to the present. Prereq: ENGL 150 or passing letter grade in a 100 level first year seminar in USFS, FSCC, FSNA, FSSO, FSSY, FSTS, FSCS.

ENGL 309. Immersion Journalism/Multimedia Storytelling. 3 Units.
Students will spend the bulk of the semester documenting lives and stories from a local nursing home through audio slideshows and video projects. Prereq: ENGL 204 or instructor approval.

ENGL 310. History of the English Language. 3 Units.
An introductory course covering the major periods of English language development: Old, Middle, and Modern. Students will examine both the linguistic forms and the cultures in which the forms were used. Offered as ENGL 310 and ENGL 410. Prereq: ENGL 150 or passing letter grade in a 100 level first year seminar in USFS, FSCC, FSNA, FSSO, FSSY, FSTS, FSCS.

ENGL 312. Chaucer. 3 Units.
An introduction to the work of Geoffrey Chaucer, with emphasis on "The Canterbury Tales." Prereq: ENGL 150 or passing letter grade in a 100 level first year seminar in USFS, FSCC, FSNA, FSSO, FSSY, FSTS, FSCS.

ENGL 314. Advanced Playwriting. 3 Units.
Theory and practice of dramatic writing with special focus on the craft of writing a full-length play. Offered as ENGL 314 and THTR 314. Prereq: ENGL 305 or THTR 312.

ENGL 316. Screenwriting. 3 Units.
A critical exploration of the craft of writing for film, in which reading and practicum assignments will culminate in the student submitting an original full-length screenplay. Offered as ENGL 316 and THTR 316.

ENGL 320. Renaissance Literature. 3 Units.
Aspects of English Renaissance literature and its contexts from 1500-ca. 1620. Genres studied might include poetry, drama, prose fiction, expository and polemic writing, or some works from Continental Europe. Writers such as Skelton, More, Erasmus, Wyatt, Sidney, Spenser, Marlowe, Lanier, Wroth, Shakespeare, Donne. Maximum 6 credits. Offered as ENGL 320 and ENGL 420. Prereq: ENGL 150 or passing letter grade in a 100 level first year seminar in USFS, FSCC, FSNA, FSSO, FSSY, FSTS, FSCS.

ENGL 323. Milton. 3 Units.
Poetry and selected prose, including the careful study of "Paradise Lost." Offered as ENGL 323 and ENGL 423. Prereq: ENGL 150 or passing letter grade in a 100 level first year seminar in USFS, FSCC, FSNA, FSSO, FSSY, FSTS, FSCS.

ENGL 324. Shakespeare: Histories and Tragedies. 3 Units.
Close reading of a selection of Shakespeare's tragedies and history plays (e.g., "Richard the Third," "Julius Caesar," "Hamlet," "King Lear"). Topics of discussion may include Renaissance drama as a social institution, the nature of tragedy, national history, gender roles, sexual politics, the state and its opponents, theatrical conventions. Assessment may include opportunities for performance. Offered as ENGL 324, ENGL 424, and THTR 334. Prereq: ENGL 150 or passing letter grade in a 100 level first year seminar in USFS, FSCC, FSNA, FSSO, FSSY, FSTS, FSCS.

ENGL 325. Shakespeare: Comedies and Romances. 3 Units.
Close reading of selected plays of Shakespeare in the genres of comedy and romance (e.g., "The Merchant of Venice," "Twelfth Night," "Measure for Measure," "The Tempest"). Topics of discussion may include issues of sexual desire, gender roles, marriage, the family, genre conventions. Assessment may include opportunities for performance. Offered as ENGL 325, ENGL 425, and THTR 335. Prereq: ENGL 150 or passing letter grade in a 100 level first year seminar in USFS, FSCC, FSNA, FSSO, FSSY, FSTS, FSCS.

ENGL 327. Eighteenth-Century Literature. 3 Units.
Survey of a variety of writings from or relevant to the eighteenth century. Writers discussed may include Dryden, Behn, Defoe, Pope, Swift, Gay, Fielding, Richardson, Burney, Wolstonecraft and others working in drama, lyric and epic poetry, biography and autobiography, political and philosophical writings and prose fiction. Thematic approaches may include: satire, journalism and literature, the rise of the novel. Maximum 6 credits. Offered as ENGL 327 and ENGL 427. Prereq: ENGL 150 or passing letter grade in a 100 level first year seminar in USFS, FSCC, FSNA, FSSO, FSSY, FSTS, FSCS.

ENGL 328. Studies in the Eighteenth Century. 3 Units.
This course examines selected topics in the English literary culture of the eighteenth century, a culture which extended to the Americas and to other English colonies. Literary writings will be examined in relation to other aspects of the century culture, which may include visual arts, marital institutions, the printing industry, property law, medicine, and other topics. Maximum 6 credits. Offered as ENGL 328 and ENGL 428. Prereq: ENGL 150 or passing letter grade in a 100 level first year seminar in USFS, FSCC, FSNA, FSSO, FSSY, FSTS, FSCS.
ENGL 329. English Literature, 1780-1837. 3 Units.
Aspects of English literature and its contexts in the early 19th century. Genres might include poetry, prose fiction, political and philosophical writing, literary theory of the period. Writers such as Wordsworth, Coleridge, Blake, Austen, Byron, the Shelleys. Maximum 6 credits. Offered as ENGL 329 and ENGL 429. Prereq: ENGL 150 or passing letter grade in a 100 level first year seminar in USFS, FSCC, FSNA, FSSO, FSSY, FSTS, FSCS.

ENGL 330. Victorian Literature. 3 Units.
Aspects of English literature and its contexts during the reign of Queen Victoria. Genres studied might include poetry, prose fiction, political and philosophical writing. Writers such as the Brontes, Gaskell, Dickens, Eliot, Hardy, Tennyson, the Brownings, Arnold, Carlyle, Ruskin, Gosse, Swinburne, and Hopkins. Maximum 6 credits. Offered as ENGL 330 and ENGL 430. Prereq: ENGL 150 or passing letter grade in a 100 level first year seminar in USFS, FSCC, FSNA, FSSO, FSSY, FSTS, FSCS.

ENGL 331. Studies in the Nineteenth-Century. 3 Units.
Individual topics in English literary culture of the 19th century. Topics might be thematic or formal, such as literature and science; medicine; labor; sexuality; Empire; literature and other arts; Gothic fiction; decadence. Maximum 6 credits. Offered as ENGL 331 and ENGL 431. Prereq: ENGL 150 or passing letter grade in a 100 level first year seminar in USFS, FSCC, FSNA, FSSO, FSSY, FSTS, FSCS.

ENGL 332. Twentieth-Century British Literature. 3 Units.
Aspects of British literature (broadly interpreted) and its contexts during the 20th century. Genres studied might include poetry, fiction, and drama. Such writers as Joyce, Woolf, Conrad, Ford, Lawrence, Mansfield, Shaw, Beckett, Stoppard, Yeats, Edward or Dylan Thomas, Stevie Smith, Bowen, Spark. Maximum 6 credits. Offered as ENGL 332 and ENGL 432. Prereq: ENGL 150 or passing letter grade in a 100 level first year seminar in USFS, FSCC, FSNA, FSSO, FSSY, FSTS, FSCS.

ENGL 333. Studies in the Twentieth and Twenty-first Centuries. 3 Units.
Individual topics in twentieth- and twenty-first century literary culture. Particular issues and topics may cross national boundaries and genre lines as well as exploring political, psychological, and social themes, such as movements, comparative studies across the arts, literature and war, literature and occultism. Maximum 6 credits. Offered as ENGL 333 and ENGL 433. Prereq: ENGL 150 or passing letter grade in a 100 level first year seminar in USFS, FSCC, FSNA, FSSO, FSSY, FSTS, FSCS.

ENGL 341. Rhetoric of Science and Medicine. 3 Units.
This course explores the roles language and rhetoric play in constructing, communicating, and understanding science and medicine. It surveys current and historical debates, theories, research, and textual conventions of scientific and medical discourse. May be taught with a specific focus, such as scientific controversies, concepts of health and illness, visualizations of science, the body in medicine, and the history of scientific writing. Offered as: ENGL 341 and ENGL 441. Prereq: ENGL 150 or letter grade in SAGES First Seminar.

ENGL 343. Language and Gender. 3 Units.
This course introduces students to the study of language and gender by exploring historical and theoretical trends, methods, and research findings on the ways gender, sexuality, language, and discourse interact with and even shape each other. Topics may include “grammatical” versus “biological” gender, feminine écriture, the women and language debate, speech acts and queer performativity, nonsexist language policy, discourses of gender and sexuality, feminist stylistics, and LGBT sociolinguistics. Offered as: ENGL 343, ENGL 443, and WGST 343. Prereq: ENGL 150 or passing letter grade in a 100 level first year seminar in USFS, FSCC, FSNA, FSSO, FSSY, FSTS, FSCS.

ENGL 353. Major Writers. 3 Units.
Close and detailed study of the work of one or two writers: development, social and aesthetic contexts, reception, interpretation, significance. Maximum 6 credits. Offered as ENGL 353 and ENGL 453. Prereq: ENGL 150 or passing letter grade in a 100 level first year seminar in USFS, FSCC, FSNA, FSSO, FSSY, FSTS, FSCS.

ENGL 356. American Literature Before 1865. 3 Units.
Aspects of American literature and its contexts from the colonial period through the end of the Civil War. Writers such as Bradstreet, Taylor, Franklin, Poe, Stowe, Alcott, Melville, Hawthorne, Emerson, Douglass. Maximum 6 credits. Offered as ENGL 356 and ENGL 456. Prereq: ENGL 150 or passing letter grade in a 100 level first year seminar in USFS, FSCC, FSNA, FSSO, FSSY, FSTS, FSCS.

ENGL 357. American Literature 1865-1914. 3 Units.
Aspects of American literature and its contexts from the Civil War to the First World War. Writers such as Whitman and Dickinson, Twain, Howells, James, Chopin, Wharton. Maximum 6 credits. Offered as ENGL 357 and ENGL 457. Prereq: ENGL 150 or passing letter grade in a 100 level first year seminar in USFS, FSCC, FSNA, FSSO, FSSY, FSTS, FSCS.

ENGL 358. American Literature 1914-1960. 3 Units.
Aspects of American literature and its contexts from the First World War to the Cold War. Genres studied might include fiction, poetry, drama, polemics. Writers such as T.S. Eliot, Pound, Stevens, Moore, W.C. Williams, Dos Passos, West, Fitzgerald, Hemingway, Cather, Faulkner, Barnes, Miller, T. Williams, O’Neill. Maximum 6 credits. Offered as ENGL 358 and ENGL 458. Prereq: ENGL 150 or passing letter grade in a 100 level first year seminar in USFS, FSCC, FSNA, FSSO, FSSY, FSTS, FSCS.

ENGL 359. Studies in Contemporary American Literature. 3 Units.
Individual topics in literary culture since the 1960s. Topics may include the Beats, literature of the Vietnam war, post-modern fiction, contemporary poetry, the documentary novel. Maximum 6 credits. Offered as ENGL 359 and ENGL 459. Prereq: ENGL 150 or passing letter grade in a 100 level first year seminar in USFS, FSCC, FSNA, FSSO, FSSY, FSTS, FSCS.
ENGL 363H. African-American Literature. 3 Units.
A historical approach to African-American literature. Such writers as Wheatley, Equiano, Douglass, Jacobs, DuBois, Hurston, Hughes, Wright, Baldwin, Ellison, Morrison. Topics covered may include slave narratives, African-American autobiography, the Harlem Renaissance, the Black Aesthetic, literature of protest and assimilation. Maximum 6 credits. Offered as ENGL 363H, ETHS 363H, WLIT 363H, ENGL 463H, and WLIT 463H. Prereq: ENGL 150 or passing letter grade in a 100 level first year seminar in USFS, FSCC, FSNA, FSSO, FSSY, FSTS, FSCS.

ENGL 365E. The Immigrant Experience. 3 Units.
Study of fictional and/or autobiographical narrative by authors whose families have experienced immigration to the U.S. Among the ethnic groups represented are Asian-American, Jewish-American, Hispanic-American. May include several ethnic groups or focus on a single one. Attention is paid to historical and social aspects of immigration and ethnicity. Maximum 6 credits. Offered as ENGL 365E, WLIT 365E, ENGL 465E, and WLIT 465E. Prereq: ENGL 150 or passing letter grade in a 100 level first year seminar in USFS, FSCC, FSNA, FSSO, FSSY, FSTS, FSCS.

ENGL 365N. Topics in African-American Literature. 3 Units.
Selected topics and writers from nineteenth, twentieth, and twenty-first century African-American literature. May focus on a genre, a single author or a group of authors, a theme or themes. Maximum 6 credits. Offered as ENGL 365N, ETHS 365N, WLIT 365N, ENGL 465N, and WLIT 465N. Prereq: ENGL 150 or passing letter grade in a 100 level first year seminar in USFS, FSCC, FSNA, FSSO, FSSY, FSTS, FSCS.

ENGL 365Q. Post-Colonial Literature. 3 Units.
Readings in national and regional literatures from former European colonies such as Australia and African countries. Maximum 6 credits. Offered as ENGL 365Q, ETHS 365Q, WLIT 365Q, ENGL 465Q, and WLIT 465Q. Prereq: ENGL 150 or passing letter grade in a 100 level first year seminar in USFS, FSCC, FSNA, FSSO, FSSY, FSTS, FSCS.

ENGL 367. Introduction to Film. 3 Units.
An introduction to the aesthetics of film form. We will analyze the elements that make up a film, screening films that facilitate our discussion of how these elements interact with one another to constitute whole formal systems that generate meanings and other effects. We will bring various theoretical and historical considerations to bear as we explore and appreciate the art of cinema. Offered as ENGL 367 and ENGL 467.

ENGL 368B. History of Film. 3 Units.
Analysis of selected topics in film history, such as film before 1940, American cinema 1940 to the present, European or Asian cinema since 1940. Maximum 6 credits. Offered as ENGL 368B and ENGL 468B. Prereq: ENGL 150 or passing letter grade in a 100 level first year seminar in USFS, FSCC, FSNA, FSSO, FSSY, FSTS, FSCS.

ENGL 368C. Topics in Film. 3 Units.
Individual topics in film, such as a particular national cinema, horror films, films of Alfred Hitchcock, images of women in film, film comedy, introduction to film genres, Asian cinema and drama, dance on screen, science fiction films, storytelling and cinema, and literature and film. Maximum 12 credits. Offered as ENGL 368C, WLIT 368C, ENGL 468C, and WLIT 468C.

ENGL 369. Children’s Literature. 3 Units.
Individual topics in 19th-, 20th-, and 21st-century children’s literature. Topics may focus on narrative and thematic developments in the genre, historical contexts, literary influences, or adaptations of children’s literature into film and other media. Offered as ENGL 369 and ENGL 469. Prereq: ENGL 150 or passing letter grade in a 100 level first year seminar in USFS, FSCC, FSNA, FSSO, FSSY, FSTS, FSCS.

ENGL 371. Topics in Women's and Gender Studies. 3 Units.
Individual topics and issues in women’s studies relating to writing by and about women, such as feminist theory and criticism; the politics of gender and sexuality; women in popular culture; women in the writing business. Maximum 6 credits. Offered as ENGL 371 and ENGL 471. Prereq: ENGL 150 or passing letter grade in a 100 level first year seminar in USFS, FSCC, FSNA, FSSO, FSSY, FSTS, FSCS.

ENGL 372. Studies in the Novel. 3 Units.
Selected topics in the history and formal development of the novel, such as detective novels; science fiction; epistolary novels; the rise of the novel; the stream of consciousness novel; the Bildungsroman in English. Maximum 6 credits. Offered as ENGL 372 and ENGL 472. Prereq: ENGL 150 or passing letter grade in a 100 level first year seminar in USFS, FSCC, FSNA, FSSO, FSSY, FSTS, FSCS.

ENGL 373. Studies in Poetry. 3 Units.
Selected topics and issues in the study of poetry, such as reading poetry, the elegy, pastoral poetry, love poetry, the long poem, form and meter in poetry. Maximum 6 credits. Offered as ENGL 373 and ENGL 473. Prereq: ENGL 150 or passing letter grade in a 100 level first year seminar in USFS, FSCC, FSNA, FSSO, FSSY, FSTS, FSCS.

ENGL 374. Internship in Journalism. 3 - 6 Units.
Students work as interns at area newspapers, magazines, trade publications, radio or television and meet as a class to share their experiences as interns and to focus on editorial issues--reporting, writing, fact-checking, editing--that are a part of any journalistic enterprise. Students are responsible for pre-arranging their internship prior to the semester they intend to take the class but can expect guidance from the instructor in this regard. Recommended preparation: ENGL 204 or permission of the department.

ENGL 376. Studies in Genre. 3 Units.
Topics in literary genres, such as comedy, biography and autobiography, satire, allegory, the short story, the apologue, narrative poetry. May cross over the prose/poetry boundary. Maximum 6 credits. Offered as ENGL 376 and ENGL 476. Prereq: ENGL 150 or passing letter grade in a 100 level first year seminar in USFS, FSCC, FSNA, FSSO, FSSY, FSTS, FSCS.

ENGL 377. Studies in Drama. 3 Units.
Readings and discussion of plays and related critical literature pertaining to a specific period in American or British drama. Topics and material will vary from semester to semester. Offered as ENGL 377 and ENGL 477. Prereq: ENGL 150 or passing letter grade in a 100 level first year seminar in USFS, FSCC, FSNA, FSSO, FSSY, FSTS, FSCS.
ENGL 378. Topics in Visual and New Media Studies. 3 Units.
This course will focus on selected topics in the study of visual rhetoric and/or new media, including theoretical, critical, and historical issues raised by texts and media platforms that communicate largely through visual means or through the interaction of visual and verbal modes. Possible syllabi may focus on topics such as visual rhetoric; new media story-telling; historical perspectives on visual rhetoric and/or new media; concentrations on a particular genre (for instance, the graphic novel, video games, etc); visual narrative; theories of new media; etc. Offered as ENGL 378 and ENGL 478. Prereq: ENGL 150 or passing letter grade in a 100 level first year seminar in USFS, FSCC, FSNA, FSSO, FSSY, FSTS, FSCS.

ENGL 379. Topics in Language Studies. 3 Units.
Aspects of contemporary language studies. Topics might include history/theories of rhetoric, discourse studies, cognitive linguistics, metaphor, language acquisition, stylistics. Maximum 9 credits. Offered as ENGL 379 and ENGL 479. Prereq: ENGL 150 or passing letter grade in a 100 level first year seminar in USFS, FSCC, FSNA, FSSO, FSSY, FSTS, FSCS.

ENGL 380. Departmental Seminar. 3 Units.
A topical course, emphasizing disciplinary forms of writing. Required of all English majors, preferable in the junior year; also fulfills a SAGES requirement. Prereq: ENGL 300.

ENGL 385. Special Topics in Literature. 3 Units.
Close study of a theme or aspect of literature not covered by traditional generic or period rubrics, such as "spatial imagination," "semiotics of fashion in literature," "epistolarity." Maximum 9 credits. Offered as ENGL 385 and ENGL 485. Prereq: ENGL 150 or passing letter grade in a 100 level first year seminar in USFS, FSCC, FSNA, FSSO, FSSY, FSTS, FSCS.

ENGL 386. Studies in Literature and Culture. 3 Units.
Boundary-crossing study of the relations between literary and other aspects of a particular culture or society, including theoretical and critical issues raised by such study. For example, literature and medicine, law and literature, gay and lesbian literature, Asian/Western literary relations, emotion in literature, philosophy and literature, literature and music. Maximum 9 credits. Offered as ENGL 386 and ENGL 486. Prereq: ENGL 150 or passing letter grade in a 100 level first year seminar in USFS, FSCC, FSNA, FSSO, FSSY, FSTS, FSCS.

ENGL 387. Literary and Critical Theory. 3 Units.
A survey of major schools and texts of literary and critical theory. May include e-mail, memos, letters, reports, documentation, and oral presentations. Prereq: ENGL 150 or passing letter grade in a 100 level first year seminar in USFS, FSCC, FSNA, FSSO, FSSY, FSTS, FSCS.

ENGL 388. Advanced Creative Writing. 3 Units.
Workshop for serious undergraduate and graduate writers. Offered alternate years; alternates between poetry and fiction. Admission requires review of writing sample by faculty. Maximum 6 credits. Prereq: Graduate standing.

ENGL 390. Independent Study and Creative Projects. 1 - 3 Unit.
Up to three semester hours of independent study may be taken in a single semester. Must have prior approval of faculty member directing the project. Projects may be critical or creative in nature.
ENGL 420. Renaissance Literature. 3 Units.
Aspects of English Renaissance literature and its contexts from 1500-ca. 1620. Genres studied might include poetry, drama, prose fiction, expository and polemic writing, or some works from Continental Europe. Writers such as Skelton, More, Erasmus, Wyatt, Sidney, Spenser, Marlowe, Lanier, Wroth, Shakespeare, Donne. Maximum 6 credits. Offered as ENGL 320 and ENGL 420. Prereq: Graduate standing.

ENGL 423. Milton. 3 Units.
Poetry and selected prose, including the careful study of "Paradise Lost." Offered as ENGL 323 and ENGL 423. Prereq: Graduate standing.

ENGL 424. Shakespeare: Histories and Tragedies. 3 Units.
Close reading of a selection of Shakespeare's tragedies and history plays (e.g., "Richard the Third," "Julius Caesar," "Hamlet," "King Lear"). Topics of discussion may include Renaissance drama as a social institution, the nature of tragedy, national history, gender roles, sexual politics, the state and its opponents, theatrical conventions. Assessment may include opportunities for performance. Offered as ENGL 324, ENGL 424, and THTR 334. Prereq: Graduate standing.

ENGL 425. Shakespeare: Comedies and Romances. 3 Units.
Close reading of selected plays of Shakespeare in the genres of comedy and romance (e.g., "The Merchant of Venice," "Twelfth Night," "Measure for Measure," "The Tempest"). Topics of discussion may include issues of sexual desire, gender roles, marriage, the family, genre conventions. Assessment may include opportunities for performance. Offered as ENGL 325, ENGL 425, and THTR 335. Prereq: Graduate standing.

ENGL 427. Eighteenth-Century Literature. 3 Units.
Survey of a variety of writings from or relevant to the eighteenth century. Writers discussed may include Dryden, Behn, Defoe, Pope, Swift, Gay, Fielding, Richardson, Burney, Wollstonecraft and others working in drama, lyric and epic poetry, biography and autobiography, political and philosophical writings and prose fiction. Thematic approaches may include: satire, journalism and literature, the rise of the novel. Maximum 6 credits. Offered as ENGL 327 and ENGL 427. Prereq: Graduate standing or permission of instructor.

ENGL 428. Studies in the Eighteenth Century. 3 Units.
This course examines selected topics in the English literary culture of the eighteenth century, a culture which extended to the Americas and to other English colonies. Literary writings will be examined in relation to other aspects of the century culture, which may include visual arts, marital institutions, the printing industry, property law, medicine, and other topics. Maximum 6 credits. Offered as ENGL 328 and ENGL 428. Prereq: Graduate standing.

ENGL 429. English Literature, 1780-1837. 3 Units.
Aspects of English literature and its contexts in the early 19th century. Genres might include poetry, prose fiction, political and philosophical writing, literary theory of the period. Writers such as Wordsworth, Coleridge, Blake, Austen, Byron, the Shelleys. Maximum 6 credits. Offered as ENGL 329 and ENGL 429. Prereq: Graduate standing.

ENGL 430. Victorian Literature. 3 Units.
Aspects of English literature and its contexts during the reign of Queen Victoria. Genres studied might include poetry, prose fiction, political and philosophical writing. Writers such as the Brontes, Gaskell, Dickens, Eliot, Hardy, Tennyson, the Brownings, Arnold, Carlyle, Ruskin, Gosse, Swinburne, and Hopkins. Maximum 6 credits. Offered as ENGL 330 and ENGL 430. Prereq: Graduate standing or permission of instructor.

ENGL 431. Studies in the Nineteenth-Century. 3 Units.
Individual topics in English literary culture of the 19th century. Topics might be thematic or formal, such as literature and science; medicine; labor; sexuality; Empire; literature and other arts; Gothic fiction; decadence. Maximum 6 credits. Offered as ENGL 331 and ENGL 431. Prereq: Graduate standing.

ENGL 432. Twentieth-Century British Literature. 3 Units.
Aspects of British literature (broadly interpreted) and its contexts during the 20th century. Genres studied might include poetry, fiction, and drama. Such writers as Joyce, Woolf, Conrad, Ford, Lawrence, Mansfield, Shaw, Beckett, Stoppard, Yeats, Edward or Dylan Thomas, Stevie Smith, Bowen, Spark. Maximum 6 credits. Offered as ENGL 332 and ENGL 432. Prereq: Graduate standing.

ENGL 433. Studies in the Twentieth and Twenty-first Centuries. 3 Units.
Individual topics in twentieth- and twenty-first century literary culture. Particular issues and topics may cross national boundaries and genre lines as well as exploring political, psychological, and social themes, such as movements, comparative studies across the arts, literature and war, literature and occultism. Maximum 6 credits. Offered as ENGL 333 and ENGL 433. Prereq: Graduate standing.

ENGL 441. Rhetoric of Science and Medicine. 3 Units.
This course explores the roles language and rhetoric play in constructing, communicating, and understanding science and medicine. It surveys current and historical debates, theories, research, and textual conventions of scientific and medical discourse. May be taught with a specific focus, such as scientific controversies, concepts of health and illness, visualizations of science, the body in medicine, and the history of scientific writing. Offered as: ENGL 341 and ENGL 441. Prereq: Graduate standing.

ENGL 443. Language and Gender. 3 Units.
This course introduces students to the study of language and gender by exploring historical and theoretical trends, methods, and research findings on the ways gender, sexuality, language, and discourse interact and even shape each other. Topics may include "grammatical" versus "biological" gender, feminine escritura, the women and language debate, speech acts and queer performativity, nonsexist language policy, discourses of gender and sexuality, feminist stylistics, and LGBT sociolinguistics. Offered as: ENGL 343, ENGL 443, and WGST 343. Prereq: Graduate standing.

ENGL 453. Major Writers. 3 Units.
Close and detailed study of the work of one or two writers: development, social and aesthetic contexts, reception, interpretation, significance. Maximum 6 credits. Offered as ENGL 353 and ENGL 453.

ENGL 456. American Literature Before 1865. 3 Units.
Aspects of American literature and its contexts from the colonial period through the end of the Civil War. Writers such as Bradstreet, Taylor, Franklin, Poe, Stowe, Alcott, Melville, Hawthorne, Emerson, Douglass. Maximum 6 credits. Offered as ENGL 356 and ENGL 456. Prereq: Graduate standing.

ENGL 457. American Literature 1865-1914. 3 Units.
Aspects of American literature and its contexts from the Civil War to the First World War. Writers such as Whitman and Dickinson, Twain, Howells, James, Chopin, Wharton. Maximum 6 credits. Offered as ENGL 357 and ENGL 457. Prereq: Graduate standing.
ENGL 458. American Literature 1914-1960. 3 Units.
Aspects of American literature and its contexts from the First World War to the Cold War. Genres studied might include fiction, poetry, drama, polemics. Writers such as T.S. Eliot, Pound, Stevens, Moore, W.C. Williams, Dos Passos, West, Fitzgerald, Hemingway, Cather, Faulkner, Barnes, Miller, T. Williams, O'Neill. Maximum 6 credits. Offered as ENGL 358 and ENGL 458. Prereq: Graduate standing.

ENGL 459. Studies in Contemporary American Literature. 3 Units.
Individual topics in literary culture since the 1960s. Topics may include the Beats, literature of the Vietnam war, post-modern fiction, contemporary poetry, the documentary novel. Maximum 6 credits. Offered as ENGL 359 and ENGL 459. Prereq: Graduate standing.

ENGL 460. Studies in American Literature. 3 Units.
Individual topics in American literary culture such as regionalism, realism, impressionism, literature and popular culture, transcendentality, the lyric, proletarian literature, the legacy of the Civil War. Maximum 6 credits. Offered as ENGL 360 and ENGL 460. Prereq: Graduate standing or permission of instructor.

ENGL 463H. African-American Literature. 3 Units.
A historical approach to African-American literature. Such writers as Wheatley, Equiano, Douglass, Jacobs, DuBois, Hurston, Hughes, Wright, Baldwin, Ellison, Morrison. Topics covered may include slave narratives, African-American autobiography, the Harlem Renaissance, the Black Aesthetic, literature of protest and assimilation. Maximum 6 credits. Offered as ENGL 363H, ETHS 363H, WLIT 363H, ENGL 463H, and WLIT 463H. Prereq: Graduate standing.

ENGL 465E. The Immigrant Experience. 3 Units.
Study of fictional and/or autobiographical narrative by authors whose families have experienced immigration to the U.S. Among the ethnic groups represented are Asian-American, Jewish-American, Hispanic-American. May include several ethnic groups or focus on a single one. Attention is paid to historical and social aspects of immigration and ethnicity. Maximum 6 credits. Offered as ENGL 365E, WLIT 365E, ENGL 465E, and WLIT 465E. Prereq: Graduate standing.

ENGL 465N. Topics in African-American Literature. 3 Units.
Selected topics and writers from nineteenth, twentieth, and twenty-first century African-American literature. May focus on a single author or a group of authors, a theme or themes. Maximum 6 credits. Offered as ENGL 365N, ETHS 365N, WLIT 365N, ENGL 465N, and WLIT 465N. Prereq: Graduate standing.

ENGL 465Q. Post-Colonial Literature. 3 Units.
Readings in national and regional literatures from former European colonies such as Australia and African countries. Maximum 6 credits. Offered as ENGL 365Q, ETHS 365Q, WLIT 365Q, ENGL 465Q, and WLIT 465Q. Prereq: Graduate standing.

ENGL 467. Introduction to Film. 3 Units.
An introduction to the aesthetics of film form. We will analyze the elements that make up a film, screening films that facilitate our discussion of how these elements interact with one another to constitute whole formal systems that generate meanings and other effects. We will bring various theoretical and historical considerations to bear as we explore and appreciate the art of cinema. Offered as ENGL 367 and ENGL 467. Prereq: Graduate standing.

ENGL 468B. History of Film. 3 Units.
Analysis of selected topics in film history, such as film before 1940, American cinema 1940 to the present, European or Asian cinema since 1940. Maximum 6 credits. Offered as ENGL 368B and ENGL 468B. Prereq: Graduate standing.

ENGL 468C. Topics in Film. 3 Units.
Individual topics in film, such as a particular national cinema, horror films, films of Alfred Hitchcock, images of women in film, film comedy, introduction to film genres, Asian-cinema and drama, dance on screen, science fiction films, storytelling and cinema, and literature and film. Maximum 12 credits. Offered as ENGL 368C, WLIT 368C, ENGL 468C, and WLIT 468C. Prereq: Graduate standing.

ENGL 469. Children's Literature. 3 Units.
Individual topics in 19th-, 20th-, and 21st-century children's literature. Topics may focus on narrative and thematic developments in the genre, historical contexts, literary influences, or adaptations of children's literature into film and other media. Offered as ENGL 369 and ENGL 469. Prereq: Graduate standing or requisites not met permission.

ENGL 471. Topics in Women's and Gender Studies. 3 Units.
Individual topics and issues in women's studies relating to writing by and about women, such as feminist theory and criticism; the politics of gender and sexuality; women in popular culture; women in the writing business. Maximum 6 credits. Offered as ENGL 371 and ENGL 471. Prereq: Graduate standing.

ENGL 472. Studies in the Novel. 3 Units.
Selected topics in the history and formal development of the novel, such as detective novels; science fiction; epistolary novels; the rise of the novel; the stream of consciousness novel; the Bildungsroman in English. Maximum 6 credits. Offered as ENGL 372 and ENGL 472. Prereq: Graduate standing.

ENGL 473. Studies in Poetry. 3 Units.
Selected topics and issues in the study of poetry, such as reading poetry, the elegy, pastoral poetry, love poetry, the long poem, form and meter in poetry. Maximum 6 credits. Offered as ENGL 373 and ENGL 473. Prereq: Graduate standing.

ENGL 476. Studies in Genre. 3 Units.
Topics in literary genres, such as comedy, biography and autobiography, satire, allegory, the short story, the apologue, narrative poetry. May cross over the prose/poetry boundary. Maximum 6 credits. Offered as ENGL 376 and ENGL 476. Prereq: Graduate standing.

ENGL 477. Studies in Drama. 3 Units.
Readings and discussion of plays and related critical literature pertaining to a specific period in American or British drama. Topics and material will vary from semester to semester. Offered as ENGL 377 and ENGL 477. Prereq: ENGL 150 or passing letter grade in a 100 level first year seminar in USFS, FSCC, FSNA, FSSO, FSSY, FSTS, FSCS.
ENGL 478. Topics in Visual and New Media Studies. 3 Units.
This course will focus on selected topics in the study of visual rhetoric and/or new media, including theoretical, critical, and historical issues raised by texts and media platforms that communicate largely through visual means or through the interaction of visual and verbal modes. Possible syllabi may focus on topics such as visual rhetoric; new media story-telling; historical perspectives on visual rhetoric and/or new media; concentrations on a particular genre (for instance, the graphic novel, video games, etc); visual narrative; theories of new media; etc. Offered as ENGL 378 and ENGL 478.

ENGL 479. Topics in Language Studies. 3 Units.
Aspects of contemporary language studies. Topics might include history/theories of rhetoric, discourse studies, cognitive linguistics, metaphor, language acquisition, stylistics. Maximum 9 credits. Offered as ENGL 379 and ENGL 479. Prereq: Graduate standing.

ENGL 485. Special Topics in Literature. 3 Units.
Close study of a theme or aspect of literature not covered by traditional generic or period rubrics, such as "spatial imagination," "semiotics of fashion in literature," "epistololarity." Maximum 9 credits. Offered as ENGL 385 and ENGL 485. Prereq: Graduate standing.

ENGL 486. Studies in Literature and Culture. 3 Units.
Boundary-crossing study of the relations between literary and other aspects of a particular culture or society, including theoretical and critical issues raised by such study. For example, literature and medicine, law and literature, gay and lesbian literature, Asian/Western literary relations, emotion in literature, philosophy and literature, literature and music. Maximum 9 credits. Offered as ENGL 386 and ENGL 486. Prereq: Graduate standing.

ENGL 487. Literary and Critical Theory. 3 Units.
A survey of major schools and texts of literary and critical theory. May be historically or thematically organized. Maximum 6 credits. Offered as ENGL 387, WLIT 387, ENGL 487, and WLIT 487. Prereq: Graduate standing.

ENGL 501. Writing History and Theory. 3 Units.
This course addresses general research methods and theories specific to the study of writing, and functions as a required core course and overview for the Writing, History and Theory (WHIT) sequence in the English Department's Ph.D. program. Prereq: Graduate standing.

ENGL 506. Professional Writing: Theory and Practice. 3 Units.
Prepares graduate students to teach disciplinary forms of writing, including technical and professional writing, in academic and non-academic settings. Prereq: ENGL 400.

ENGL 508. Seminar: English Literature 1550-1660. 3 Units.
Prereq: Graduate standing.

ENGL 509. Seminar: English Literature 1660-1800. 3 Units.
Prereq: Graduate standing.

ENGL 510. Seminar: English Literature 1800-1900. 3 Units.
Prereq: Graduate standing.

ENGL 511. Seminar: 20th Century Literature. 3 Units.
Prereq: Graduate standing.

ENGL 512. Seminar: Novel. 3 Units.
Prereq: Graduate standing.

ENGL 513. Seminar: Topics in Poetry. 3 Units.
Prereq: Graduate standing.

ENGL 514. Seminar: Criticism and Other Special Topics. 3 Units.
Prereq: Graduate standing.

ENGL 515. Intellectual Property and the Construction of Authorship. 3 Units.
Study of the concepts, laws, norms, and practices through which writers and other creative producers establish "property" in their work. Offered as ENGL 515 and HSTY 515. Prereq: Graduate standing or permission.

ENGL 516. Seminar: American Literature. 3 Units.
Prereq: Graduate standing.

ENGL 517. Seminar: English Literature 1660-1800. 3 Units.
Prereq: Graduate standing.

ENGL 518. Seminar: English Literature 1800-1900. 3 Units.
Prereq: Graduate standing.

ENGL 519. Seminar: 20th Century Literature. 3 Units.
Prereq: Graduate standing.

ENGL 520. Seminar: Novel. 3 Units.
Prereq: Graduate standing.

ENGL 521. Seminar: Topics in Poetry. 3 Units.
Prereq: Graduate standing.

ENGL 522. Seminar: Criticism and Other Special Topics. 3 Units.
Prereq: Graduate standing.

ENGL 523. Seminar: Intellectual Property and the Construction of Authorship. 3 Units.
Prereq: Graduate standing or permission.

ENGL 524. Seminar: American Literature. 3 Units.
Prereq: Graduate standing.

ENGL 525. Seminar: English Literature 1660-1800. 3 Units.
Prereq: Graduate standing.

ENGL 526. Seminar: 20th Century Literature. 3 Units.
Prereq: Graduate standing.

ENGL 527. Seminar: Novel. 3 Units.
Prereq: Graduate standing.

ENGL 528. Seminar: Topics in Poetry. 3 Units.
Prereq: Graduate standing.

ENGL 529. Seminar: Criticism and Other Special Topics. 3 Units.
Prereq: Graduate standing.

ENGL 530. Seminar: Intellectual Property and the Construction of Authorship. 3 Units.
Prereq: Graduate standing or permission.
Department of Earth, Environmental, and Planetary Sciences

The earth, environmental and planetary sciences encompass a wide range of inquiries into the physical, chemical, and biological processes that shape the earth and the planets. Application of these inquiries to understanding a planet’s evolution through time is a unique attribute of geological investigations. Knowledge of the past and present reveals the constraints of our environment and serves as a guide for the future.

In recent years, significant advances have been made in the understanding of plate tectonics, properties of the earth’s interior, the nature of surface and near-surface processes, the history of the earth’s climate, the ecology of living and ancient organisms, and the comparative geology of other planets. Geologic knowledge is fundamental to resource conservation, land use planning, environmental geochemistry, hydrology, engineering construction works, and other environmental concerns.

Department faculty focus their research in three areas: surficial processes, planetary materials, and geochemistry. The department offers degree programs leading to the Bachelor of Arts (BA) and Bachelor of Science (BS) in geological sciences, BA in environmental geology, BA in environmental studies, Master of Science (MS), and Doctor of Philosophy (PhD). The Environmental Studies Program (p. 408) is described elsewhere in this bulletin.

Undergraduate Programs

Majors

Students in earth, environmental, and planetary sciences obtain a solid background in basic science and mathematics as well as intensive training in the major. In addition, because of the wide variety of ways in which geologic knowledge can be applied, all students are encouraged to take electives in subjects appropriate to their personal objectives, which may be as diverse as the engineering applications of geology or the socioeconomic and legal systems bearing on environmental issues. The undergraduate programs stress practical experience and fieldwork as well as classroom study. The environmental geology major combines courses in geological sciences with courses in basic and applied sciences to provide students with an understanding of environmental problems, with employable skills, and with a background for graduate study or professional school.

All students participate in a three-semester Senior Project sequence in which they propose a research project, conduct the research, write a thesis, and present it to the department.

Geological Sciences Major

Required courses:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>EEPS 100</td>
<td>Introduction to Geology in the Field</td>
<td>3</td>
</tr>
<tr>
<td>EEPS 110</td>
<td>Physical Geology</td>
<td>3</td>
</tr>
<tr>
<td>EEPS 115</td>
<td>Introduction to Oceanography</td>
<td>3</td>
</tr>
<tr>
<td>EEPS 119</td>
<td>Geology Laboratory</td>
<td>1</td>
</tr>
<tr>
<td>EEPS 210</td>
<td>Historical Geology/Paleontology</td>
<td>3</td>
</tr>
<tr>
<td>EEPS 301</td>
<td>Stratigraphy and Sedimentation</td>
<td>3</td>
</tr>
<tr>
<td>EEPS 315</td>
<td>Structural Geology and Geodynamics</td>
<td>3</td>
</tr>
<tr>
<td>EEPS 317</td>
<td>Introduction to Field Methods</td>
<td>3</td>
</tr>
<tr>
<td>EEPS 341</td>
<td>Mineralogy</td>
<td>4</td>
</tr>
<tr>
<td>EEPS 344</td>
<td>Igneous and Metamorphic Petrology</td>
<td>4</td>
</tr>
</tbody>
</table>

Nine hours of EEPS electives (at least two of these courses must be at the 200 level or higher) 9

Environmental Geology Major

Required courses:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>EEPS 360</td>
<td>Summer Field Camp</td>
<td>6</td>
</tr>
<tr>
<td>EEPS 390</td>
<td>Introduction to Geological Research</td>
<td>3</td>
</tr>
<tr>
<td>EEPS 391</td>
<td>Senior Project</td>
<td>2</td>
</tr>
<tr>
<td>EEPS 392</td>
<td>Professional Presentation</td>
<td>2</td>
</tr>
</tbody>
</table>

Nine hours of EEPS electives (at least two of these courses must be at the 200 level or higher) 9

Additional Required Courses

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 105</td>
<td>Principles of Chemistry I</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 106</td>
<td>Principles of Chemistry II</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 113</td>
<td>Principles of Chemistry Laboratory</td>
<td>2</td>
</tr>
<tr>
<td>MATH 125</td>
<td>Math and Calculus Applications for Life, Managerial, and Social Sci I</td>
<td>4</td>
</tr>
<tr>
<td>or MATH 121</td>
<td>Calculus for Science and Engineering I</td>
<td>4</td>
</tr>
<tr>
<td>MATH 126</td>
<td>Math and Calculus Applications for Life, Managerial, and Social Sci II</td>
<td>4</td>
</tr>
<tr>
<td>or MATH 122</td>
<td>Calculus for Science and Engineering II</td>
<td>4</td>
</tr>
<tr>
<td>or MATH 124</td>
<td>Calculus II</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 115</td>
<td>Introductory Physics I</td>
<td>4</td>
</tr>
<tr>
<td>or PHYS 121</td>
<td>General Physics I - Mechanics</td>
<td>3</td>
</tr>
<tr>
<td>or PHYS 123</td>
<td>Physics and Frontiers I - Mechanics</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 116</td>
<td>Introductory Physics II</td>
<td>4</td>
</tr>
<tr>
<td>or PHYS 122</td>
<td>General Physics II - Electricity and Magnetism</td>
<td>4</td>
</tr>
<tr>
<td>or PHYS 124</td>
<td>Physics and Frontiers II - Electricity and Magnetism</td>
<td>4</td>
</tr>
</tbody>
</table>

Total Units 70

EEPS 360 Summer Field Camp provides comprehensive field training in the summer between the junior and senior years (this course necessitates transfer credit, which must be approved by the department).

Environmental Sciences Major

Required courses:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>EEPS 110</td>
<td>Physical Geology</td>
<td>3</td>
</tr>
<tr>
<td>EEPS 119</td>
<td>Geology Laboratory</td>
<td>1</td>
</tr>
<tr>
<td>EEPS 210</td>
<td>Historical Geology/Paleontology</td>
<td>3</td>
</tr>
<tr>
<td>EEPS 220</td>
<td>Environmental Geology</td>
<td>3</td>
</tr>
<tr>
<td>EEPS 303</td>
<td>Environmental Law</td>
<td>3</td>
</tr>
<tr>
<td>or EEPS 202</td>
<td>Global Environmental Problems</td>
<td>3</td>
</tr>
<tr>
<td>EEPS 305</td>
<td>Geomorphology and Remote Sensing</td>
<td>3</td>
</tr>
<tr>
<td>EEPS 317</td>
<td>Introduction to Field Methods</td>
<td>3</td>
</tr>
<tr>
<td>EEPS 321</td>
<td>Hydrogeology</td>
<td>3</td>
</tr>
<tr>
<td>EEPS 390</td>
<td>Introduction to Geological Research</td>
<td>3</td>
</tr>
<tr>
<td>EEPS 391</td>
<td>Senior Project</td>
<td>2</td>
</tr>
<tr>
<td>EEPS 392</td>
<td>Professional Presentation</td>
<td>2</td>
</tr>
</tbody>
</table>

Nine hours of EEPS electives (three additional courses at the 200 level or higher which relate to the science or societal implications of environmental concerns. Must be approved by department advisor.) 9

Additional Required Courses

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL 114</td>
<td>Principles of Biology</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 105</td>
<td>Principles of Chemistry I</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 106</td>
<td>Principles of Chemistry II</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 113</td>
<td>Principles of Chemistry Laboratory</td>
<td>2</td>
</tr>
<tr>
<td>ESTD 101</td>
<td>Introduction to Environmental Thinking</td>
<td>3</td>
</tr>
<tr>
<td>STAT 201</td>
<td>Basic Statistics for Social and Life Sciences</td>
<td>3</td>
</tr>
<tr>
<td>MATH 125</td>
<td>Math and Calculus Applications for Life, Managerial, and Social Sci I</td>
<td>4</td>
</tr>
<tr>
<td>or MATH 121</td>
<td>Calculus for Science and Engineering I</td>
<td>4</td>
</tr>
<tr>
<td>MATH 126</td>
<td>Math and Calculus Applications for Life, Managerial, and Social Sci II</td>
<td>4</td>
</tr>
<tr>
<td>or MATH 122</td>
<td>Calculus for Science and Engineering II</td>
<td>4</td>
</tr>
<tr>
<td>or PHYS 115</td>
<td>Introductory Physics I</td>
<td>4</td>
</tr>
<tr>
<td>or PHYS 121</td>
<td>General Physics I - Mechanics</td>
<td>4</td>
</tr>
<tr>
<td>or PHYS 123</td>
<td>Physics and Frontiers I - Mechanics</td>
<td>4</td>
</tr>
</tbody>
</table>

Total Units 67
In the above majors, the student and his or her advisor will design the remainder of the curriculum based on individual interests, in accordance with departmental and college requirements. Through the Integrated Graduate Studies Program (p. 549), students may earn a bachelor’s and a master’s degree in five years. Special programs, such as interdisciplinary majors, also may be arranged.

Minor

Students may complete a minor in geological sciences by taking at least 15 hours of coursework.

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>EEPS 119</td>
<td>Geology Laboratory</td>
<td>1</td>
</tr>
<tr>
<td>EEPS 101</td>
<td>The Earth and Planets</td>
<td>3</td>
</tr>
<tr>
<td>EEPS 110</td>
<td>Physical Geology</td>
<td>3</td>
</tr>
<tr>
<td>EEPS 115</td>
<td>Introduction to Oceanography</td>
<td>3</td>
</tr>
<tr>
<td>EEPS 117</td>
<td>Weather and Climate</td>
<td>3</td>
</tr>
<tr>
<td>Upper-level EEPS courses totaling 15 hours</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Total Units</td>
<td></td>
<td>15</td>
</tr>
</tbody>
</table>

Graduate Programs

Graduate programs leading to the Master of Science and Doctor of Philosophy degrees are offered. Both programs are flexible so as to meet the needs of the individual student. General areas of study include aquatic systems, aquatic and groundwater chemistry, environmental geochemistry, benthic ecology, biostratigraphy and paleontology, environmental and urban geology, geomorphology, limnology, paleoclimatology, petrology, sedimentary geochemistry, sedimentation and stratigraphy, stable isotope studies, meteoritics, planetary materials, geodynamics of planetary interiors, and planetary geology. More specific information is available from the departmental office, the departmental Web page, and the Office of Admission of the School of Graduate Studies.

Facilities

The department’s research facilities include thin sectioning and mineral separation facilities; laboratories for chemical analysis of water, including an ion chromatograph, colorimetric spectrometer, atomic absorption spectrophotometer, electrochemistry equipment, and an environmental glove box; alpha and gamma spectroscopic facilities for analysis of environmental nuclides; equipment for studying animal-sediment relations, including a scanning gamma spectrometer; scanning electron microscope; electron microprobe; chemical reactors and a diamond anvil press for high-temperature and high-pressure geochemical experiments; and high-speed computing equipment.

Also housed in the department are laboratories for paleontological and micropaleontological investigations and for work in ecology and sedimentology. A well-field owned by the university is available for groundwater sampling and analysis.

The department also contains a wide range of other equipment, such as reflected and transmitted light microscopes, fluid inclusion microscope, cathodoluminescence microscope, submicron and clay-silt-sand particle size analyzers, high magnetic field mineral separator, X-ray diffractometer, and field equipment for groundwater and geophysical work, including resistivity meter, seismic refraction instrument, ground conductivity meter, magnetometer, and gravimeter and field equipment for soil and sediment sampling.

Department Faculty

Gerald Matisoff, PhD

(Johns Hopkins University)
Professor and Chair
Sedimentary and environmental geochemistry

Ralph P. Harvey, PhD
(University of Pittsburgh)
Associate Professor
Planetary geology

Steven A. Hauck, II, PhD
(Washington University in St. Louis)
Assistant Professor
Geodynamics

Peter L. McCall, PhD, JD
(Yale University)
Professor; Director, Environmental Studies Program
Benthic ecology; paleoecology

Beverly Z. Saylor, PhD
(Massachusetts Institute of Technology)
Associate Professor
Sedimentary geology

James A. Van Orman, PhD
(Massachusetts Institute of Technology)
Professor
Geochemistry

Peter J. Whiting, PhD
(University of California, Berkeley)
Associate Professor and Associate Dean
Geomorphology; surface water hydrology; environmental geology

Adjunct Faculty

Philip O. Banks, PhD
(California Institute of Technology)
Adjunct Associate Professor
Geology; geochronology

George Collins, PhD
(University of Wisconsin)
Adjunct Professor
Astronomy

Andrew Dombard, PhD
(Washington University in St. Louis)
Adjunct Associate Professor; University of Illinois-Chicago
Planetary geophysics

Joseph Hannibal, PhD
(Kent State University)
Adjunct Associate Professor; Cleveland Museum of Natural History
Invertebrate paleontology

Michael Ketterer, PhD
(University of Colorado)
Adjunct Professor; Northern Arizona University
Analytical chemistry

David Saja, PhD
(University of Pennsylvania)
Adjunct Assistant Professor; Cleveland Museum of Natural History
Mineralogy

Richard C. Schmidt, PhD
(McGill University, Canada)
Adjunct Professor
Economic geology

Emeritus
Samuel M. Savin, PhD
(California Institute of Technology)
Jesse Earl Hyde Professor Emeritus of Geological Sciences and Dean Emeritus, College of Arts and Sciences
Isotope geochemistry

Courses

EEPS 100. Introduction to Geology in the Field. 3 Units.
This 3-week field course will serve as an introduction to geology by looking at the land around us: glacial features, sedimentary rocks, and the structures they form when continents collide. We will travel by van to six different states and visit some famous rock outcrops and glacial features, collect from some of the best fossil localities in the world, investigate some environmental geology problems (hazardous waste disposal and groundwater pollution, landslides, mining benefits and costs), and see how the Appalachian mountains were made. The course is constructed, operated, and graded assuming no prior geologic experience. Students will have multiple opportunities to observe, measure, and interpret at the outcrop level, and work together to piece together the history of a region. Discussion will proceed from what is observed to what is interpreted/inferred to its regional/larger significance. The course is carried out mostly in the field away from Cleveland; tent camping and hiking are required. Course fee in addition to summer tuition rates.

EEPS 101. The Earth and Planets. 3 Units.
An examination of the geological processes that have shaped the planets and moons of the inner solar system, focusing on those with relevance to our own planet Earth. Following an introduction to the fundamentals of planetary geology, lectures and exercises will explore how the inner planets (the asteroids, Mercury, Venus, Earth, the Moon, and Mars) exhibit the effects of planetary differentiation, impact cratering, volcanic activity, tectonics, climate, and interactions with life.

EEPS 110. Physical Geology. 3 Units.
Introduction to geologic processes and materials that shape the world we live in. Hydrologic cycle and evolution of landscapes. Earthquakes, volcanoes, plate tectonics, and geologic resources. Students desiring laboratory experience should enroll in EEPS 119 concurrently.

EEPS 115. Introduction to Oceanography. 3 Units.
The sciences of oceanography. Physical, chemical, biologic, and geologic features and processes of the oceans. Differences and similarities between the oceans and large lakes including the Great Lakes. Required: Sunday field trip.

EEPS 117. Weather and Climate. 3 Units.
Introduction to the study of weather and climate. Covers the basics of meteorology, climate zones, the hydrologic cycle, and weather prediction. Lectures address timely topics including greenhouse warming, past global climates, and recent advances in meteorology.

EEPS 119. Geology Laboratory. 1 Unit.
Principles and techniques common to the geological sciences including rock and mineral identification, map interpretation, land form analysis, application of geological information to engineering works, and more. One three-hour laboratory or field trip weekly. Recommended preparation: EEPS 110.

EEPS 202. Global Environmental Problems. 3 Units.
Global Environmental Problems is a course designed to provide students with an understanding of, and an appreciation for, human-influenced environmental changes that are global in scope. Accordingly, much of the material will focus on the nature and structure of natural global systems, how and where in those systems human influences occur, and will delve deeply into a few particular problems and solutions of current interest, such as population growth, climate change, ozone depletion, and fisheries, from a variety of viewpoints. Offered as ESTD 202 and EEPS 202.

EEPS 210. Historical Geology/Paleontology. 3 Units.
History of life as recorded in sedimentary rocks. Case histories of important basins of deposition; the interrelationships of paleogeography, plate tectonics, and evolution. Two lectures and one laboratory weekly.

EEPS 220. Environmental Geology. 3 Units.

EEPS 225. Evolution. 3 Units.
Multidisciplinary study of the course and processes of organic evolution provides a broad understanding of the evolution of structural and functional diversity, the relationships among organisms and their environments, and the phylogenetic relationships among major groups of organisms. Topics include the genetic basis of micro- and macro-evolutionary change, the concept of adaptation, natural selection, population dynamics, theories of species formation, principles of phylogenetic inference, biogeography, evolutionary rates, evolutionary convergence, homology, Darwinian medicine, and conceptual and philosophic issues in evolutionary theory. Offered as ANTH 225, BIOL 225, EEPS 225, HSTY 225, and PHIIL 225.

EEPS 301. Stratigraphy and Sedimentation. 3 Units.
Formation, distribution, and composition of sediments and sedimentary rocks. Modern depositional environments and their ancient analogues; principles of stratigraphic and biostratigraphic correlation. Two lectures and one laboratory per week.

EEPS 303. Environmental Law. 3 Units.
Introduction to treatment of environmental issues in legal proceedings. Sources of environmental law, legal procedure, common law remedies (toxic torts and human health, nuisance, contract law), statutes and regulations, endangered species, public lands, toxics regulation, nuclear power, coal. The course employs the case method of reading and recitation of appellate judicial opinions. We read both classic cases in environmental law as well as current controversies. Offered as ESTD 303 and EEPS 303.
EEPS 305. Geomorphology and Remote Sensing. 3 Units.
Recognition and interpretation of land forms and their significance in revealing present and past geologic processes. Introduction to acquisition and analysis of data through aerial photography and satellite imagery. Two lectures and one laboratory weekly. Recommended preparation: EEPS 110 and EEPS 119. Offered as EEPS 305 and EEPS 405.

EEPS 307. Evolutionary Biology and Paleobiology of Invertebrates. 3 Units.
Important events in the evolution of invertebrate life; structure, function, and phylogeny of major invertebrate groups.

EEPS 315. Structural Geology and Geodynamics. 3 Units.
Theoretical analysis of deformation in earth materials, with illustrations of deformational styles in various tectonic settings and the dynamics of the Earth’s interior. Recommended preparation: EEPS 110. Offered as EEPS 315 and EEPS 415.

EEPS 317. Introduction to Field Methods. 3 Units.
Practice in field procedures, recognition and testing of hypotheses in the field, field mapping and analysis of igneous, sedimentary, and metamorphic rocks in deformed and tectonically active settings. Weekly meeting plus spring break field trip. Students required to pay partial cost of meals, lodging, and travel. Offered as EEPS 317 and EEPS 417. Prereq: EEPS 119.

EEPS 318. Topics in Field Methods. 3 Units.
Field analysis of geological and environmental problems. Topics and locations will vary. Requires preparatory meetings and week-long field trip, usually during spring break. Students required to pay partial cost of meals, lodging, and travel. Recommended preparation: EEPS 119 or permission of instructor.

EEPS 321. Hydrogeology. 3 Units.
Basic and applied concepts pertaining to the occurrence and movement of groundwater. Definitions, basic equations, applications to a variety of geologic settings, wells. Requires one Saturday field trip to make field measurements, collect and analyze data, and prepare a report. Offered as EEPS 321 and EEPS 421.

EEPS 330. Geophysical Field Methods and Laboratory. 4 Units.
Use of seismic refraction and reflection, gravity, electrical, magnetic, and electromagnetic methods to infer the earth’s structure and composition. Application of inverse theory to estimate model parameters. Requires students to make field measurements, analyze data, and prepare a report. Includes several required Saturday field trips. Offered as EEPS 330 and EEPS 430.

EEPS 336. Aquatic Chemistry. 4 Units.
Chemical equilibria occurring in natural waters. Quantitative methods of describing acid-base, metal ion/ligand, precipitation/dissolution, and oxidation/reduction reactions. Geochemical cycling of trace metals and nutrients. Offered as EEPS 336 and EEPS 436.

EEPS 341. Mineralogy. 4 Units.
Crystallography, hand specimen mineralogy and petrology, principles of crystal structure and crystal chemistry, elementary thermodynamics and phase diagrams, and an introduction to the petrographic microscope. Three lectures and one three-hour laboratory weekly. Recommended preparation: EEPS 119.

EEPS 344. Igneous and Metamorphic Petrology. 4 Units.
Composition, classification, and genesis of igneous and metamorphic rocks, emphasizing physical and chemical principles governing their origin. Laboratory study of rocks in thin section. Two lectures and two three-hour laboratories weekly. Prereq: EEPS 341.

EEPS 345. Planetary Materials. 1 - 3 Units.
An introduction to the materials that make up the solid matter of the solar system. Student presentations will review our current understanding of accessible primitive materials such as meteorites, cosmic dust, lunar and ancient terrestrial rocks, and their relationship to modern natural materials and solar system processes. Offered as EEPS 345 and EEPS 445.

EEPS 349. Geological Problems. 1 - 3 Units.
Special work arranged according to the qualifications of the student.

EEPS 350. Geochemistry. 3 Units.
Introduction to geochemistry. Properties of the elements, elemental and isotopic fractionation, element transport, geochemical systems, geochronology, mineral reactions, the solid Earth, Earth in the solar system. A quantitative approach to modeling geochemical processes will be emphasized throughout. Offered as EEPS 350 and EEPS 450.

EEPS 360. Summer Field Camp. 6 Units.
Six-week course in geologic field methods and mapping. Not offered at CWRU; must be taken at another college or university. Credits will be transferred.

EEPS 367. Topics in Evolutionary Biology. 3 Units.
The focus for this course on a special topic of interest in evolutionary biology will vary from one offering to the next. Examples of possible topics include theories of speciation, the evolution of language, the evolution of sex, evolution and biodiversity, molecular evolution. ANAT/ANTH/EEPS/PHIL/PHOL/BIOL 467 will require a longer, more sophisticated term paper, and additional class presentation. Offered as ANTH 367, BIOL 368, EEPS 367, PHIL 367, ANAT 467, ANTH 467, BIOL 468, EEPS 467, PHIL 467 and PHOL 467.

EEPS 390. Introduction to Geological Research. 3 Units.
Examination of factors in the selection, design, and conduct of research projects and in the analysis and interpretation of research results. Consideration of ethical issues in scientific research. Development of a written research proposal and oral presentation of proposed research. Consultations with department faculty in development of research proposal. Research initiation. Offered as EEPS 390 and EEPS 490.

EEPS 391. Senior Project. 2 Units.
Research project required of all department majors, based on formal project proposals presented to department faculty. Proposals may be submitted prior to the semester in which EEPS 391 is taken. Grading based on project progress presentation that will include a statement of the problem, a literature review, a description of their field/lab work and presentation of their data collected to date. This course is the first of a 2 semester Senior Capstone (EEPS 391, 392) sequence. Recommended preparation: EEPS 390.
EEPS 392. Professional Presentation. 2 Units.
Preparation and presentation of final written and oral reports on individual Senior Projects. Class meetings focus on group discussion of problem areas in analysis and interpretation of project results, and in styles of writing poster and oral presentation as demonstrated by practice examples. This course is the second in a two-course (EEPS 391, 392) Senior Capstone sequence. Prereq: EEPS 390 and EEPS 391. Or Coreq: EEPS 390.

EEPS 394. Seminar in Evolutionary Biology. 3 Units.
This seminar investigates 20th-century evolutionary theory, especially the Modern Evolutionary synthesis and subsequent expansions of and challenges to that synthesis. The course encompasses the multidisciplinary nature of the science of evolution, demonstrating how disciplinary background influences practitioners’ conceptualizations of pattern and process. This course emphasizes practical writing and research skills, including formulation of testable theses, grant proposal techniques, and the implementation of original research using the facilities on campus and at the Cleveland Museum of Natural History. Offered as ANTH 394, BIOL 394, EEPS 394, HSTY 394, PHIL 394, ANTH 494, BIOL 494, EEPS 494, HSTY 494, and PHIL 494.

EEPS 396. Undergraduate Research in Evolutionary Biology. 3 Units.
Students propose and conduct guided research on an aspect of evolutionary biology. The research will be sponsored and supervised by a member of the CASE faculty or other qualified professional. A written report must be submitted to the Evolutionary Biology Steering Committee before credit is granted. Offered as ANTH 396, BIOL 396, EEPS 396, and PHIL 396.

EEPS 405. Geomorphology and Remote Sensing. 3 Units.
Recognition and interpretation of land forms and their significance in revealing present and past geologic processes. Introduction to acquisition and analysis of data through aerial photography and satellite imagery. Two lectures and one laboratory weekly. Recommended preparation: EEPS 110 and EEPS 119. Offered as EEPS 305 and EEPS 405.

EEPS 415. Structural Geology and Geodynamics. 3 Units.
Theoretical analysis of deformation in earth materials, with illustrations of deformational styles in various tectonic settings and the dynamics of the Earth's interior. Recommended preparation: EEPS 110. Offered as EEPS 315 and EEPS 415.

EEPS 417. Introduction to Field Methods. 3 Units.
Practice in field procedures, recognition and testing of hypotheses in the field, field mapping and analysis of sedimentary, igneous, and metamorphic rocks in deformed and tectonically active settings. Weekly meeting plus spring break field trip. Students required to pay partial cost of meals, lodging, and travel. Offered as EEPS 317 and EEPS 417.

EEPS 421. Hydrogeology. 3 Units.
Basic and applied concepts pertaining to the occurrence and movement of groundwater. Definitions, basic equations, applications to a variety of geologic settings, wells. Requires one Saturday field trip to make field measurements, collect and analyze data, and prepare a report. Offered as EEPS 321 and EEPS 421.

EEPS 425. Geotectonics. 3 Units.
Interpretation of the major crustal features of the earth in terms of plate tectonics and associated phenomena.

EEPS 430. Geophysical Field Methods and Laboratory. 4 Units.
Use of seismic refraction and reflection, gravity, electrical, magnetic, and electromagnetic methods to infer the earth's structure and composition. Application of inverse theory to estimate model parameters. Requires students to make field measurements, analyze data, and prepare a report. Includes several required Saturday field trips. Offered as EEPS 330 and EEPS 430.

EEPS 436. Aquatic Chemistry. 4 Units.
Chemical equilibria occurring in natural waters. Quantitative methods of describing acid-base, metal ion/ligand, precipitation/dissolution, and oxidation/reduction reactions. Geochemical cycling of trace metals and nutrients. Offered as EEPS 336 and EEPS 436.

EEPS 437. Chemistry of Natural Waters. 3 Units.
Advanced topics in aquatic chemistry. Thermodynamics models for ion/ligand speciation in natural waters; origin and composition of seawater, chemical and mineralogical sequence during evaporation, chemical weathering, groundwater and river water chemistry, chemical cycling and a global mass balances; perturbations on natural systems by man. Predictive capabilities of box models.

EEPS 444. Flow and Sediment Transport. 3 Units.
This course focuses on open channel flow and sediment transport mechanics. A mathematical framework for the description of free surface flow and various modes of particle transport is built. This framework is used in discussions of geomorphic and sedimentologic processes and features. Specific topics covered include dimensional analysis, forces on settling particles, fluid flow, initiation of particle movement, bedload and suspended load transport and their calculation, and channel form.

EEPS 445. Planetary Materials. 1 - 3 Unit.
An introduction to the materials that make up the solid matter of the solar system. Student presentations will review our current understanding of accessible primitive materials such as meteorites, cosmic dust, lunar and ancient terrestrial rocks, and their relationship to modern natural materials and solar system processes. Offered as EEPS 345 and EEPS 445.

EEPS 450. Geochemistry. 3 Units.
Introduction to geochemistry. Properties of the elements, elemental and isotopic fractionation, element transport, geochemical systems, geochronology, mineral reactions, the solid Earth, Earth in the solar system. A quantitative approach to modeling geochemical processes will be emphasized throughout. Offered as EEPS 350 and EEPS 450.

EEPS 455. Isotope Geochemistry. 3 Units.
Principles and applications of naturally occurring variations of isotopic abundances in geologic, hydrologic, and biologic systems. Includes consideration of radioactive and radiogenic isotopes and their use in geochronology and as tracers; consideration of isotopic fractionations (especially of light stable isotopes), their thermodynamic and kinetic causes, and their use in understanding mechanisms and conditions of geologic processes and as tracers.
EEPS 467. Topics in Evolutionary Biology. 3 Units.
The focus for this course on a special topic of interest in evolutionary biology will vary from one offering to the next. Examples of possible topics include theories of speciation, the evolution of language, the evolution of sex, evolution and biodiversity, molecular evolution. ANAT/ANTH/EEPS/PHIL/PHOL 467/BIOL 468 will require a longer, more sophisticated term paper, and additional class presentation. Offered as ANTH 367, BIOL 368, EEPS 367, PHIL 367, ANAT 467, ANTH 467, BIOL 468, EEPS 467, PHIL 467 and PHOL 467.

EEPS 490. Introduction to Geological Research. 3 Units.
Examination of factors in the selection, design, and conduct of research projects and in the analysis and interpretation of research results. Consideration of ethical issues in scientific research. Development of a written research proposal and oral presentation of proposed research. Consultations with department faculty in development of research proposal. Research initiation. Offered as EEPS 390 and EEPS 490.

EEPS 494. Seminar in Evolutionary Biology. 3 Units.
This seminar investigates 20th-century evolutionary theory, especially the Modern Evolutionary synthesis and subsequent expansions of and challenges to that synthesis. The course encompasses the multidisciplinary nature of the science of evolution, demonstrating how disciplinary background influences practitioners' conceptualizations of pattern and process. This course emphasizes practical writing and research skills, including formulation of testable theses, grant proposal techniques, and the implementation of original research using the facilities on campus and at the Cleveland Museum of Natural History. Offered as ANTH 394, BIOL 394, EEPS 394, HSTY 394, PHIL 394, ANTH 494, BIOL 494, EEPS 494, HSTY 494, and PHIL 494.

EEPS 503. Seminar: Geomorphology/Glacial Geology. 1 Unit.

EEPS 504. Seminar: Geochemistry. 1 Unit.

EEPS 506. Seminar in Geophysics. 1 - 3 Unit.
Selected topics in geophysics: advanced research issues, classical papers, current state of the field, advanced techniques. Course content will vary depending on interests of students and faculty.

EEPS 509. Seminar: Graduate Research. 1 Unit.

EEPS 511. Special Readings in Geology. 1 - 6 Unit.
Detailed study of a selected topic in geology under the guidance of a faculty member.

EEPS 512. Special Readings in Geology. 1 - 6 Unit.
Detailed study of a selected topic in geology under the guidance of a faculty member.

EEPS 601. Special Problems and Research. 1 - 18 Unit.
(Credit as arranged.)

EEPS 651. Thesis M.S.. 1 - 18 Unit.
(Credit as arranged.)

(Credit as arranged.) Prereq: Predoctoral research consent or advanced to Ph.D. candidacy milestone.
Department of History

The Department of History offers comprehensive undergraduate and graduate programs in all fields of history, with particular strengths in American history; the history of science, technology, environment, and medicine; and social history and policy. Historical studies are sometimes categorized among humanistic studies and sometimes among the social sciences. Allied with both traditions, historians seek an understanding of the past by analyzing societies and how they change over time.

The Department of History offers instruction within the customary frameworks that have formed the basis of historical studies, and it also has developed special emphases in social, cultural, political, and economic perspectives that allow instruction and research on such topics as the African-American experience, the environment, business and economy, technology and science, medicine, women’s history and gender studies, legal history, and comparative social history. Courses in history, or a formal major or minor in history, traditionally have been attractive to students as preparation for a wide variety of career and professional interests, including teaching, law, government, and journalism, and such public history activities as archival administration, historical museum administration, restoration and preservation of historic sites, and writing.

Facilities

Case Western Reserve University, the other institutions in University Circle, and the Cleveland area in general offer excellent facilities for historical research. These facilities are especially strong in the fields of social history and policy and in the history of medicine, health care, nonprofit organizations, technology, and science. The university library’s extensive collections in these fields are significantly augmented by the holdings of the nationally ranked Allen Memorial Library in the history of medicine and health care, and of the equally distinguished Western Reserve Historical Society in regional economic, social, nonprofit, ethnic, African-American, and Jewish history. Both the Allen Memorial Library and the Western Reserve Historical Society library are adjacent to the campus. The Cleveland Public Library, just five miles from campus in downtown Cleveland, is the third largest public library in the U.S.; it maintains excellent research collections in Ohio, U.S., and British history, technology, and business. The university has also pioneered the development of electronic connections to other libraries and to research resources in general; Ohio’s many colleges and universities have one of the nation’s leading interlibrary loan programs.

Undergraduate Programs

Major

The history major may be elected in one of two formats: the regular major or the teacher licensure major.

Regular Major

The regular major requires a minimum of 30 hours in history courses, including:

- **HSTY 112** Introduction to American History 3
- **HSTY 113** Introduction to Modern World History 3
- **HSTY 250** Issues and Methods in History 3
- **HSTY 398** Senior Research Seminar 3

The major also requires six additional courses in history, four of which must be agreed upon in consultation with the departmental advisor to form a coherent field of historical inquiry. All majors are encouraged to take at least two courses focused in geographical areas outside of Europe and the United States. With permission, one course in a related discipline outside of the history department may be accepted towards the requirements of the major.

Teacher Licensure Major

The teacher licensure major requires 30 hours of history, including the same four courses required for the regular major and a minimum of six semester hours in each of three focus areas: United States history, world/European studies, and Asian, African, and Latin American studies. Candidates for teacher licensure (Integrated Social Studies, Adolescents and Young Adults) must also take courses in economics, political science, and sociology (9 hours), and 35 hours in education courses offered through Case Western Reserve and John Carroll University culminating in student teaching. Students interested in pursuing this option should confer with the department’s undergraduate advisor. See the Teacher Licensure (p. 437) section in this bulletin.

Subject area requirements:

- HSTY 112 Introduction to American History 3
- HSTY 113 Introduction to Modern World History 3
- HSTY 250 Issues and Methods in History 3
- HSTY 398 Senior Research Seminar 3

Two of the following: 6

- HSTY 152 Technology in America
- HSTY 206 Ancient and Medieval Spain: Prehistory to 1492
- HSTY 255 Economic History of the United States
- HSTY 256 American Political History
- HSTY 257 Immigrants in America
- HSTY 260 U.S. Slavery and Emancipation
- HSTY 262 African-American History Since 1945
- HSTY 325 U.S. Politics, Culture, and Society: 1790-1860
- HSTY 353 Women in American History I
- HSTY 354 Women in American History II
- HSTY 355 Age of American Civil War 1815-80
- HSTY 378 North American Environmental History

Two of the following: 6

- HSTY 151 Technology in European Civilization
- HSTY 211 The Medieval World, 300-1500
- HSTY 212 Modern European History
- HSTY 254 The Holocaust
- HSTY 309 Reformation Europe, 1500-1650
- HSTY 310 The French Revolutionary Era
- HSTY 334 History of 19th Century Germany
- HSTY 335 History of 20th Century Germany
- HSTY 342 Water

Two of the following: 6

- HSTY 135 Introduction to Modern African History
- HSTY 280 History of Modern Mexico
- HSTY 285 Modern Japan
- HSTY 383 Readings in PRC History

One of the following: 3

- ECON 102 Principles of Microeconomics
- ECON 103 Principles of Macroeconomics
- POSC 260 Introduction to Comparative Politics

One of the following: 3

- SOCI 101 Introduction to Sociology
- SOCI 113 Critical Problems in Modern Society
- SOCI 302 Race and Ethnic Minorities in American Society
- SOCI 310 The Individual in Society

Total Units: 36
(With advisor approval, the economics requirement may be met with HSTY 255 Economic History of the United States, the sociology requirement may be met with HSTY 262 African-American History Since 1945 or HSTY 325 U.S. Politics, Culture, and Society: 1790-1860, and the political science requirement may be met with HSTY 256 American Political History.)

**Integrated Graduate Studies**

The Department of History participates in the Integrated Graduate Studies (IGS) Program (p. 549). Interested students should note the general requirements and procedures of the Graduate School, but must also consult the departmental advisor about the specific requirements, guidelines, and opportunities for IGS in history.

**Minor**

A minor in history is available to all undergraduate students. It consists of 15 hours in history, including HSTY 112 Introduction to American History and HSTY 113 Introduction to Modern World History (history core courses) and three additional courses, chosen in consultation with the departmental advisor; these courses must form a coherent field of historical inquiry.

**Advanced Placement Credit**

Students with Advanced Placement (AP) scores of 5 or better will receive three semester hours of college credit, applicable to the total number of credits required for graduation as well as to any major, minor, or sequence in history. AP credit may not be applied to the HSTY 112 Introduction to American History and HSTY 113 Introduction to Modern World History core courses. Credit by way of AP examination in U.S. history is given for HSTY 256 American Political History or in European history for HSTY 212 Modern European History.

**Graduate Programs**

The Department of History offers both the MA and the PhD in history. Most but not all of our PhD students work within one of the department's two focused PhD programs: (1) Social History and Policy, and (2) History of Science, Technology, Environment and Medicine. In practice, these two programs are often closely related. The department also joins with the Law School to offer an MAJD dual-degree program. Applicants for graduate degrees in history must submit transcripts from all previous undergraduate, graduate, and professional study; scores on the GRE or a comparable standardized test; three letters of recommendation; application essays; and a writing sample.

**Master of Arts**

The MA in history requires 27 hours of course work, including 6 hours of carefully supervised work on a master's thesis (a work of original research based on primary sources). For the joint JD/MA program, students must be admitted to both the history graduate program and the law school. They can earn the degree in either three and one-half years or three years and two summers of study, completing a total of 106 hours (including double credits of up to nine hours).

**Doctor of Philosophy**

Students are admitted into the history department's graduate programs with or without a master's or professional degree. Students who do not have a master's degree in history will generally be required to complete that degree in the department before moving on to the PhD; those who have earned graduate or professional degrees closely related to their PhD programs may petition for direct admission to the PhD program. Students who first complete their MA in history at Case Western Reserve must complete an additional 24 hours of course work, pass the qualifying exams required by their program of study, and prepare a PhD dissertation while enrolling in at least 18 hours of supervised dissertation-writing work. Students who have completed their master's-level work before coming to Case Western Reserve must complete at least 24 hours of course work before taking their qualifying exams and proceeding to their dissertation. All PhD students are required to take:

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<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
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<tbody>
<tr>
<td>HSTY 470</td>
<td>Historiography, Method, and Theory</td>
<td>3</td>
</tr>
<tr>
<td>HSTY 476</td>
<td>Seminar in Comparative History</td>
<td>3</td>
</tr>
<tr>
<td>HSTY 479</td>
<td>Historical Research and Writing</td>
<td>3</td>
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**Social History and Policy Program (SHP)**

The Social History and Policy Program is designed to prepare students for careers either as analysts and administrators of social policy or as teachers and researchers in colleges and universities. The program defines social policy broadly to include not only welfare, family and juvenile matters, aging, health care, and medicine, but also education, urban history, environmental history, cultural policies regarding museums, libraries and similar agencies, and labor. The program recognizes that social policies are made and put into practice by private, nonprofit organizations and through legal institutions as well as through federal, state, and local legislatures and executives.

Entry into the program does not require an MA in history; several students have been admitted with JD, MSW, library science, or other degrees. However, the program often requires students with limited backgrounds in U.S. history to take extra course work.

More tightly structured than the traditional PhD, the Social History and Policy Program requires 18 hours of course work (and possibly additional hours to prepare for examinations); qualifying examinations in U.S. history and in the history of social policy; a cognate field; and a dissertation. The program also includes an option for the student to complete a policy-related internship; recent internships have been conducted with the Cleveland Federation for Community Planning, the Interchurch Council of Greater Cleveland, the Bureau of Jewish Education, the Sisters of Charity of St. Augustine, and the Hathaway Brown School.

**History of Science, Technology, Environment and Medicine Program (STEM)**

The History of Science, Technology, Environment and Medicine Program was established in 1961 as the first in the nation to emphasize the history of technology as well as the history of science. The program's areas of particular strength include the social and cultural history of technology, both American and European; technology and science policy; the history of the physical sciences since the Renaissance; gender issues in technology and science; the history of medicine; and the history of the environment. The course of study for the PhD includes the MA requirements, written and oral qualifying examinations, and a dissertation. While most graduates of the program teach in universities, others work in museums or archives or deal with science policy questions.

**General PhD Program**

In addition to the specialized SHP and STEM programs, the Department of History also offers a general PhD in history, allowing students to specialize in any geographical, temporal, or topical area of history adequately covered by department faculty. In the past, this general program has been largely restricted to students pursuing topics in U.S. history (including American women's history, African-American history, U.S. cultural history, and the history of social movements), but the gradual expansion of the department now allows us to support
PhD work in certain comparative or non-U.S. fields. All prospective graduate applicants are encouraged to examine the research specialties of department faculty before applying to the program.

**Department Faculty**

Jonathan Sadowsky, PhD  
(Johns Hopkins University)  
*Theodore J. Castele Professor; Associate Professor and Chair*  
Medical history; African history; comparative history

Molly W. Berger, PhD  
(Case Western Reserve University)  
*Instructor; Associate Dean, College of Arts and Sciences*  
History of technology; U.S. cultural history; nineteenth and twentieth centuries

John Broich, PhD  
(Stanford University)  
*Assistant Professor, and Director of Undergraduate Studies*  
British history; British Empire; environmental history; history of public health

Daniel Cohen, PhD  
(Brandeis University)  
*Associate Professor*  
Colonial America; U.S. cultural history

Jia-Chen Fu, PhD  
(Yale University)  
*Assistant Professor*  
Qing and 20th-century China; history of medicine; history of the body

Jay Howard Geller, PhD  
(Yale University)  
*Samuel Rosenthal Professor of Judaic Studies; Associate Professor*  
Jewish history, modern European history, modern German history

David C. Hammack, PhD  
(Columbia University)  
*Hiram C. Haydn Professor of History*  
American social and urban history; economic history; history of civil society and philanthropy

Marixa Lasso, PhD  
(University of Florida)  
*Associate Professor*  
Latin American and Caribbean history; race and nationalism; urban history

Kenneth F. Ledford, PhD, JD  
(Johns Hopkins University; University of North Carolina)  
*Associate Professor*  
Modern German history; Modern European history; European legal history; history of the professions

Miriam R. Levin, PhD  
(University of Massachusetts, Amherst)  
*Professor*  
History of industrial societies and cultures; history of modern France; women in science

Alan Rocke, PhD  
(University of Wisconsin, Madison)  

**Henry Eldridge Bourne Professor of History and Distinguished University Professor**  
History of science; science, technology, and society

Renée M. Sentilles, PhD  
(College of William and Mary)  
*Associate Professor*  
American women’s history; U.S. cultural history; American studies; children’s studies

Peter Shulman, PhD  
(Massachusetts Institute of Technology)  
*Assistant Professor*  
History of science, technology and American politics; environmental history and the history of energy; United States foreign relations

Theodore L. Steinberg, PhD  
(Brandeis University)  
*Adeline Barry Davie Distinguished Professor of History; Professor of Law*  
U.S. environmental and legal history

Gillian L. Weiss, PhD  
(Stanford University)  
*Associate Professor*  
Early modern France; comparative slavery; the Mediterranean

Rhonda Y. Williams, PhD  
(University of Pennsylvania)  
*Associate Professor; Director, CWRU Social Justice Institute; Director, Postdoctoral Fellowship in African American Studies*  
African American history; U.S. social history

**Secondary Faculty**

Rachel Sternberg, PhD  
(Bryn Mawr College)  
*Associate Professor, Department of Classics*  
Greek language and literature; Greek social history; history of emotion; reception of the classical tradition in the age of Jefferson

**Adjunct Faculty**

Amy Absher, PhD  
(University of Washington)  
*Lecturer and SAGES Fellow*  
US Urban history; race & ethnicity in America; American & European cultural & intellectual history

Elizabeth Bly, PhD  
(Case Western Reserve University)  
*Lecturer*  
Gender history/studies, sexuality, popular culture (U.S. 1945-present)

Virginia Dawson, PhD  
(Case Western Reserve University)  
*Adjunct Associate Professor*  
History of science and technology

James M. Edmonson, PhD  
(University of Delaware)  
*Adjunct Associate Professor; Director, Dittrick Medical History Center*  
Medical history

John Grabrowski, PhD  
(Case Western Reserve University)  
*Krieger-Mueller Joint Professor in Applied History*
HSTY 101. Technology & American Culture. 3 Units.

HSTY 112. Introduction to American History. 3 Units.
History of the United States from the first settlements to the present. Emphasis on themes such as political and social revolution, slavery and race relations, industrialism, and national cultures.

HSTY 113. Introduction to Modern World History. 3 Units.
The history of the nineteenth and twentieth centuries in global context. Emphasis on the forces that have created or shaped the modern world: industrialization and technological change; political ideas and movements such as nationalism; European imperialism and decolonization; and the interplay of cultural values.

HSTY 117. Exploring American History Through Biography. 3 Units.
This discussion and lecture class uses various forms of biography to explore issues of American Identity throughout the course of American history. The class will discuss how certain biographies have created archetypal American identities, and how issues such as race, class, gender, sexuality, religion, and historical context have shaped the writing, reading, and purpose of biography. The last third of the class will consider the process of "national memory," the way the United States has decide to remember its past. Here the "biography" is collective, and created by myriad strands of mass culture woven together to create a national mythology. We will explore the works of those striving to pull apart these different strands, and explore what these memories tell us about established national identity. Students will explore biographical process through their assignments, and consider such questions as: How do American biographies influence our understanding of what it means to be American? How does biographical medium affect the message? Can we accept biography as history? This course investigates biography as a constructed genre that comes in a variety of forms, including autobiography, biographical novels, oral histories, and film. Offered as AMST 117 and HSTY 117.

HSTY 133. Introduction to Chinese History and Civilization. 3 Units.
This course explains the continuities and discontinuities in the history of China by stressing the development and distinctive adaptations of cultural, religious, and political patterns from the origins of the Chinese civilization to the present. By focusing on major cultural, socioeconomic, and political issues such as Confucianism, Buddhism, trade relations, imperialism, and intellectual discourse in the overall Asian context (with particular reference to Korea and Japan), we discuss the historical development of China and its situation on entering the 21st century. Taking into account the key historical events in the last century, we examine the emergence of China as a modern nation-state and the fundamental transformation of Chinese society in the postwar period. Offered as ASIA 133 and HSTY 133.

HSTY 134. Introduction to Japanese History and Civilization. 3 Units.
This course provides an introduction to various aspects of Japanese civilization, from its origins to the present. By focusing on major cultural, socio-economic, and political issues such as the adaptation and transformation of Confucianism, Buddhism, Shintoism, social structures, material culture, foreign relations, militarism, nationalism, and intellectual discourse in the overall Asian context (with particular reference to Korea and China), we discuss the historical development of Japan and the country's position on entering the 21st century. We examine the emergence of Japan as a modern nation-state and the fundamental transformation of its society in the post-war period. Offered as ASIA 134 and HSTY 134.

HSTY 135. Introduction to Modern African History. 3 Units.
A general introduction to major themes in modern African history, with an emphasis on the nineteenth and twentieth centuries. Topics include oral tradition and narrative, economic structure and dynamics, religious movements, colonialism, nationalism, and the dilemmas of independent African states. Offered as ETHS 253A and HSTY 135.

HSTY 136. Introduction to Latin American History. 3 Units.
This course provides an introduction to the historical and cultural development of Latin America, in an attempt to identify the forces, both internal and external, which shape the social, economic and political realities in present day Latin America. Beginning with its pre-Columbian civilizations, the course moves through the conquest and colonial period of the Americas, the wars of independence and the emergence of nation-states in the nineteenth century, and the issues confronting the region throughout the turbulent twentieth century, such as migration and urbanization, popular protest and revolution, environmental degradation, great power intervention, the drug trade and corruption, and the integration of the region into the global economy. Offered as ETHS 253B and HSTY 136.

HSTY 151. Technology in European Civilization. 3 Units.
The history of technology in ancient Mediterranean, medieval, and modern European society until the First World War. The course introduces students to the relationship between technology and its social, political, and cultural settings, and to the values invested in technology at significant historical moments. There will be visits to local industrial sites, architectural and engineering monuments, and the Cleveland Museum of Art.

HSTY 152. Technology in America. 3 Units.
Origins and significance of technological developments in American history, from the first settlements to the present. Emphasis on the social, cultural, political, and economic significance of technology in American history.
HSTY 163. Modern Britain and Its Empire. 3 Units.
This lecture and discussion course covers the history of Britain at the height of its political and industrial power and the history of the expanding and contracting British Empire. Britain was a nation of great technological, economic, and military power, but it also experienced extraordinary stresses. Industrialization meant material prosperity for some, but hardship and dehumanization for others. Many questioned how overwhelming poverty and ignorance could be allowed to stand beside such vast affluence. And subjects of the British in India, Ireland, and elsewhere struggled for independence from an empire that claimed to bring freedom, reason, and equality. The British learned to their cost, too, that decolonization often meant being caught in the crossfire of ethnic rivals. This course will explore the many paradoxes of the history of the British at their most dominant.

HSTY 193. The Ancient World. 3 Units.
Ancient Western history from the origins of civilization in Mesopotamia to the dissolution of the Roman Empire in the West. Offered as CLSC 193 and HSTY 193.

HSTY 201. Science in Western Thought I. 3 Units.
The development of Western thinking about the natural world and our relation to it, as part of culture, from pre-classical civilizations to the age of Newton.

HSTY 202. Science in Western Thought II. 3 Units.
The development of Western thinking about the natural world and our relation to it, as part of culture, from Newton to the modern age. HSTY 201 is not a prerequisite.

HSTY 203. Natural Philosophy I. 3 Units.
Historical and philosophical interpretation of some epochal events in development of science. Copernican revolution, Newtonian mechanics, Einstein’s relativity physics, quantum mechanics, and evolutionary theory; patterns of scientific growth; structure of scientific “revolutions;” science and “pseudo-science.” First half of a year-long sequence. Offered as HSTY 203 and PHIL 203.

HSTY 204. Introduction to the Nonprofit Sector. 3 Units.
The United States has by far the largest and most important “nonprofit sector” in the world, a sector consisting of volunteer non-governmental organizations that provide health care, education and social services as well as arts, religious, and advocacy activities. Using mostly primary sources, this course considers the significance of the nonprofit sector in the U.S., its advantages and disadvantages, its uses for different groups of Americans, and current trends. Students have the option of writing either a standard term paper, or a study of strategic challenges facing a contemporary nonprofit organization. Offered as HSTY 204 and HSTY 404.

HSTY 206. Ancient and Medieval Spain: Prehistory to 1492. 3 Units.
This course focuses on the history of the Iberian peninsula from before the Roman conquest from the Iberians, Greek, and Carthaginian settlements, through Roman, Visigothic, and Muslim rule to the conquest of Ferdinand and Isabella of the last non-Christian territory on the peninsula in 1492. The issues of conquest, frontier, cultural diversity, and change, tolerance, and intolerance will be examined. Offered as CLSC 206, HSTY 206.

HSTY 207. Natural Philosophy II. 3 Units.
Conceptual, methodological, and epistemological issues about science: concept formation, explanation, prediction, confirmation, theory construction and status of unobservables; metaphysical presuppositions and implications of science; semantics of scientific language; illustrations from special sciences. Second half of a year-long sequence. Offered as HSTY 207 and PHIL 204.

HSTY 208. Social History of Crime. 3 Units.
This course explores the relationship between law and history in American society. It uses social history methodology to suggest new ways of understanding how the law works as a system of power to advance certain interests at the expense of less powerful groups. Emphasis is on issues of pressing concern to America’s poor and working class, including the death penalty, abortion, rape, the war on drugs, and the prison industry.

HSTY 210. Byzantine World 300-1453. 3 Units.
Development of the Byzantine empire from the emperor Constantine’s conversion to Christianity and founding of the eastern capital at Constantinople to the fall of Constantinople to Turkish forces in 1453. Offered as CLSC 210 and HSTY 210.

HSTY 211. The Medieval World, 300-1500. 3 Units.
Medieval history and civilization from the fall of the Roman Empire to the age of the Renaissance. Interactions between medieval Europe and other Mediterranean and Eurasian cultures.

HSTY 212. Modern European History. 3 Units.
The history of Europe from the late eighteenth century to the present. Themes include political upheavals and movements, as well as industrial, social, intellectual, and cultural changes. This course provides a solid foundation for those wishing to take more specialized courses in European history.

HSTY 215. Europe in the 20th Century. 3 Units.
The twentieth century has seen stupendous transformations in the internal structures of European politics, economics, society, and culture and in Europe’s place in the world. This course traces Europe’s transition from a continent of sovereign nation-states or empires ruled by monarchs with starkly hierarchical social structures, through wars, revolution, dictatorships, destruction, division, and destitution, to a conflicted present. The contradictory combination of peace, freedom, and pluralism combined with cultural critique of the very consumer society that has reduced conflict challenges students’ linear notions of historical development.

HSTY 216. Vikings and Medieval Scandinavia. 3 Units.
A survey of the history of the Vikings and medieval Scandinavia, covering approximately the eighth to the fifteenth centuries AD. Topics explored include: causes of the “outbreak” and cessation of Viking expeditions, the role of the Vikings as raiders and/or traders in Western Europe, the role of the Vikings in the emerging states of Russia, Iceland and medieval Scandinavian law, the historicity of the saga literature, and Viking descendents--Normans and “Rus.”
HSTY 217. History of Corporate America. 3 Units.
This course will explore the origins and evolution of big business’s role in American society. It is not a course about the history of corporations but rather a course that examines how corporate entities have affected fundamental aspects of political, social, and economic life. It will deal with the period from the late nineteenth century to the present and cover such topics as diverse as labor relations and advertising to media issues and lobbying. Our goal is to examine how an historical perspective can help us come to grips with topics of pressing importance to us as Americans today.

HSTY 218. Jews in Early Modern Europe. 3 Units.
This course surveys the history of Jews in Europe and the wider world from the Spanish expulsion through the French Revolution. Tracking peregrinations out of the Iberian Peninsula to the British Isles, France, Holland, Italy, Germany, Poland-Lithuania, the Ottoman Empire, and the American colonies, it examines the diverse ways Jews organized their communities, interacted with their non-Jewish neighbors, and negotiated their social, economic, and legal status within different states and empires. What role did Jews play and what symbolic place did they occupy during a period of European expansion, technological innovation, artistic experimentation, and religious and political turmoil? What internal and external dynamics affected Jewish experiences in the sixteenth, seventeenth, and eighteenth centuries? Through a selection of inquisitorial transcripts, government records, memoirs, and historical literature, we will explore topics such as persecution, conversion, messianism, toleration, emancipation, and assimilation. Offered as HSTY 218, JDST 218, and ETHS 218.

HSTY 224. Early Modern Europe. 3 Units.
Europe has not always existed. To find out who created it and when, this course will ask two fundamental questions: First, how did the geographic, linguistic, religious and ethnic characteristics of European identity develop over the course of the sixteenth, seventeenth and eighteenth centuries? Second, how did Europeans in this period influence other parts of the world? Through close readings of memoirs, treatises and chronicles, and discussions of secondary literature, we will explore the political, social, and religious history of Europe from roughly 1500 to 1800. Topics include: exploration and conquest; Protestant and Catholic reformations; witchcraft and popular culture; science and medicine; Enlightenment and Revolution.

HSTY 225. Evolution. 3 Units.
Multidisciplinary study of the course and processes of organic evolution provides a broad understanding of the evolution of structural and functional diversity, the relationships among organisms and their environments, and the phylogenetic relationships among major groups of organisms. Topics include the genetic basis of micro- and macro-evolutionary change, the concept of adaptation, natural selection, population dynamics, theories of species formation, principles of phylogenetic inference, biogeography, evolutionary rates, evolutionary convergence, homology, Darwinian medicine, and conceptual and philosophic issues in evolutionary theory. Offered as ANTH 225, BIOL 225, EEPS 225, HSTY 225, and PHIL 225.

HSTY 228. African Americans and Internationalism, 1885-1960s. 3 Units.
This course explores the development and articulation of African American Internationalism from the formal advent of the colonial project with the Berlin Conference in 1884-1885 up through the early stages of African decolonization in the 1960s. Internationalism is defined here, especially as it relates to African Americans, as the sustained interest among governmental and non-governmental actors in promoting a foreign policy agenda that sought to impact events in the Diaspora and on the African continent itself. Using Africa, Asia and the Caribbean as case studies, this course will excavate the role of governmental and non-governmental actors such as the African American press, church, civil rights organizations, advocacy groups and diplomats in developing a viable African American foreign policy constituency. This course will stress the centrality of race, gender and transnationalism as central proponents in the development of black internationalism. This course will examine a number of global events and the roles played by African Americans in shaping the outcomes including the Berlin Conference (1885), the Spanish American War (1898), the Russo-Japanese War (1905), The Mexican Revolution (1910-1920), World War I (1914-1919), the Italo-Ethiopian War (1935), World War II (1939-1945), and the beginning of the formal decolonization of Africa with Ghanaian independence in 1957 and the subsequent challenges faced by various African countries in the early 1960s. The course will utilize biographies, case studies, and primary documents to examine these issues.

HSTY 231. Greek Civilization. 3 Units.
This course constitutes the first half of a year-long sequence on classical civilization. It examines the enduring significance of the Greeks studied through their history, literature, art, and philosophy. Lectures and discussion. (For the second course in the sequence, see CLSC 232 and HSTY 232.) Offered as CLSC 231 and HSTY 231.

HSTY 232. Roman Civilization. 3 Units.
The enduring significance of the Romans studied through their history, literature, art, and philosophy. Lectures and discussion. Offered as CLSC 232 and HSTY 232.

HSTY 234. France and Islam. 3 Units.
This seminar examines French encounters with the Muslim world from the Middle Ages to the present. Over the last millennium, France has viewed Saracens, Moriscos, Turks, Berbers, and Arabs with admiration and fear, disdain and incomprehension. Between the eleventh and thirteenth centuries, French soldiers battled in the Holy Land; for several hundred years after that, France and the Ottoman Empire exchanged diplomats, traders and slaves. The colonial occupation of Algeria that began in 1830 ended violently in 1962. By then, the empire that struck hundred years after that, France and the Ottoman Empire exchanged diplomats, traders and slaves. The colonial occupation of Algeria that began in 1830 ended violently in 1962. By then, the empire that struck back had also come home through large waves of immigration. Today, the social and economic status, religious affiliation, political significance and cultural impact of French citizens of North African descent are the subject of burning national debate. Taking a long view on Franco-Muslim relations, the course will explore such topics as the Crusades, Mediterranean piracy and captivity, Napoleon’s Egyptian campaign, the Algerian War of Independence, the “veil affair,” riots in the suburbs of Paris and World Cup soccer. Offered as ETHS 234, HSTY 234.
HSTY 235. Pirates in the Early Modern World. 3 Units.
From the Caribbean to Somalia, pirates have captivated the American imagination. Beyond examining images of heroic outlaws and bloodthirsty criminals in popular culture and current affairs, this course investigates maritime predators of the early modern period (16th-18th centuries). With a focus on the Mediterranean and the Atlantic—and forays into the Indian Ocean, the Red Sea and elsewhere—it considers the motivations and strategies of sea robbers and the responses of states. What, it asks, can Barbary corsairs, Dutch freebooters, Spanish “sea dogs,” and Catholic privateers, teach us about social rebellion, religious conflict, economic development, political authority, legal norms, naval power and imperial expansion?

HSTY 238. Jews in the Modern World. 3 Units.
Investigation of the impact of modernity on the Jewish community. In particular, the course will examine the influence of the Emancipation and Enlightenment on the social situation of the Jews in Europe and America and the corresponding changes in Judaic religion, philosophy, social structure, and culture. Attention will be paid to the creation of a modern Jewish identity in the secular culture of the post-Modern world. Offered as HSTY 238, JDST 231, and RLGN 231.

HSTY 241. Inventing Public Health. 3 Units.
The core principle of this course is that public health is a concept that was formed in different ways at different times in different places. It had no existence as we know it before the nineteenth century, but course participants will learn how it grew out of an ancient tradition of the political elite’s concern that its subjects were a threat to them and the stability of the realm. Course participants will discover how, in the nineteenth century, it became a professional practice as we know it and realized advances in human health, longevity, and security perhaps greater than any made since. At the same time, the course will also cover how many of the assumptions of those that inaugurated public health were completely alien to present-day practitioners—even though in many ways it is a practice that helped inaugurate the modern world so familiar to us. Course participants will learn about the close relationship between public health agencies and agendas and various kinds of social authority: political power, moral influence, colonial power, and others. Ultimately, the aim of the course is to show participants that even though public health seems a supremely common sense practice, it had a highly contested birth and early life that was anything but natural or preordained. That complicated birth continues to shape public health to this day.

HSTY 243. The Age of Prozac: Social and Cultural Aspects of Depression. 3 Units.
Although often experienced as an intensely individual, private, and painfully isolated affliction, depression has profound social and cultural dimensions. This course will neglect neither biological (neurochemical or genetic) perspectives, nor personal or psychological aspects, but will emphasize perspectives derived from history, anthropology, and sociology. While there may be tangential attention to bi-polar disorder (“manic depression”), the emphasis will be on unipolar depression. The course will conclude with an in-depth exploration of the rise of pharmaceutical treatments.

HSTY 246. People and the Land in Pre-Modern Europe. 3 Units.
This course explores the relationship between the peoples of Europe and their environments as Europe changed from a backwater of the Roman Empire into the seat of a number of globe-spanning empires. It examines how Europeans changed the land over time in order to derive a subsistence, produce profit, and, later, to fuel the growth and power of early modern state. The course will delve into the ways that Europeans thought about nature and conceived of their place in it. It will also explore how the environment itself influenced the courses of European societies; how climate and disease, animals and energy sources affected population growth, industrial activity, and even legal systems. As European powers sent their conquerors and colonists across the globe, they carried with them a tradition of thinking about, and interacting with, the environment in ways that had dramatic consequences for the world beyond Europe, and this course investigates whence this tradition came.

HSTY 250. Issues and Methods in History. 3 Units.
A methodological introduction to historical research. Students use a variety of approaches to interpret and study historical problems. Specific topics and instructors normally vary from year to year.

HSTY 252A. Introduction to African-American Studies. 3 Units.
This course is designed to introduce students to the study of Black History, cultures, economics, and politics. Students will learn about the development of the field by exploring theoretical questions, methodological approaches, and major themes that have shaped the study of black people, primarily in the U.S. context. This is a seminar-style, discussion-based course that emphasizes critical analysis and expository writing. Offered as ETHS 252A and HSTY 252A.

HSTY 254. The Holocaust. 3 Units.
This class seeks to answer fundamental questions about the Holocaust: the German-led organized mass murder of nearly six million Jews and millions of other ethnic and religious minorities. It will investigate the origins and development of racism in modern European society, the manifestations of that racism, and responses to persecution. An additional focus of the course will be comparisons between different groups, different countries, and different phases during the Nazi era. Offered as HSTY 254, RLGN 254, ETHS 254, and JDST 254.

HSTY 255. Economic History of the United States. 3 Units.
The growth of the American economy from the colonial period to the present. Competing explanations of economic growth; significant attention to the political and legal environment in which the U.S. economy developed; “lessons” of past experience for contemporary policy; some attention to inequality and the changing distribution of wealth and income. Offered as ECON 255 and HSTY 255.

HSTY 256. American Political History. 3 Units.
From the origins of American politics in the colonial period to the present. The Revolution and Constitutional debate; presidential politics and leadership; voters and voting patterns; Congress and the courts. Emphasis both on the ideas that animated American politics and on the relation of politics to society.

HSTY 257. Immigrants in America. 3 Units.
Immigration to America has constantly reshaped the way the nation views itself. This course examines the overall history of immigration to the United States, but places that movement within a global context. It also pays particular attention to the roles that policy and technology have played in controlling or defining immigration to America.
HSTY 259. Introduction to Latina/o Studies. 3 Units.
Interdisciplinary introduction to the basis for a Latina/o ethnicity through an exploration of commonalities and differences in the peoples of Latin American and Caribbean origin within the continental United States. Topics include methodological and theoretical formulations central to the field (e.g., racial, gender, and sexual formations, modes and relations of production and class, nation and transnation), history and contemporary issues of identity, family, community, immigration, and the potential for a pan-ethnic identity. Discussions will focus on major demographic, social, economic and political trends: historical roots of Latinas/os in the U.S.; the evolution of Latina/o ethnicity and identity; immigration and the formation of Latina/o communities; schooling and language usage; tendencies and determinants of socioeconomic and labor force status; discrimination, segregation and bias in contemporary America; racial and gender relations; and political behavior among Latinas/os. Offered as: ETHS 252B and HSTY 259.

HSTY 260. U.S. Slavery and Emancipation. 3 Units.
Begin with the African encounter with Europeans during the emergence of the modern slave trade. Students are introduced to the documents and secondary literature on the creation and maintenance of slavery, first in colonial America, and then in the United States. The course concludes with the destruction of slavery. Offered as ETHS 260 and HSTY 260.

HSTY 261. African-American History 1865-1945. 3 Units.
Explores the fashioning of a modern African-American culture between emancipation and the end of World War II. Emergence of a northernbased leadership, the challenge of segregation, emergence of bourgeois culture, the fashioning of racial consciousness and black nationalism, the shift from a primarily southern and rural population to one increasingly northern and urban, the creation and contours of a modern African-American culture, the construction of racial/gender and racial/class consciousness. Offered as ETHS 261 and HSTY 261.

HSTY 262. African-American History Since 1945. 3 Units.
Completes the three-term sequence of the African-American history survey (although the first two courses are not prerequisites for this course). Explores some of the key events and developments shaping African-American social, political, and cultural history since 1945. Offered as HSTY 262 and ETHS 262.

HSTY 270. Introduction to Gender Studies. 3 Units.
This course introduces women and men students to the methods and concepts of gender studies, women’s studies, and feminist theory. An interdisciplinary course, it covers approaches used in literary criticism, history, philosophy, political science, sociology, anthropology, psychology, film studies, cultural studies, art history, and religion. It is the required introductory course for students taking the women’s and gender studies major. Offered as ENGL 270, HSTY 270, PHIL 270, RLGN 270, SOCI 201, and WGST 201. Prereq: ENGL 150 or passing letter grade in a 100 level first year seminar in USFS, FSCC, FSNA, FSSO, FSSY, FSTS, FSCS.

HSTY 272. Sports in America: From Play to Profit. 3 Units.
This course reviews the history of sports in America from the colonial period to the present. It gives particular attention to the evolution of sports as a major business and to the roles of gender, ethnicity, and race in the history of America sport, as well as to the emergence of sport as a major defining characteristic of America life and society.

HSTY 278. Nineteenth-Century Europe. 3 Units.
This course examines the history of Europe during the so-called long nineteenth century, lasting from the French Revolution, which signaled the end of the Old Order, through World War I, which led to the end of the European primacy in the world. Major themes include decline of aristocratic hegemony, the emergence of new ideologies (especially nationalism, liberalism, and socialism), the rise of the bourgeoisie, culture in Europe’s golden age, and increasing national rivalry and competition.

HSTY 280. History of Modern Mexico. 3 Units.
This course explores the major issues that have influenced the formation of modern Mexico. This class is organized around three major themes. First, we will examine Mexican identity formation and its political implications. Second, we will assess Mexican life in relation to the development of the Mexican economy. Finally, we will survey how elite and popular forms of violence have affected Mexican society. Throughout the course, we will discuss the significance of the colonial heritage, regional distinctions, racial and gender stratification, and the creation and reconfiguration of various types of borders. Offered as HSTY 280 and ETHS 280.

HSTY 285. Modern Japan. 3 Units.
This course introduces students to the many changes that characterize the social, political, economic, and intellectual history of modern Japan from the mid-19th century to the present. We discuss to what extent the Meiji state was built upon Japan’s “traditional” heritage, how modernization and Western influence were implemented in and perceived by society, and which factors led the government to adopt extreme imperialist and militarist policies in the early 20th century. Looking at the emergence of a new Japan after World War II, we focus on employment structures, mass culture, urbanization, gender roles, and social patterns in order to understand the transformation of modern Japanese society.

HSTY 287. State, War, Drugs, and Coffee in Colombia: History of Modern Colombia. 3 Units.
This course will analyze the major forces that have shaped Colombian history from the 19th century to the present. Colombia is one of the largest and most fascinating countries in Latin America. It has been intricately linked to the U.S. market as a major coffee producer and, more recently, as a major supplier of illicit drugs. Colombia has always been one of the wealthiest Latin American countries, and it has a high degree of electoral democracy. Paradoxically, however, Colombia has also experienced rather high levels of regionalism and political violence. This course seeks to explore the history of these paradoxes. It will situate Colombia’s contemporary conflicts within a larger historical perspective. Offered as ETHS 287 and HSTY 287.
HSTY 288. Imperial China: The Great Qing. 3 Units.
This course is an introduction to the history of Imperial China, from the fall of the Ming Dynasty in 1644 to the creation of the Chinese republic in 1912. We will explore the major historical transformations (political, economic, social, and cultural) of the last imperial dynasty, the Qing (1644-1911), and develop an understanding of the major social, political, economic, and intellectual cultural forces shaping the formation of modern China. Contrary to commonly-held ideas in both West and in China that traditional Chinese society was timeless or stagnant, historians now see dramatic and significant changes during this period—to the economy, to gender relations, to religion, and to many other aspects of life. This course surveys the social, political, economic, and cultural history of this era, with emphasis on recent research. The main goals of the course will be to acquaint students with the key changes and to show the interplay between economic, social, and cultural changes on the one hand and political developments on the other. By the end of the semester you should have a good sense of how Chinese society was transformed over the course of the 17th through early 20th centuries. The topics we will discuss include urbanization and commerce; gender, family and kinship; education and the examination system; opium and free trade; and ethnicity and nationalism. Offered as ASIA 288 and HSTY 288.

HSTY 289. History of Twentieth Century China. 3 Units.
Completes a two-term sequence of the Chinese history survey, although HSTY 288 is not a prerequisite for this course. Beginning with the First Sino-Japanese War (1895), we review the historical development of intellectual discourse, public reaction, and political protest in later Imperial China through the creation of the People’s Republic in 1949 forward to contemporary times. In contrast to the conventional description of China from a Western point of view, this course tries to explain the emergence of modern China in the context of its intellectual, political, and socio-economic transformation as experienced by Chinese in the late 19th and into the 20th century. By discussing the influence of the West, domestic rebellions, and political radicalism, we examine how the Chinese state and society interacted in search for modernization and reforms, how these reforms were continued during the Republican period, and to what extent historical patterns can be identified in China’s present-day development. Offered as ASIA 289 and HSTY 289.

HSTY 292. Energy and Environment in American History 1750-2010. 3 Units.
This course uses the prism of energy to examine the history of the United States from the colonial period to the present. We will consider how energy has affected, and is affected by, American society, culture, science and technology, politics, diplomacy, and the environment. Four broad, thematic questions will recur throughout the semester. First, how has increasing energy use transformed American social life, the economy, and politics? Second, what are the relationships between energy consumption and environmental change? Third, what are the relationships between scientific discoveries, technological innovation and social change? And finally, how did the United States grow to be the largest consumer of energy in the history of the world? Addressing these questions will reveal the fundamental ways in which energy has shaped American history.

HSTY 293. History of Drugs. 3 Units.
This course will survey the rise and political, social, and cultural effects of drugs in modern societies with an emphasis on the late 19th and 20th century United States. First we will examine the global emergence and popularization of drugs as part of what David Courtwright has coined the “psychoactive revolution.” Then, we will narrow this broad lens by shifting our gaze to narcotics in the expanding U.S. nation. Specifically, we will examine the shifting demographics, nature of, and debates regarding narcotic consumption, regulation, and policy—and how these disparately affect and shape the lives of diverse populations. Finally, we will explore the human toll of narcotics in post-World War II culture and cities.

HSTY 298. Departmental Seminar. 3 Units.
The Department of History Departmental Seminar. A topical course, emphasizing disciplinary forms of writing, it is recommended for students before the end of their junior years. The class will advance the goals of SAGES within the disciplinary context of history by focusing on close readings of texts, analytical writing, and intensive seminar-style classroom discussions.

HSTY 299. Topics in History. 3 Units.
Subject matter will vary with instructor but will focus on some particular topic or historical approach. Course description available from departmental office.

HSTY 302. Ancient Greece: Archaic, Classical, and Hellenistic Periods. 3 Units.
The rise of Hellenic thought and institutions from the eighth to the third centuries B.C., the rise of the polis, the evolution of democracy at Athens, the crises of the Persian and Peloponnesian Wars, fifth-century historiography, the growth of individualism, and the revival of monarchy in the Hellenistic period. Offered as CLSC 302 and HSTY 302.

HSTY 303. History of the Early Church: First Through Fourth Centuries. 3 Units.
Explores the development of the diverse traditions of Christianity in the Roman Empire from the first through the fourth centuries C.E. A variety of New Testament and extra-Biblical sources are examined in translation. Emphasis is placed on the place of Christianity in the larger Roman society, and the variety of early Christian ideals of salvation, the Church, and Church leadership. Offered as HSTY 303 and RLGN 373.

HSTY 304. Ancient Rome: Republic and Empire. 3 Units.
Growth and development of the Roman state from the unification of Italy in the early third century B.C. to the establishment of the oriental despotism under Diocletian and Constantine. The growth of empire in the Punic Wars, the uncertain steps toward an eastern hegemony, the crisis in the Republic from the Gracchi to Caesar, the new regime of Augustus, the transformation of the leadership class in the early Empire, and the increasing dominance of the military over the civil structure. Offered as CLSC 304 and HSTY 304.

HSTY 306. History of Museums: Theory and Reality. 3 Units.
This course is an intensive summer internship (10 hours per week) at the Western Reserve Historical Society, complemented by extensive readings in museum/archival theory and public historical perception. It is designed both to introduce students to museum/archival work and to compare theoretical concepts with actual museum situations. Interns will be assigned a specific project within one of the Society’s curatorial or administrative divisions, but will have the opportunity to work on ancillary tasks throughout the Historical Society’s headquarters in University Circle. Offered as HSTY 306 and HSTY 406.
HSTY 307. Development of Chemistry and Chemical Engineering. 3 Units.
The development of chemical ideas; theories of matter, composition, structure, and reaction; the application of chemistry and chemical theory from antiquity to the 20th century; all considered in social context.

HSTY 309. Reformation Europe, 1500-1650. 3 Units.
Origins and development of Protestantism, the Catholic Counter-Reformation, and the interaction between secular power and religious identity in Christian Europe. Offered as HSTY 309 and RLGN 374.

HSTY 310. The French Revolutionary Era. 3 Units.
Causes, progress, and results of the internal transformation of France from 1789 to 1815; impact of revolutionary ideas on other European and non-European societies.

HSTY 311. Seminar: Modern American Historiography. 3 Units.
This seminar examines the approaches that professional historians of the United States have taken to the writing of American history in the past fifty years, with emphasis on changes in historical concerns, master debates among historians, and contemporary interests. Topics covered include national politics and government, economic development, social history, the history of ethnicity, race, and gender, and foreign policy and international relations. Each student will read widely and will prepare a series of reports on selected books and authors. Offered as HSTY 311 and HSTY 411.

HSTY 315. Heresy and Dissidence in the Middle Ages. 3 Units.
Survey of heretical individuals and groups in Western Europe from 500-1500 A.D., focusing on popular rather than academic heresies. The development of intolerance in medieval society and the problems of doing history from hostile sources will also be explored. Offered as HSTY 315 and RLGN 315.

HSTY 318. History of Black Women in the U.S.. 3 Units.
Chronologically arranged around specific issues in black women's history organizations, participation in community and political movements, labor experiences, and expressive culture. The course will use a variety of materials, including autobiography, literature, music, and film. Offered as ETHS 318, HSTY 318, and WGST 318.

HSTY 319. The Crusades. 3 Units.
This course is a survey of the history of the idea of "crusade," the expeditions of Western Europeans to the East known as crusades, the Muslim and Eastern Christian cultures against which these movements were directed, as well as the culture of the Latin East and other consequences of these crusades. Offered as HSTY 319 and RLGN 319.

HSTY 320. Departmental Seminar: Alexander the Great. 3 Units.
This course is the Classics Departmental Seminar in the SAGES sequence, though it can also be taken for regular credit in Classics or History. The seminar on Alexander the Great is normally taken in the Spring semester of junior year, and offers students a firm grounding in the diverse materials, methods, and approaches that can be brought to bear on the study of Greco-Roman antiquity and of its legacy up to today. Alexander's career is urgently relevant today for two primary reasons: the establishment of new forms of interaction between European"western" and Asian"eastern" civilizations; and the idea of global domination, wedding Greek and Asian as well as African (Egyptian) conceptions of rule and governance. Beyond the exploration of the ancient world of, or shaped by, Alexander, we will focus also on the reception of the historical figure, i.e., on the sometimes fantastic image of Alexander diffused in later epochs (Islamic, medieval) as well as on the more critical but often ideologically slanted early modern approach. Because of the expansion of the scope of the seminar (as of Alexander himself) beyond Europe and the critical examination of the traditional separation of East and West--or the three continents (Europe, Africa, and Asia) distinguished in antiquity--this course qualifies as a Global and Cultural Diversity course. Offered as CLSC 320 and HSTY 320.

HSTY 325. U.S. Politics, Culture, and Society: 1790-1860. 3 Units.
This is a survey of the history of the United States during the years between the Revolutionary era and the Civil War, exploring the transformation of American politics, religion, and culture, as well as the emergence of distinctive regional economies and social systems in the South, the Midwest, and the Northeast. It focuses especially on the emergence of the social institutions, patterns, and conflicts that still characterize the United States during the early twenty-first century. Particular attention is also paid to the experience of women and African Americans.

HSTY 327. Comparative Environmental History. 3 Units.
Environmental history is the study of how humans have influenced the environments around them and how the environment itself has influenced the course of human societies. This course provides students with the skill to identify and analyze these interactions. It introduces course participants to the main themes of environmental history literature and the driving questions guiding environmental history research by examining case studies drawn around the globe, including Pre-Columbian America, Medieval Japan, Colonial Africa, and Modern Germany. This course will help course participants recognize the important patterns and developments that have led to present day human-environmental relationships. Offered as HSTY 327 and HSTY 427.
HSTY 328. Comparative Perspectives on Museum and Archive History and Practice. 3 Units.
Comparative Perspectives on Archives and Museum History and Practice is a distance learning based course shared with students at Bilkent University in Ankara, Turkey. The course focuses on a comparison of the history and development of archives and museums in the United States and in late Ottoman and Republican Turkey. Topics considered include the "ownership" of culture; state vs. private control of heritage; marketing of museums; and the impact of evolving technologies on the presentation and preservation of culture. Students work together via a shared, live lecture format. In addition to the instructor, museum and archive professionals from both the US and Turkey provide lectures and lead discussions during the semester. The primary intellectual product of the course is a final paper/project which compares the history, operational structure, and mission of a museum/archive in the US with a similar institution in Turkey. The paper/project is created by collaborative effort between a student at CWRU and one at Bilkent. Provided grant funding is available, the course may involve exchange visits to Turkey and the US. Offered as HSTY 328 and HSTY 428.

HSTY 329. Museums and Globalization. 3 Units.
Museums are everywhere contested spaces today. Historically designed as symbols of power, centers for research, agents of public education and community formation in Western industrial societies, they have become sites of development and cultural controversy on a global scale. From Cleveland and Paris to Nairobi and Dubai museums figure in urban redevelopment, national identity formation, conflicts between religion and science, and global tourism. Questions we will consider in this course: what are the fundamental features of museums as institutions? what ties have linked them to wider national and international communities of academics, NGO’s and business? to political, economic and social concerns? how do museums in Asia, Africa the Middle East and Latin America figure in the current international contention over heritage rights? This is an innovative course allowing students to collaborate on projects, engage with guest lecturers and access museums across the globe. The course is organized in three parts: Part I: National Identity Building and Museums; Part II: Museums and Identity Politics; Part III: Museums and Global Development. Offered as HSTY 329, ARTH 301, HSTY 429, and ARTH 401.

HSTY 330. European Diplomacy in the Age of Nationalism: 1789-1945. 3 Units.
Presents a broad interpretation of the development of the international system in Europe between the French Revolution of 1789 and the end of the European era in 1945. It explains why and how the closed European state system at the beginning of the nineteenth century evolved into an international transcontinental system by the early twentieth century. Approved SAGES Departmental Seminar.

HSTY 333. Reading Capital: Political Economy in the Age of Modern Industry. 3 Units.
Since its first publication in German in 1867, and its appearance in English in 1886, Karl Marx’s Capital: A Critique of Political Economy, Volume I, has occupied a seminal position in European thought. Beginning with the presumptions of classical liberal political economy, Marx employed his technique of the materialist dialectic to unmask, in his view, the contradictions and structural limitations that the capitalist mode of production imposed upon capitalists and proletarians alike. Much mentioned, but seldom read, Volume I of Capital remains a crucial window into understanding the intellectual, economic, social, and cultural currents of the 19th century, and its impact extends into the 21st . This course consists of a close, directed reading of the entire text of this volume, combined with discussion, research, and coordinated exploration, so that students can bring this powerful critique to bear on their reading of history and economics in the modern era.

HSTY 334. History of 19th Century Germany. 3 Units.
Examines the political, social, economic, and cultural history of Germany from the late eighteenth century to 1914. Explores the intellectual and social background to the rise of German liberalism and nationalism, the struggle with bureaucratic absolutism, the revolutions of 1848, industrial capitalism and the emergence of a class society, unification under Bismarck, the role of the state, culture, religion, and changes of mentality, the development of mass politics, and the coming of World War I.

HSTY 335. History of 20th Century Germany. 3 Units.
Examines the tumultuous history of Germany from 1914 to the unification of the two Germany’s in 1989-1990. From the totalizing and traumatic experience of World War I, through a failed revolution, the republican experiment of Weimar, the National Socialist dictatorship under Hitler and the divided Germany suspended between the superpowers, to the newly unified democratic Federal Republic. Examines the ways in which Germans have tried to reconcile the state to their society, economy, and individual lives.

HSTY 336. The Struggle for Justice in Latin America. 3 Units.
This course looks at how indigenous peoples, women, students, workers, peasants, and Afro-Latin Americans struggled for justice in Latin America. It will study how notions of justice have changed from colonial times to the present. It will also examine how different sectors of Latin American society understood the meaning of justice and how that understanding evolved through time. This class seeks to familiarize students with the history of the idea of justice in Latin America. At the end of this course students will understand the complex intellectual and political differences behind Latin America’s apparent chaotic and tumultuous political history. Second, it seeks to develop students’ critical thinking by examining how an abstract term, such as justice, changes across time and space. Offered as ETHS 336 and HSTY 336.
HSTY 338. History of the American West. 3 Units.
The U.S. West has meant many things throughout American history--early explorers called it the Great American Desert, railroad boosters lured settlers to it by promising to make the arid land bloom into an agricultural Eden, urban immigrants looked to its limitless stretches of land as an escape from industrial labor, children read dime novels that glorified its heroes, and millions of tourists celebrate its raw beauty by visiting Yellowstone, Yosemite, and the Grand Canyon. The West has also been home diverse native societies for thousands of years, Asian immigrants who viewed it as an eastern frontier, women who struggled to feed their children in an arid land, and Latin Americans, whose ancestors often preceded the entry of White Americans. This course introduces students to the themes, questions, and debates central to the study of the American west by drawing in primary source material and scholarly interpretations. The goal of this course is to provide students with an understanding of the human history of the American west and the ability to express that history in clear, passionate writing and in-class discussion.

HSTY 339. The Origins of the Arab-Israeli Conflict, 1900-1948. 3 Units.
The British Empire took control of Palestine after driving the Germans and Turks from the region near the end of World War I. From that moment on, the British had an increasingly difficult time administering the region. Jewish colonists had already been settling in the land for decades, and with their takeover, the British gave them and other Zionists reason to believe that the Empire would facilitate Jewish efforts. At the same time, the indigenous Arabs of Palestine appealed to the British to protect their very birthright, to keep their country from passing into someone else’s hands. The British gave Arabs, too, reason to believe that they would recognize and defend their claims. In the few decades that the British Mandate governed Palestine it oversaw riots, revolution, and terrorist bombings. When it withdrew from Palestine, its legacy was a brutal war between Arabs and Jews; and the legacy of that war holds an iron grip on the course of world history to this day. Had the British Empire not been in Palestine, and not made the fateful decisions that it did, there would be no Israel and no Arab-Israeli conflict as we know them. Course materials include histories of Zionism, pre-Zionist Palestine, the British Mandate years, the British Empire in other Arab lands, and the 1948 war and aftermath. Primary sources from the perspective British officials on the ground in Palestine receive much attention. The histories of engineering and agriculture are highlighted alongside traditional social and political perspectives.

HSTY 340. A History of Workers in the United States. 3 Units.
This course examines the experience of working people in the United States with an emphasis on twentieth-century social movements. It explores the lives of the women and men, skilled and unskilled, and rural and urban laborers that produce the goods and provide the services that society consumes. At crucial moments, working people have created or helped sustain national social movements in an effort to improve some aspect of their lives. We therefore will assess laborers in relation to several known and less known American social movements, such as the eight-hour day movement during the late nineteenth century, the peace movement during WWI, and the Civil Rights movement in the wake of WWII. Throughout the course we will also discuss the politics of time-managed work; the influence of public policy and government institutions; the role of unions within a competitive market economy; the relationship between industrial economies and functional blue-collar communities; and the correlation between immigration and globalization. Offered as HSTY 340, HSTY 430, and ETHS 340.

HSTY 341. Jewish Urban History. 3 Units.
This course examines the relationship between Jews and the modern urban environment. It seeks to answer questions such as: How did the modernization of cities affect Jews and Jewish communities? In what ways did Jews contribute to modern urban cultural and social forms? What is Jewish urban space, is it unique, and how is it remembered later on? Are there differences between the patterns in Europe, the Middle East, and the Americas? Offered as HSTY 341 and JDST 341.

HSTY 342. Water. 3 Units.
This seminar will explore the history of the meaning of water--that is, the social, cultural, and/or political significance placed on water by individuals and governments in different times and places. It will also examine how humans have acted upon water, and how it has acted upon humans, with great consequences for human life. This seminar will look at the history of water in the context of science, technology and society; public health; political science; and environmental history. Case studies will be drawn from a wide chronological and geographical range; from the ancient world to Renaissance Italy, nineteenth century India, modern Britain, Egypt, and the U.S. The course provides a wide perspective on the themes of the history of human-water interactions, but will also focus closely on some critical cases. Seminar participants will write a research paper on the topic of their choice in the environmental history of water. Offered as: HSTY 342, HSTY 442, POSC 342, POSC 442.

HSTY 343. Origins of the British Empire 1450-1750. 3 Units.
How did early modern England come to rule an empire upon which the sun never set? What compelled individuals to seek their fortunes abroad, planting the flag of St. George in the outlying areas of the archipelago and halfway across the globe? This course examines the troubled birth of an empire and of a place called "Britain" at the same time. This seminar provides history majors with an experience of working with early modern primary documents of a wide variety; essays and book chapters will be paired with documents from early modern England itself. How do documents, images, and quantitative analyses help historians explain how the British Empire came into being? Offered as HSTY 344 and HSTY 444.

HSTY 344. Origins of the British Empire 1450-1750. 3 Units.
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HSTY 345. The European City. 3 Units.
An examination of architectural, social, cultural, philosophical, political, and economic aspects of life in European cities. The principle focus will be the transition of medieval and early modern cities to modern metropolises, both spatially and socially. An additional theme will be urban development and concomitant social questions in non-European cities that were built either to serve expatriate Europeans or to emulate European modernity. Case studies may include London, Paris, Berlin, Vienna, Moscow, the provincial and national capitals of East-Central Europe, and cities in Africa, Asia, and Latin America. Offered as HSTY 345 and HSTY 445.
HSTY 346. Guns, Germs, and Steel. 3 Units.
Jared Diamond’s Guns, Germs, and Steel won the Pulitzer for non-fiction in 1998. Diamond, a physiologist, explains that Western Europe came to occupy and dominate large areas of the globe because of natural resources present in certain regions of the Old World since the end of the last Ice Age. Where a historian might look for answers in the written evidence left by historical individuals, Diamond examines ancient patterns of plant diffusion or the place of mountain ranges and deserts in the development of technologies. This seminar is about applying the history of a specific time and place namely North America from European contact to 1850 - to Diamond’s general environmental explanations and models. Placing Diamond’s broad explanations within specific historical contexts is revealing. A range of alternative methods, perspectives, primary sources from North America, and case studies (especially within environmental history) help develop a critical understanding of the complexities of European expansion into the New World. The course engages in an extended comparative exploration of the worldviews of different world cultures, most extensively comparing European worldviews with Native American, but also paying significant attention to Asian worldviews. The Native American cultures under consideration include those of both North and South America.

HSTY 348. History of Modern Political and Social Thought. 3 Units.
This course explores the responses of philosophers, economic theorists, culture critics, and public policy makers to changes in western society wrought by industrialization by focusing on their concerns with technological change. Offered as HSTY 348, HSTY 448 and POSC 348.

HSTY 351. Colonial America 1607-1763. 3 Units.
The formative years of American society and culture. Slavery and racism, expansionism, regionalism, the family, pluralism, sense of mission, and republican ideology.

HSTY 352. The Era of the American Revolution, 1763 - 1789. 3 Units.
This is an intensive survey of the Revolutionary period of American history, from the end of the French and Indian War in 1763 to the ratification of the U.S. Constitution in 1789, focusing especially on the underlying causes of the American Revolution, the chain of events leading to the Declaration of Independence, the war with England, the Constitutional Convention, and the ratification struggle that followed, with some background on the earlier period (1607-1763).

HSTY 353. Women in American History I. 3 Units.
The images and realities of women’s social, political, and economic lives in early America. Uses primary documents and biographers to observe individuals and groups of women in relation to legal, religious, and social restrictions. Offered as HSTY 353, WGST 353, and HSTY 453.

HSTY 354. Women in American History II. 3 Units.
With HSTY 353, forms a two-semester introduction to women’s studies. The politics of suffrage and the modern woman’s efforts to balance marriage, motherhood, and career. (HSTY 353 not a prerequisite.) Offered as HSTY 354, WGST 354, and HSTY 454.

HSTY 355. Age of American Civil War 1815-80. 3 Units.
This course examines the causes and consequences of the Civil War, focusing on the rise of sectionalism, the dynamics of conflict, and reconstruction. Heavy emphasis is placed on archival research in relevant first person accounts from the period.

HSTY 359. Books as Bombs: Books that Reshaped American Culture. 3 Units.
Every now and again a piece of prose profoundly reshapes American society and culture. In this advanced undergraduate seminar, students will read and discuss a selection of such works under the tutelage of Professors Shulman, a specialist in the History of Science and Technology, and Sentilles, who specializes in social and cultural history. The professors will set up the context of the work’s publication or creation and then lead the class in a lively dissection of both the work and its impact. The main question asked of each book is “how and why did this work have such an effect?” In attempting to answer that question, students will come to a greater understanding of society that created and then responded to each work. Offered as HSTY 359 and HSTY 459.

HSTY 361. Crime and Culture in Early America. 3 Units.
This course explores the intersection of crime, punishment, and popular culture in colonial British America and the early United States through 1860 by closely examining a series of popular crime genres, including execution sermons, criminal conversion narratives, criminal autobiographies, and trial reports. Readings in modern scholarship—drawing on several disciplines—will shed light on the popular literature and on underlying patterns of crime and punishment, while students will critically evaluate modern scholarly interpretations in light of the early crime publications. Types of crimes explored in the readings include witchcraft, piracy, burglary, robbery, and various types of murder, such as infanticide, familicide (cases of men murdering their wives and children), and sexual homicide. Each student will write several short analytical papers drawn from the shared readings and, at the end of the semester, produce an independent research paper. Offered as HSTY 361 and HSTY 461.

HSTY 363. Gender in America. 3 Units.
Gender is the term used to describe the social characteristics attributed to the different sexes by the larger contextual society. This social and cultural history seminar allows students to explore various constructions of masculine and feminine identity in America between the late 18th century and the end of the 20th century. This is a multicultural course using a mixture of historical texts, gender theory, and personal biography to explore changing notions of gender (and with it sexuality, race, and religion) over time in the United States. Offered as HSTY 363, HSTY 463 and WGST 363.

HSTY 366. Science, Technology, and Government. 3 Units.
Traces the development and influence of federal technology and science policies from colonial times to the present, with emphasis on the 20th century. Offered as HSTY 366 and POSC 365.

HSTY 371. Jews under Islam and Christianity. 3 Units.
This course examines the social and political status of Jews under Muslim and Christian rule since the Middle Ages. Themes include interfaith relations, Islamic and Christian beliefs regarding the Jews, Muslim and Christian regulation of Jewry, and the Jewish response. Offered as HSTY 371, JDST 371 and RLGN 371.
HSTY 373. Advanced Topics in American Women’s History. 3 Units.
This advanced seminar is designed to allow students to investigate aspects of American women’s history that are not deeply explored in other courses. The two central purposes of the course are to move students forward in their study of American women’s history and to provide advanced study for graduate students and other students interested in women-focused topics. The topic is subject to change, but may be any of the following or something similar: women and medicine, images of women in popular culture, growing up female, women and political movements, women and war, etc. Recommended preparation: HSTY 353/453 or HSTY 354/454. Offered as HSTY 373, WGST 373, and HSTY 473.

HSTY 375. Advance Readings in Latin American History. 3 Units.
This course will introduce graduate students and upper level undergraduates to the most important debates in the field of Latin American History. It will provide an overview of the evolution of the (English language) historical literature on Latin America during the past three decades. It will also help students with a field in Latin American history prepare for their comprehensive examinations. The course readings have been chosen thematically and chronologically. Student will critically engage a group of monographs that stand out for their historiographical and methodological value and that will help illuminate the discussions and approaches that guide research in this field. Offered as HSTY 375 and HSTY 475.

HSTY 376. North American Environmental History. 3 Units.
This course introduces major questions and approaches in the study of environmental history. Taking North American as our subject, we explore how humans have shaped the environment of the continent and how human history has, in turn been shaped by the natural world form antiquity to the present. Major topics include Pleistocene extinctions, the Columbian exchange, the market revolution in agriculture, American epidemics, industrialization, the origins of conservation, the environmental movement, and the globalization of America’s environmental footprint. Offered as: HSTY 378 and HSTY 463.

HSTY 378. The Sixties in America. 3 Units.
This course examines social, cultural, and political changes in the United States during the 1960s. We begin by examining the economic prosperity and "fragile" political consensus of the post-WWII period, as well as the undercurrent of poverty, dissent, and Cold War fears. We then cover the civil rights movement, student activism, the women’s movement, the growth of Liberal America and the welfare state, the Vietnam War, the counterculture and conservative youth movements, the growth of a national consumer-driven, mass-mediated market, and the music, art, and pop culture—as well as their growing reliance on technological intervention—during this period of creative efflorescence. We will do this through reading books, but also through "reading" contemporary evidence of life in America, including listening to music, viewing films, analyzing pictures and artifacts.

HSTY 379. City as Classroom. 3 Units.
In this course, the city is the classroom. We will engage with the urban terrain. We will meet weekly off-campus, interact with community members, and interface--both literally and figuratively--with the city as a way to examine the linkages between historical, conceptual, and contemporary issues, with particular attention paid to race and class dynamics, inequality, and social justice. This course will have four intersecting components, primarily focusing on American cities since the 1930s: the social and physical construction of urban space, the built environment, life and culture in the city, and social movements and grassroots struggles. Offered as HSTY 381, POSC 381, SOCI 381, HSTY 481, POSC 481, and SOCI 481.

HSTY 380. The Sixties in America: 1607 - 2000. 3 Units.
The primary goal of this course is to provide students an opportunity to explore at greater length specific topics in Chinese social and cultural history. The period covered by the assigned readings roughly spans the late eighteenth century through the first half of the twentieth century. Readings will cover a wide range of topical themes, including childhood, gender and sexuality, urban life, print media, religion, and the environment. Offered as HSTY 385 and HSTY 485.

HSTY 381. City as Classroom. 3 Units.
This course examines the historiography of several key issues in the history of the People’s Republic of China. Although the emphasis will be to explore at greater length and greater detail specific topics in post-1949 Chinese social, cultural, and political history, some topics will incorporate key historiographic works addressing the pre-1949 period as a point of comparison. We will explore the major historical transformations that led to a political break from China’s imperial past, and we will examine both the continuities and discontinuities shaping China’s experience as a modern nation during the latter half of the 20th century. Major themes covered include: the origins of the Chinese revolution, the Great Leap Forward, Cultural Revolution, rural-urban divide, the one-child policy, socialism with Chinese characteristics, et al.

HSTY 385. Readings in Society and Culture in Modern Chinese History. 3 Units.
The primary goal of this course is to provide students an opportunity to explore at greater length specific topics in Chinese social and cultural history. The period covered by the assigned readings roughly spans the late eighteenth century through the first half of the twentieth century. Readings will cover a wide range of topical themes, including childhood, gender and sexuality, urban life, print media, religion, and the environment. Offered as HSTY 385 and HSTY 485.

HSTY 387. Growing Up in America: 1607 - 2000. 3 Units.
Children have been growing up in the United States since it was declared independent, in 1776, but how adults conceive of (and therefore legislate and interpret) children and childhood constantly changes to fit current circumstances. The experiences of children themselves have varied not only in terms of race, class, gender, and religion but also depending on specific events (i.e., coming of age during the Civil War versus the Civil Rights movement) or geography (i.e., growing up in rural Hawaii vs. urban New Jersey). We cannot cover all of those histories in one course, so this seminar course instead focuses on exploring the interplay of ideas about children and the expressed or historical experiences of children. When the puritans and plantations members (slave, bonded and free) came to the Atlantic shore, they brought with them particular ideas about what is meant to be a child, and to experience childhood. They encountered already established residents who also had ideas about childhood. How did those concepts adjust/meld/contrast over time, and how do we see those ideas reflected or reshaped by actual experiences? This course engages particular lines of inquiry: How and why do we understand about what is “natural” for children change over time? How do variables like race, class, gender, etc., uphold the manifestation of such concepts? What is the role of the state in children’s lives and how has that changed over time? What is the impact of mass culture on modern childhood?
HSTY 388. The United States in the World. 3 Units.
Traditional accounts of American history usually stay within the geographical boundaries of the modern United States. Recent historical research, however, has found that many well-known events of the past, from the Revolution to Progressive Era social reforms to the environmental movement, make more sense when examined from a global perspective. Through approaches variously known as "transnational history," "International history," "global history," and "borderlands history," historians have come to redefine the United States' role in the world. This course offers an introduction to this literature. Motivating questions range over time and topic: How were the Americans a product of Early Modern globalization? Was (or is) the United States an empire? How has the meaning of this term changed over time? What role have racial issues played in American involvement overseas as well as at home? How have the global flows of commodities shaped economic development? How was the American Civil War actually a global event? How was domestic social policy shaped by the exchange of ideas across the globe? How did American ideas about political rights and the consumer economy become globalized? How did Americans use new forms of media technologies to interpret and affect people from other parts of the world? This is not a course in the history of American diplomacy (though diplomacy will often come up), nor is it a history of American warfare abroad (though war, too, will often come up as well). Instead, it is a broad, thematic survey of the ways that American ideas, institutions, and people have shaped—and been shaped by—the rest of the world. Primary emphasis is placed on reading and discussing recent historical work: books and articles, but also essays, fiction, and visual art as well.

HSTY 389. History of Zionism. 3 Units.
This course seeks to elucidate the major strands of Zionism, their origins, how they have interacted, and their impact on contemporary Israeli society. These may include political Zionism, cultural Zionism, socialist (labor) Zionism, Revisionist Zionism, and religious Zionism. This course will also examine the differences in the appeal of Zionism to Jews in different places, such as Western Europe, Eastern Europe and the United States. Offered as HSTY 389 and JDST 389.

HSTY 390. Senior Research Seminars in History and Philosophy of Science. 3 Units.
Directed independent research seminar for seniors who are majors in the History and Philosophy of Science program. The goal of the course is to develop and demonstrate command of B.A.-level factual content, methodologies, research strategies, historiography, and theory relevant to the field of history of science and/or philosophy of science. The course includes both written and oral components. Offered as HSTY 380 and PHIL 390.

HSTY 391. Food in History. 3 Units.
Food is inextricably interconnected with the development of agriculture and other technologies, with the rise and fall of empires, with increasing understanding of diet and nutrition, with laws and regulations, with the arts, with economic development and consumer culture, and with religious and ethnic identities. By examining selective and representative episodes pertaining to each of these topics, this course explores the global history of food, from the agricultural revolution of the neolithic era to the consumer revolution of the last generation. Offered as HSTY 391 and HSTY 491.

HSTY 393. Advanced Readings in the History of Race. 3 Units.
This course examines the concept of race as a social construction that carries political and economic implications. We begin by examining the histories of the early racial taxonomists (e.g., Bernier, Linnaeus, and Blumenbach among others) and the contexts that informed their writings. We then assess how the concept of race changed from the nineteenth to the twentieth century in the United States. We conclude by evaluating how the ideology of race has influenced U.S. domestic life and foreign policy at specific historical moments. Offered as HSTY 393, HSTY 493, and ETHS 393.

HSTY 394. Seminar in Evolutionary Biology. 3 Units.
This seminar investigates 20th-century evolutionary theory, especially the Modern Evolutionary synthesis and subsequent expansions of and challenges to that synthesis. The course encompasses the multidisciplinary nature of the science of evolution, demonstrating how disciplinary background influences practitioners' conceptualizations of pattern and process. This course emphasizes practical writing and research skills, including formulation of testable theses, grant proposal techniques, and the implementation of original research using the facilities on campus and at the Cleveland Museum of Natural History. Offered as ANTH 394, BIOL 394, EEPS 394, HSTY 394, PHIL 394, ANTH 494, BIOL 494, EEPS 494, HSTY 494, and PHIL 494.

HSTY 395. History of Medicine. 3 Units.
This course treats selected topics in the history of medicine, with an emphasis on social and cultural history. Focusing on the modern period, we examine illnesses, patients, and healers, with attention to the ways sickness and medicine touch larger questions of politics, social relations and identity. Offered as HSTY 395 and HSTY 495.

HSTY 396. Advanced Topics in History. 3 Units.
Advanced topics in history, changing from semester to semester. The course provides students an opportunity to explore special themes or theoretical issues in history that are too briefly covered in broader surveys. Students may take this course more than once for credit, when different topics are covered. Offered as HSTY 396 and HSTY 496.

HSTY 397. Undergraduate Tutorial. 1 - 3 Unit.
Individual instruction with members of the history faculty. Recommended preparation: 12 hours of History.

HSTY 398. Senior Research Seminar. 3 Units.
Training in the nature and methods of historical writing and research. Prereq: Majors only, Senior standing.

HSTY 399. Advanced Readings in Black History. 3 Units.
This is an advanced readings course that may change from semester to semester. This course will provide students with an opportunity to more deeply explore special themes and theoretical issues in the field of black history that are often quickly and briefly covered in broad survey courses. Readings may be organized around specific topics such as resistance and social protest, black intellectual history, black nationalism and identity, black film and historical literacy black cultural forms and politics, black urban history, or some such other combination. Students may take this course more than once and receive credit as long as the course topic differs. Students should contact the History Department for more details on course content during any given semester. Offered as ETHS 391, HSTY 399 and HSTY 499.
HSTY 400. Graduate Topical Seminar. 3 Units.
A rotating graduate seminar, offered every semester by a different faculty member. Each semester focuses on a topic of central historiographical or methodological importance. Prereq: Graduate standing or instructor permission.

HSTY 402. Introduction to Historiography of Science. 3 Units.
A graduate-level historiographic review of the history of the sciences from the seventeenth century to the present. Prereq: Graduate standing or instructor permission.

HSTY 404. Introduction to the Nonprofit Sector. 3 Units.
The United States has by far the largest and most important "nonprofit sector" in the world, a sector consisting of voluntary non-governmental organizations that provide health care, education and social services as well as arts, religious, and advocacy activities. Using mostly primary sources, this course considers the significance of the nonprofit sector in the U.S., its advantages and disadvantages, its uses for different groups of Americans, and current trends. Students have the option of writing either a standard term paper, or a study of strategic challenges facing a contemporary nonprofit organization. Offered as HSTY 204 and HSTY 404. Prereq: Graduate standing or instructor permission.

HSTY 406. History of Museums: Theory and Reality. 3 Units.
This course is an intensive summer internship (10 hours per week) at the Western Reserve Historical Society, complemented by extensive readings in museum/archival theory and public historical perception. It is designed both to introduce students to museum/archival work and to compare theoretical concepts with actual museum situations. Interns will be assigned a specific project within one of the Society's curatorial or administrative divisions, but will have the opportunity to work on ancillary tasks throughout the Historical Society's headquarters in University Circle. Offered as HSTY 306 and HSTY 406. Prereq: Graduate standing or instructor permission.

HSTY 410. Seminar: Early American Historiography. 3 Units.
This seminar examines the historiography of early America. It is designed to acquaint history doctoral students with the major themes, methods, and scholars of American history from the seventeenth century to the mid-nineteenth century. Students will be expected to read and report on major works in the field. Prereq: Graduate standing or instructor permission.

HSTY 411. Seminar: Modern American Historiography. 3 Units.
This seminar examines the approaches that professional historians of the United States have taken to the writing of American history in the past fifty years, with emphasis on changes in historical concerns, master debates among historians, and contemporary interests. Topics covered include national politics and government, economic development, social history, the history of ethnicity, race, and gender, and foreign policy and international relations. Each student will read widely and will prepare a series of reports on selected books and authors. Offered as HSTY 311 and HSTY 411. Prereq: Graduate standing or instructor permission.

HSTY 427. Comparative Environmental History. 3 Units.
Environmental history is the study of how humans have influenced the environments around them and how the environment itself has influenced the course of human societies. This course provides students with the skill to identify and analyze these interactions. It introduces course participants to the main themes of environmental history literature and the driving questions guiding environmental history research by examining case studies drawn around the globe, including Pre-Columbian America, Medieval Japan, Colonial Africa, and Modern Germany. This course will help course participants recognize the important patterns and developments that have led to present day human-environmental relationships. Offered as HSTY 327 and HSTY 427. Prereq: Graduate standing or instructor permission.

HSTY 428. Comparative Perspectives on Museum and Archive History and Practice. 3 Units.
Comparative Perspectives on Archives and Museum History and Practice is a distance learning based course shared with students at Bilkent University in Ankara, Turkey. The course focuses on a comparison of the history and development of archives and museums in the United States and in late Ottoman and Republican Turkey. Topics considered include the "ownership" of culture; state vs. private control of heritage; marketing of museums; and the impact of evolving technologies on the presentation and preservation of culture. Students work together via a shared, live lecture format. In addition to the instructor, museum and archive professionals from both the US and Turkey provide lectures and lead discussions during the semester. The primary intellectual product of the course is a final paper/project which compares the history, operational structure, and mission of a museum/archive in the US with a similar institution in Turkey. The paper/project is created by collaborative effort between a student at CWRU and one at Bilkent. Provided grant funding is available, the course may involve exchange visits to Turkey and the US. Offered as HSTY 328 and HSTY 428.

HSTY 429. Museums and Globalization. 3 Units.
Museums are everywhere contested spaces today. Historically designed as symbols of power, centers for research, agents of public education and community formation in Western industrial societies, they have become sites of development and cultural controversy on a global scale. From Cleveland and Paris to Nairobi and Dubai museums figure in urban redevelopment, national identity formation, conflicts between religion and science, and global tourism. Questions we will consider in this course: what are the fundamental features of museums as institutions? what ties have linked them to wider national and international communities of academics, NGO's and business? to political, economic and social concerns? how do museums in Asia, Africa the Middle East and Latin America figure in the current international contention over heritage rights? This is an innovative course allowing students to collaborate on projects, engage with guest lecturers and access museums across the globe. The course is organized in three parts: Part I: National Identity Building and Museums; Part II: Museums and Identity Politics; Part III: Museums and Global Development. Offered as HSTY 329, ARTH 301, HSTY 429, and ARTH 401. Prereq: Graduate standing or instructor permission.
HSTY 430. A History of Workers in the United States. 3 Units.
This course examines the experience of working people in the United States with an emphasis on twentieth-century social movements. It explores the lives of the women and men, skilled and unskilled, and rural and urban laborers that produce the goods and provide the services that society consumes. At crucial moments, working people have created or helped sustain national social movements in an effort to improve some aspect of their lives. We therefore will assess laborers in relation to several known and less known American social movements, such as the eight-hour day movement during the late nineteenth century, the peace movement during WWII, and the Civil Rights movement in the wake of WWII. Throughout the course we will also discuss the politics of time-managed work; the influence of public policy and government institutions; the role of unions within a competitive market economy; the relationship between industrial economies and functional blue-collar communities; and the correlation between immigration and globalization. Offered as HSTY 340, HSTY 430, and ETHS 340.

HSTY 440. Science and Society Through Literature. 3 Units.
This course will examine the interaction of scientific investigation and discovery with the society it occurred in. What is the effect of science on society and, as importantly, what is the effect of society on science? An introduction will consider the heliocentric controversy with focus on Galileo. Two broad areas, tuberculosis and the Frankenstein myth, will then be discussed covering the period 1800-present. With tuberculosis, fiction, art and music will be examined to understand the changing views of society towards the disease, how society's perception of tuberculosis victims changed, and how this influenced their treatments and research. With Frankenstein, the original novel in its historical context will be examined. Using fiction and film, the transformation of the original story into myth with different connotations and implications will be discussed. Most classes will be extensive discussions coupled with student presentations of assigned materials. Offered as PHRM 340, BETH 440, PHRM 440, and HSTY 440.

HSTY 442. Water. 3 Units.
This seminar will explore the history of the meaning of water—that is, the social, cultural, and/or political significance placed on water by individuals and governments in different times and places. It will also examine how humans have acted upon water, and how it has acted upon humans, with great consequences for human life. This seminar will look at the history of water in the context of science, technology and society; public health; political science; and environmental history. Case studies will be drawn from a wide chronological and geographical range; from the ancient world to Renaissance Italy, nineteenth century India, modern Britain, Egypt, and the U.S. The course provides a wide perspective on the themes of the history of human-water interactions, but will also focus closely on some critical cases. Seminar participants will write a research paper on the topic of their choice in the environmental history of water. Offered as: HSTY 342, HSTY 442, POSC 342, POSC 442.

HSTY 445. The European City. 3 Units.
An examination of architectural, social, cultural, philosophical, political, and economic aspects of life in European cities. The principle focus will be the transition of medieval and early modern cities to modern metropolises, both spatially and socially. An additional theme will be urban development and concomitant social questions in non-European cities that were built either to serve expatriate Europeans or to emulate European modernity. Case studies may include London, Paris, Berlin, Vienna, Moscow, the provincial and national capitals of East-Central Europe, and cities in Africa, Asia, and Latin America. Offered as HSTY 345 and HSTY 445.

HSTY 448. History of Modern Political and Social Thought. 3 Units.
This course explores the responses of philosophers, economic theorists, culture critics, and public policy makers to changes in western society wrought by industrialization by focusing on their concerns with technological change. Offered as HSTY 348, HSTY 448 and POSC 348.

HSTY 451. History of European Technology. 3 Units.
A graduate-level, research seminar on the history of European technology from the Industrial Revolution to the present. Special emphasis is on cultural history of technology with a transatlantic view. The themes of the seminar vary from year to year, but include: communications, industrialization, control, cultural and intellectual approaches to the history of technology. Required work includes a research paper based on original sources. Prereq: Graduate standing or instructor permission.

HSTY 452. Readings in the History of American Technology. 3 Units.
A graduate-level review of the history of American technology. Prereq: Graduate standing or instructor permission.

HSTY 453. Women in American History I. 3 Units.
The images and realities of women’s social, political, and economic lives in early America. Uses primary documents and biographers to observe individuals and groups of women in relation to legal, religious, and social restrictions. Offered as HSTY 353, WGST 353, and HSTY 453. Prereq: Graduate standing or instructor permission.

HSTY 454. Women in American History II. 3 Units.
With HSTY 353, forms a two-semester introduction to women’s studies. The politics of suffrage and the modern woman’s efforts to balance marriage, motherhood, and career. (HSTY 353 not a prerequisite.) Offered as HSTY 354, WGST 354, and HSTY 454. Prereq: Graduate standing or instructor permission.

HSTY 455. Books as Bombs: Books that Reshaped American Culture. 3 Units.
Every now and again a piece of prose profoundly reshapes American society and culture. In this advanced undergraduate seminar, students will read and discuss a selection of such works under the tutelage of Professors Shulman, a specialist in the History of Science and Technology, and Sentilles, who specializes in social and cultural history. The professors will set up the context of the work’s publication or creation and then lead the class in a lively dissection of both the work and its impact. The main question asked of each book is “how and why did this work have such an effect?” In attempting to answer that question, students will come to a greater understanding of society that created and then responded to each work. Offered as HSTY 359 and HSTY 459.
HSTY 473. Advanced Topics in American Women's History. 3 Units.
This advanced seminar is designed to allow students to investigate aspects of American women's history that are not deeply explored in other courses. The two central purposes of the course are to move students forward in their study of American women's history and to provide advanced study for graduate students and other students interested in women-focused topics. The topic is subject to change, but may be any of the following or something similar: women and medicine, images of women in popular culture, growing up female, women and political movements, women and war, etc. Recommended preparation: HSTY 353/453 or HSTY 354/454. Offered as HSTY 373, WGST 373, and HSTY 473. Prereq: Graduate standing or instructor permission.

HSTY 475. Advance Readings in Latin American History. 3 Units.
This course will introduce graduate students and upper level undergraduates to the most important debates in the field of Latin American History. It will provide an overview of the evolution of the (English language) historical literature on Latin America during the past three decades. It will also help students with a field in Latin American history prepare for their comprehensive examinations. The course readings have been chosen thematically and chronologically. Student will critically engage a group of monographs that stand out for their historiographical and methodological value and that will help illuminate the discussions and approaches that guide research in this field. Offered as HSTY 375 and HSTY 475.

HSTY 476. Seminar in Comparative History. 3 Units.
An introduction to comparative method for historians. The topics will vary year to year, but the course will require exposure to historical contexts outside of the United States. Prereq: Graduate standing or instructor permission.

HSTY 477. Modern Policy History of the United States. 3 Units.
This course offers a historical perspective on policy and policy making in the United States since the late nineteenth century. It emphasizes the increasing role of the federal government, the persisting importance of the states, the significance of the courts, the revolutionary impact of the women's and civil rights movements, and the consequences of the growth and transformation of the American economy. Each student selects a policy area for detailed exploration; students often choose topics related to civil rights, women's rights, health care, environmental reform, non-profit and non-governmental organizations, the arts, and education, but other topics are also appropriate. Prereq: Graduate standing or instructor permission.

HSTY 479. Historical Research and Writing. 3 Units.
Research seminar for graduate students. Intensive focus on processes of historical research and writing. Students produce conference paper and research paper based on primary sources. Prereq: Graduate standing or instructor permission.

HSTY 480. Public Policy and Aging. 3 Units.
Overview of aging and the aged. Concepts in the study of public policy. Policies on aging and conditions that they address. The politics of policies on aging. Emergent trends and issues. Offered as ANTH 498, BETH 496, EPBI 408, GERO 496, HSTY 480, MPHP 408, NURS 479, NURS 579, POSC 480, and SOCI 496.

HSTY 481. City as Classroom. 3 Units.
In this course, the city is the classroom. We will engage with the urban terrain. We will meet weekly off-campus, interact with community members, and interface--both literally and figuratively--with the city as a way to examine the linkages between historical, conceptual, and contemporary issues, with particular attention paid to race and class dynamics, inequality, and social justice. This course will have four intersecting components, primarily focusing on American cities since the 1930s: the social and physical construction of urban space, the built environment, life and culture in the city, and social movements and grassroots struggles. Offered as HSTY 381, POSC 381, SOCI 381, HSTY 481, POSC 481, and SOCI 481.
HSTY 485. Readings in Society and Culture in Modern Chinese History. 3 Units.
The primary goal of this course is to provide students an opportunity to explore at greater length specific topics in Chinese social and cultural history. The period covered by the assigned readings roughly spans the late eighteenth century through the first half of the twentieth century. Readings will cover a wide range of topical themes, including childhood, gender and sexuality, urban life, print media, religion, and the environment. Offered as HSTY 385 and HSTY 485.

HSTY 491. Food in History. 3 Units.
Food is inextricably interconnected with the development of agriculture and other technologies, with the rise and fall of empires, with increasing understanding of diet and nutrition, with laws and regulations, with the arts, with economic development and consumer culture, and with religious and ethnic identities. By examining selective and representative episodes pertaining to each of these topics, this course explores the global history of food, from the agricultural revolution of the neolithic era to the consumer revolution of the last generation. Offered as HSTY 391 and HSTY 491. Prereq: Graduate standing or instructor permission.

HSTY 493. Advanced Readings in the History of Race. 3 Units.
This course examines the concept of race as a social construction that carries political and economic implications. We begin by examining the histories of the early racial taxonomists (e.g., Bernier, Linnaeus, and Blumenbach among others) and the contexts that informed their writings. We then assess how the concept of race changed from the nineteenth to the twentieth century in the United States. We conclude by evaluating how the ideology of race has influenced U.S. domestic life and foreign policy at specific historical moments. Offered as HSTY 393, HSTY 493, and ETHS 393.

HSTY 494. Seminar in Evolutionary Biology. 3 Units.
This seminar investigates 20th-century evolutionary theory, especially the Modern Evolutionary synthesis and subsequent expansions of and challenges to that synthesis. The course encompasses the multidisciplinary nature of the science of evolution, demonstrating how disciplinary background influences practitioners' conceptualizations of pattern and process. This course emphasizes practical writing and research skills, including formulation of testable theses, grant proposal techniques, and the implementation of original research using the facilities on campus and at the Cleveland Museum of Natural History. Offered as ANTH 394, BIOL 394, EEPS 394, HSTY 394, PHIL 394, ANTH 494, BIOL 494, EEPS 494, HSTY 494, and PHIL 494.

HSTY 495. History of Medicine. 3 Units.
This course treats selected topics in the history of medicine, with an emphasis on social and cultural history. Focusing on the modern period, we examine illnesses, patients, and healers, with attention to the ways sickness and medicine touch larger questions of politics, social relations and identity. Offered as HSTY 395 and HSTY 495. Prereq: Graduate standing or instructor permission.

HSTY 496. Advanced Topics in History. 3 Units.
Advanced topics in history, changing from semester to semester. The course provides students an opportunity to explore special themes or theoretical issues in history that are too briefly covered in broader surveys. Students may take this course more than once for credit, when different topics are covered. Offered as HSTY 396 and HSTY 496.

HSTY 497. Graduate Independent Study. 1 - 3 Unit.
Independent reading and research programs with individual members of the faculty.

HSTY 499. Advanced Readings in Black History. 3 Units.
This is an advanced readings course that may change from semester to semester. This course will provide students with an opportunity to more deeply explore special themes and theoretical issues in the field of black history that are often quickly and briefly covered in broad survey courses. Readings may be organized around specific topics such as resistance and social protest, black intellectual history, black nationalism and identity, black film and historical literacy black cultural forms and politics, black urban history, or some such other combination. Students may take this course more than once and receive credit as long as the course topic differs. Students should contact the History Department for more details on course content during any given semester. Offered as ETHS 391, HSTY 399 and HSTY 499. Prereq: Graduate standing or instructor permission.

HSTY 525. Intellectual Property and the Construction of Authorship. 3 Units.
Study of the concepts, laws, norms, and practices through which writers and other creative producers establish "property" in their work. Offered as ENGL 525 and HSTY 525. Prereq: Graduate standing or permission.

HSTY 601. Independent Studies. 1 - 18 Unit.
(Credit as arranged.)

HSTY 651. Thesis M.A.. 1 - 18 Unit.
(Credit as arranged.)

HSTY 701. Dissertation Ph.D.. 1 - 18 Unit.
(Credit as arranged.) Limited to Ph.D. candidates actively engaged in the research and writing of their dissertations. Prereq: Predoctoral research consent or advanced to Ph.D. candidacy milestone.
Department of Mathematics

The Department of Mathematics at Case Western Reserve University is an active center for mathematical research. Faculty members conduct research in algebra, analysis, applied mathematics, convexity, dynamical systems, geometry, imaging, inverse problems, life sciences applications, mathematical biology, modeling, numerical analysis, probability, scientific computing, stochastic systems, and other areas.

The department offers a variety of programs leading to both undergraduate and graduate degrees in traditional and applied mathematics. Undergraduate degrees are Bachelor of Arts or Bachelor of Science in mathematics and Bachelor of Science in applied mathematics. Graduate degrees are Master of Science and Doctor of Philosophy.

The BS/MS program allows a student to earn a Bachelor of Science in either mathematics or applied mathematics and a master’s degree from the mathematics department or another department in five years. The department, in cooperation with John Carroll University, offers a program for individuals interested in pre-college teaching. Together with the Department of Physics, it offers a specialized joint Bachelor of Science in Mathematics and Physics.

Mathematics plays a central role in the physical, biological, economic, and social sciences. Because of this, employment prospects are always strong for individuals with degrees in mathematics, and there are excellent career opportunities. A bachelor’s degree in mathematics or applied mathematics offers a strong background for graduate school in many areas (including computer science, medicine, and law, in addition to mathematics and science) or a position in the private sector. A master’s degree in mathematics or applied mathematics, or an undergraduate degree in applied mathematics combined with a master’s in a different area, is an excellent basis for employment in the private sector in a technical field. A PhD degree is usually necessary for college teaching and research.

Students in the mathematics department, both undergraduate and graduate, have opportunities to interact personally with faculty and other students, and research and other activities are available. In addition, undergraduates can obtain teaching experience via the department’s supplemental instruction program.

Teacher Licensure

(a) Completion of the BA program in mathematics, including the following as the three approved technical electives:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
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</thead>
<tbody>
<tr>
<td>MATH 150</td>
<td>Mathematics from a Mathematician’s Perspective</td>
<td>3</td>
</tr>
<tr>
<td>MATH 304</td>
<td>Discrete Mathematics</td>
<td>3</td>
</tr>
<tr>
<td>STAT 312</td>
<td>Basic Statistics for Engineering and Science</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total Units</strong></td>
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<td><strong>9</strong></td>
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</table>

(b) The completion of a second major in teacher education. Students interested in this option should consult the description of the Teacher Licensure Program (p. 437) elsewhere in this bulletin or contact the director of teacher licensure.

Bachelor of Science in Mathematics

The BS degree in mathematics requires at least 50 hours of mathematics courses, including:

<table>
<thead>
<tr>
<th>Course</th>
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<tbody>
<tr>
<td>MATH 112</td>
<td>Calculus for Science and Engineering I</td>
<td>4</td>
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<tr>
<td>MATH 122</td>
<td>Calculus for Science and Engineering II</td>
<td>4</td>
</tr>
<tr>
<td>MATH 223</td>
<td>Calculus II</td>
<td>3</td>
</tr>
<tr>
<td>or MATH 124</td>
<td>Calculus II</td>
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Three approved technical electives *

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<thead>
<tr>
<th>Course</th>
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<tr>
<td>MATH 217</td>
<td>Calculus III</td>
<td>3</td>
</tr>
<tr>
<td>MATH 224</td>
<td>Elementary Differential Equations</td>
<td>3</td>
</tr>
<tr>
<td>or MATH 228</td>
<td>Differential Equations</td>
<td></td>
</tr>
<tr>
<td>MATH 307</td>
<td>Introduction to Abstract Algebra I</td>
<td>3</td>
</tr>
<tr>
<td>MATH 308</td>
<td>Introduction to Abstract Algebra II</td>
<td>3</td>
</tr>
<tr>
<td>MATH 321</td>
<td>Fundamentals of Analysis I</td>
<td>3</td>
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<tr>
<td>MATH 322</td>
<td>Fundamentals of Analysis II</td>
<td>3</td>
</tr>
<tr>
<td>MATH 324</td>
<td>Introduction to Complex Analysis I</td>
<td>3</td>
</tr>
<tr>
<td>or MATH 425</td>
<td>Complex Analysis I</td>
<td></td>
</tr>
<tr>
<td>or MATH 330</td>
<td>Introduction of Scientific Computing</td>
<td></td>
</tr>
<tr>
<td><strong>Total Units</strong></td>
<td></td>
<td><strong>41</strong></td>
</tr>
</tbody>
</table>

* No more than one can be from outside the department.

** Or other approved computer science course.

Undergraduate Programs

Majors

A Bachelor of Arts in mathematics, a Bachelor of Science in mathematics, a Bachelor of Science in mathematics and physics, and a Bachelor of Science in applied mathematics are available to students at Case Western Reserve University. All undergraduate mathematics degrees are based on a four-course sequence in calculus and differential equations and a five-course mathematics core in analysis and algebra.

Bachelor of Arts in Mathematics

The BA degree in mathematics requires at least 38 hours of mathematics courses, including:

<table>
<thead>
<tr>
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<tr>
<td>MATH 112</td>
<td>Calculus for Science and Engineering I</td>
<td>4</td>
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<tr>
<td>MATH 122</td>
<td>Calculus for Science and Engineering II</td>
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</tr>
<tr>
<td>or MATH 124</td>
<td>Calculus II</td>
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</tr>
<tr>
<td>MATH 223</td>
<td>Calculus for Science and Engineering III</td>
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<td>3</td>
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<td>MATH 224</td>
<td>Elementary Differential Equations</td>
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<td>or MATH 228</td>
<td>Differential Equations</td>
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<tr>
<td>MATH 307</td>
<td>Introduction to Abstract Algebra I</td>
<td>3</td>
</tr>
<tr>
<td>MATH 308</td>
<td>Introduction to Abstract Algebra II</td>
<td>3</td>
</tr>
<tr>
<td>MATH 321</td>
<td>Fundamentals of Analysis I</td>
<td>3</td>
</tr>
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<td>MATH 322</td>
<td>Fundamentals of Analysis II</td>
<td>3</td>
</tr>
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<td>MATH 324</td>
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</tr>
<tr>
<td>or MATH 330</td>
<td>Introduction of Scientific Computing</td>
<td></td>
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<td><strong>Total Units</strong></td>
<td></td>
<td><strong>41</strong></td>
</tr>
</tbody>
</table>

* No more than one can be from outside the department.

** Or other approved computer science course.
Bachelor of Science in Applied Mathematics

A student in this degree program must design a program of study in consultation with his or her academic advisor. This program of study must explicitly list the mathematics electives and the professional core in the area of application.

Areas of research in applied mathematics well represented in the department include:

- Applied dynamical systems
- Applied probability and stochastic processes
- Imaging
- Life science
- Scientific computing

Study plans with emphasis on areas of application closely related to mathematics but centered in other departments will also be considered. Such areas might include engineering applications, biology, cognitive science, or economics.

The BS degree in applied mathematics requires at least 50 hours of course work in mathematics and related subjects, in addition to a professional core that is specific to the area of application of interest to the student, including:

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>MATH 121</td>
<td>Calculus for Science and Engineering I</td>
<td>4</td>
</tr>
<tr>
<td>MATH 122</td>
<td>Calculus for Science and Engineering II</td>
<td>4</td>
</tr>
<tr>
<td>or MATH 124</td>
<td>Calculus II</td>
<td>4</td>
</tr>
<tr>
<td>MATH 223</td>
<td>Calculus for Science and Engineering III</td>
<td>3</td>
</tr>
<tr>
<td>or MATH 227</td>
<td>Calculus III</td>
<td>3</td>
</tr>
<tr>
<td>MATH 224</td>
<td>Elementary Differential Equations</td>
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One of the following two courses:

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<thead>
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</thead>
<tbody>
<tr>
<td>MATH 324</td>
<td>Introduction to Complex Analysis</td>
<td>3</td>
</tr>
<tr>
<td>MATH 425</td>
<td>Complex Analysis I</td>
<td>3</td>
</tr>
</tbody>
</table>

Approved mathematics electives:

- Four courses specific to the concentration area of interest to the student (12 units)
- Two MATH courses at the 300 level or higher (6 units)

Professional Core requirement

- 12 approved credit hours specific to an area of application. This requirement is intended to promote scientific breadth and encourage application of mathematics to other fields.

Non-mathematics requirements

The following three courses:

<table>
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<tr>
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</thead>
<tbody>
<tr>
<td>PHYS 121</td>
<td>General Physics I - Mechanics</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 122</td>
<td>General Physics II - Electricity and Magnetism</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 221</td>
<td>Introduction to Modern Physics</td>
<td>3</td>
</tr>
</tbody>
</table>

One of the following sequences:

- PHYS 315 Introduction to Solid State Physics
- PHYS 316 Introduction to Nuclear and Particle Physics
- PHYS 326 Physical Optics
- PHYS 327 Quantum Electronics
- PHYS 328 Cosmology and the Structure of the Universe
- PHYS 336 Modern Cosmology
- PHYS 365 General Relativity
- PHYS 423 Classical Electromagnetism
- PHYS 472 Graduate Physics Laboratory

Bachelor of Science in Mathematics and Physics

In contrast to the BS in applied mathematics or the BS in physics with a mathematical physics concentration, this degree provides a synergistic, coherent, and parallel education in mathematics and physics. To a close approximation, the challenging course work corresponds to combining the mathematics and physics cores, with the Physics Laboratory cluster replaced by a single, fourth-year laboratory semester. A student in this new program may use either of two official advisors, one available from each department, who would also constitute a committee for the administration of the degree and the approval of curriculum petitions.

The BS degree in mathematics and physics requires a total of 126 credits, including:

A. Mathematics requirements (35)

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 121</td>
<td>Calculus for Science and Engineering I</td>
<td>4</td>
</tr>
<tr>
<td>MATH 122</td>
<td>Calculus for Science and Engineering II</td>
<td>4</td>
</tr>
<tr>
<td>or MATH 124</td>
<td>Calculus II</td>
<td>4</td>
</tr>
<tr>
<td>MATH 223</td>
<td>Calculus for Science and Engineering III</td>
<td>3</td>
</tr>
<tr>
<td>or MATH 227</td>
<td>Calculus III</td>
<td>3</td>
</tr>
<tr>
<td>MATH 224</td>
<td>Elementary Differential Equations</td>
<td>3</td>
</tr>
<tr>
<td>or MATH 228</td>
<td>Differential Equations</td>
<td>3</td>
</tr>
<tr>
<td>MATH 307</td>
<td>Introduction to Abstract Algebra I</td>
<td>3</td>
</tr>
<tr>
<td>MATH 308</td>
<td>Introduction to Abstract Algebra II</td>
<td>3</td>
</tr>
<tr>
<td>or MATH 330</td>
<td>Introduction of Scientific Computing</td>
<td>3</td>
</tr>
<tr>
<td>MATH 321</td>
<td>Fundamentals of Analysis I</td>
<td>3</td>
</tr>
<tr>
<td>MATH 322</td>
<td>Fundamentals of Analysis II</td>
<td>3</td>
</tr>
<tr>
<td>MATH 324</td>
<td>Introduction to Complex Analysis</td>
<td>3</td>
</tr>
</tbody>
</table>

Approved Mathematics electives:

B. Physics requirements (38)

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYS 121</td>
<td>General Physics I - Mechanics</td>
<td>4</td>
</tr>
<tr>
<td>or PHYS 123</td>
<td>Physics and Frontiers I - Mechanics</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 122</td>
<td>General Physics II - Electricity and Magnetism</td>
<td>4</td>
</tr>
<tr>
<td>or PHYS 124</td>
<td>Physics and Frontiers II - Electricity and Magnetism</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 221</td>
<td>Introduction to Modern Physics</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 310</td>
<td>Classical Mechanics</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 313</td>
<td>Thermodynamics and Statistical Mechanics</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 331</td>
<td>Introduction to Quantum Mechanics I</td>
<td>3</td>
</tr>
<tr>
<td>or PHYS 481</td>
<td>Quantum Mechanics I</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 332</td>
<td>Introduction to Quantum Mechanics II</td>
<td>3</td>
</tr>
<tr>
<td>or PHYS 482</td>
<td>Quantum Mechanics II</td>
<td>3</td>
</tr>
</tbody>
</table>

One of the following:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
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<tbody>
<tr>
<td>PHYS 315</td>
<td>Introduction to Solid State Physics</td>
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<tr>
<td>PHYS 316</td>
<td>Introduction to Nuclear and Particle Physics</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 326</td>
<td>Physical Optics</td>
<td>3</td>
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<td>PHYS 327</td>
<td>Quantum Electronics</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 328</td>
<td>Cosmology and the Structure of the Universe</td>
<td>3</td>
</tr>
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<td>PHYS 336</td>
<td>Modern Cosmology</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 365</td>
<td>General Relativity</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 423</td>
<td>Classical Electromagnetism</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 472</td>
<td>Graduate Physics Laboratory</td>
<td>3</td>
</tr>
</tbody>
</table>
Two of the following:

PHYS 250 Computational Methods in Physics
PHYS 349 Methods of Mathematical Physics I
PHYS 350 Methods of Mathematical Physics II

C. Senior project and seminar; one of two options: (6-7)

C. (i) Mathematics option
MATH 351 Senior Project for the Mathematics and Physics Program
SAGES departmental seminar in Mathematics

C. (ii) Physics option
PHYS 303 Advanced Laboratory Physics Seminar
PHYS 351 Senior Physics Project Seminar

D. Other science requirements (9-11)

CHEM 105 Principles of Chemistry I 3-4
or CHEM 111 Principles of Chemistry for Engineers
CHEM 106 Principles of Chemistry II 3-4
or ENGR 145 Chemistry of Materials
ENGR 131 Elementary Computer Programming 3

Total Units 88-91

If approved by the M&P committee, other science sequence courses may be substituted.

In addition to the major coursework listed, there are requirements of 10 hours of SAGES First and University Seminars, 12 hours of CAS distribution requirements, and enough open electives to bring the total number of hours to at least 126.

First Year

<table>
<thead>
<tr>
<th>Units</th>
<th>Fall</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Physics I - Mechanics (PHYS 121)</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>or Physics and Frontiers I - Mechanics (PHYS 123)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calculus for Science and Engineering I (MATH 121)</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Elementary Computer Programming (ENGR 131)</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Principles of Chemistry I (CHEM 105)</td>
<td>3-4</td>
<td></td>
</tr>
<tr>
<td>or Principles of Chemistry for Engineers (CHEM 111)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SAGES First Seminar</td>
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<tr>
<td>Principles of Chemistry Laboratory (CHEM 113)</td>
<td>2</td>
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<tr>
<td>General Physics II - Electricity and Magnetism (PHYS 122)</td>
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<tr>
<td>or Physics and Frontiers II - Electricity and Magnetism (PHYS 124)</td>
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<tr>
<td>Calculus for Science and Engineering II (MATH 122)</td>
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<tr>
<td>or Calculus II (MATH 124)</td>
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<tr>
<td>Principles of Chemistry II (CHEM 106)</td>
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<tr>
<td>or Chemistry of Materials (ENGR 145)</td>
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<tr>
<td>Principles of Chemistry Laboratory (CHEM 113)</td>
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<tr>
<td>Other non-major course **</td>
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<td>Year Total:</td>
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Second Year

<table>
<thead>
<tr>
<th>Units</th>
<th>Fall</th>
<th>Spring</th>
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<tbody>
<tr>
<td>Introduction to Modern Physics (PHYS 221)</td>
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<td></td>
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<tr>
<td>Calculus for Science and Engineering III (MATH 223)</td>
<td>3</td>
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<tr>
<td>or Calculus III (MATH 227)</td>
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<tr>
<td>Introduction to Abstract Algebra I (MATH 307)</td>
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<td>Non-major courses **</td>
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<tr>
<td>Classical Mechanics (PHYS 310)</td>
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<tr>
<td>MP Group I</td>
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<tr>
<td>Elementary Differential Equations (MATH 224)</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>or Differential Equations (MATH 228)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Introduction to Abstract Algebra II (MATH 308)</td>
<td>3</td>
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<tr>
<td>or Introduction of Scientific Computing (MATH 330)</td>
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<td>Year Total:</td>
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</table>

Third Year

<table>
<thead>
<tr>
<th>Units</th>
<th>Fall</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thermodynamics and Statistical Mechanics (PHYS 313)</td>
<td>3</td>
<td></td>
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<tr>
<td>Introduction to Quantum Mechanics I (PHYS 331)</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>or Quantum Mechanics I (PHYS 481)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fundamentals of Analysis I (MATH 321)</td>
<td>3</td>
<td></td>
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<tr>
<td>MP Group II</td>
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<tr>
<td>Non-major courses **</td>
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<td></td>
</tr>
<tr>
<td>Introduction to Quantum Mechanics II (PHYS 332)</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>or Quantum Mechanics II (PHYS 482)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fundamentals of Analysis II (MATH 322)</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Introduction to Complex Analysis (MATH 324)</td>
<td>3</td>
<td></td>
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<td>MP Group III</td>
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<td></td>
</tr>
<tr>
<td>Year Total:</td>
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<td>12</td>
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</table>

Fourth Year

<table>
<thead>
<tr>
<th>Units</th>
<th>Fall</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYS 3XX</td>
<td>3</td>
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<tr>
<td>Graduate Physics Laboratory (PHYS 472)</td>
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<tr>
<td>MP Group IV **</td>
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<tr>
<td>SAGES Departmental Seminar ****</td>
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<tr>
<td>Classical Electromagnetism (PHYS 423)</td>
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<td></td>
</tr>
<tr>
<td>Senior Project ****</td>
<td>3-4</td>
<td></td>
</tr>
<tr>
<td>Non-major courses **</td>
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<td></td>
</tr>
<tr>
<td>Year Total:</td>
<td>12</td>
<td>18-19</td>
</tr>
</tbody>
</table>

Total Units in Sequence: 129-132

The "M&P group" of four courses corresponds to two physics courses and two mathematics courses. The physics courses would be chosen from PHYS 250, PHYS 349, and PHYS 350. The mathematics courses are subject to approval by the advisory committee and are hereby referred to as ‘approved electives.’ They may be chosen from the general list of mathematics courses at the 300 level or higher. Also subject to approval, students may choose a course from outside the mathematics and physics departments as a substitute in the M&P group.

The number of open electives will vary depending on whether students choose 3-credit or 4-credit courses to fulfill other requirements (chemistry, senior project).

An advanced physics course to be selected from the following list: PHYS 315 Introduction to Solid State Physics, PHYS 316 Introduction to Nuclear and Particle Physics, PHYS 326 Physical Optics, PHYS 327 Quantum Electronics, PHYS 328 Cosmology and the Structure of the Universe, PHYS 336 Modern Cosmology, PHYS 365 General Relativity.

The Senior Project and SAGES Departmental Seminar should either be the Mathematics option (MATH 351 Senior Project for the Mathematics and Physics Program and a Mathematics departmental seminar), or the Physics option (PHYS 351 Senior Physics Project, and PHYS 352 Senior Physics Project Seminar).
Integrated BS/MS Program in Mathematics and/or Applied Mathematics

The integrated BS/MS program is intended for highly motivated candidates for the BS in mathematics and applied mathematics who wish to pursue an advanced degree. Application to the BS/MS program must be made after completion of 75 semester hours of course work and prior to attaining senior status (completion of 90 semester hours). Generally, this means that a student will submit the application during his/her sixth semester of undergraduate course enrollment and will have no fewer than two semesters of remaining BS requirements to complete. Applicants should consult the dean of undergraduate studies.

A student admitted to the program may, in the senior year, take up to nine hours of graduate courses (400 level and above) that will count towards both BS and MS requirements. The courses to be doubled-counted must be specified at the time of application. Any undergraduate course work that is to be applied to the MS must be beyond that used to satisfy BS degree requirements and must conform to university, graduate school, and department rules. Students may petition to transfer graduate course work taken prior to application to the BS/MS program subject to the rules of the graduate school.

Students for whom the master’s project or thesis is a continuation and development of the senior project should register for (or the appropriate project course) during the senior year and are expected to complete all other courses for the BS before enrolling in further MS course work and thesis (continuing the senior project). Students for whom the master’s thesis or project is distinct from the senior project will be expected to complete the BS degree before taking further graduate courses for the master’s degree.

Integrated BS/MS in Applied Mathematics and Another Discipline

There is the possibility of an integrated five-year study plan leading to a BS in applied mathematics and an MS in the area of application. In order to complete the requirements for the BS/MS in five years, students must choose an area outside mathematics that integrates well with mathematics, such as computing/information science, operations research, systems engineering, control theory, biology, or cognitive science. The general academic requirements for Integrated BS/MS programs must be followed. (Since the graduate courses required for the MS degree are determined by the respective department, each student in the dual-degree program should have a secondary advisor in that department, starting no later than the junior year, and consult with this advisor concerning requirements for the MS degree.)

Minor

A minor in mathematics is available to all undergraduates. No more than two courses can be used to satisfy both minor requirements and the requirements of the student’s major field (meaning departmental degree requirements, including departmental technical electives and common course requirements of the student’s school).

The minor in mathematics requires 17 hours of mathematics courses, including:

<table>
<thead>
<tr>
<th>Course</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 121</td>
<td>Calculus for Science and Engineering I</td>
</tr>
<tr>
<td>or MATH 125</td>
<td>Math and Calculus Applications for Life, Managerial, and Social Sci I</td>
</tr>
<tr>
<td>MATH 122</td>
<td>Calculus for Science and Engineering II</td>
</tr>
<tr>
<td>or MATH 124</td>
<td>Calculus II</td>
</tr>
<tr>
<td>or MATH 126</td>
<td>Math and Calculus Applications for Life, Managerial, and Social Sci II</td>
</tr>
<tr>
<td>MATH 223</td>
<td>Calculus for Science and Engineering III</td>
</tr>
<tr>
<td>or MATH 227</td>
<td>Calculus III</td>
</tr>
<tr>
<td>MATH 224</td>
<td>Elementary Differential Equations</td>
</tr>
<tr>
<td>or MATH 228</td>
<td>Differential Equations</td>
</tr>
<tr>
<td>MATH 228</td>
<td>Mathematics from a Mathematician’s Perspective *</td>
</tr>
<tr>
<td>MATH 201</td>
<td>Introduction to Linear Algebra</td>
</tr>
<tr>
<td>or MATH 307</td>
<td>Introduction to Abstract Algebra I</td>
</tr>
<tr>
<td>MATH 301</td>
<td>Undergraduate Reading Course</td>
</tr>
<tr>
<td>MATH 302</td>
<td>Departmental Seminar</td>
</tr>
<tr>
<td>MATH 303</td>
<td>Elementary Number Theory</td>
</tr>
<tr>
<td>MATH 304</td>
<td>Discrete Mathematics</td>
</tr>
<tr>
<td>MATH 308</td>
<td>Introduction to Abstract Algebra II</td>
</tr>
<tr>
<td>MATH 321</td>
<td>Fundamentals of Analysis I</td>
</tr>
<tr>
<td>MATH 322</td>
<td>Fundamentals of Analysis II</td>
</tr>
<tr>
<td>MATH 324</td>
<td>Introduction to Complex Analysis</td>
</tr>
<tr>
<td>MATH 327</td>
<td>Convexity and Optimization</td>
</tr>
<tr>
<td>MATH 330</td>
<td>Introduction of Scientific Computing</td>
</tr>
<tr>
<td>MATH 333</td>
<td>Mathematics and Brain</td>
</tr>
<tr>
<td>MATH 338</td>
<td>Introduction to Dynamical Systems</td>
</tr>
<tr>
<td>MATH 343</td>
<td>Theoretical Computer Science</td>
</tr>
<tr>
<td>MATH 363</td>
<td>Knot Theory</td>
</tr>
<tr>
<td>MATH 380</td>
<td>Introduction to Probability</td>
</tr>
</tbody>
</table>

* To count toward a minor in Mathematics, MATH 150 Mathematics from a Mathematician’s Perspective must be taken in the first or second year.

Graduate Programs

The department offers programs leading to the Master of Science and the Doctor of Philosophy degrees. At both the master’s and the doctoral levels, students may pursue degrees in mathematics or applied mathematics.

A student must satisfy all of the general requirements of the graduate school as well as the more specific requirements of the department to earn either a master’s or doctoral degree. Each graduate student is assigned a faculty advisory committee during the first year of study. The committee’s primary responsibility is to help the student plan an appropriate and sufficiently broad program of course work and study that will satisfy both the degree requirements and the special interests of the student. With the aid of the advisory committee, each student must present a study plan indicating how he or she intends to satisfy the requirements for a graduate degree.

The main requirements are as follows.

Master of Science in Mathematics

A minimum of 27 credit hours of approved course work, at least 18 of which must be at the 400 level or higher, is required for the MS degree in mathematics. Courses in two of the following three basic areas must be included among the 27 credit hours required for graduation:

<table>
<thead>
<tr>
<th>Area</th>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abstract Algebra</td>
<td>MATH 401</td>
<td>Abstract Algebra I</td>
</tr>
<tr>
<td>or MATH 402</td>
<td>Abstract Algebra II</td>
<td></td>
</tr>
<tr>
<td>Analysis</td>
<td>MATH 423</td>
<td>Introduction to Real Analysis I</td>
</tr>
<tr>
<td>or MATH 424</td>
<td>Introduction to Real Analysis II</td>
<td></td>
</tr>
<tr>
<td>or MATH 425</td>
<td>Complex Analysis I</td>
<td></td>
</tr>
</tbody>
</table>
The student must pass a comprehensive oral examination on three areas, two of which must be selected from the basic ones listed above (although no particular courses are specified). The third area for the examination may be any approved subject.

A student in the MS program in mathematics may substitute the comprehensive exam examination requirement with an expository or original thesis, which will count as 6 credit hours of course work. The thesis will be defended in the course of an oral examination, during which the student will be questioned about the thesis and related topics. These two variants correspond to the graduate school’s plan A and plan B.

### Master of Science in Applied Mathematics

The department offers specialized programs in applied mathematics. For each of the programs, there is a minimum requirement of 27 credit hours of course work, at least 18 of which must be at the 400 level or higher. Students in the program must complete course work requirements in each of the following groups:

- At least 15 hours offered by the Department of Mathematics
- At least 6 hours of courses offered outside the Department of Mathematics
- 6 hours of thesis work (see below) or successful completion of a comprehensive exam

Given the great diversity of topics used in applications, there cannot be a large common core of requirements for the MS in applied mathematics. Still, all students pursuing this degree are strongly advised to take MATH 431 Introduction to Numerical Analysis I and MATH 441 Mathematical Modeling. In addition, to add breadth to the student’s education, the set of courses taken within the department must include three credit hours of approved course work in at least three of the following seven breadth areas. (The list includes suitable courses for each area. Please note that a course may be used to satisfy only one breadth area requirement.)

### Applied Mathematics Breadth Areas

**Analysis and Linear Analysis:**
- MATH 471 Advanced Engineering Mathematics
- MATH 423 Introduction to Real Analysis I
- MATH 405 Advanced Matrix Analysis

**Probability and its Applications:**
- MATH 491 Probability I
- MATH 493 Probability II

**Numerical Analysis and Scientific Computing:**
- MATH 431 Introduction to Numerical Analysis I
- MATH 432 Numerical Differential Equations
- MATH 433 Numerical Solutions of Nonlinear Systems and Optimization

**Differential Equations:**
- MATH 435 Ordinary Differential Equations
- MATH 445 Introduction to Partial Differential Equations
- MATH 449 Dynamical Models for Biology and Medicine

**Inverse Problems and Imaging:**
- MATH 439 Integrated Numerical and Statistical Computations
- MATH 440 Computational Inverse Problems
- MATH 475 Mathematics of Imaging in Industry and Medicine

**Logic and Discrete Mathematics:**
- MATH 406 Mathematical Logic and Model Theory
- MATH 408 Introduction to Cryptology

**Life Science:**

<table>
<thead>
<tr>
<th>Units</th>
<th>Course</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>MATH 441 Mathematical Modeling</td>
</tr>
<tr>
<td>3</td>
<td>MATH 449 Dynamical Models for Biology and Medicine</td>
</tr>
<tr>
<td>3</td>
<td>MATH 478 Computational Neuroscience</td>
</tr>
</tbody>
</table>

Not suitable for credit towards the PhD requirements.

Other suitable courses for students in applied mathematics include:

- MATH 424 Introduction to Real Analysis II
- MATH 425 Complex Analysis I
- MATH 427 Convexity and Optimization
- MATH 428 Fourier Analysis
- MATH 444 Mathematics of Data Mining and Pattern Recognition
- MATH 475 Mathematics of Imaging in Industry and Medicine
- MATH 492 Probability II

The student must pass a comprehensive oral examination on three areas, two of which must be on the list of breadth areas (although no particular courses are specified). The third area for the examination may be any approved subject.

A student in the MS program in applied mathematics may substitute the comprehensive examination requirement with an expository or original thesis, which will count as 6 credit hours of course work. The thesis will be defended in the course of an oral examination, during which the student will be questioned about the thesis and related topics. These two variants correspond to the graduate school’s plan A and plan B.

### PhD Program

The doctorate is conferred not merely upon completion of a stipulated course of study, but rather upon clear demonstration of scholarly attainment and capability of original research work in mathematics. A doctoral student may plan either a traditional program of studies in mathematics (mathematics track) or a program of studies oriented toward applied mathematics (applied mathematics track). In either case, each student must take 36 credit hours of approved courses with a grade average of B or better. For students entering with a master’s degree in a mathematical subject compatible with our program, as determined by the graduate committee, this requirement is reduced to 18 credit hours of approved courses.

In addition to the course work, all PhD students in both tracks must complete the following specific requirements:

- Pass the PhD qualifying examination, which consists of examinations on three different subjects. All examinations are general proficiency examinations which may or may not be connected to specific courses. The topics for each subject are spelled out in a syllabus, periodically updated, which is available to the student. Students are expected to take the qualifying examination by the end of the second year of study and to successfully pass all parts of it by the beginning of their sixth semester in the PhD program. The subject requirements are different in the two tracks; see below.

- Write an acceptable thesis that constitutes an original contribution to mathematical knowledge. It is the responsibility of the student to find a thesis advisor who is willing to help plan a program and guide his or her research. This should be done immediately after passing the qualifying examination. A copy of a student’s thesis is to be available no later than 10 days prior to the final oral examination (see below), and the student is required to deliver an expository lecture on the subject of his or her thesis sometime prior to the final oral examination. This lecture is open to all students and faculty.

- Pass a final oral examination consisting of a defense of the thesis. The examination committee, which consists of not fewer than four members of the faculty, including one whose appointment is outside
the mathematics department, is responsible for certifying that the material presented in the thesis meets acceptable scholarly standards. The examination may also include an inquiry into the student’s competence in the major and related fields. All faculty members are welcome to attend.

Requirements specific to the different tracks

Mathematics Track
A student in the traditional mathematics program must demonstrate knowledge of the basic concepts and techniques of algebra, analysis (real and complex), and topology. This includes taking all courses in the three basic areas, and successfully completing qualifying examinations in algebra and analysis.

Qualifying Examination
A doctoral student in the mathematics track must take examinations on abstract algebra and real analysis. The third subject is to be selected from the following list: complex analysis, control and calculus of variations, differential equations, dynamical systems, functional analysis, geometry, probability, and topology. The choice of the examination subjects should be finalized by the end of the first year of study.

Abstract Algebra:

<table>
<thead>
<tr>
<th>Course</th>
<th>Units</th>
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</thead>
<tbody>
<tr>
<td>MATH 401</td>
<td>3</td>
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<tr>
<td>MATH 402</td>
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Analysis:

<table>
<thead>
<tr>
<th>Course</th>
<th>Units</th>
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</thead>
<tbody>
<tr>
<td>MATH 423: Introduction to Real Analysis</td>
<td>3</td>
</tr>
<tr>
<td>MATH 424: Introduction to Real Analysis II</td>
<td>3</td>
</tr>
<tr>
<td>MATH 425: Complex Analysis I</td>
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Topology:

<table>
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<tr>
<th>Course</th>
<th>Units</th>
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</thead>
<tbody>
<tr>
<td>MATH 461: Introduction to Topology</td>
<td>3</td>
</tr>
</tbody>
</table>

18 credit hours of approved course work 18

Total Units 36

A student with a master’s degree in a mathematical subject compatible with our program, as determined by the graduate committee, must take 18 credit hours of approved courses. The graduate committee will determine which of the specific course requirements stated above have been satisfied by the master’s course work.

Applied Mathematics Track
A student in the applied mathematics track must demonstrate knowledge of scientific computing, mathematical modeling, and differential equations. This includes taking qualifying examinations in the areas of computational mathematics and mathematical modeling, and taking certain courses in these three areas, as specified below.

Qualifying Examination
A doctoral student in the applied mathematics track must take examinations in an area of computational mathematics and in an area of mathematical modeling. The third area of examination may be a more applied subject, including but not restricted to fluid mechanics, statistical mechanics, epidemiology, neuroscience, or a more traditional field of mathematics.

<table>
<thead>
<tr>
<th>Course</th>
<th>Units</th>
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</thead>
<tbody>
<tr>
<td>MATH 431: Introduction to Numerical Analysis I</td>
<td>3</td>
</tr>
<tr>
<td>One of the following:</td>
<td>3</td>
</tr>
<tr>
<td>MATH 432: Numerical Differential Equations</td>
<td>3</td>
</tr>
<tr>
<td>MATH 433: Numerical Solutions of Nonlinear Systems and Optimization</td>
<td>3</td>
</tr>
<tr>
<td>MATH 441: Mathematical Modeling</td>
<td>3</td>
</tr>
<tr>
<td>One of the following:</td>
<td>3</td>
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<tr>
<td>MATH 435: Ordinary Differential Equations</td>
<td>3</td>
</tr>
<tr>
<td>MATH 445: Introduction to Partial Differential Equations</td>
<td>3</td>
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</tbody>
</table>

24 hours of approved courses * 24

Total Units 36

* Must include at least 9 hours of courses offered outside the Department of Mathematics and at least 9 credit hours offered by the Department of Mathematics.

A student with a master’s degree in a mathematical subject compatible with our program, as determined by the graduate committee, must take 18 credit hours of approved courses, which must include at least 6 credit hours of courses offered outside the Department of Mathematics and at least 9 credit hours offered by the Department of Mathematics. The graduate committee will determine which of the specific course requirements stated above have been satisfied by the master’s course work.

Sample study plans for students with concentrations in scientific computing, imaging, mathematical biology, and stochastics follow. The graduate committee will entertain ideas for other serious study plans or qualifying exam subjects in addition to the most common variants.

Scientific Computing Concentration

<table>
<thead>
<tr>
<th>Course</th>
<th>Units</th>
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<tbody>
<tr>
<td>MATH 431: Introduction to Numerical Analysis I</td>
<td>3</td>
</tr>
<tr>
<td>MATH 432: Numerical Differential Equations</td>
<td>3</td>
</tr>
<tr>
<td>MATH 433: Numerical Solutions of Nonlinear Systems and Optimization</td>
<td>3</td>
</tr>
<tr>
<td>MATH 439: Integrated Numerical and Statistical Computations</td>
<td>3</td>
</tr>
<tr>
<td>or MATH 440: Computational Inverse Problems</td>
<td>3</td>
</tr>
<tr>
<td>MATH 441: Mathematical Modeling</td>
<td>3</td>
</tr>
<tr>
<td>MATH 445: Introduction to Partial Differential Equations</td>
<td>3</td>
</tr>
<tr>
<td>MATH 449: Dynamical Models for Biology and Medicine</td>
<td>3</td>
</tr>
<tr>
<td>or MATH 478: Computational Neuroscience</td>
<td>3</td>
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</table>

Imaging Concentration

<table>
<thead>
<tr>
<th>Course</th>
<th>Units</th>
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<tbody>
<tr>
<td>MATH 428: Fourier Analysis</td>
<td>3</td>
</tr>
<tr>
<td>MATH 431: Introduction to Numerical Analysis I</td>
<td>3</td>
</tr>
<tr>
<td>MATH 432: Numerical Differential Equations</td>
<td>3</td>
</tr>
<tr>
<td>MATH 433: Numerical Solutions of Nonlinear Systems and Optimization</td>
<td>3</td>
</tr>
<tr>
<td>MATH 439: Integrated Numerical and Statistical Computations</td>
<td>3</td>
</tr>
<tr>
<td>or MATH 440: Computational Inverse Problems</td>
<td>3</td>
</tr>
<tr>
<td>MATH 441: Mathematical Modeling</td>
<td>3</td>
</tr>
<tr>
<td>MATH 444: Mathematics of Data Mining and Pattern Recognition</td>
<td>3</td>
</tr>
<tr>
<td>MATH 445: Introduction to Partial Differential Equations</td>
<td>3</td>
</tr>
<tr>
<td>MATH 475: Mathematics of Imaging in Industry and Medicine</td>
<td>3</td>
</tr>
<tr>
<td>EBME 410: Medical Imaging Fundamentals</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 431: Physics of Imaging</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 460: Advanced Topics in NMR Imaging</td>
<td>3</td>
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</tbody>
</table>

Life Science Concentration

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<tr>
<th>Course</th>
<th>Units</th>
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<tbody>
<tr>
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<td>MATH 449: Dynamical Models for Biology and Medicine</td>
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<tr>
<td>MATH 478: Computational Neuroscience</td>
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</table>

Stochastics Concentration

<table>
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<tr>
<th>Course</th>
<th>Units</th>
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<tbody>
<tr>
<td>MATH 423: Introduction to Real Analysis I</td>
<td>3</td>
</tr>
<tr>
<td>MATH 424: Introduction to Real Analysis II</td>
<td>3</td>
</tr>
<tr>
<td>MATH 431: Introduction to Numerical Analysis I</td>
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</tr>
</tbody>
</table>
PhD students entering with a bachelor’s degree are subject to the same breadth requirements as students pursuing the MS degree in applied mathematics.

**Petitions**

Any exceptions to departmental regulations or requirements must have the formal approval of the department’s graduate committee. Such exceptions are to be sought by a written petition, approved by the student’s advisory committee or thesis advisor, to the graduate committee.

Any exception to university rules and regulations must be approved by the dean of graduate studies. Such exceptions are to be sought by presenting a written petition to the graduate committee for departmental endorsement and approval prior to forwarding the petition to the dean.

**Department Faculty**

Daniela Calvetti, PhD  
(University of North Carolina)  
*Armington Professor and Chair*  
Scientific computing; imaging, inverse problems; modeling and simulation in life science  

Alethea Barbaro, PhD  
(University of California, Santa Barbara)  
*Assistant Professor*  
Computational Science and Engineering  

Christopher Butler, MS  
(Case Western Reserve University)  
*Instructor and Theodore M. Focke Professorial Fellow*  
Teaching of mathematics  

John Duncan, PhD  
(Yale University)  
*Assistant Professor*  
The structure theory of vertex algebras; applications of vertex algebra in representation theory; algebraic geometry; number theory; topology  

Weihong Guo, PhD  
(University of Florida)  
*Assistant Professor*  
Image processing and analysis; compressive sensing; computational neuroscience; computer vision  

David Gurarie, PhD  
(Hebrew University, Jerusalem, Israel)  
*Professor*  
Applied mathematics (differential equations, dynamical systems) in physics, chemistry, biology; applications to population biology, infectious disease modeling, epidemiology, metabolism, geophysical fluid dynamics  

Michael Hurley, PhD  
(Northwestern University)  
*Professor*  
Dynamical systems; dynamics of cellular automata; dynamics of numerical methods  

Steven H. Izen, PhD  
(Massachusetts Institute of Technology)  
*Professor*  
Image reconstruction from projections, both theoretically and in applied situations  

Peter Kotelnenez, PhD  
(Universität Bremen)  
*Professor*  
Stochastic partial and ordinary differential equations; transitions from microscopic to macroscopic equations for particle systems; correlated Brownian motions and depletion phenomena in colloids; stochastic models in nanotechnology and complex systems  

Joel Langer, PhD  
(University of California, Santa Cruz)  
*Professor*  
Static and dynamics of curves and related physical models; the interplay between geometry and integrable Hamiltonian systems; geometry of finite and infinite dimensional spaces of curves  

Marshall J. Leitman, PhD  
(Brown University)  
*Professor and Theodore M. Focke Professorial Fellow*  
Continuum physics; integral equations; functional analysis; mechanics of materials  

Elizabeth Meckes, PhD  
(Stanford University)  
*Assistant Professor*  
Probability theory; probabilistic problems in geometry, topology, and physics; random matrix theory  

Mark Meckes, PhD  
(Case Western Reserve University)  
*Assistant Professor*  
Geometry in high dimensions; random matrix theory; geometric probability  

Benjamin Nill, PhD  
(Eberhard Karls Universität Tübingen)  
*Assistant Professor*  
Algebraic and toric geometry; convex and discrete geometry; geometric combinatorics  

David A. Singer, PhD  
(University of Pennsylvania)  
*Professor*  
Geometry; dynamical systems; variational problems  

Erkki Somersalo, PhD  
(University of Helsinki)  
*Professor*  
Modeling and simulation of complex biological systems; inverse problems and Bayesian scientific computing; medical imaging  

Stanislaw J. Szarek, PhD  
(Mathematical Institute, Polish Academy of Science)  
*Kerr Professor of Mathematics*  
Geometric functional analysis and its applications to study of high-dimensional phenomena including quantum information theory  

Peter Thomas, PhD  
(University of Chicago)  
*Assistant Professor*  
Synchronization and reliability of neural activity; gradient sensing, signal transduction and information theory; pattern formation in the visual cortex; malaria informatics  

Elisabeth Werner, PhD  
(Université Pierre et Marie Curie, Paris VI)
Introduction to multivariable calculus. Prereq: MATH 123 or placement by the department.


Continuation of MATH 121 covering differential equations, multivariable calculus, discrete methods. Partial derivatives, maxima and minima for functions of two variables, linear regression. Differential equations; first and second order equations, systems, Taylor series methods; Newton's method; difference equations. Prereq: MATH 121, MATH 123 or MATH 125.

MATH 120. Elementary Functions and Analytic Geometry. 3 Units.
Polynomial, rational, exponential, logarithmic, and trigonometric functions (emphasis on computation, graphing, and location of roots) straight lines and conic sections. Primarily a precalculus course for the student without a good background in trigonometric functions and graphing and/or analytic geometry. Not open to students with credit for MATH 121 or MATH 125. Prereq: Three years of high school mathematics.

MATH 121. Calculus for Science and Engineering I. 4 Units.
Functions, analytic geometry of lines and polynomials, limits, derivatives of algebraic and trigonometric functions. Definite integral, antiderivatives, fundamental theorem of calculus, change of variables. Prereq: Three and one half years of high school mathematics.

MATH 122. Calculus for Science and Engineering II. 4 Units.
Continuation of MATH 121. Exponential and logarithmic, growth and decay, inverse trigonometric functions, related rates, basic techniques of integration, area and volume, polar coordinates, parametric equations. Taylor polynomials and Taylor's theorem. Prereq: MATH 121, MATH 123 or MATH 126.

MATH 124. Calculus II. 4 Units.
MATH 301. Undergraduate Reading Course. 1 - 3 Unit.
Students must obtain the approval of a supervising professor before registration. More than one credit hour must be approved by the undergraduate committee of the department.

MATH 302. Departmental Seminar. 3 Units.
A seminar devoted to understanding the formulation and solution of mathematical problems. SAGES Department Seminar. Students will investigate, from different possible viewpoints, via case studies, how mathematics advances as a discipline—what mathematicians do. The course will largely be in a seminar format. There will be two assignments involving writing in the style of the discipline. Enrollment by permission (limited to majors depending on demand).

MATH 303. Elementary Number Theory. 3 Units.
Primes and divisibility, theory of congruencies, and number theoretic functions. Diophantine equations, quadratic residue theory, and other topics determined by student interest. Emphasis on problem solving (formulating conjectures and justifying them). Prereq: MATH 122 or MATH 124.

MATH 304. Discrete Mathematics. 3 Units.
A general introduction to basic mathematical terminology and the techniques of abstract mathematics in the context of discrete mathematics. Topics introduced are mathematical reasoning, Boolean connectives, deduction, mathematical induction, sets, functions and relations, algorithms, graphs, combinatorial reasoning. Offered as EECS 320 and MATH 304. Prereq: MATH 122, MATH 124 or MATH 126.

MATH 305. Introduction to Advanced Mathematics. 3 Units.
A course on the theory and practice of writing, and reading mathematics. Main topics are logic and the language of mathematics, proof techniques, set theory, and functions. Additional topics may include introductions to number theory, group theory, topology, or other areas of advanced mathematics. Prereq: MATH 122, MATH 124 or MATH 126.

MATH 306. Introduction to Linear Algebra. 3 Units.
First semester of an integrated, two-semester theoretical course in abstract and linear algebra, studied on an axiomatic basis. The major algebraic structures studied are groups, rings, fields, modules, vector spaces, and inner product spaces. Topics include homomorphisms and quotient structures, the theory of polynomials, canonical forms for linear transformations and the principal axis theorem. This course is required of all students majoring in mathematics. Only one of MATH 201 or MATH 306 may be taken for credit. Prereq: MATH 122 or MATH 124.

MATH 307. Introduction to Abstract Algebra I. 3 Units.
Continuation of MATH 306. Prereq: MATH 306.

MATH 308. Introduction to Abstract Algebra II. 3 Units.

MATH 309. Advanced Linear Algebra. 3 Units.
Continuation of MATH 306. Prereq: MATH 306.

MATH 310. Advanced Linear Algebra. 3 Units.

MATH 311. Introduction to Abstract Algebra I. 3 Units.

MATH 312. Introduction to Abstract Algebra II. 3 Units.
Continuation of MATH 311. Prereq: MATH 311.

MATH 313. Introduction to Advanced Mathematics. 3 Units.
A course on the theory and practice of writing, and reading mathematics. Main topics are logic and the language of mathematics, proof techniques, set theory, and functions. Additional topics may include introductions to number theory, group theory, topology, or other areas of advanced mathematics. Prereq: MATH 122, MATH 124 or MATH 126.

MATH 314. Introduction to Advanced Mathematics. 3 Units.
A course on the theory and practice of writing, and reading mathematics. Main topics are logic and the language of mathematics, proof techniques, set theory, and functions. Additional topics may include introductions to number theory, group theory, topology, or other areas of advanced mathematics. Prereq: MATH 122, MATH 124 or MATH 126.

MATH 315. Introduction to Advanced Mathematics. 3 Units.
A course on the theory and practice of writing, and reading mathematics. Main topics are logic and the language of mathematics, proof techniques, set theory, and functions. Additional topics may include introductions to number theory, group theory, topology, or other areas of advanced mathematics. Prereq: MATH 122, MATH 124 or MATH 126.

MATH 316. Introduction to Advanced Mathematics. 3 Units.
A course on the theory and practice of writing, and reading mathematics. Main topics are logic and the language of mathematics, proof techniques, set theory, and functions. Additional topics may include introductions to number theory, group theory, topology, or other areas of advanced mathematics. Prereq: MATH 122, MATH 124 or MATH 126.

MATH 317. Introduction to Advanced Mathematics. 3 Units.
A course on the theory and practice of writing, and reading mathematics. Main topics are logic and the language of mathematics, proof techniques, set theory, and functions. Additional topics may include introductions to number theory, group theory, topology, or other areas of advanced mathematics. Prereq: MATH 122, MATH 124 or MATH 126.

MATH 318. Introduction to Advanced Mathematics. 3 Units.
A course on the theory and practice of writing, and reading mathematics. Main topics are logic and the language of mathematics, proof techniques, set theory, and functions. Additional topics may include introductions to number theory, group theory, topology, or other areas of advanced mathematics. Prereq: MATH 122, MATH 124 or MATH 126.

MATH 319. Applied Probability and Stochastic Processes for Biology. 3 Units.
Applications of probability and stochastic processes to biological systems. Mathematical topics will include: introduction to discrete and continuous probability spaces (including numerical generation of pseudo random samples from specified probability distributions), Markov processes in discrete and continuous time with discrete and continuous sample spaces, point processes including homogeneous and inhomogeneous Poisson processes and Markov chains on graphs, and diffusion processes including Brownian motion and the Ornstein-Uhlenbeck process. Biological topics will be determined by the interests of the students and the instructor. Likely topics include: stochastic ion channels, molecular motors and stochastic ratchets, actin and tubulin polymerization, random walk models for neural spike trains, bacterial chemotaxis, signaling and genetic regulatory networks, and stochastic predator-prey dynamics. The emphasis will be on practical simulation and analysis of stochastic phenomena in biological systems. Numerical methods will be developed using both MATLAB and the R statistical package. Student projects will comprise a major part of the course. Offered as BIOL 319, EECES 319, MATH 319, BIOL 419, EBMIE 419, and PHOL 419. Prereq: MATH 224 or MATH 223 and BIOL 300 or BIOL 306 and MATH 201 or MATH 307 or consent of instructor.

MATH 320. Fundamentals of Analysis I. 3 Units.
Abstract mathematical reasoning in the context of analysis in Euclidean space. Introduction to formal reasoning, sets and functions, and the number systems. Sequences and series; Cauchy sequences and convergence. Required for all mathematics majors. Additional work required for graduate students. (May not be taken for graduate credit by graduate students in the Department of Mathematics.) Offered as MATH 320 and MATH 421. Prereq: MATH 223 or MATH 227.

MATH 321. Fundamentals of Analysis I. 3 Units.
Continuation of MATH 320. Point-set topology in metric spaces with attention to n-dimensional space; completeness, compactness, connectedness, and continuity of functions. Topics in sequences, series of functions, uniform convergence, Fourier series and polynomial approximation. Theoretical development of differentiation and Riemann integration. Required for all mathematics majors. Additional work required for graduate students. (May not be taken for graduate credit by graduate students in the Department of Mathematics.) Offered as MATH 322 and MATH 422. Prereq: MATH 321.

MATH 322. Fundamentals of Analysis II. 3 Units.
Continuation of MATH 321. Point-set topology in metric spaces with attention to n-dimensional space; completeness, compactness, connectedness, and continuity of functions. Topics in sequences, series of functions, uniform convergence, Fourier series and polynomial approximation. Theoretical development of differentiation and Riemann integration. Required for all mathematics majors. Additional work required for graduate students. (May not be taken for graduate credit by graduate students in the Department of Mathematics.) Offered as MATH 322 and MATH 422. Prereq: MATH 321.

MATH 323. Introduction to Complex Analysis. 3 Units.

MATH 324. Geometry and Complex Analysis. 3 Units.
The theme of this course will be the interplay between geometry and complex analysis, algebra and other fields of mathematics. An effort will be made to highlight significant, unexpected connections between major fields, illustrating the unity of mathematics. The choice of text(s) and syllabus itself will be flexible, to be adapted to the range of interests and backgrounds of pre-enrolled students. Possible topics include: the Mobius group and its subgroups, hyperbolic geometry, elliptic functions, Riemann surfaces, applications of conformal mapping, and potential theory in classical physical models. Offered as MATH 326 and MATH 426. Prereq: MATH 324.
MATH 327. Convexity and Optimization. 3 Units.
Introduction to the theory of convex sets and functions and to the extremes in problems in areas of mathematics where convexity plays a role. Among the topics discussed are basic properties of convex sets (extreme points, facial structure of polytopes), separation theorems, duality and polars, properties of convex functions, minima and maxima of convex functions over convex set, various optimization problems. Offered as MATH 327, MATH 427, and OPRE 427. Prereq: MATH 223 or MATH 227.

MATH 330. Introduction of Scientific Computing. 3 Units.
An introductory survey to Scientific Computing from principles to applications. Topics which will be covered in the course include: solution of linear systems and least squares, approximation and interpolation, solution of nonlinear systems, numerical integration and differentiation, and numerical solution of differential equations. Projects where the numerical methods are used to solve problems from various application areas will be assigned throughout the semester. Prereq or Coreq: MATH 224 or MATH 228.

MATH 333. Mathematics and Brain. 3 Units.
This course is intended for upper level undergraduate students in Mathematics, Cognitive Science, Biomedical Engineering, Biology or Neuroscience who have an interest in quantitative investigation of the brain and its functions. Students will be introduced to a variety of mathematical techniques needed to model and simulate different brain functions, and to analyze the results of the simulations and of available measured data. The mathematical exposition will be followed–when appropriate–by the corresponding implementation in Matlab. The course will cover some basic topics in the mathematical aspects of differential equations, electromagnetism, Inverse problems and imaging related to brain functions. Validation and falsification of the mathematical models in the light of available experimental data will be addressed. This course will be a first step towards organizing the different brain investigative modalities within a unified mathematical framework. A final presentation and written report are part of the course requirements. Prereq; MATH 224 or MATH 228.

MATH 338. Introduction to Dynamical Systems. 3 Units.
Nonlinear discrete dynamical systems in one and two dimensions. Chaotic dynamics, elementary bifurcation theory, hyperbolicity, symbolic dynamics, structural stability, stable manifold theory. Prereq; MATH 223 or MATH 227.

MATH 342. Introduction to Research in Mathematical Biology. 1 Unit.
The purpose of this seminar is to introduce students to some of the research being done at Case that explores questions at the intersection of mathematics and biology. Students will explore roughly five research collaborations, spending two weeks with each research group. In the first three classes of each two-week block, students will read and discuss relevant papers, guided by members of that research group, and the two-week period will culminate in a talk in which a member of the research group will present a potential undergraduate project in that area. After the final group’s talk, students will divide themselves into groups of two to four people and choose one project for further exploration. Together, they will write up this project as a research proposal, introducing the problem, explaining how it connects to broader scientific questions, and outlining the proposed work. It is expected that students will use the associated research group as a resource, but the proposal should be their own work. Students will submit a first draft, receive feedback, and then submit a revised draft. Offered as BIOL 309 and MATH 342.

MATH 343. Theoretical Computer Science. 3 Units.
Introduction to mathematical logic, different classes of automata and their correspondence to different classes of formal languages, recursive functions and computability, assertions and program verification, denotational semantics. MATH/EECS 343 and MATH 410 cannot both be taken for credit. Offered as EECS 343 and MATH 343. Prereq: MATH 304 and EECS 340.

MATH 351. Senior Project for the Mathematics and Physics Program. 2 Units.
A two-semester course (2 credits per semester) in the joint B.S. in Mathematics and Physics program. Project based on numerical and/or theoretical research under the supervision of a mathematics faculty member, possibly jointly with a faculty member from physics. Study of the techniques utilized in a specific research area and of recent literature associated with the project. Work leading to meaningful results which are to be presented as a term paper and an oral report at the end of the second semester. Supervising faculty will review progress with the student on a regular basis, including detailed progress reports made twice each semester, to ensure successful completion of the work.

MATH 352. Mathematics Capstone. 3 Units.
Mathematics Senior Project. Students pursue a project based on experimental, theoretical or teaching research under the supervision of a mathematics faculty member, a faculty member from another Case department or a research scientist or engineer from another institution. A departmental Senior Project Coordinator must approve all project proposals and this same person will receive regular oral and written progress reports. Final results are presented at the end of the second semester as a paper in a style suitable for publication in a professional journal as well as an oral report in a public Mathematics Capstone symposium.

MATH 361. Geometry I. 3 Units.
An introduction to the various two-dimensional geometries, including Euclidean, spherical, hyperbolic, projective, and affine. The course will examine the axiomatic basis of geometry, with an emphasis on transformations. Topics include the parallel postulate and its alternatives, isometrics and transformation groups, tilings, the hyperbolic plane and its models, spherical geometry, affine and projective transformations, and other topics. We will examine the role of complex and hypercomplex numbers in the algebraic representation of transformations. The course is self-contained. Prereq: MATH 224.

MATH 363. Knot Theory. 3 Units.
An introduction to the mathematical theory of knots and links, with emphasis on the modern combinatorial methods. Reidemeister moves on link projections, ambient and regular isotopies, linking number tricolorability, rational tangles, braids, torus knots, seifert surfaces and genus, the knot polynomials (bracket, X, Jones, Alexander, HOMFLY), crossing numbers of alternating knots and amphicheirality. Connections to theoretical physics, molecular biology, and other scientific applications will be pursued in term projects, as appropriate to the background and interests of the students. Prereq: MATH 223 or MATH 227.
MATH 376. Dynamics of Biological Systems II: Tools for Mathematical Biology. 3 Units.
Building on the material in Biology 300, this course focuses on the mathematical tools used to construct and analyze biological models, with examples drawn largely from ecology but also from epidemiology, developmental biology, and other areas. Analytic “paper and pencil” techniques are emphasized, but we will also use computers to help develop intuition. By the end of the course, students should be able to recognize basic building blocks in biological models, be able to perform simple analysis, and be more fluent in translating between verbal and mathematical descriptions. Offered as BIOL 306 and MATH 376. Prereq: BIOL 300 or MATH 224 or consent of instructor.

MATH 378. Computational Neuroscience. 3 Units.
Computer simulations and mathematical analysis of neurons and neural circuits, and the computational properties of nervous systems. Students are taught a range of models for neurons and neural circuits, and are asked to implement and explore the computational and dynamic properties of these models. The course introduces students to dynamical systems theory for the analysis of neurons and neural learning, models of brain systems, and their relationship to artificial and neural networks. Term project required. Students enrolled in MATH 478 will make arrangements with the instructor to attend additional lectures and complete additional assignments addressing mathematical topics related to the course. Recommended preparation: MATH 223 and MATH 224 or BIOL 300 and BIOL 306. Offered as BIOL 378, COGS 378, MATH 378, BIOL 478, EBME 478, EECS 478, MATH 478 and NEUR 478.

MATH 380. Introduction to Probability. 3 Units.

MATH 394. Introduction to Information Theory. 3 Units.
This course is intended as an introduction to information and coding theory with emphasis on the mathematical aspects. It is suitable for advanced undergraduate and graduate students in mathematics, applied mathematics, statistics, physics, computer science and electrical engineering. Course content: Information measures-entropy, relative entropy, mutual information, and their properties. Typical sets and sequences, asymptotic equipartition property, data compression. Channel coding and capacity: channel coding theorem. Differential entropy, Gaussian channel, Shannon-Nyquist theorem. Information theory inequalities (400 level). Additional topics, which may include compressed sensing and elements of quantum information theory. Recommended Preparation: MATH 201 or MATH 307. Offered as MATH 394, EECS 394, MATH 494 and EECS 494. Prereq: MATH 223 and MATH 380 or requisites not met permission.

MATH 400. Mathematics Teaching Practicum. 1 Unit.
Practicum for teaching college mathematics. Includes preparation of syllabi, exams, lectures. Grading, alternative teaching styles, use of technology, interpersonal relations and motivation. Handling common problems and conflicts.

MATH 401. Abstract Algebra I. 3 Units.
Basic properties of groups, rings, modules and fields. Isomorphism theorems for groups; Sylow theorem; nilpotency and solvability of groups; Jordan-Holder theorem; Gauss lemma and Eisenstein’s criterion; finitely generated modules over principal ideal domains with applications to abelian groups and canonical forms for matrices; categories and functors; tensor product of modules, bilinear and quadratic forms; field extensions; fundamental theorem of Galois theory, solving equations by radicals. Prereq: MATH 308.

MATH 402. Abstract Algebra II. 3 Units.
A continuation of MATH 401. Prereq: MATH 401.

MATH 405. Advanced Matrix Analysis. 3 Units.
An advanced course in linear algebra and matrix theory. Topics include variational characterizations of eigenvalues of Hermitian matrices, matrix and vector norms, characterizations of positive definite matrices, singular value decomposition and applications, perturbation of eigenvalues. This course is more theoretical than MATH 431, which emphasizes computational aspects of linear algebra. Prereq: MATH 307.

MATH 406. Mathematical Logic and Model Theory. 3 Units.
Propositional calculus and quantification theory; consistency and completeness theorems; Gödel incompleteness results and their philosophical significance; introduction to basic concepts of model theory; problems of formulation of arguments in philosophy and the sciences. Offered as PHIL 306, MATH 406 and PHIL 406.

MATH 408. Introduction to Cryptology. 3 Units.
Introduction to the mathematical theory of secure communication. Topics include: classical cryptographic systems; one-way and trapdoor functions; RSA, DSA, and other public key systems; Primality and Factorization algorithms; birthday problem and other attack methods; elliptic curve cryptosystems; introduction to complexity theory; other topics as time permits. Recommended preparation: MATH 303.

MATH 421. Fundamentals of Analysis I. 3 Units.
Abstract mathematical reasoning in the context of analysis in Euclidean space. Introduction to formal reasoning, sets and functions, and the number systems. Sequences and series; Cauchy sequences and convergence. Required for all mathematics majors. Additional work required for graduate students. (May not be taken for graduate credit by graduate students in the Department of Mathematics.) Offered as MATH 321 and MATH 421.

MATH 422. Fundamentals of Analysis II. 3 Units.
Continuation of MATH 321. Point-set topology in metric spaces with attention to n-dimensional space; completeness, compactness, connectedness, and continuity of functions. Topics in sequences, series of functions, uniform convergence, Fourier series and polynomial approximation. Theoretical development of differentiation and Riemann integration. Required for all mathematics majors. Additional work required for graduate students. (May not be taken for graduate credit by graduate students in the Department of Mathematics.) Offered as MATH 322 and MATH 422. Prereq: MATH 321 or MATH 421.
MATH 423. Introduction to Real Analysis I. 3 Units.

MATH 424. Introduction to Real Analysis II. 3 Units.

MATH 425. Complex Analysis I. 3 Units.
Analytic functions. Integration over paths in the complex plane. Index of a point with respect to a closed path; Cauchy's theorem and Cauchy's integral formula; power series representation; open mapping theorem; singularities; Laurent expansion; residue calculus; harmonic functions; Poisson's formula; Riemann mapping theorem. More theoretical and at a higher level than MATH 324. Prereq: MATH 322 or MATH 422.

MATH 426. Geometry and Complex Analysis. 3 Units.
The theme of this course will be the interplay between geometry and complex analysis, algebra and other fields of mathematics. An effort will be made to highlight significant, unexpected connections between major fields, illustrating the unity of mathematics. The choice of text(s) and syllabus itself will be flexible, to be adapted to the range of interests and backgrounds of pre-enrolled students. Possible topics include: the Mobius group and its subgroups, hyperbolic geometry, elliptic functions, Riemann surfaces, applications of conformal mapping, and potential theory in classical physical models. Offered as MATH 326 and MATH 426.

MATH 427. Convexity and Optimization. 3 Units.
Introduction to the theory of convex sets and functions and to the extremes in problems in areas of mathematics where convexity plays a role. Among the topics discussed are basic properties of convex sets (extreme points, facial structure of polytopes), separation theorems, duality and polars, properties of convex functions, minima and maxima of convex functions over convex set, various optimization problems. Offered as MATH 327, MATH 427, and OPRE 427.

MATH 428. Fourier Analysis. 3 Units.

MATH 431. Introduction to Numerical Analysis I. 3 Units.

MATH 432. Numerical Differential Equations. 3 Units.

MATH 433. Numerical Solutions of Nonlinear Systems and Optimization. 3 Units.
The course provides an introduction to numerical solution methods for systems of nonlinear equations and optimization problems. The course is suitable for upper-undergraduate and graduate students with some background in calculus and linear algebra. Knowledge of numerical linear algebra is helpful. Among the topics which will be covered in the course are Nonlinear systems in one variables; Newton's method for nonlinear equations and unconstrained minimization; Quasi-Newton methods; Global convergence of Newton's methods and line searches; Trust region approach; Secant methods; Nonlinear least squares. Prereq: MATH 223 or MATH 227, and MATH 431 or permission.

MATH 434. Optimization of Dynamic Systems. 3 Units.

MATH 435. Ordinary Differential Equations. 3 Units.
A second course in ordinary differential equations. Existence, uniqueness, and continuation of solutions of ODE. Linear systems, fundamental matrix, qualitative methods (phase plane). Dependence on initial data and parameters (Gronwall's inequality, nonlinear variation of parameters). Stability for linear and nonlinear equations, linearization, Poincare-Bendixson theory. Additional topics may include regular and singular perturbation methods, autonomous oscillations, entrainment of forced oscillators, and bifurcations. Prereq: MATH 224 and either MATH 201 or MATH 307.
MATH 439. Integrated Numerical and Statistical Computations. 3 Units.
This course will embed numerical methods into a Bayesian framework. The statistical framework will make it possible to integrate a priori information about the unknowns and the error in the data directly into the most efficient numerical methods. A lot of emphasis will be put on understanding the role of the priors, their encoding into fast numerical solvers, and how to translate qualitative or sample-based information—or lack thereof—into a numerical scheme. Confidence on computed results will also be discussed from a Bayesian perspective, at the light of the given data and a priori information. The course should be of interest to anyone working on signal and image processing statistics, numerical analysis and modeling. Recommended Preparation: MATH 431. Offered as MATH 439 and STAT 439.

MATH 440. Computational Inverse Problems. 3 Units.
This course will introduce various computational methods for solving inverse problems under different conditions. First the classical regularization methods will be introduced, and the computational challenges which they pose, will be addressed. Following this, the statistical methods for solving inverse problems will be studied and their computer implementation discussed. We will combine the two approaches to best exploit their potentials. Applications arising from various areas of science, engineering, and medicine will be discussed throughout the course.

MATH 441. Mathematical Modeling. 3 Units.
Mathematics is a powerful language for describing real world phenomena and providing predictions that are otherwise hard or impossible to obtain. The course gives the students pre-requisites for translating qualitative descriptions given in the professional non-mathematical language into the quantitative language for mathematics. While the variety in the subject matter is wide, some general principles and methodologies that a modeler can pursue are similar in many applications. The course focuses on these similarities. The course is based on representative case studies that are discussed and analyzed in the classroom, the emphasis being on general principles of developing and analyzing mathematical models. The examples will be taken from different fields of science and engineering, including life sciences, environmental sciences, biomedical engineering and physical sciences. Modeling relies increasingly on computation, so the students should have basic skills for using computers and programs like Matlab or Mathematica. Prereq: MATH 224 or MATH 228.

MATH 444. Mathematics of Data Mining and Pattern Recognition. 3 Units.
This course will give an introduction to a class of mathematical and computational methods for the solution of data mining and pattern recognition problems. By understanding the mathematical concepts behind algorithms designed for mining data and identifying patterns, students will be able to modify them suitable for specific applications. Particular emphasis will be given to matrix factorization techniques. The course requirements will include the implementations of the methods in MATLAB and their application to practical problems. Prereq: MATH 201 or MATH 307.

MATH 445. Introduction to Partial Differential Equations. 3 Units.
Method of characteristics for linear and quasilinear equations. Second order equations of elliptic, parabolic, type; initial and boundary value problems. Method of separation of variables, eigenfunction expansions, Sturm-Liouville theory. Fourier, Laplace, Hankel transforms; Bessel functions, Legendre polynomials. Green’s functions. Examples include heat diffusion, Laplace’s equation, wave equations, one dimensional gas dynamics and others. Appropriate for seniors and graduate students in science, engineering, and mathematics. Prereq: MATH 201 or MATH 308 and MATH 224 or MATH 228.

MATH 449. Dynamical Models for Biology and Medicine. 3 Units.
Introduction to discrete and continuous dynamical models with applications to biology and medicine. Topics include: population dynamics and ecology; models of infectious diseases; population genetics and evolution; biological motion (reaction-diffusion and chemotaxis); Molecular and cellular biology (biochemical kinetics, metabolic pathways, immunology). The course will introduce students to the basic mathematical concepts and techniques of dynamical systems theory (equilibria, stability, bifurcations, discrete and continuous dynamics, diffusion and wave propagation, elements of system theory and control). Mathematical exposition is supplemented with introduction to computer tools and techniques (Mathematica, Matlab). Prereq: MATH 224 or MATH 228, or BIOL/EBME 300, and MATH 201.

MATH 461. Introduction to Topology. 3 Units.

MATH 462. Algebraic Topology. 3 Units.
The fundamental group and covering spaces; van Kampen’s theorem. Higher homotopy groups; long-exact sequence of a pair. Homology theory; chain complexes; short and long exact sequences; Mayer-Vietoris sequence. Homology of surfaces and complexes; applications. Prereq: MATH 461.

MATH 465. Differential Geometry. 3 Units.
Manifolds and differential geometry. Vector fields; Riemannian metrics; curvature; intrinsic and extrinsic geometry of surfaces and curves; structural equations of Riemannian geometry; the Gauss-Bonnet theorem. Prereq: MATH 321.

MATH 467. Differentiable Manifolds. 3 Units.
Differentiable manifolds and structures on manifolds. Tangent and cotangent bundle; vector fields; differential forms; tensor calculus; integration and Stokes’ theorem. May include Hamiltonian systems and their formulation on manifolds; symplectic structures; connections and curvature; foliations and integrability. Prereq: MATH 322.

MATH 471. Advanced Engineering Mathematics. 3 Units.
MATH 475. Mathematics of Imaging in Industry and Medicine. 3 Units.
The mathematics of image reconstruction; properties of radon transform, relation to Fourier transform; inversion methods, including convolution, backprojection, rho-filtered layergram, algebraic reconstruction technique (ART), and orthogonal polynomial expansions. Reconstruction from fan beam geometry, limited angle techniques used in MRI; survey of applications. Recommended preparation: PHYS 431 or MATH 471.

MATH 478. Computational Neuroscience. 3 Units.
Computer simulations and mathematical analysis of neurons and neural circuits, and the computational properties of nervous systems. Students are taught a range of models for neurons and neural circuits, and are asked to implement and explore the computational and dynamic properties of these models. The course introduces students to dynamical systems theory for the analysis of neurons and neural learning, models of brain systems, and their relationship to artificial and neural networks. Term project required. Students enrolled in MATH 478 will make arrangements with the instructor to attend additional lectures and complete additional assignments addressing mathematical topics related to the course. Recommended preparation: MATH 223 and MATH 224 or BIOL 300 and BIOL 306. Offered as BIOL 378, COGS 378, MATH 378, BIOL 478, EBME 478, EECS 478, MATH 478 and NEUR 478.

MATH 491. Probability I. 3 Units.

MATH 492. Probability II. 3 Units.

MATH 494. Introduction to Information Theory. 3 Units.
This course is intended as an introduction to information and coding theory with emphasis on the mathematical aspects. It is suitable for advanced undergraduate and graduate students in mathematics, applied mathematics, statistics, physics, computer science and electrical engineering. Course content: Information measures-entropy, relative entropy, mutual information, and their properties. Typical sets and sequences, asymptotic equipartition property, data compression. Channel coding and capacity; channel coding theorem. Differential entropy, Gaussian channel, Shannon-Nyquist theorem. Information theory inequalities (400 level). Additional topics, which may include compressed sensing and elements of quantum information theory. Recommended Preparation: MATH 201 or MATH 307. Offered as MATH 394, EECS 394, MATH 494 and EECS 494.

MATH 499. Special Topics. 3 Units.
Special topics in mathematics.

MATH 528. Analysis Seminar. 1 - 3 Unit.
Continuing seminar on areas of current interest in analysis. Allows graduate and advanced undergraduate students to become involved in research. Topics will reflect interests and expertise of the faculty and may include functional analysis, convexity theory, and their applications. May be taken more than once for credit. Consent of department required.

MATH 535. Applied Mathematics Seminar. 1 - 3 Unit.
Continuing seminar on areas of current interest in applied mathematics. Allows graduate and advanced undergraduate students to become involved in research. Topics will reflect interests and expertise of the faculty and may include topics in applied probability and stochastic processes, continuum mechanics, numerical analysis, mathematical physics or mathematical biology. May be taken more that once for credit.

MATH 549. Mathematical Life Sciences Seminar. 1 - 3 Unit.
Continuing seminar on areas of current interest in the applications of mathematics to the life sciences. Allows graduate and advanced undergraduate students to become involved in research. Topics will reflect interests and expertise of the faculty and may include mathematical biology, computational neuroscience, mathematical modeling of biological systems, models of infectious diseases, computational cell biology, mathematical ecology and mathematical biomedicine broadly constructed. May be taken more than once for credit.

MATH 601. Reading and Research Problems. 1 - 18 Unit.
Presentation of individual research, discussion, and investigation of research papers in a specialized field of mathematics.

MATH 651. Thesis (M.S.). 1 - 18 Unit.

Prereq: Predoctoral research consent or advanced to Ph.D. candidacy milestone.
Department of Modern Languages and Literatures

The Department of Modern Languages and Literatures is committed to helping students become informed and liberally educated citizens of the world. Through the acquisition of language skills and cultural awareness, our students prepare for careers that have an international dimension. To that end, we strongly encourage them to spend their junior year abroad in order to immerse themselves in a foreign culture and perfect their language skills. We also run our own study abroad programs: one German program ("The Munich Experience"), two French programs ("The Paris Experience" and "The Montreal Experience"), three Spanish programs ("The Cuban Experience," "The Buenos Aires Experience" and "Advanced Spanish in Spain"), and one in Italy ("The Italian Experience").

We work closely with other university departments and interdisciplinary programs as well as with the cultural institutions of University Circle to provide students with a broad understanding of the many opportunities that language and culture study offer. The department has strong interdisciplinary ties with the college’s programs in Asian studies, French and Francophone studies, German studies, international studies, women’s and gender studies, and world literature. Students also gain practical experience in different cultural and language environments through service learning in the Spanish, French, and Russian communities of Cleveland.

Undergraduate Programs

The Department of Modern Languages and Literatures offers courses of study leading to the Bachelor of Arts in French, German, Japanese Studies, and Spanish. In addition, the department offers minors in Chinese, Hebrew, Italian, and Russian, as well as course work in Arabic and Portuguese. Except in the case of courses cross-listed with the World Literature Program, all courses in modern languages and literatures are taught primarily in the target language. In addition to class meetings, work outside of class with audio materials is an integral part of all elementary and intermediate language courses taught by the department. Career opportunities exist in college and university teaching, translation and interpretation, diplomatic and other government service, business, international nonprofit agencies, and the arts, and are often enhanced by a double major.

Placement Procedure

Students with prior experience in French, German, or Spanish, however gained (e.g., in high school, with or without AP courses, at another institution, via study abroad), must take a placement examination before the first week of the semester in which they enroll in one of those languages. Placement depends both on examination results and on consultation with individual faculty members.

Majors

French, German, Japanese Studies, and Spanish

Majors in French, German, Japanese Studies, and Spanish are expected: 1) to acquire the ability to understand, speak, read, and write the language(s) of their choice; and 2) to develop a sound understanding of the relevant cultures and literatures. The major in French, German, or Spanish consists of 30-32 hours of course work and will vary based on students’ background in the language. The major in Japanese Studies requires a minimum of 35 credit hours. Individual counseling and placement tests are provided by the department.

Course requirements are as follows:

- For students placed into the 200 level: 201-202 and eight courses at the 300 level taught in the target language, or six 300-level courses plus two related courses.
- For students placed into the 300-level: ten 300-level courses taught in the target language, or eight 300-level courses plus two related courses.

Related courses are those outside the department which are closely related to French, German, Japanese, and Spanish cultures, as well as those departmental courses cross-listed with World Literature.

Additional Information for French Major

- Students who take both FRCH 311 and 312 may count only one of these toward the major.
- At least two of the 300-level courses should be numbered above 320 and taught in French.
- At least two courses numbered 320 or higher should be taken in residence at CWRU.
- French courses taught in English end with -5 (FRCH 295, 335, etc.)

Integrated Graduate Studies (French)

The department participates in the Integrated Graduate Studies Program, which makes it possible to complete both a BA and an MA in French in about five years of full-time study. The department particularly recommends the program to qualified students who are interested in seeking admission to highly competitive professional schools or PhD programs. Interested students should note the general requirements and the admission procedures listed elsewhere in the general bulletin.

Additional Information for Spanish Major

- At least three of the 300-level courses should be numbered above 320.

Spanish subject area requirements

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>SPAN 201</td>
<td>Intermediate Spanish I</td>
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<tr>
<td>SPAN 202</td>
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<tr>
<td>SPAN 308</td>
<td>Advanced Spanish in Spain</td>
<td>3</td>
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<tr>
<td>SPAN 310</td>
<td>Advanced Composition and Reading</td>
<td>3</td>
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<td>SPAN 311</td>
<td>Advanced Spanish Conversation</td>
<td>3</td>
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<td>SPAN 314</td>
<td>Practice of Translation</td>
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<tr>
<td>SPAN 315</td>
<td>Latin American Cultural Conflicts</td>
<td>3</td>
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<tr>
<td>SPAN 316</td>
<td>Studies in Civilization</td>
<td>3</td>
</tr>
<tr>
<td>SPAN 317</td>
<td>Contemporary Latin American Culture</td>
<td>3</td>
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<tr>
<td>SPAN 318</td>
<td>Contemporary Spanish Culture</td>
<td>3</td>
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<td>SPAN 319</td>
<td>Spanish for Legal Professionals</td>
<td>3</td>
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<tr>
<td>SPAN 320</td>
<td>Introduction to Readings in Hispanic Literature</td>
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<td>SPAN 322</td>
<td>Latin American Short Story</td>
<td>3</td>
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<td>SPAN 331</td>
<td>Spanish Golden Age Literature</td>
<td>3</td>
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<tr>
<td>SPAN 340</td>
<td>Contemporary Latin-American Narrative</td>
<td>3</td>
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<tr>
<td>SPAN 342</td>
<td>Latin American Feminist Voices</td>
<td>3</td>
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<tr>
<td>SPAN 343</td>
<td>The New Drama in Latin American</td>
<td>3</td>
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<tr>
<td>SPAN 345</td>
<td>Hispanic Autobiographical Writing</td>
<td>3</td>
</tr>
<tr>
<td>SPAN 350</td>
<td>Spanish Fiction</td>
<td>3</td>
</tr>
<tr>
<td>SPAN 351</td>
<td>Hispanic Turn of the Century Literature</td>
<td>3</td>
</tr>
<tr>
<td>SPAN 353</td>
<td>Transatlantic Vanguard</td>
<td>3</td>
</tr>
<tr>
<td>SPAN 358</td>
<td>Latin American Cinema</td>
<td>3</td>
</tr>
</tbody>
</table>
SPAN 370 Special Topics in Spanish ** 3
SPAN 385 Hispanic Literature in Translation ** 3
SPAN 398 Honors Thesis II ** 3
SPAN 399 Independent Study ** 1

* Required only for students who begin their Spanish major at the intermediate level.

** Students at the intermediate (200) level select five courses (15 credit hours); students entering the program at the advanced (300) level select seven courses (21 credit hours).

Departmental Honors
The departmental honors program is for especially dedicated majors. Requirements for honors in modern languages and literatures are: 1) a GPA of at least 3.5 in the major, and 2) an honors thesis (FRCH, GRMN, JAPN, or SPAN 397 and 398, beyond the 30-32 hours required for the major) devoted to the investigation of a literary, linguistic, or cultural topic. The thesis is written in the target language, except in the case of Japanese Studies, which may permit papers in English. It must be read and approved by two readers and will be accepted for honors only if it achieves a grade of B or better. Students who qualify receive their degree “with Honors in Modern Languages and Literatures.” A registration form for students electing honors is available in the departmental office.

Minors
Chinese, French, German, Hebrew, Italian, Japanese Studies, Russian, Spanish

Course requirements for the minors are as follows:

• For students placed into the introductory level (no previous knowledge of the language): 101, 102, 201, 202, and one 300-level course.

• For students placed into the 200 level or higher: five courses at the 200 and 300 levels.

Hebrew language courses may also count toward the minor in Judaic Studies.

Graduate Programs
The department offers the Master of Arts degree in French and, together with the Departments of English and Classics, the Master of Arts degree in world literature.

• The standard MA in French requires 27-28 semester hours. An MA in French with a minor concentration in German, Japanese, or Spanish requires 36 hours.

• The MA in world literature, emphasizing Francophone and Anglophone literature, requires 27 hours.

Full-time students are expected to complete the MA within two academic years.

Department Faculty
Antonio Candau, PhD
(University of Massachusetts, Amherst)
Associate Professor and Chair
19th- to 21st-century Spanish culture; Golden Age literature

Christine M. Cano, PhD
(Yale University)
Associate Professor
20th- and 21st-century French literature and culture

Denise Caterinacci, MA
(Kent State University)
Instructor
Italian language and culture; language pedagogy; the role of motivation in language learning

M. Gabriela Copertari, PhD
(Georgetown University)
Associate Professor
Latin American literature and film, especially Argentinian; women’s writing; the modernista novel

Margaretmary Daley, PhD
(Yale University)
Associate Professor
18th- and 19th-century German literature; German women writers; women’s studies; feminist literary criticism

Gilbert Doho, Docteur d’Etat
(University of the Sorbonne Nouvelle)
Associate Professor
French drama; African Francophone theater and film; people theater and social movements; playwriting; African performing arts

Linda C. Ehrlich, PhD
(University of Hawaii/East-West Center)
Associate Professor
Asian (Japanese) cinema; traditional Asian theatre; set design, landscape architecture, and film; Japanese poetry; literature and film; cinema of Spain

Cristián G. Gómez Olivares, PhD
(University of Iowa)
Assistant Professor
20th century Latin American narrative and poetry

Takao Hagiwara, PhD
(University of British Columbia)
Associate Professor
Japanese literature, especially modern prose and poetry; classical and modern Japanese literature; pre-modern Japanese sensibilities and (post) modernism

Jutta Ittner, PhD
(University of Hamburg)
Associate Professor
20th-century German literature; contemporary women writers; poetry; literary translation; German culture; representation of animals in contemporary literature

Marie Lathers, PhD
(Brown University)
Elizabeth M. and William C. Treuhaft Professor of Humanities
Women and the visual arts; 19th-century French literature and the arts (painting, sculpture, photography, film); gender, science, and technology; feminist theory; space studies

Jacqueline C. Nanfito, PhD
(University of California, Los Angeles)
Associate Professor
Colonial and 19th-century Latin American literature; Golden Age Hispanic literature; literary theory; Chicano literature; contemporary Latin American women writers
Damaris Punales-Alpizar, PhD  
(University of Iowa)  
*Assistant Professor*  
20th-century Latin American literature; Latin American cinema; Cuban cinema; contemporary Cuban and Caribbean narrative; 19th- and 20th-century Latin American poetry; 20th-century peninsular literature

Cheryl Toman, PhD  
(University of Illinois, Urbana-Champaign)  
*Associate Professor*  
African and Middle Eastern Francophone literature, especially Cameroon; women's writing; immigrant communities in France

Susanne Vees-Gulani, PhD  
(University of Illinois, Urbana-Champaign)  
*Associate Professor*  
20th- and 21st-century literature and literary movements; German cultural studies; science and literature; medicine and literature; trauma studies; victim discourses; literary and cultural responses to World War II; German civil defense strategies in World War II

Peter Jianhua Yang, PhD  
(University of Utah)  
*Associate Professor*  
German literature, emphasis on 20th-century German literature; German theater; technology-enhanced language teaching; teaching pedagogy; business German; theatricality

Tatiana Zilotina, PhD  
(University of Virginia)  
*Instructor*  
19th- and 20th-century Russian literature; the poetry of Marina Tsvetaeva; women writers; Russian culture; Russian folklore

**Lecturers**

Man-Lih Chai, MA  
(University of Illinois, Urbana-Champaign)  
*Lecturer* (*Chinese*)

Yoram Daon, MBA  
(Keller Graduate School of Management, DeVry University)  
*Lecturer* (*Hebrew*)

Elena Fernández, MA  
(Cleveland State University)  
*Lecturer* (*Spanish*)

Margaret M. Fitzgerald, MA  
(The Ohio State University)  
*Lecturer* (*Japanese*)

Ramez Islambouli, MA  
(Case Western Reserve University)  
*Lecturer* (*Arabic*)

Yoshiko Kishi, MA  
(New York University)  
*Lecturer* (*Japanese*)

Clara Lipszyz-Arroyo, MA  
(University of Western Ontario)  
*Lecturer* (*Portuguese and Spanish*)

Enno Lohmeyer, PhD  
(University of Kansas)  
*Lecturer* (*German*)

Silvia Marotta, MA  
(Youngstown State University)  
*Lecturer* (*Italian*)

Carolina Perera Olivares, MA  
(University of South Florida)  
*Lecturer* (*Spanish*)

Fabienne Pizot-Haymore, MA  
(Université Paul Valéry, Montpellier III)  
*Lecturer* (*French*)

**ARAB Courses**

**ARAB 101. Beginning Arabic I. 4 Units.**  
The course introduces learners of Arabic to the sound and writing systems of this language and provides them with basic structural and lexical knowledge to enable them to say things in Arabic, such as greeting others, thanking someone, introducing oneself, describing one's background, seeking and providing info and so forth. The ability to perform these language functions in real-life or lifelike situations is developed by engaging the learner in structured functional activities and grammatical exercises.

**ARAB 102. Beginning Arabic II. 4 Units.**  
ARAB 102 builds on the proficiency that students should have acquired in ARAB 101. The course follows a student-centered communicative approach in which class time is used in active learning through pair or group activities, role-play, games, selective listening and reading and other activities. The course emphasizes the four basic skills, reading, speaking, listening and writing. Students will be exposed to real audiovisual material in order to enhance comprehension and they will have to develop short oral and written responses about it. Aspects of culture across the Arab world will be included as a element of learning the language. Recommended preparation: ARAB 101

**ARAB 201. Intermediate Arabic I. 4 Units.**  
Intensive review of grammar and conversational skills in modern Arabic through readings, discussions and other activities that explore contemporary Arab life and culture. Recommended preparation: ARAB 102 or equivalent.

**ARAB 202. Intermediate Arabic II. 4 Units.**  
ARAB 202 is a continuation of ARAB 201 and will enable the students to develop advanced communicative skills for the use of Modern Arabic. It will focus on speaking, listening, reading and writing skills, and emphasize creative use of the language. Recommended preparation: ARAB 201 or equivalent.

**ARAB 301. Advanced Arabic I. 3 Units.**  
This is a higher level of Arabic study. The course objectives are to enhance the student's language skills and to develop ability to use high-level Arabic effectively. It is designed to help students move from the intermediate level of proficiency, which centers on daily life and the immediate world, to the advanced, which broadens to include topics of general and professional interest. Recommended preparation: ARAB 202 or equivalent.

**ARAB 399. Independent Study in Arabic. 1 - 3 Unit.**  
Topics will be constructed to fit the interest of a student who has already taken an advanced course in Arabic. Prereq: ARAB 301.
CHIN Courses

CHIN 101. Elementary Chinese I. 4 Units.
Introductory course in speaking, understanding, reading and writing Chinese. Students are expected to achieve control of the sound system and basic sentence patterns of standard Mandarin Chinese. The course emphasizes speaking and aural comprehension.

CHIN 102. Elementary Chinese II. 4 Units.
Continuation of CHIN 101. Recommended preparation: Consent of department.

CHIN 201. Intermediate Chinese I. 4 Units.
Emphasizes basic structures of standard Mandarin Chinese; helps students improve reading, writing, listening and speaking abilities. Chinese culture, society, and people introduced through supplementary materials and activities. Recommended preparation: CHIN 102 or equivalent.

CHIN 202. Intermediate Chinese II. 4 Units.
Continuation of CHIN 201. Students must use course material offered by the Online Language Learning Center in addition to class meetings. Recommended preparation: CHIN 201.

CHIN 203. Intermediate Chinese III. 4 Units.
As the continuation of CHIN 202, CHIN 203 is the third course at the intermediate level in Chinese language at CWRU. In this course, students focus on conversation combined with further study of grammatical and syntactic rules, and of cultural elements. The objective is a further development of communicative skills in listening, speaking, reading, and writing. Upon completion of this course, students' proficiency will be optimal for entering CHIN 301. The course is a 4 credit course. The course uses integrated Chinese Level 2, Part 1, from the same series of textbooks for CHIN 201 and 202. The course covers 7 lessons of the book, two weeks for each lesson, in average. Students are expected to preview each lesson before class, to complete the assigned homework, and to study after class the content covered that day. The final grade will be based on the mid-term and final exams, and on quizzes. There will be a quiz at the end of each lesson. Chinese word-processing ability is one of the objectives of this course. Students will learn how to type Chinese texts using the Pinyin input method. Prereq: CHIN 202, or two years of study, or requisites not met permission.

CHIN 301. Advanced Chinese I. 4 Units.
Students work to achieve fluency in listening, speaking, reading and writing. Students must attend Language Resource Center in addition to class meetings. Recommended preparation: CHIN 202 or equivalent.

CHIN 302. Advanced Chinese II. 4 Units.
Continuation of CHIN 301.

CHIN 303. Topics in Chinese. 3 Units.

CHIN 304. Topics in Chinese. 3 Units.

CHIN 315. Business Chinese. 3 Units.
The Business Chinese course is designed to enhance students' listening, speaking, reading, and writing skills in Chinese through a variety of activities. It will focus on China’s contemporary international business issues and practices. At the end of the semester, the students will have a basic knowledge of China’s socio-cultural values, trade policy, and role in the world economy after its entry into the WTO and the ability to hold conversations on selected business topics with correct business vocabulary and in a culturally appropriate manner; to read business-related materials; and to write basic business communications including letters, reports and resumes. It is taught in Chinese and English. Offered as CHIN 315 and CHIN 415. Prereq: CHIN 202 or equivalent.

CHIN 399. Independent Study. 1 - 3 Unit.
Directed study for those students who have progressed beyond available course offerings. Prereq: CHIN 202.

FRCH Courses

FRCH 101. Elementary French I. 4 Units.
Emphasizes conversational skills. Students are expected to achieve control of sound system and basic sentence structures of French. Students must complete assignments at the Online Language Learning Center in addition to attending scheduled class meetings.

FRCH 102. Elementary French II. 4 Units.

FRCH 201. Intermediate French I. 4 Units.
Intensive review of grammar and usage through readings, discussions and other activities that emphasize contemporary French life. Students must complete assignments at the Online Language Learning Center in addition to attending scheduled class meetings. Recommended preparation: FRCH 102 or equivalent.

FRCH 202. Intermediate French II. 4 Units.
A continuation of FRCH 201, the course focuses on the acquisition of intermediate-level skills in language and culture. Students must complete assignments at the Online Language Learning Center in addition to attending scheduled class meetings. Recommended preparation: FRCH 201 or equivalent.
FRCH 208. The Montreal Experience. 1 Unit.
One-week immersion learning experience performing community service in Montreal, Canada. Students meet several times for orientation before spending spring break in French-speaking Montreal. Community service may include volunteering in a homeless center, a hospital, or school. Application available from Department office. This course may be repeated once. Permit required. Prereq or Coreq: FRCH 202 or equivalent.

FRCH 295. The Francophone World. 3 Units.
The course offers an introduction to the Francophone World from a historical, cultural, and literary perspective. The Francophone World includes countries and regions around the globe with a substantial French-speaking population (and where French is sometimes, but not always, an official language): North America (Louisiana, Quebec, and Acadia); North Africa (Tunisia, Morocco, Algeria, and Egypt); the Middle-East (Lebanon, Syria); the Caribbean (Martinique, Guadeloupe, Haiti); Southeast Asia (Vietnam); and Europe (France, Belgium, Switzerland, and Luxembourg). FRCH 295 provides a comprehensive overview of the Francophone World, while focusing on a particular area or areas in any given semester. Offered as ETHS 295, FRCH 295, and WLIT 295.

FRCH 308. The Paris Experience. 3 Units.
Three-week immersion learning experience living and studying in Paris. The focus of the course is the literature and culture of the African, Arab, and Asian communities of Paris. Students spend a minimum of fifteen hours per week visiting cultural centers and museums and interviewing authors and students about the immigrant experience. Assigned readings complement course activities. Students enrolled in FRCH 308/408 do coursework in French. WLIT 308/408 students have the option of completing coursework in English. Graduate students have additional course requirements. Offered as FRCH 308, WLIT 308, FRCH 408, and WLIT 408. Prereq: FRCH 202.

FRCH 310. Advanced Composition and Reading. 3 Units.
An initiation to the literature of Francophone expression with a focus on close reading. Texts may include short stories, essays, and novels. Students engage in the discussion of their readings and learn how to express their ideas both orally and in written form. Prereq: FRCH 202 or equivalent.

FRCH 311. Advanced Conversation I. 3 Units.
Designed to enhance pronunciation, speaking and listening-comprehension through the discussion of French literature and media for children. Required for Teacher Licensure candidates. Prereq: FRCH 202 or equivalent.

FRCH 312. Advanced Conversation II. 3 Units.
A functional approach to conversation. Students work to develop fluency in spoken French using current colloquial vocabulary and focusing on current issues. Practice in using speech appropriate to a variety of situations, including public debates. Prereq: FRCH 202 or equivalent.

FRCH 314. Translation Techniques. 3 Units.
Contrastive grammar analysis and stylistics are used to foster linguistic awareness and to introduce students to the methods and skills of translation. Recommended preparation: FRCH 310. Prereq: FRCH 202.

FRCH 315. Business French. 3 Units.
Business French is an upper-level course with a focus on the economic life of France and other Francophone countries. Students gain knowledge of the economic structures and the business organization of Francophone countries as they enhance the linguistic skills used in professional communication. Prereq: FRCH 202 or equivalent.

FRCH 316. Contemporary France. 3 Units.
A study of contemporary France, this course features discussions and lectures on a variety of topics (geography, political and social life, contemporary culture) to develop factual knowledge about France and a sound understanding of current issues as presented in the media. Prereq: FRCH 202 or equivalent.

FRCH 317. French Cinema. 3 Units.

FRCH 318. The Origins of France. 3 Units.
Examination through texts, films, and other media of major historical, intellectual, and artistic influences that have shaped the evolution of French civilization. Students will attempt to identify the values and myths that have contributed to the ongoing formation of modern France. Recommended preparation: FRCH 310. Prereq: FRCH 202.

FRCH 319. Modern France. 3 Units.
A study of France’s political, social and cultural history from the French Revolution to World War II, with emphasis on the events, movements, and people that have shaped Modern France. Highly recommended for students of Nineteenth- and Twentieth-Century French culture. Recommended preparation: FRCH 310. Prereq: FRCH 202.

FRCH 320. Introduction to French Literature. 3 Units.
Taught in French. An introduction to literary analysis through the study of important works of French literature. Written assignments are designed to develop skills in close reading, to introduce students to literary terminology in French, and to develop a capacity for clear, precise communication of an argument. Classes are discussion-based. Recommended preparation: FRCH 310. Prereq: FRCH 202.

FRCH 331. Seventeenth-Century French Literature. 3 Units.
The Age of Classicism, from Racine to Mme de Lafayette. Authors, works and topics may vary. Prereq: FRCH 320.

FRCH 335. Women in Developing Countries. 3 Units.
This course will feature case studies, theory, and literature of current issues concerning women in developing countries primarily of the French-speaking world. Discussion and research topics include matriarchal traditions and FGM in Africa, the Tunisian feminist movement, women, Islam, and tradition in the Middle East, women-centered power structures in India (Kerala, Pondichery), and poverty and women in Vietnam, Laos, and Cambodia. Guest speakers and special projects are important elements of the course. Seminar-style format, taught in English, with significant disciplinary writing in English for WGST, EThS, and some WLIT students, and writing in French for FRCH and WLIT students. Writing assignments include two shorter essays and a substantial research paper. Offered as EThS 335, FRCH 335, WLIT 335, WGST 335, FRCH 435 and WLIT 435.
FRCH 338. The Cameroon Experience. 3 Units.
Three-week immersion learning experience living and studying in Cameroon. The focus of the course is the culture, language, and literature of Francophone Cameroon, with some emphasis on Anglophone Cameroon. Students spend a minimum of fifteen hours per week visiting cultural sites and attending arranged courses at the University of Buea. Students will prepare a research paper. Coursework is in French. To do coursework in English, students should enroll in WLIT 338/438 or ETHS 338/438. Offered as ETHS 338, FRCH 338, WLIT 338, ETHS 438, FRCH 438, and WLIT 438. Prereq: FRCH 202.

FRCH 341. Eighteenth-Century French Literature. 3 Units.
Topics from the Age of Enlightenment, from libertinage to revolution. Authors and works may vary. Offered as FRCH 341 and FRCH 441. Prereq or Coreq: FRCH 320.

FRCH 351. Nineteenth-Century French Literature. 3 Units.
Romanticism, realism, and naturalism in the novel and the dramatic tradition. Authors, works, and topics may vary. Offered as FRCH 351 and FRCH 451. Prereq or Coreq: FRCH 320.

FRCH 361. Twentieth-Century French Literature. 3 Units.
A study of representative novelists (e.g., Proust, Gide, Colette, Sartre, Beauvoir) and playwrights (e.g., Claudel, Beckett, Genet) in historical context. Authors, works, and topics may vary. Offered as FRCH 361 and FRCH 461. Prereq or Coreq: FRCH 320.

FRCH 372. Topics in French Drama. 3 Units.
A topical approach to issues and problems specific to drama. Plays, playwrights, aesthetic theories, and historical periods studied in this course may vary. Offered as FRCH 372 and FRCH 472. Prereq or Coreq: FRCH 320.

FRCH 373. The Novel and the Novella. 3 Units.
A study of narrative fiction focused on either a particular genre (the novel, the short story) or a particular type of novel (psychological novel, realist novel, detective novel), tale (the fantastic tale, the fairytale), or novella. Offered as FRCH 373 and FRCH 473. Prereq or Coreq: FRCH 320.

FRCH 374. Major Writers and Literary Movements. 3 Units.
In-depth study of the work of a major writer, film director, or intellectual figure; or of a significant literary, intellectual, or artistic movement. Approaches, content, and instructor will vary. Offered as FRCH 374 and FRCH 474. Prereq: FRCH 320.

FRCH 375. Francophone Literature. 3 Units.
An examination of Francophone literature focused on the problematics of identity within the colonial and post-colonial context. Writers and works may vary. Offered as FRCH 375 and FRCH 475. Prereq or Coreq: FRCH 320.

FRCH 376. Women Writers. 3 Units.
An examination of important literary texts by French and Francophone women writers. Critical essays are also studied to introduce historical and theoretical perspectives. Offered as FRCH 376 and FRCH 476. Prereq or Coreq: FRCH 320.

FRCH 377. Special Topics. 3 Units.
The special topics course is designed to provide a forum for specific themes or subjects not otherwise covered in the curriculum. Approaches and content will vary. Maximum 6 credits. Offered as FRCH 377 and FRCH 477. Prereq or Coreq: FRCH 320.

FRCH 378. Francophone Literature in Translation. 3 Units.
Topics vary according to student and faculty interest. May include Francophone literature, literature and cinema, women writers, contemporary literature. Counts toward French major only as related course. No knowledge of French required. Offered as FRCH 395, WLIT 395, FRCH 495, and WLIT 495.

FRCH 394. Senior Capstone - French. 3 Units.
The Senior Capstone in French in an independent study project chosen in consultation with a capstone advisor. The capstone project should reflect both the student’s interest within French and/or Francophone Studies and the courses he or she has taken to fulfill the major. The project requires independent research using an approved bibliography and plan of action. In addition to written research, the student will also present the capstone project in a public forum that is agreed upon by the project advisor and the student. Prereq: Senior status required. Major in French or Francophone Studies required.

FRCH 399. Independent Study. 1 - 3 Units.
The course is for students who have special interests and commitments that are not addressed in regular courses, and who wish to work independently.

FRCH 408. The Paris Experience. 3 Units.
Three-week immersion learning experience living and studying in Paris. The focus of the course is the literature and culture of the African, Arab, and Asian communities of Paris. Students spend a minimum of fifteen hours per week visiting cultural centers and museums and interviewing authors and students about the immigrant experience. Assigned readings complement course activities. Students enrolled in FRCH 308/408 or the Paris Experience. Offered as FRCH 308, WLIT 308, FRCH 408, and WLIT 408. Prereq: Graduate standing.

FRCH 435. Women in Developing Countries. 3 Units.
This course will feature case studies, theory, and literature of current issues concerning women in developing countries primarily of the French-speaking world. Discussion and research topics include matriarchal traditions and FGM in Africa, the Tunisian feminist movement, women, Islam, and tradition in the Middle East, women-centered power structures in India (Kerala, Pondichery), and poverty and women in Vietnam, Laos, and Cambodia. Guest speakers and special projects are important elements of the course. Seminar-style format, taught in English, with significant disciplinary writing in English for WGST, ETHS, and some WLIT students, and writing in French for FRCH and WLIT students. Writing assignments include two shorter essays and a substantial research paper. Offered as ETHS 335, FRCH 335, WLIT 335, WGST 335, FRCH 435, and WLIT 435.
FRCH 438. The Cameroon Experience. 3 Units.
Three-week immersion learning experience living and studying in Cameroon. The focus of the course is the culture, literature, and language of Francophone Cameroon, with some emphasis on Anglophone Cameroon. Students spend a minimum of fifteen hours per week visiting cultural sites and attending arranged courses at the University of Buea. Students will prepare a research paper. Coursework is in French. To do coursework in English, students should enroll in WLIT 338/438 or ETHS 338/438. Offered as ETHS 338, FRCH 338, WLIT 338, ETHS 438, FRCH 438, and WLIT 438.

FRCH 441. Eighteenth Century French Literature. 3 Units.
Topics from the Age of Enlightenment, from libertinage to revolution. Authors and works may vary. Offered as FRCH 341 and FRCH 441.

FRCH 451. Nineteenth-Century French Literature. 3 Units.
Romanticism, realism, and naturalism in the novel and the dramatic tradition. Authors, works, and topics may vary. Offered as FRCH 351 and FRCH 451.

FRCH 461. Twentieth-Century French Literature. 3 Units.
A study of representative novelists (e.g., Proust, Gide, Colette, Sartre, Beauvoir) and playwrights (e.g., Claudel, Beckett, Genet) in historical context. Authors, works, and topics may vary. Offered as FRCH 361 and FRCH 461.

FRCH 472. Topics in French Drama. 3 Units.
A topical approach to issues and problems specific to drama. Plays, playwrights, aesthetic theories, and historical periods studied in this course may vary. Offered as FRCH 372 and FRCH 472.

FRCH 473. The Novel and the Novella. 3 Units.
A study of narrative fiction focused on either a particular genre (the novel, the short story) or a particular type of novel (psychological novel, realist novel, detective novel), tale (the fantastic tale, the fairytale), or novella. Offered as FRCH 373 and FRCH 473.

FRCH 474. Major Writers and Literary Movements. 3 Units.
In-depth study of the work of a major writer, film director, or intellectual figure; or of a significant literary, intellectual, or artistic movement. Approaches, content, and instructor will vary. Offered as FRCH 374 and FRCH 474. Prereq: Graduate standing.

FRCH 475. Francophone Literature. 3 Units.
An examination of Francophone literature focused on the problematic of identity within the colonial and post-colonial context. Writers and works may vary. Offered as FRCH 375 and FRCH 475.

FRCH 476. Women Writers. 3 Units.
An examination of important literary texts by French and Francophone women writers. Critical essays are also studied to introduce historical and theoretical perspectives. Offered as FRCH 376 and FRCH 476.

FRCH 477. Special Topics. 3 Units.
The special topics course is designed to provide a forum for specific themes or subjects not otherwise covered in the curriculum. Approaches and content will vary. Maximum 6 credits. Offered as FRCH 377 and FRCH 477.

FRCH 479. French Literature in Translation. 3 Units.
Topics vary according to student and faculty interest. May include Francophone literature, literature and cinema, women writers, contemporary literature. Counts toward French major only as related course. No knowledge of French required. Offered as FRCH 395, WLIT 395, FRCH 495, and WLIT 495. Coreq: Graduate standing.

FRCH 590. Seminar: Topics in Modern Literature and Culture. 3 Units.
French literature and culture since the Revolution of 1789. Topics vary depending on student and instructor interests; may include realism and naturalism, Proust, contemporary film, or French philosophy. Maximum 9 credits. Prereq: Graduate standing.

FRCH 595. Independent Research. 1 - 3 Unit.
Graded independent work on a literary topic arranged individually with the instructor. Prereq: Graduate standing.

FRCH 601. Independent Study. 1 - 18 Unit.
For individual students or larger groups with special interests.

FRCH 651. Thesis M.A.. 6 - 9 Unit.
Thesis M.A. serves the graduate plan A of the Graduate Handbook.

GRMN Courses

GRMN 101. Elementary German I. 4 Units.
Introductory course emphasizing conversational skills. Students achieve control of the sound system and basic sentence structures of spoken and written German. Students must use the course material offered by the Online Language Learning Center in addition to class meetings.

GRMN 102. Elementary German II. 4 Units.
Continuation of GRMN 101, emphasizing conversational skills. Prereq: GRMN 101 or equivalent.

GRMN 201. Intermediate German I. 4 Units.
Emphasizes both language and culture and is taught in German. Review of grammar and usage of German while studying texts and videotapes which focus on contemporary life in Germany. Prereq: GRMN 102 or equivalent.

GRMN 202. Intermediate German II. 4 Units.
Continuation of GRMN 201; conducted in German. Study of texts and videotapes which focus on contemporary life in Germany. Prereq: GRMN 201 or equivalent.

GRMN 303. German Culture & Civilization. 3 Units.
Examines aspects of contemporary Germany, including political and social systems and cultural life through seminar discussions of texts, films, and other media. Along with oral presentations and essay tests, students must select a research topic of interest to the discipline and write an analytic essay in German on the topic. Prereq: GRMN 202.
GRMN 308. The Munich Experience: Spring Course/Summer Study Advanced Level. 3 Units.
A semester seminar class, conducted in German, which culminates with a three-week immersion learning experience spent living and studying in Munich. Students reside with German families, study German daily in a formal setting, and practice comprehension, speaking, reading, and writing. Regular visits to museums, galleries, and cultural events; first-hand observation of history, life, and architecture of a major cultural center; day trips to cultural phenomena and events in the German countryside. Prereq or Coreq: GRMN 202 or equivalent.

GRMN 310. Advanced German Reading and Composition. 3 Units.
An advanced-level skills course focusing on reading and writing for students who have already studied intermediate German. Develops abilities to read authentic, unabridged texts, such as contemporary newspaper and magazine articles; readings increase progressively in length and vary in genre. Also practices composition skills by composing academic prose such as subjective summaries, reviews, precis, letters, short creative texts, and analytic written forms such as short essays to produce increasingly sophisticated analytical compositions in German. Includes instruction on use of English- and German-language research tools, German-German dictionaries, and study guides. Taught in German. Prereq: GRMN 202 or equivalent.

GRMN 311. Advanced Conversation. 3 Units.
Students work to improve fluency in spoken German. Topics include contemporary issues; current vocabulary is stressed. Students practice using speech appropriate to various situations. Prereq: GRMN 202 or equivalent.

GRMN 312. German Proficiency Through Drama. 3 Units.
Readings begin with single scenes and progress to full length radio plays and theater plays which gradually increase in linguistic difficulty and complexity of central themes. Introduction to the elements of drama such as dialogue, character and dramatic structure, as well as the genres of tragedy, comedy, and tragicomedy. Focus: effective communication of critical, interpretative, and analytic ideas in discussion and in writing. Prereq: GRMN 202 or equivalent.

GRMN 313. Intro to German Literature. 3 Units.
Introduction to German literature and the cultural issues it addresses. Readings include the main literary and folk genres (short texts or excerpts), gradually increasing in linguistic difficulty and complexity of central themes. They cover the major literary periods from the 18th to the 21st centuries. Focus: effective communication of critical, interpretative, and analytic ideas in discussion and in writing. Prereq: GRMN 202 or equivalent.

GRMN 315. Business German. 3 Units.
This course is taught in German. It is designed to enhance students’ German listening, speaking, reading, and writing skills through a variety of activities. It also aims at developing students’ cross-cultural awareness and communicative competence in the specialized field of German for Business and Economics in an increasingly global workplace. The course will explore German demography and economic geography; the European Union, the Euro, and Germany’s role in this union; German economic systems, industries, banking systems, advertising and sales, transportation and tourism; Germany’s corporate culture, industrial relations, codetermination in German companies, etc. Prereq: GRMN 202 or equivalent.

GRMN 320. Topics in Narrative. 3 Units.
This course examines representative prose works (tales, novellas, short novels, letters, and essays) chosen to present reactions and impressions to social and aesthetic conditions in German-speaking countries and to introduce students to different styles and varieties of German prose. Prereq: One 300-level GRMN course.

GRMN 326. Witches, Weddings, and Wolves. 3 Units.
Intensive study of German Folk Tales as collected and altered by the Brothers Grimm. The Maerchen as both children’s and adult literature. Prereq: One 300-level GRMN course.

GRMN 330. Topics in German Cinema. 3 Units.
Overview of German Cinema from the beginning to the present. Film selection representative of major directors, major periods (such as expressionism or The New German Cinema), particular themes from different historical perspectives, and literature in film. All films are in German. Taught in German. Prereq: One 300-level GRMN course.

GRMN 340. Topics in German Drama. 3 Units.
Overview of German drama from the beginning to the present. Explores German plays by applying different disciplinary approaches such as historical, cultural, and literary analyses. All plays are in German. Taught in German. Prereq: One 300-level GRMN course.

GRMN 350. Topics in German Lyric. 3 Units.
This course presents a detailed study of German lyric through the frequent writing of critical papers and literary analysis of the formal elements of poetry: rhyme schemes, diction, meter, figures of speech. The poems selected cover a variety of styles, a range of historical periods, and a sampling of authors. Readings and discussions in German. Prereq: One 300-level GRMN course.

GRMN 360. Topics in Major German Authors. 3 Units.
Concentrates on a specific author or small group of authors within an aesthetic or historical context, for example: Goethe, Heine, Bachmann, Junges Deutschland, or die Gruppe 47. Examines the breadth of themes and styles and may include literary, philosophical, biographical, and other kinds of texts. Readings and discussions in German. Prereq: One 300-level GRMN course.

GRMN 365. German Literature in Translation. 3 Units.
Goethe defined “World Literature” (Weltliteratur) as “Intellectual Trade Relations” (geistiger Handelsverkehr). This course gives students the opportunity to study German literary works in translation and thus to trade intellectual relations with a literary culture previously unknown to them. Counts toward the German major only as a related course. No knowledge of German required. Offered as GRMN 365 and WLT 365.

GRMN 367. German Classicism/Romanticism. 3 Units.
Selected works of Goethe, Schiller, Hölderlin, von Kleist, and others. Prereq: One 300-level GRMN course.

GRMN 370. Topics in Literary Periods. 3 Units.
Overview of German literary periods from the beginning to the present. Explores German literary works in all three major genres from the historical, social, and literary perspectives. All works are in German. Taught in German. Prereq: One 300-level GRMN course.
GRMN 380. Topics in Advanced German Culture Studies. 3 Units.
Exploration of the culture of the arts, political culture, and the cultural self-expression of the German-speaking countries from their beginnings to the present. Focus: The cultural changes within certain historical periods. Examination of particular aspects such as culture as mass deception in fascist Germany and the GDR, the reflection of contemporary culture in literature and cinema, problems of cultural identity and multiculturalism, and the role of postmodern culture industry and the critical discourse today. Taught in German. Prereq: One 300-level GRMN course.

GRMN 395. Special Topics in German Literature. 3 Units.
For majors and advanced students upon presentation of a written plan of investigation. Consent of department required. Prereq: One 300-level GRMN course.

GRMN 396. Senior Capstone - German. 3 Units.
The Senior Capstone in German in an independent study project chosen in consultation with a capstone advisor. The capstone project should reflect both the student’s interest within German and/or German studies and the courses he or she has taken to fulfill the major. The project requires independent research using and approved bibliography and plan of action. In addition to written research, the student will also present the capstone project in a public forum that agreed upon by the project advisor and the students. Prereq: Senior status required. Major in German required.

GRMN 397. Honors Thesis I. 3 Units.
Intensive study of a literary, linguistic, or cultural topic with a faculty member, leading to the writing of a research paper in German. Limited to senior majors. Permit required. Prereq: One 300-level GRMN course.

GRMN 398. Honors Thesis II. 3 Units.
Continuation of GRMN 397. Limited to senior majors. Permit required. Prereq: GRMN 397.

GRMN 399. Independent Study in German. 1 - 3 Unit.
For majors and advanced students under special circumstances. Permit required.

HBRW Courses
HBRW 101. Elementary Modern Hebrew I. 4 Units.
The course objective is to enable students to develop basic communicative skills in standard Modern Hebrew. Students will become acquainted with the Hebrew alphabet and vowels, and with basic grammar and vocabulary.

HBRW 102. Elementary Modern Hebrew II. 4 Units.
The course objective is to continue to develop the students’ basic communicative skills in standard Modern Hebrew. Students will be introduced to more complex grammatical constructs, linguistic forms and vocabulary. Prereq: HBRW 101 or consent of department.

HBRW 201. Intermediate Modern Hebrew I. 4 Units.
The course objective is to advance the students’ Hebrew communicative skills by studying the language in its cultural context. The focus will be on speaking, reading, and writing, with an emphasis on the use of the language as reflected in Israeli culture. Prereq: HBRW 102 or consent of department.

HBRW 202. Intermediate Modern Hebrew II. 4 Units.
The course objectives are to enhance and strengthen the students’ Hebrew language skills, and to develop the ability to express thoughts, ideas and opinions freely, in both verbal and written forms. Prereq: HBRW 201 or consent of department.

HBRW 301. Advanced Modern Hebrew I. 3 Units.
The course objectives are to enhance the students’ language skills and to develop their ability to use an advanced level of Hebrew effectively. Classes will be conducted in Hebrew, and will focus on speaking, reading, and writing with an emphasis on active and creative use of the language. Prereq: HBRW 202 or consent of department.

HBRW 302. Advanced Modern Hebrew II. 3 Units.
The course objectives are to enhance the students’ language skills within the domain of Modern Hebrew literature, and to enable them to use their Hebrew skills to perform detailed literary analyses in Hebrew. Classes will be conducted in Hebrew. Prereq: HBRW 301 or consent of department.

HBRW 399. Independent Studies. 1 - 3 Unit.
The course is for students with special interests and commitments that are not fully addressed in regular courses, and who wish to work independently. Prereq: HBRW 301 or consent of department.

ITAL Courses
ITAL 101. Elementary Italian I. 4 Units.
Introductory course; stress on mastery of the sound system and basic sentence structure of spoken and written Italian. Independent laboratory practice is a requirement.

ITAL 102. Elementary Italian II. 4 Units.
Continuation of ITAL 101; independent laboratory practice is required in addition to scheduled class meetings. Prereq: ITAL 101.

ITAL 201. Review and Progress in Italian. 4 Units.
Emphasizes language and culture. Review of Italian grammar and usage while studying written forms. Independent laboratory practice is required in addition to scheduled class meetings. Prereq: ITAL 102 or equivalent.

ITAL 202. Read and Discuss Italian Texts. 4 Units.
Focus on increasing proficiency acquired in elementary Italian and on mastering short narratives. Review of Italian grammar and usage through reading, conversation, and media. Independent laboratory practice is required in addition to scheduled class meetings. Prereq: ITAL 201 or equivalent.
ITAL 308. The Italian Experience. 3 Units.
A three-week summer study abroad course spent at a university in an Italian city well-known for its cultural and linguistic heritage and at other important sites during travel. Focus: Language immersion and processing of cultural experience. Main features: 1. Intense collaboration with an Italian university. Students interact with Italian peers; seminars are co-taught by Italian faculty. 2. Creation of an individual journal that synthesizes students’ perception of and reflections on their experience, records the progress of their final project, and documents their improvement in language proficiency. 3. Final project. Students meet M-F in a formal setting for advanced language study designed to improve proficiency in speaking, comprehension, reading, and writing. They attend seminars on varied topics in literature, history, and civilization. Visits to museums, galleries, and attendance at cultural events are included. Prereq: ITAL 202 or equivalent.

ITAL 311. Conversation in Italian. 3 Units.
Focused on oral communication, ITAL 311 is designed to enhance listening/comprehension skills in Italian. Using audio-visual materials, students acquire the skills necessary to understand conversations between native-speakers and to emulate them. The situational and functional approach to the course facilitates progress towards advanced-level fluency in Italian. Prereq: ITAL 202 or equivalent.

ITAL 370. Special Topics in Italian Literature. 3 Units.
Special topics in Italian literature, literary criticism, and culture. Prereq: ITAL 202 or equivalent.

ITAL 399. Independent Study. 1 - 3 Unit.
The course is for students with special interests and commitments that are not fully addressed in regular courses, and who wish to work independently.

JAPN Courses

JAPN 101. Elementary Japanese I. 4 Units.
Introduction to understanding, speaking, reading, and writing Japanese. Students learn to read and write hiragana and katakana syllabaries and 50 kanji characters. Students are expected to achieve control of the sound system and basic structure of the language. Emphasizes aural comprehension and speaking.

JAPN 102. Elementary Japanese II. 4 Units.

JAPN 201. Intermediate Japanese I. 4 Units.
Further study of fundamental structures of Japanese. Students improve aural comprehension, speaking, reading, and writing abilities and learn approximately 100 new characters. Recommended preparation: JAPN 102 or equivalent.

JAPN 202. Intermediate Japanese II. 4 Units.
Continuation of JAPN 201. Students learn an additional 100 kanji characters. With the completion of JAPN 201 - 202, students should have control of the fundamentals of modern Japanese and a firm foundation in the writing system. Recommended preparation: JAPN 201 or equivalent.

JAPN 203. Japanese Women Writers. 3 Units.
Recommended preparation: JAPN 301 or equivalent. This course highlights salient aspects of modern Japanese popular culture as expressed in animation, comics and literature. The works examined include films by Hayao Miyazaki, writings by Kenji Miyazawa, Haruki Murakami and Banana Yoshimoto, among others. The course introduces students to essential aspects of modern Japanese popular culture and sensibility. Offered as JAPN 225 and WLIT 225.

JAPN 204. Classical Japanese Literature in Translation. 3 Units.
Readings, in English translation, of classical Japanese poetry, essays, narratives, and drama to illustrate essential aspects of Japanese culture and sensibility before the Meiji Restoration (1868). Lectures explore the sociohistorical contexts and the character of major literary genres; discussions focus on interpreting the central images of human value within each period. Japanese sensibilities compared to and contrasted with those of Western and other cultures. Offered as JAPN 245 and WLIT 245.

JAPN 205. Modern Japanese Literature in Translation. 3 Units.
Focus on the major genres of modern Japanese literature, including poetry, short story, and novel (shosetsu). No knowledge of Japanese language or history is assumed. Lectures, readings, and discussions are in English. Films and slides complement course readings. Offered as JAPN 255 and WLIT 255.

JAPN 301. Advanced Japanese I. 4 Units.
Emphasizes conversational proficiency and reading. Students must use the course material offered by the Online Language Learning Center in addition to class meetings. Recommended preparation: JAPN 202 or equivalent.

JAPN 302. Advanced Japanese II. 4 Units.
Continuation of JAPN 301; emphasizes conversational proficiency and reading. Japanese life and culture introduced through supplemental materials and activities. Students must use the course material offered by the Online Language Learning Center in addition to class meetings. Recommended preparation: JAPN 301 or equivalent.

JAPN 345. Japanese Women Writers. 3 Units.
Contributions of women writers to the literature of pre-modern and modern Japan; investigations of how their works exemplify and diverge from "mainstream" literary practices. Emphasis on the social and cultural contexts of the texts. Offered as JAPN 345 and WLIT 345.

JAPN 350. Contemporary Japanese Texts I. 3 Units.
The primary aim of this course is to develop communication skills in Japanese based on those that the students have acquired in JAPN 302 or equivalent. The students will read and discuss various texts such as daily conversations, essays, and news scripts with the assistance of vocabulary and kanji (Chinese character) lists and formal grammar explanations. Attention also will be given to enhancing the students’ writing and aural/oral proficiencies through regularly assigned homework, presentations, tape listening, video viewing, and classroom discussion. Recommended preparation: JAPN 302 or equivalent.
JAPN 351. Contemporary Japanese Texts II. 3 Units.
This course is a continuation of JAPN 350 and its primary aim overlaps with that of JAPN 350: to develop more sophisticated communication skills in Japanese. Students will read and discuss various texts such as daily conversations, essays, and news scripts largely with the assistance of vocabulary and kanji (Chinese character) lists. Attention will be given to enhancing the students’ writing and aural/oral proficiencies through regularly assigned homework, presentations, tape listening, video viewing, and classroom discussion. Prereq: JAPN 350 or consent of instructor.

JAPN 355. Modern Japanese Novels and the West. 3 Units.
This course will compare modern Japanese and Western novelas, drama, and novels. Comparisons will focus on the themes of family, gender and alienation, which subsume a number of interrelated sub-themes such as marriage, home, human sexuality, amae (dependence), innocence, experience, death, God/gods, and nature (the ecosystem). Offered as JAPN 355, WLIT 355.

JAPN 356. Senior Capstone - Japanese. 3 Units.
The Senior Capstone in Japanese is an independent study project chosen in consultation with a capstone advisor. The capstone project should reflect both the student’s interest within Japanese and the courses he or she has taken to fulfill the major. The project requires independent research using an approved bibliography and plan of action. In addition to written research, the student will also present the capstone project in a public forum that is agreed upon by the project advisor and the student. Prereq: Senior status required. Major in Japanese required.

JAPN 357. Senior Thesis I. 3 Units.
Intensive study of a literary, linguistic, or cultural topic with a faculty member, leading to the writing of a research paper in English or Japanese. Limited to senior majors. Permit required.

JAPN 358. Senior Thesis II. 3 Units.
Continuation of JAPN 357. Limited to senior majors. Prereq: JAPN 357.

JAPN 359. Independent Study. 1 - 3 Unit.
Directed study for students who have progressed beyond available course offerings.

JAPN 360. Japanese in Cultural Context I. 3 Units.
The primary aim of this graduate course is to develop sophisticated communication skills (listening, speaking, reading, and writing) in Japanese. The students will read and discuss various texts in the original, such as essays, news scripts, and literary works. Classroom instruction and discussion will be conducted in Japanese. The students also will be required to write a research paper of 4000-6000 letters/characters (10-15 genkoyoshi pages) in Japanese on a topic related to Japan and the student’s specialty. Recommended preparation: JAPN 351 or equivalent.

JAPN 361. Japanese in Cultural Context II. 3 Units.
This course is a continuation of JAPN 360 and it aims at a further development of sophisticated communication skills (listening, speaking, reading, and writing) in Japanese. The students will read and discuss various texts in the original, such as essays, news scripts, and literary works both classical and modern. Classroom instruction and discussion will be conducted in Japanese. The students also will be required to write a research paper of 6000-8000 letters/characters (15-20 genkoyoshi pages) in Japanese on a topic related to Japan and the student’s specialty. Recommended preparation: JAPN 450 or equivalent.

MLIT Courses

MLIT 315. Mysticism and Literature. 3 Units.
This co-taught seminar will explore and compare mystical elements in selected literary and theoretical works from the West and the East. Comparisons will focus on a number of interrelated sub-themes such as mind, language, alienation, innocence, experience, life, death, cosmogony, cosmology, good, evil, God/gods, and nature (the ecosystem). Offered as MLIT 315, WLIT 315, MLIT 415 and WLIT 415.

MLIT 325. Seminar in Cognitive Poetics and Text Analysis. 3 Units.
This seminar will cover the methodology of text analysis and the theory of cognitive poetics. The latter includes the study of formal semantic structures occurring in the primarily aesthetic aspects of written language. The seminar will cover narratology, metaphor, metonymy, and related conceptual phenomena in texts and discourse. Offered as MLIT 325 and MLIT 425.

MLIT 327. Gesture in Cognition and Communication. 3 Units.
Most people never notice that when they are talking, they’re also gesturing. Why do we produce these gestures? What can studying them tell us about the human mind? This course surveys scientific research on gesture, exploring topics such as the role of gesture in communication, cross-cultural differences in gesture, and the relationship between gesture and signed languages. The course will focus on gestures produced with speech, but will cover symbolic and ritualized gesture in the visual arts and in dance. Offered as COGS 327 and COGS 427 and MLIT 327.

MLIT 328. Seminar in Intercultural Communication: A Multilingual Media Approach. 3 Units.
This seminar will study communication, especially news communication, through current media in different languages and cultures. It will compare discourse, terminology, vocabulary, and general rhetorical features of the genres of media-borne languages taught in the department. It will enhance the student’s general knowledge of contemporary use of discourse in the foreign language.

MLIT 415. Mysticism and Literature. 3 Units.
This co-taught seminar will explore and compare mystical elements in selected literary and theoretical works from the West and the East. Comparisons will focus on a number of interrelated sub-themes such as mind, language, alienation, innocence, experience, life, death, cosmogony, cosmology, good, evil, God/gods, and nature (the ecosystem). Offered as MLIT 315, WLIT 315, MLIT 415 and WLIT 415.

MLIT 425. Seminar in Cognitive Poetics and Text Analysis. 3 Units.
This seminar will cover the methodology of text analysis and the theory of cognitive poetics. The latter includes the study of formal semantic structures occurring in the primarily aesthetic aspects of written language. The seminar will cover narratology, metaphor, metonymy, and related conceptual phenomena in texts and discourse. Offered as MLIT 325 and MLIT 425.

PORT Courses

PORT 101. Elementary Portuguese I. 4 Units.
Introductory course. Students achieve control of the sound system and basic sentence structures of spoken and written Portuguese. Students use materials offered through the Language Center in addition to class meetings.
PORT 102. Elementary Portuguese II. 4 Units.
Continuation of PORT 101, emphasizing conversational skills. Prereq: PORT 101 or equivalent.

PORT 201. Intermediate Portuguese I. 4 Units.
PORT 201 is an intermediate language course. It assumes a fair knowledge of basic grammar that is reviewed and expanded. The course needs the student to show a strong determination to engage in conversation in Portuguese, and to commit to develop better writing in Portuguese. The student learns more about cultural aspects in the Portuguese-speaking world. The course is taught completely in Portuguese. Prereq: PORT 102 or equivalent.

PORT 399. Independent Study. 1 - 3 Unit.
This course is for students with special interests and commitments that are not addressed in regular courses and who wish to work independently.

RUSN Courses

RUSN 101. Elementary Russian I. 4 Units.
Introductory course emphasizing conversational skills. Students achieve control of alphabet, sound system, and basic sentence structures in spoken and written Russian. Students must use the course material offered by the Online Language Learning Center in addition to class meetings.

RUSN 102. Elementary Russian II. 4 Units.

RUSN 201. Intermediate Russian. 4 Units.
Furthers students’ ability in four basic language skills: understanding, speaking, reading and writing; expands knowledge of Russian grammar and vocabulary. Recommended preparation: RUSN 102.

RUSN 202. Introduction to Contemporary Civilization. 4 Units.
Continuation of RUSN 201; introduces contemporary Russian culture through readings and discussion. Recommended preparation: RUSN 201.

RUSN 311. Advanced Conversation. 3 Units.
Students work to improve fluency in spoken Russian. Topics of conversation include aspects of contemporary civilization; current vocabulary is stressed. Recommended preparation: RUSN 202.

RUSN 319. Life in Modern Russia. 3 Units.
Examines aspects of life in modern Russia, between the 1917 Revolution and the present, including political and social systems and cultural life through the study of texts, films and other media. Recommended preparation: RUSN 202.

RUSN 320. Introduction to Russian Literature. 3 Units.
Introduction to major literary movements, principal writers, and outstanding works of Russian literary works. Recommended preparation: RUSN 202 or equivalent.

RUSN 375. Russian Literature in Translation. 3 Units.
Topics vary according to student and faculty interest. May include Russian classical and modern literature, cinema, women writers, individual authors. May count towards Russian minor. No knowledge of Russian required. Offered as RUSN 375 and WLIT 375.

RUSN 399. Independent Study. 1 - 3 Unit.

SPAN Courses

SPAN 101. Elementary Spanish I. 4 Units.
Introductory course. Students achieve control of the sound system and basic sentence structures of spoken and written Spanish. Students must use the course material offered by the Online Language Learning Center in addition to class meetings.

SPAN 102. Elementary Spanish II. 4 Units.
Continuation of SPAN 101, emphasizing conversational skills. Recommended preparation: SPAN 101.

SPAN 201. Intermediate Spanish I. 4 Units.
Intensive review of grammar and usage through readings, discussions, and other activities. Recommended preparation: SPAN 102 or equivalent.

SPAN 202. Intermediate Spanish II. 4 Units.
Continues grammar review of SPAN 201. Students will study texts and cultural documents which focus on contemporary life in Hispanic countries. Recommended preparation: SPAN 201 or equivalent.

SPAN 285. The Hispanophone World. 3 Units.
A survey of the imaginative literatures in a variety of genres from the Spanish-speaking world, including texts authored by Hispanics living in the United States. The selections will help students gain a greater understanding and appreciation of the impact and adaptation of Spanish language and culture among widely diverse populations of the world over the past centuries. Counts towards Spanish major as related course. No knowledge of Spanish required. Offered as SPAN 285 and WLIT 285.

SPAN 305. Spanish for Political Science and International Relations. 3 Units.
Spanish 305 is an upper-level Spanish language course designed to give students interested in political science and international relations specific field-related vocabulary and cultural information not found in basic textbooks. The course is divided into two parts: the first deals with political science; the second with international relations. Readings, discussions, and lectures are conducted in Spanish. Prereq: SPAN 202 or requisites not met permission.
SPAN 306. The Cuban Experience: an immersion in its culture and society. 3 Units.
This is a three week study-abroad intensive course that takes place at Editorial Vigía, in Matanzas, Cuba. The course combines the unique advantages of a total immersion environment in Spanish with a classroom curriculum that includes conversation practice and study of relevant cultural, literary and historical issues. Students complete three hours of classroom instruction and an hour and a half of publishing workshop four days per week. In this workshop, they work in the edition of a bilingual book. In addition, they participate in organized visits to historic sites and museums connected to the culture curriculum. The focus of the culture curriculum is the study of Cuban history and culture through its literature, visual arts, films, and music. After applying and being accepted in the program, students meet for personal advising with the program director and attend four different one hour orientation-information meetings in the spring semester. After successful completion of the study-abroad program, students receive 3 upper-level credits in Spanish. The course is interdisciplinary in approach and provides students with the tools they need to analyze and understand the complexities of modern Cuba. Students will have formal classes taught by their professor and talks and meetings with specialists on Cuban literature, art, architecture, history and other aspects of culture and society. In addition, they will attend lectures, participate in discussions, and take field trips that will expose them to many aspects of Cuban culture, such as art, architecture, music, dance, film, literature, artisan work, folklore, history and urban growth. Offered as SPAN 306, SPAN 406, and ETHS 306. Prereq: SPAN 202.

SPAN 307. Spanish Phonetics and Phonology. 3 Units.
Spanish Phonetics and Phonology is designed to introduce students to the study and practice of the sound system of Spanish. The course will focus on the articulatory descriptions of native pronunciations, the differences between letters and sounds, and the classification of sounds. The course will focus mainly on the sounds of Spanish but will also include the differences with English Language sounds. It will also develop awareness of the different dialectal variations of Spanish across the world. In addition, cultural competency will be achieved through a contextualized approach. The main goal of this course is to improve pronunciation and intonation in Spanish with special emphasis in the production of native-like sounds. Prereq: SPAN 202.

SPAN 308. Advanced Spanish in Spain. 3 Units.
Three week study-abroad intensive course that takes place in Valladolid, Spain. The course combines the unique advantages of a total immersion environment in Spanish with a classroom curriculum that includes grammar review, conversation practice, and study of relevant cultural issues. The focus of the culture curriculum is the study of Spain’s key historical moments through the city of Valladolid and nearby communities: their literature, visual arts, films, and music. The cultural component is enhanced by visits to historic and cultural sites and museums. Four different one-hour orientation meetings during Spring semester. Prereq: SPAN 202 or equivalent.

SPAN 309. The Buenos Aires Experience. 3 Units.
Three week study-abroad intensive course that takes place in Buenos Aires, Argentina. The course combines the unique advantages of a total immersion environment in Spanish with a classroom curriculum that includes grammar review, conversation practice, and study of relevant cultural issues. The focus of the culture curriculum is the study of the city of Buenos Aires’ history and culture through its literature, visual arts, films, and music. The cultural component is enhanced by visits to historic and cultural sites and museums. Four different one-hour orientation meetings during Spring semester. Prereq: SPAN 202 or equivalent.

SPAN 310. Advanced Composition and Reading. 3 Units.
Designed to facilitate the transition between lower and upper division courses in Spanish, and focus upon the simultaneous development of the reading and writing skills expected of students in all advanced Spanish courses. Prereq: SPAN 202.

SPAN 311. Advanced Spanish Conversation. 3 Units.
Engages students in conversation so that they develop oral proficiency. Short essays and newspaper articles dealing with everyday activities, socio-cultural roles and experiences, and self-awareness and life goals discussed; some literary materials discussed. Prereq: SPAN 202.

SPAN 312. Business Spanish. 3 Units.
Spanish for business is an upper-level language and culture course which is designed for students at the advance intermediate level. The course stresses the vocabulary and expressions used to describe economic and commercial structure, the language to solve problems and conduct negotiations, and the culture of specific aspects of the Spanish world of the business. Students will continue being exposed to listening, speaking, reading and writing through a variety of activities. Prereq: SPAN 202 or permission.

SPAN 313. Spanish for Health Professionals. 3 Units.
Designed for students who are majoring in, or considering a major in, a health-related field. Focus on the vocabulary and expressions needed for the workplace, task-based practical skills, and grammatical structures. Prereq: SPAN 202 or equivalent.

SPAN 314. Practice of Translation. 3 Units.
Students learn necessary skills and techniques for solving linguistic problems in translation. Texts with a variety of contents, including articles from current press, will be translated from English into Spanish and occasionally from Spanish into English. Prereq: SPAN 202.

SPAN 315. Latin American Cultural Conflicts. 3 Units.
Evolution of Latin American socioeconomic characteristics and artistic production up to the present. Class discussions of diverse literary works, social research essays, and testimonials focus on conflicting elements in class structures, ethnicity, and urban modernization as well as family ethos, religious trends, cultural identity, and educational problems. Prereq: SPAN 202.

SPAN 316. Studies in Civilization. 3 Units.
Major historical, intellectual, and artistic influences that have shaped the evolution of Spanish civilization. Prereq: SPAN 202.
SPAN 317. Contemporary Latin American Culture. 3 Units.
An intensive study of Latin American culture and civilization through the examination of its arts: literature, music, film, painting, photography, popular art. Designed to bring together the various strands of Latin American realities, emphasis is placed on the predominant view among Latin American intellectuals that artists and intellectuals have the power and the obligation to modify society. Prereq: SPAN 202.

SPAN 318. Contemporary Spanish Culture. 3 Units.
Study of several key historical moments and several key aspects in contemporary Spain: Spanish civil war, Franco's dictatorship, and democratic Spain; rural-urban differences, industrialization and migratory movements; nationalism and terrorism; foreign immigration and tourism, the cultural renaissance and the cultural wars in Madrid and Barcelona. Feature films and literary texts will illustrate the issues under study. Prereq: SPAN 202.

SPAN 319. Spanish for Legal Professionals. 3 Units.
Spanish for Legal Professionals is designed to familiarize students with technical language, legal topics, and documents used in legal professions. The course will focus in the American common law system but will also include comparison with the civil law tradition as applied in Latin America. It will also develop oral and written communication skills in order to improve the communication with Spanish speaking clients and the Hispanic community as required. In addition, cultural competency will be achieved through a contextualized approach. This course reviews the grammar studied in previous courses and promotes class discussions and includes readings as well as translation of legal documents. Prereq: SPAN 202 or equivalent.

SPAN 320. Introduction to Readings in Hispanic Literature. 3 Units.
Introduction to major literary movements and genres, and the works of outstanding authors of Spanish and Latin American literature through close readings and seminar-based discussions of the texts, as well as to disciplinary modes of inquiry and presentation. Requirements include active participation in seminar discussions, oral presentations, tests, and several written assignments, such as response papers, in-class writing exercises, and an analytic essay in Spanish on a research topic of interest to the discipline. Prereq: SPAN 202.

SPAN 321. Spanish Golden Age Literature. 3 Units.
The history and development of the Latin American short story from the nineteenth century to the present. Intertextuality, rise of the Nuevo Cuento, and major characteristics of the works. Prereq: SPAN 320.

SPAN 322. Latin American Short Story. 3 Units.
The history and development of the Latin American short story from the nineteenth century to the present. Intertextuality, rise of the Nuevo Cuento, and major characteristics of the works. Prereq: SPAN 320.

SPAN 325. Hispanic Intellectuals and Society: A Critical Approach. 3 Units.
This course offers an overview of the most important critical approaches to Spanish American culture and literature, with a socio-historical emphasis. Some of the authors we will discuss are Angel Rama, Jose Antonio Cornejo Polar and Nestor Garcia Canclini. We will analyze how the Latin American intellectuals had thought about specific issues such as identity, race, ideology, colonial and post-colonial relations with the metropolis and the process of formation of the nations in the continent. The class, the discussions, exams, oral presentations and papers will be in Spanish. Some of the readings must be in English, but most of them will be in Spanish. Prereq: SPAN 320.

SPAN 326. The Fantastic in Latin American Prose. 3 Units.
Introduction to a distinctive trend in contemporary Latin American literature, the prose portrayal of the "fantastic," a new narrative mode in Latin America. Critical examination of selected texts reveals new concepts of space and time and an increasing complexity of structure and style, one which juxtaposes and analyzes fantasy and reality. Offered as SPAN 326 and SPAN 426. Prereq: SPAN 320.

SPAN 331. Spanish Golden Age Literature. 3 Units.
Through close reading and discussion of representative texts, we will study different examples of Spanish and Latin American writing from the Middle Ages, Renaissance and Baroque periods. We will stress connections between Spain and Latin America, as well as cultural and literary topics of special relevance for contemporary Hispanic cultures. Prereq: SPAN 320.

SPAN 332. Contemporary Caribbean Literature. 3 Units.
In addition to developing a general familiarity with the literature and history of this region, students will acquire an awareness of the interrelationship of national identity, memory, and language in the texts produced by contemporary Caribbean authors, and of the cultural hybridity characteristic of this production. The themes treated by these authors include colonialism and postcolonialism, cultural and religious syncretism, and sexual politics. Prereq: SPAN 320.

SPAN 333. Contemporary Caribbean Literature. 3 Units.
An introduction to Chicana/o literature written after 1943. Literary history, clarification of linguistic terminology, and an examination of the cultural components of each work. Readings, discussions, and lectures in Spanish. Prereq: SPAN 320.

SPAN 339. Latin American Poetic Revolt. 3 Units.
Introduction to most important poets in contemporary Latin America, a region home to a significant number of eminent poets, including Nobel Laureates from Chile, Gabriela Mistral and Pablo Neruda. The course focuses on detailed textual analysis of pivotal works, combined with historical-literary perspective, so students gain insight into the diverse styles and tendencies that reflect the tumultuous history of poetry’s development in a relentless search for a Latin American cultural identity. Prereq: SPAN 320.

SPAN 340. Contemporary Latin-American Narrative. 3 Units.
Students explore the most significant narrative techniques since 1945 in Latin American fiction: Borges, Cortazar, Garcia Marquez, Vargas Llosa, Isabel Allende. Prereq: SPAN 320.

SPAN 342. Latin American Feminist Voices. 3 Units.
Examination of the awakening of feminine and feminist consciousness in the literary production of Latin American women writers, particularly from the 1920s to the present. Close attention paid to the dominant themes of love and dependency; imagination as evasion; alienation and rebellion; sexuality and power; the search for identity and the self-preservation of subjectivity. Readings include prose, poetry, and dramatic texts of female Latin American writers contributing to the emerging of feminist ideologies and the mapping of feminist identities. Offered as SPAN 342, SPAN 442, ETHS 342, WGST 342, WLIT 342, and WLIT 442. Prereq: SPAN 320.
SPAN 343. The New Drama in Latin American. 3 Units.
Representative works of contemporary Latin American drama. Critical examination of selected dramatic works of twentieth-century Latin America provides students insight into the nature of drama and into the structural and stylistic strategies utilized by Latin American dramatists to create the "new theater," one which is closely related to Latin American political history. Prereq: SPAN 320.

SPAN 345. Hispanic Autobiographical Writing. 3 Units.
The course studies issues of self-representation through the reading of autobiographical works from different periods from Latin America, Spain, and the U.S., and of theoretical works that address topics of first-person narratives, autobiography, and sub-alternity. IT SATISFIES GLOBAL AND CULTURAL DIVERSITY REQUIREMENT. Offered as SPAN 345 and SPAN 445. Prereq: SPAN 320.

SPAN 350. Spanish Fiction. 3 Units.
Narrative masterpieces from Cervantes and the picaresque (El Lazarillo) to the short stories and novels of 19th and 20th century authors. Prereq: SPAN 320.

SPAN 351. Hispanic Turn of the Century Literature. 3 Units.
Cultural and political transitions between 19th and 20th Century, between Spain and Latin America, and between literary models. Study of Spanish and Latin American writers and their literary connections (Generation of 1898, modernistas) in the context of colonial conflicts and economic changes. Offered as SPAN 351 and SPAN 451. Prereq: SPAN 320.

SPAN 353. Transatlantic Vanguard. 3 Units.
Presentation of transatlantic tendencies of the early vanguard movements represented by poets from Spain, Central and South America. Beginning with the advent of Modernism in Latin America and Symbolism in Spain, this course will trace the development of resulting movements in the early twentieth century. Surrealism, Creationism, Futurism, Ultralism and Dadaism forged a vital link between poets and artists from the Americas and their European counterparts. We will focus on the similarities and differences between these "isms" while drawing conclusions about the uniqueness of vanguard movements on both sides of the Atlantic. Offered as SPAN 353 and SPAN 453. Prereq: SPAN 320.

SPAN 356. Afro-Hispanic Literature. 3 Units.
This course will survey the literary and cultural production of writers and artists of African descent in Latin America and the Caribbean, paying attention to both their creative and theoretical texts. Discussion of questions of race and ethnicity will allow students to explore the ways in which these texts reformulate the idea of national identity and cultural belonging in the context of the nation-state, whose traditional centrality is being weakened through the effects of migration and exile. Readings include works by writers from Cuba, Puerto Rico, Dominican Republic, Costa Rica, Colombia, Panama, Ecuador, and Peru. Prereq: SPAN 320 or equivalent.

SPAN 358. Latin American Cinema. 3 Units.
This course is designed to introduce students to the basic tools of film analysis as well as to the major trends and movements in Latin American cinema from the 1960s to the present. Through the analysis of representative films from Latin America, the course will examine the development of a variety of cinematic styles, paying particular attention to the historical contexts in which the films were produced and to the political, cultural, and aesthetic debates that surrounded their production. Prereq: SPAN 320 or equivalent.

SPAN 370. Special Topics in Spanish. 3 Units.
This course is designed to respond to students' and faculty interest in specific themes or issues not otherwise covered in the curriculum. Approaches, content, and instructor will vary and this course may have a focus that crosses generic, artistic, historical, disciplinary, and geographical boundaries. The honing of analytical and interpretative skills as well as the further development of Spanish language skills also are integral objectives of this course. The class is conducted in Spanish. Prereq: SPAN 320 or equivalent.

SPAN 385. Hispanic Literature in Translation. 3 Units.
Critical analysis and appreciation of representative literary masterpieces from Spain and Latin America, and by Hispanics living in the U.S. Texts cover a variety of genres and a range of literary periods, from works by Cervantes to those of Gabriel Garcia Marquez. The course will examine the relationship between literature and other forms of artistic production, as well as the development of the Hispanic literary text within the context of historical events and cultural production of the period. Counts toward Spanish major only as related course. No knowledge of Spanish required. Offered as ETNS 385, ETNS 485, SPAN 385, SPAN 485, WLIT 385, and WLIT 485.

SPAN 396. Senior Capstone - Spanish. 3 Units.
The Senior Capstone in Spanish in an independent study project chosen in consultation with a capstone advisor. The capstone project should reflect both the student’s interest within Spanish and the courses he or she has taken to fulfill the major. The project requires independent research using an approved bibliography and plan of action. In addition to written research, the student will also present the capstone project in a public forum that is agreed upon by the project advisor and the student. Senior status required. Major in Spanish required.

SPAN 397. Honors Thesis I. 3 Units.
Intensive study of a literary, linguistic, or cultural topic with a faculty member, leading to the writing of a research paper in Spanish. Limited to senior majors.

SPAN 398. Honors Thesis II. 3 Units.
Continuation of SPAN 397. Limited to senior majors. Permit required. Prereq: SPAN 397.

SPAN 399. Independent Study. 1 - 3 Unit.
The course is for students with special interests and commitments that are not fully addressed in regular courses, and who wish to work independently.
SPAN 406. The Cuban Experience: an immersion in its culture and society. 3 Units.
This is a three week study-abroad intensive course that takes place at Editorial Vigía, in Matanzas, Cuba. The course combines the unique advantages of a total immersion environment in Spanish with a classroom curriculum that includes conversation practice and study of relevant cultural, literacy and historical issues. Students complete three hours of classroom instruction and an hour and a half of publishing workshop four days per week. In addition, they participate in organized visits to historic sites and museums connected to the culture curriculum. The focus of the culture curriculum is the study of Cuban history and culture through its literature, visual arts, films, and music. After applying and being accepted in the program, students meet for personal advising with the program director and attend four different one hour orientation-information meetings in the spring semester. After successful completion of the study-abroad program, students receive 3 upper-level credits in Spanish. The course is interdisciplinary in approach and provides students with the tools they need to analyze and understand the complexities of modern Cuba. Students will have formal classes taught by their professor and talks and meetings with specialists on Cuban literature, art, architecture, history and other aspects of culture and society. In addition, they will attend lectures, participate in discussions, and take field trips that will expose them to many aspects of Cuban culture, such as art, architecture, music, dance, film, literature, artisan work, folklore, history and urban growth. Offered as SPAN 306, SPAN 406, and ETHS 306. Prereq: SPAN 202.

SPAN 426. The Fantastic in Latin American Prose. 3 Units.
Introduction to a distinctive trend in contemporary Latin American literature, the prose portrayal of the "fantastic," a new narrative mode in Latin America. Critical examination of selected texts reveals new concepts of space and time and an increasing complexity of structure and style, one which juxtaposes and analyzes fantasy and reality. Offered as SPAN 326 and SPAN 426.

SPAN 442. Latin American Feminist Voices. 3 Units.
Examination of the awakening of feminine and feminist consciousness in the literary production of Latin American women writers, particularly from the 1920s to the present. Close attention paid to the dominant themes of love and dependency; imagination as evasion; alienation and rebellion; sexuality and power; the search for identity and the self-preservation of subjectivity. Readings include prose, poetry, and dramatic texts of female Latin American writers contributing to the emerging of feminist ideologies and the mapping of feminist identities. Offered as SPAN 342, SPAN 442, ETHS 342, WGST 342, WLIT 342, and WLIT 442.

SPAN 445. Hispanic Autobiographical Writing. 3 Units.
The course studies issues of self-representation through the reading of autobiographical works from different periods from Latin America, Spain, and the U.S., and of theoretical works that address topics of first-person narratives, autobiography, and sub-alternity. IT SATISFIES GLOBAL AND CULTURAL DIVERSITY REQUIREMENT. Offered as SPAN 345 and SPAN 445. Prereq: SPAN 320.

SPAN 451. Hispanic Turn of the Century Literature. 3 Units.
Cultural and political transitions between 19th and 20th Century, between Spain and Latin America, and between literary models. Study of Spanish and Latin American writers and their literary connections (Generation of 1898, modernistas) in the context of colonial conflicts and economic changes. Offered as SPAN 351 and SPAN 451.

SPAN 453. Transatlantic Vanguard. 3 Units.
Presentation of transatlantic tendencies of the early vanguard movements represented by poets from Spain, Central and South America. Beginning with the advent of Modernism in Latin America and Symbolism in Spain, this course will trace the development of resulting movements in the early twentieth century. Surrealism, Creationism, Futurism, Ultralism and Dadaism forged a vital link between poets and artists from the Americas and their European counterparts. We will focus on the similarities and differences between these "isms" while drawing conclusions about the uniqueness of vanguard movements on both sides of the Atlantic. Offered as SPAN 353 and SPAN 453.

SPAN 485. Hispanic Literature in Translation. 3 Units.
Critical analysis and appreciation of representative literary masterpieces from Spain and Latin America, and by Hispanics living in the U.S. Texts cover a variety of genres and a range of literary periods, from works by Cervantes to those of Gabriel Garcia Marquez. The course will examine the relationship between literature and other forms of artistic production, as well as the development of the Hispanic literary text within the context of historical events and cultural production of the period. Counts toward Spanish major only as related course. No knowledge of Spanish required. Offered as ETHS 385, ETHS 485, SPAN 385, SPAN 485, WLIT 385, and WLIT 485. Prereq: Graduate standing.
Department of Music

The Department of Music offers a range of degree programs and ensemble experiences for undergraduate and graduate students. Thanks to the diverse interests of our faculty, our students can explore everything from medieval music to rock and pop. The department offers the following degree programs:

- Music (Bachelor of Arts within the context of liberal arts; see list of concentrations under “Majors” below)
- Music Education (Bachelor of Science, Master of Arts, Master of Arts for Teacher Licensure, Doctor of Philosophy)
- Historical Performance Practice (Master of Arts, Doctor of Philosophy, Doctor of Musical Arts)
- Music History and Literature (Master of Arts)
- Musicology (Doctor of Philosophy)

Since 1968, the department has participated in a Joint Music Program (JMP) with the Cleveland Institute of Music (http://www.cim.edu) (CIM). Through our JMP, students enjoy the advantages of a top research university while receiving conservatory-level training in theory and performance. They also benefit from our active collaborations with the Cleveland Orchestra, the Rock and Roll Hall of Fame and Museum, the Cleveland Museum of Art, the Music Settlement, and other local cultural and educational institutions.

The Department of Music offers private instruction. Music majors should consult with their program advisor before registering for lessons. Non-major students interested in private instruction should visit the department office (Haydn 201) to begin the lesson registration process and learn further details.

A number of music ensembles (http://music.case.edu/ensembles) are open to all students. Entrance into the primary ensembles may be subject to a gateway audition; others require an audition for part assignment. Students may elect to earn one credit unit per semester for participation. Auditions for ensembles are held during the first week of classes each semester. Further information is available on the department website (http://music.case.edu/spotlight).

Facilities

Haydn Hall

Haydn Hall houses the Department of Music faculty and staff offices, classrooms, the Kulas Music Library, the Music Education Resource Center, and The Core (see below). It is located in the heart of the Mather Quad. Originally a combination of a dormitory and classrooms, this building served as the only student center on campus. It was given to the college by Flora Stone Mather and named in honor of Hiram Collins Haydn, fifth president of Western Reserve University, pastor of the Old Stone Church, and the individual most active in convincing Western Reserve College to move to Cleveland. Charles F. Schweinfurth, the premier residential architect of Euclid Avenue ("Millionaires' Row") mansions, who also rebuilt the interior of the Old Stone Church in 1884 and designed Trinity Cathedral, designed Haydn Hall.

Florence Harkness Memorial Chapel

Harkness Chapel, built in 1902, features neo-Gothic architecture, antique oak and Georgia pine woodwork, and Tiffany windows. It is a warm, intimate, and acoustically resonant space for the performance of vocal and instrumental chamber music. The building provides space for concerts, music classes, and department recitals. Harkness Chapel was built to honor Florence Harkness Severance, the only daughter of Stephen Harkness and his second wife, Anna M. Richardson Harkness.

Kulas Music Library

Kulas Music Library is a satellite library of Kelvin Smith Library, the university’s main library. It contains more than 45,000 items, including music scores, books on music, sound recordings, video recordings, microforms, and music periodicals. The library also contains a listening room for use of the sound recording and video collections. Music majors at the university also have access to the Robinson Music Library of the Cleveland Institute of Music. The Case Western Reserve Kulas Music Library and the CIM Robinson Music Library coordinate acquisitions and services, and their collections reflect institutional strengths as well as support the CWRU-CIM Joint Music Program.

The Core

The Core is a Macintosh computer classroom and lab dedicated to mind, sound, and vision. The Core is a collaborative space for all CWRU students, faculty and staff, as well as the University Circle community, to gather and collaborate, design in visual and aural mediums, and create masterpieces. It offers not only computers and software, but also video and digital cameras and microphones for checkout, one-on-one tutorial time, classes, and a meeting space. The Core is actively involved in bringing technology to the community, particularly younger children, and it works closely with faculty in providing support facilities for the department’s technology-related courses.

Denison/Wade Rehearsal Facility

The Denison/Wade Rehearsal Facility, located on East 115th Street, is used primarily for ensemble rehearsals. This facility houses several Wenger practice rooms, one of which is a "virtual reality" acoustic room; a percussion studio; and a music library. Classrooms include the Wade Rehearsal Hall, Denison Rehearsal Hall, and Denison Chamber Room. The facility also has storage lockers available on a first-come-first-serve basis. In general, Denison/Wade facilities are to be utilized by students who are music majors or are enrolled in Department of Music ensembles.

Kulas Collection of Early Instruments

The department maintains an impressive collection of modern reproductions of early instruments. The instruments are used by the Collegium Musicum, the Case/CIM Baroque Orchestra, and the department’s program in historical performance practice. The collection includes medieval, Renaissance, and baroque strings, as well as brass, woodwinds, and keyboards.

Music Education Resource Center

The department provides a resource center for music education students to prepare educational materials and research projects. The center is in Haydn Hall, Room 12, and contains a variety of audiovisual media, including a library of education-oriented music software. Students may borrow items from a large collection of music textbooks, educational recordings, testing materials, vocal and instrumental books, curriculum guides, and classroom instruments. Use of this center is encouraged, and sometimes required, for many of the projects and assignments in courses throughout the music education curriculum.

BA in Music | BS in Music Education | Minor
Undergraduate Programs

Majors

Students who wish to major in music must pass a performance audition on an acceptable instrument or in voice and take a music theory placement test. Arrangements for this audition and test must be made directly through the department website (http://music.case.edu/prospective/undergraduate). All performance and course requirements are detailed in the Undergraduate Music Handbook (http://music.case.edu/current/handbooks/undergrad).

Double Major and Dual-Degree Opportunities. The department encourages qualified students to consider a double or dual major in music and another subject. More than one half of music majors at Case Western Reserve pursue a double major. Typical combinations include the Bachelor of Arts in music with theater, English, classics, psychology, sociology, or the natural sciences. Once the Arts and Sciences SAGES requirements (39 hours) have been met, a BA student can add another major by meeting the course and hour requirements found in this bulletin under the appropriate department. In most cases, it is possible to finish a double major with music in four years.

It is also possible to receive two degrees, although this usually takes five years. Typical combinations of dual degrees include the Bachelor of Arts in music with the Bachelor of Science in engineering, or the Bachelor of Science in music education with the Bachelor of Music degree from the Cleveland Institute of Music. All admissions requirements must be met for each school, and course and hour requirements for each degree must be fulfilled. Students interested in dual degrees should declare their intent as early as possible and receive advice from faculty about both degrees.

Bachelor of Arts in Music

The Bachelor of Arts degree in music stresses a humanistic orientation and situates music study in the context of the liberal arts.

Approximately one half of the total 120 semester credit hours necessary for the degree are devoted to music study, with the remaining credits devoted to the SAGES and general education requirements (39 hours), a possible minor program, and a liberal selection of elective courses. The specific program of study differs from student to student.

The department offers several concentrations within the music portion of the degree: music history, music theory, historical performance practice, performance, general musicianship, and audio recording technology. The general musicianship concentration is particularly suitable for students interested in music as part of a double major or dual degree.

Core courses for the Bachelor of Arts in music are as follows:

<table>
<thead>
<tr>
<th>Music theory:</th>
<th>Semester hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>MUTH 107</td>
<td>3-4</td>
</tr>
<tr>
<td>or MUTH 101/105</td>
<td></td>
</tr>
<tr>
<td>MUTH 108</td>
<td>3-4</td>
</tr>
<tr>
<td>or MUTH 102/106</td>
<td></td>
</tr>
<tr>
<td>MUTH 207</td>
<td>3-4</td>
</tr>
<tr>
<td>or MUTH 201/205</td>
<td></td>
</tr>
<tr>
<td>MUTH 208</td>
<td>3-4</td>
</tr>
<tr>
<td>or MUTH 202/206</td>
<td></td>
</tr>
<tr>
<td>MUTH 320</td>
<td>3</td>
</tr>
<tr>
<td>MUDE 101</td>
<td>0</td>
</tr>
<tr>
<td>MUDE 102</td>
<td>0</td>
</tr>
</tbody>
</table>

Music history/literature:

<table>
<thead>
<tr>
<th>Course</th>
<th>Semester hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>MUTH 312</td>
<td>3</td>
</tr>
<tr>
<td>MUTH 311</td>
<td>3</td>
</tr>
<tr>
<td>MUTH 301</td>
<td>3</td>
</tr>
</tbody>
</table>

Performance instruction: MUAP (applied music) for a minimum of 10 semester hours

Additional requirements:

1. Participation in assigned musical ensemble every semester of major (6 semesters for audio concentration)
2. Participation in additional musical ensemble for one year (audio concentration excepted)
3. Recital class attendance and performance every year of principal MUAP study (auto-enrolled with MUAP course)
4. Two semesters of eurhythmics (fulfills physical education requirement)

Additional course requirements for each concentration are as follows:

Music History

- Additional applied music study at the 200 level: 2
- Three electives from music history or literature courses at the 300 level or above: 9
- Foreign Language: 6-8

Total Units: 17-19

Music Theory

- Additional applied music study at the 200 level: 2
- MUTH 311 16th Century Counterpoint (CIM class): 2
- MUTH 312 Eighteenth Century Counterpoint (CIM class): 3
- One elective from music history or literature courses at the 300 level or above: 3

Foreign Language: 6-8

Total Units: 10

Historical Performance Practice

- Additional applied music study at the 200 level: 2
- MUTH 341 Introduction to Historical Performance Practice: 3
- MUTH 342 Seminar in Historical Performance Practice: 3
- One elective from music history or literature courses at the 300 level or above: 3

Foreign Language: 6-8

Total Units: 17-19

Performance

- Additional applied music study at the 300 and 400 levels: 6
- One elective from music history or literature courses at the 300 level or above: 3

Foreign Language: 6-8

Total Units: 15-17

General Musicianship

One elective from music history or literature courses at the 300 level or above (3).

Audio Recording Technology

- MUAR 151B Case Audio Internship I: 1
- MUAR 152B Case Audio Internship II: 1
- MUAR 153B Case Audio Internship III: 1
- MUAR 154B Case Audio Internship IV: 1
- MUAR 200 Audio Recording I (CIM class): 2
- MUAR 201 Audio Recording II (CIM class): 2
- MUAR 251B Case Audio Recording Internship I: 0
- MUAR 252B Case Audio Recording Internship II: 0
- MUAR 253B Case Audio Recording Internship III: 0
- MUAR 254B Case Audio Recording Internship IV: 0
- MUAR 300 Advanced Recording Techniques I (CIM class): 2
- MUAR 301 Advanced Recording Techniques II (CIM class): 2
A minor in electronics is available from the Department of Electrical Engineering and Computer Science in the Case School of Engineering. A five-year, dual-degree program is also available in which the student earns a BA in music/audio and a BS in an elective field of engineering.

**Bachelor of Science in Music Education**

The mission of the Music Education Program is to prepare proactive scholar-practitioners who will develop into leaders, teachers, and talented musicians in the field of music education. The nationally recognized program faculty specialize in research in music education, music technology, string pedagogy, and wind conducting and repertoire. The faculty are active in their respective professional organizations and as clinicians, conductors, lecturers, and authors.

The Bachelor of Science degree in music education requires a total of 122 credits and is designed to educate professional teachers of music education for public and private schools. The program meets the requirements of the Ohio Department of Education to prepare students to take the state-mandated teacher exam (Praxis II) and apply for teaching licensure. Most states recognize the Ohio teaching license through reciprocity.

Music education students benefit from a wide range of instrumental, vocal, and general classroom methods courses. As an additional part of the program, students benefit from plentiful hands-on experiences by teaching sample lessons and conducting rehearsals in actual teaching situations.

Requirements for the Bachelor of Science in music education are as follows:

**A. Core Courses:**

**A. Core Courses (42)**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MUAR 302</td>
<td>Multitrack Recording Techniques I (CIM class)</td>
<td>2</td>
</tr>
<tr>
<td>MUAR 303</td>
<td>Multitrack Recording Techniques II (CIM class)</td>
<td>2</td>
</tr>
<tr>
<td>MUAR 310</td>
<td>Recording Studio Maintenance I (CIM class)</td>
<td>1</td>
</tr>
<tr>
<td>MUAR 311</td>
<td>Recording Studio Maintenance II (CIM class)</td>
<td>1</td>
</tr>
<tr>
<td>MUAR 320</td>
<td>Acoustics of Music I (CIM class)</td>
<td>1</td>
</tr>
<tr>
<td>MUAR 321</td>
<td>Acoustics of Music II (CIM class)</td>
<td>1</td>
</tr>
<tr>
<td>MUAR 322</td>
<td>Recording Workshop I (CIM class)</td>
<td>1</td>
</tr>
<tr>
<td>MUAR 323</td>
<td>Recording Workshop II (CIM class)</td>
<td>1</td>
</tr>
<tr>
<td>MUAR 380</td>
<td>Junior Recording Techniques (CIM class)</td>
<td>3</td>
</tr>
<tr>
<td>MUAR 385</td>
<td>Recording Studio Internship (CIM class)</td>
<td>4</td>
</tr>
<tr>
<td>MUAR 390</td>
<td>Senior Recording Tech Thesis/Senior Capstone (CIM class)</td>
<td>6</td>
</tr>
</tbody>
</table>

**B. Music Education Sequence (40)**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Applied music lessons (every semester except student teaching):</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>MUAP 121</td>
<td>Principal Performance Area I</td>
<td></td>
</tr>
<tr>
<td>MUAP 122</td>
<td>Principal Performance Area II</td>
<td></td>
</tr>
<tr>
<td>MUAP 221</td>
<td>Principal Performance Area III</td>
<td></td>
</tr>
<tr>
<td>MUAP 222</td>
<td>Principal Performance Area IV</td>
<td></td>
</tr>
<tr>
<td>MUAP 321</td>
<td>Principal Level Performance Area V</td>
<td></td>
</tr>
<tr>
<td>MUAP 322</td>
<td>Principal Level Performance Area VI</td>
<td></td>
</tr>
<tr>
<td>MUAP 421</td>
<td>Principal Level Performance Area VII (CIM class)</td>
<td></td>
</tr>
</tbody>
</table>

**Ensembles:**

- Required Home Ensemble (every semester except student teaching).
- Added ensemble (one full year, keyboard students may sign up for MUEN 386 as their added ensemble).

**B. Music Education Sequence (40)**

<table>
<thead>
<tr>
<th>Methods:</th>
<th>15</th>
</tr>
</thead>
<tbody>
<tr>
<td>MUED 240</td>
<td>Foundations of Music Education</td>
</tr>
<tr>
<td>MUED 320</td>
<td>Technology Assisted Music Teaching and Learning</td>
</tr>
<tr>
<td>MUED 350</td>
<td>General Music Methods A</td>
</tr>
<tr>
<td>MUED 355</td>
<td>Instructional Design in Music Education (Fulfills SAGES Departmental Seminar requirement)</td>
</tr>
<tr>
<td>MUED 352</td>
<td>Instrumental Methods and Materials</td>
</tr>
<tr>
<td>or MUED 353</td>
<td>Choral Methods and Materials</td>
</tr>
</tbody>
</table>

**Conducting and arranging:**

<table>
<thead>
<tr>
<th>Methods:</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>MUED 275</td>
<td>Elements of Conducting</td>
</tr>
<tr>
<td>MUED 276</td>
<td>Advanced Conducting</td>
</tr>
<tr>
<td>MUED 310</td>
<td>Instrumental and Choral Arranging</td>
</tr>
</tbody>
</table>

**Secondary instrument classes:**

<table>
<thead>
<tr>
<th>Methods:</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>MUED 200A</td>
<td>Basic Skills and Pedagogy: Voice</td>
</tr>
<tr>
<td>MUED 200B</td>
<td>Basic Skills and Pedagogy: Guitar</td>
</tr>
<tr>
<td>MUED 200C</td>
<td>Basic Skills and Pedagogy: Upper Brass</td>
</tr>
<tr>
<td>MUED 200D</td>
<td>Basic Skills and Pedagogy: Lower Brass</td>
</tr>
<tr>
<td>MUED 200E</td>
<td>Basic Skills and Pedagogy: Clarinet and Saxophone</td>
</tr>
<tr>
<td>MUED 200F</td>
<td>Basic Skills and Pedagogy: Double Reeds and Flute</td>
</tr>
<tr>
<td>MUED 200G</td>
<td>Basic Skills and Pedagogy: Violin</td>
</tr>
<tr>
<td>MUED 200H</td>
<td>Basic Skills and Pedagogy: Strings</td>
</tr>
<tr>
<td>MUED 200P</td>
<td>Basic Skills and Pedagogy: Percussion</td>
</tr>
</tbody>
</table>

**Student teaching:**

<table>
<thead>
<tr>
<th>Methods:</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td>MUED 396A</td>
<td>Student Teaching in Music Education</td>
</tr>
<tr>
<td>MUED 396B</td>
<td>Student Teaching Seminar in Music Education</td>
</tr>
</tbody>
</table>

**C. Professional Education Courses (9)**

<table>
<thead>
<tr>
<th>Methods:</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDUC 301</td>
<td>Introduction to Education</td>
</tr>
<tr>
<td>EDUC 304</td>
<td>Educational Psychology</td>
</tr>
<tr>
<td>EDUC 255</td>
<td>Literacy Across the Content Areas</td>
</tr>
</tbody>
</table>

**SAGES Requirements (22)**

22 hours in addition to those major courses that fulfill SAGES requirements

1. Strings: MUEN 385 Case/University Circle Orchestra or MUEN 386 Case Camerata Chamber Orchestra
2. Winds/Percussion: MUEN 383 Symphonic Winds
3. Piano: MUEN 389 Keyboard Ensemble
4. Voice: MUEN 382 Case Concert Choir or MUEN 387 University Singers; in some cases, MUEN 396 Early Music Singers
5. Guitar: MUEN 355 Miscellaneous Ensembles

See: Required Methods and Secondary Instrument Courses by Music Education Focus Area, below

2. PSCL 101 General Psychology I is a prerequisite
Official admission to the Music Education Program generally occurs at the Program Decision Point 1: Application for Admission to Western Reserve. Denial of admission at any decision point means the admission; conditional admission with a prescribed remedial plan which of the decision points, there are three possible outcomes: unconditional admission and retention in music education for the Ohio Provisional Music (Pre-K-12) License to teach education for the Ohio Provisional Music (Pre-K-12) License to teach.

There are four decision points in the Music Education Program. For each of the decision points, there are three possible outcomes: unconditional admission; conditional admission with a prescribed remedial plan which when successfully completed will result in unconditional admission; or denial of admission. Denial of admission at any decision point means the student is no longer able to pursue a music education degree at Case Western Reserve.

**Decision Point 1: Application for Admission to the Program**

Official admission to the Music Education Program generally occurs at the end of the freshman year. Admission to the program requires:

1. being accepted to Case Western Reserve
2. being accepted as a music major through an audition process before matriculation
3. successful completion of MUED 240 Foundations of Music Education, including evaluation of an initial Teaching ePortfolio
4. a cumulative Case Western Reserve GPA of 2.5 or better

5. submission of a signed Statement of Assurance of Good Moral Character, and
6. a satisfactory interview with music education faculty, documented on the Teacher Licensure Admission Assessment Form

**Decision Point 2: Application for Advanced Standing**

Application for Advanced Standing should be submitted by week 10 of the second semester after Decision Point 1 (usually the spring of the sophomore year). Application for Advanced Standing requires:

1. a successful review of the updated Teaching ePortfolio
2. submission of a current Academic Requirements Report documenting the following: a cumulative GPA of 2.5 or better, a music GPA of 2.5 or better, and an education GPA of 3.0 or better
3. a passing score on the Candidate Disposition Assessment Inventory completed by the music education faculty

**Decision Point 3: Application for Student Teaching**

Application for Student Teaching should be completed by Week 4 of the semester prior to student teaching. The application requires:

1. a successful review of the updated Teaching ePortfolio
2. submission of a current Academic Requirements Report documenting the following: a cumulative GPA of 2.5 or better, a music GPA of 2.5 or better, and an education GPA of 3.0 or better
3. a passing score on the Candidate Disposition Assessment Inventory completed by the music education faculty
4. passing a TB test
5. presenting documentation of Hepatitis B vaccination
6. passing an official criminal background check

**Decision Point 4: Application for Initial Licensure**

Application for Initial Licensure occurs after successful completion of all degree requirements. This application requires:

1. a successful review of the updated Teaching ePortfolio
2. submission of a current Academic Requirements Report documenting the following: a cumulative GPA of 2.5 or better, a music GPA of 2.5 or better, and an education GPA of 3.0 or better
3. a passing score on the Candidate Disposition Assessment Inventory completed by the music education faculty
4. achievement of state-mandated scores on the two Praxis II national teacher exams
5. completion of the Case Teacher Licensure Exit Interview and Survey
6. completion of the Case Student Teaching Final Assessment by the cooperating teacher and university supervisor with a grade of B or better:

**Courses by Music Education Focus Area**

### Choral/General Focus

**Required Methods Specialization Class:**

- MUED 353 Choral Methods and Materials

**Secondary Instruments:**

- MUED 200A Basic Skills and Pedagogy: Voice
- MUED 200B Basic Skills and Pedagogy: Guitar
- MUED 200P Basic Skills and Pedagogy: Percussion
- MUED 200H Basic Skills and Pedagogy: Strings

**Two of the following:**

- MUED 200C Basic Skills and Pedagogy: Upper Brass
- MUED 200D Basic Skills and Pedagogy: Lower Brass
- MUED 200E Basic Skills and Pedagogy: Clarinet and Saxophone
- MUED 200F Basic Skills and Pedagogy: Double Reeds and Flute

**Intrumental Focus - Winds/Percussion**

**Required Methods Specialization Class:**

- MUED 352 Instrumental Methods and Materials

**Secondary Instruments:**

- MUED 200A Basic Skills and Pedagogy: Voice
- MUED 200G Basic Skills and Pedagogy: Violin
- or MUED 200H Basic Skills and Pedagogy: Strings
- MUED 200P Basic Skills and Pedagogy: Percussion

**Three of the following:**

- MUED 200C Basic Skills and Pedagogy: Upper Brass
- MUED 200D Basic Skills and Pedagogy: Lower Brass
- MUED 200E Basic Skills and Pedagogy: Clarinet and Saxophone
- MUED 200F Basic Skills and Pedagogy: Double Reeds and Flute

**Intrumental Focus - Strings**

**Required Methods Specialization Class:**

- MUED 352 Instrumental Methods and Materials

**Secondary Instruments:**

- MUED 200A Basic Skills and Pedagogy: Voice
- MUED 200C Basic Skills and Pedagogy: Upper Brass
- or MUED 200D Basic Skills and Pedagogy: Lower Brass
- MUED 200E Basic Skills and Pedagogy: Clarinet and Saxophone
- or MUED 200F Basic Skills and Pedagogy: Double Reeds and Flute
- MUED 200G Basic Skills and Pedagogy: Violin
- MUED 200H Basic Skills and Pedagogy: Strings
- MUED 200P Basic Skills and Pedagogy: Percussion

**Admission and Retention in Music Education**

After successfully completing all requirements at the four decision points, the student is recommended by the university’s director of teacher education for the Ohio Provisional Music (Pre-K-12) License to teach.
music in the public schools in Ohio and more than 40 reciprocating states.

Completion of the Bachelor of Science degree does not ensure that the State of Ohio music teacher license will be awarded. Additional information is available from the Teacher Licensure (p. 437) section in this bulletin.

Departmental Honors

Departmental honors programs for the Bachelor of Arts and Bachelor of Science degrees have the following admission and completion requirements:

For all students, admission to honors status requires an overall GPA of at least 3.2, a music GPA of at least 3.5, evidence of exceptional musicianship and scholarly interests, petition to the music faculty, nomination by a faculty member, and acceptance by the music faculty. The honors project must first be approved by the faculty project advisor, with the specific project timeline to be determined in consultation with the advisor. The student must submit a proposal to the faculty before the project start date, typically by the midpoint of the spring semester preceding the senior year.

For BA students, second-semester sophomore or junior standing is required for admission to honors status. The honors project should then be completed as part of the SAGES Capstone Seminar. For BS students, admission to honors status requires advanced standing in music education. The student must register for independent study or an approved seminar during the project period, and the honors project may not be pursued or completed during student teaching.

Minor

The music minor requires 15 credits: 6 in music theory (MUTH), 6 in music history or appreciation (MUHI or MUGN) and 3 others, which may include MUAP or MUEN. For questions regarding eligible course substitutions, please contact the Department of Music Minor Advisor.

<table>
<thead>
<tr>
<th>Music Theory:</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>MUTH 102</td>
<td>Theory I</td>
</tr>
<tr>
<td>MUTH 104</td>
<td>Theory II</td>
</tr>
</tbody>
</table>

Music History (one of the following): 6

| MUGN 201  | Introduction to Music: Listening Experience I |
| & MUGN 202  | Introduction to Music: Listening Experience II |
| MUHI 301  | History of Western Music I |
| & MUHI 302  | History of Western Music II |

At least 3 additional hours, either in MUAP or MUEN 3

Total Units 15

A minor in music education may be devised in consultation with a music education advisor. CIM students may pursue a minor in music history by taking 15 hours of MUHI courses. The department welcomes students’ initiative in the development of minor programs suited to their needs. Courses can be substituted with the approval of the music minor program advisor.

Electives for Non-Music Majors

Electives designed for students not majoring in music are:

| MUTH 103  | Theory I |
| MUTH 104  | Theory II |
| MUGN 201  | Introduction to Music: Listening Experience I |
| MUGN 202  | Introduction to Music: Listening Experience II |
| MUGN 215  | History and Styles of Jazz |

MUGN 308 Digital Music: Composition and Production is designed for music majors but is open to non-music majors with the permission of the instructor. MUGN 212: History of Rock & Roll is meant for non-majors in music.

Individual instruction (MUAP) in keyboard, voice, and all instruments is available with consent of the department (additional fee for non-major). For more information about the department’s applied music offerings, please contact the Music Office 216.368.2400 or info@music.case.edu.

Non-music majors may also audition for admission to music ensembles (MUEN).

MA Programs | PhD and DMA Programs | Applied Music

Graduate Programs

General descriptions are given here; complete information on all degrees is available from the department (http://music.case.edu/prospective/graduate). Admission to each degree follows established guidelines of the School of Graduate Studies. Scores from the Graduate Record Examination are required for admission to programs in music history, musicology, and historical performance practice, and an audition is necessary for students interested in the historical performance practice program.

Master of Arts Degree

The Master of Arts degree is offered in the fields of:

1. music history and literature
2. music education

Within music history and literature, students may choose concentrations in music history and literature or in historical performance practice. Master’s degree candidates in music education may also choose to add course work that will qualify them to take teaching licensure exams for the State of Ohio.

Master of Arts in Music History and Literature

The concentration in music history and literature emphasizes research, history, literature, and the theory of music. Within the 30 hours required, the following are minimum requirements:

| Music History | 9 |
| Research      | 6-9 |
| Theory-Analysis | 6 |
| Electives       | 6-9 |
| Total Units    | 27-33 |

The concentration in historical performance practice presupposes the same strong liberal arts training as the music history and literature concentration, plus a strong performance interest and background. Research and its application to music performance are stressed. Within the 27 hours required, the following are minimum requirements:

| Bibliography and Research | 3 |
| Performance Practice    | 6 |
| Notation Theory          | 6 |
| Lecture-Recital and Document | 6 |
| Total Units              | 21 |

In both concentrations, remaining hours are freely elected in music history and research with advisor’s approval. For students pursuing the degree in historical performance practice, however, at least two semesters of applied music (0 credits) are required, in addition to MUAP 651 M.A. Lecture - Recital and Document, near the completion of the degree program. Ensemble participation is also required for performance practice students but does not earn credit hours toward the degree.
Examinations include initial placement tests in history and theory, and a reading test in a foreign language pertinent to the student’s field. In addition, performance practice students must audition as part of the admissions process. At least 18 credit hours must be at the 400 level or higher.

**Fast Track MA/PhD Program**

Students in the MA in music history and literature program are eligible for a fast track option to the PhD in historical musicology. To qualify for this option, students must complete 36 hours in the MA program and are advised to pursue the thesis option. By the end of the third semester of study (prior to the completion of the 36 hours), the student must inform the director of graduate studies of his/her desire to enter the PhD program, and, in consultation with the director, must present a petition to the musicology faculty for candidacy. Once faculty consent is secured, all remaining requirements of the degree program, as detailed above, remain the same.

**Master of Arts in Music Education**

This degree is built on a set of foundation courses in philosophy, curriculum, psychology, research, evaluation, and musicianship. Additional courses and independent studies enable students to tailor programs to their interests and needs.

Three degree options are available. Students who choose Plan A (thesis option) write a thesis based on original research and defend the thesis in an oral examination. Students who choose Plan B (comprehensive exam option) complete a comprehensive examination in music education. Applicants for Plans A or B should have a bachelor’s degree in music education, an undergraduate GPA of 3.0 or better, and at least one year of successful music teaching experience, usually in the public schools.

Students seeking teacher licensure credentials pursue Plan C (MA for Licensure, or MAL). The program includes a core of graduate music education courses, graduate music courses, undergraduate music education methods courses, and one semester of student teaching. Applicants for MAL should have a bachelor’s degree in music (BA or BM), an undergraduate GPA of 3.0 or better, and some prior experience in working with children. The regulations for students in the BS program regarding advanced standing, grade point averages, and the Praxis II exam apply to graduate students in Plan C as well. Completion of the Plan C degree does not ensure that the State of Ohio music teacher license will be awarded.

Foundation courses for Plan A and Plan B include:

<table>
<thead>
<tr>
<th>Course Description</th>
<th>Units (Total)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Music education core of philosophy, curriculum, and research</td>
<td>12</td>
</tr>
<tr>
<td>Music core of history, theory, and applied music</td>
<td>9-12</td>
</tr>
<tr>
<td>Electives</td>
<td>0-9</td>
</tr>
<tr>
<td>Total Units</td>
<td>21-33</td>
</tr>
</tbody>
</table>

Students in Plan A receive 6 credit hours for thesis research. Students in Plan B complete a comprehensive written examination at the conclusion of course work, whereas students in Plan C complete a comprehensive oral examination.

A minimum of 30 credit hours is required for Plans A and B. Plan C requires a minimum of 65 hours, including:

<table>
<thead>
<tr>
<th>Course Description</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Music education licensure core</td>
<td>35</td>
</tr>
<tr>
<td>Teacher licensure professional education core</td>
<td>9</td>
</tr>
<tr>
<td>Graduate music education core</td>
<td>12</td>
</tr>
<tr>
<td>Graduate music core</td>
<td>9</td>
</tr>
<tr>
<td>Total Units</td>
<td>65</td>
</tr>
</tbody>
</table>

To remain in Plan C’s MAL program, students must meet GPA and professional standards each year. For more information, contact the director of music education.

**Doctor of Philosophy Degree**

The Doctor of Philosophy degree is offered in two fields: (1) musicology (with concentrations in music history and historical performance practice), and (2) music education.

**Doctor of Philosophy in Musicology**

The PhD in historical musicology is granted in recognition of superior scholarly ability and attainment. Award of the degree is based not only on computation of time or enumeration of courses, but also upon distinguished work. Highly qualified applicants may enter this program directly upon completion of a bachelor’s degree. All programs of study are formulated to suit the individual needs of the student and require the consent of the advisor.

**Music History Concentration**

The PhD requires 36 credit hours of course work and an additional 18 credit hours of dissertation research. Required course work includes MUHI 610 Bibliography and Research Methods in Music and MUTH 424 Introduction to Schenkerian Analysis as well as three doctoral seminars. In the first two years, students will be expected to take three courses (or 9 credits) per semester, for a total of 36 hours.

Students admitted to the program will take diagnostic examinations prior to the start of classes in their first year. Based on these examinations, students may be required to enroll in specific courses to address deficiencies; these course credits may be applied toward the degree requirements. At the end of the first year of study, the musicology faculty will conduct a formal review with each student. This process will include an evaluation of progress to date and advisement regarding the remainder of the program.

A written summary of this review, along with course grades and materials, will constitute the beginnings of the portfolio maintained by the director of graduate studies that will be the basis for considering each student’s advancement into the PhD program.

At the end of the second year of course work, students will be asked to submit a qualifying paper, which will be added to the portfolio. At the beginning of the fall in the third year of study, students will take comprehensive examinations, which will also function as qualifying exams for advancement to the PhD program. These examinations will consist of written and oral sections, and will be conducted and evaluated by the musicology faculty. Following the examinations, the faculty will review each student’s portfolio and, based on work contained therein, make a decision regarding advancement to candidacy in the PhD program. Students who do not advance but who have done satisfactory work will be eligible to receive the MA in music history at this juncture.

Students who advance to candidacy for the PhD will register for dissertation research credits and begin research for the dissertation. Working with a faculty advisor, each student will develop a proposal for the dissertation, which will be presented in writing to the faculty no later than the end of the third year of study. It is expected that the fourth and possibly fifth year of study will be devoted to work on the dissertation. Upon completion of the thesis, each student will present a formal defense to the musicology faculty.

Under the rules of the School of Graduate Studies, a student must complete the thesis no later than five years after registering for the first dissertation research (701) credits.
The PhD in historical musicology with a concentration in historical performance practice requires a minimum of 36 hours of course work, seminars, and tutorials, and an additional 18 credit hours of dissertation research. Course distribution is as follows:

<table>
<thead>
<tr>
<th>Course</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bibliography and research</td>
<td>3</td>
</tr>
<tr>
<td>Performance practices</td>
<td>9</td>
</tr>
<tr>
<td>Notation-theory</td>
<td>9</td>
</tr>
<tr>
<td>Doctoral Seminars</td>
<td>6</td>
</tr>
<tr>
<td>MUAP 751 Doctoral Lecture-Recital and Document I</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total Units</strong></td>
<td><strong>27-30</strong></td>
</tr>
</tbody>
</table>

Remaining hours are freely elected in music history and research with the advisor’s approval. At least three semesters of applied music (0 credits) are required. Ensemble participation is also required for performance practice students but does not earn credit hours toward the degree.

For other musicology students, private lessons at the 500 level, although not required, may be counted up to a maximum of six credits, at the discretion of the advisor.

Examinations include initial placement tests in history and theory; reading tests in two foreign languages pertinent to the student’s field; and comprehensive examinations in history and theory, including written and oral sections, prior to admission to candidacy. Upon completion of the dissertation, an oral defense is held. In addition, performance practice students must audition as part of the admissions process. The candidate must teach a college-level course in music history and literature (or historical performance practice) under the supervision of a faculty member, or have had the equivalent experience before the dissertation is completed.

The PhD in historical musicology with a concentration in historical performance practice requires a minimum of 36 hours of course work, seminars, and tutorials, and an additional 18 credit hours of dissertation research. Course distribution is as follows:

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<tr>
<td>MUAP 751 Doctoral Lecture-Recital and Document I</td>
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</tr>
<tr>
<td><strong>Total Units</strong></td>
<td><strong>27-30</strong></td>
</tr>
</tbody>
</table>

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For other musicology students, private lessons at the 500 level, although not required, may be counted up to a maximum of six credits, at the discretion of the advisor.

Examinations include initial placement tests in history and theory; reading tests in two foreign languages pertinent to the student’s field; and comprehensive examinations in history and theory, including written and oral sections, prior to admission to candidacy. Upon completion of the dissertation, an oral defense is held. In addition, performance practice students must audition as part of the admissions process. The candidate must teach a college-level course in music history and literature (or historical performance practice) under the supervision of a faculty member, or have had the equivalent experience before the dissertation is completed.

**Doctor of Philosophy in Music Education**

The doctorate in music education is offered to persons who have shown a strong and continuing dedication to music teaching and scholarship. Applicants must have completed at least three years of full-time music teaching, usually in the public schools. The degree is designed to prepare professionals to assume positions of leadership in elementary, secondary, and collegiate instruction. Prior to graduation, doctoral students demonstrate competency in teaching, research, and musicianship. Every effort will be made to plan a program based on individual student needs and interests while maintaining standards of musical and scholarly excellence. Electives, therefore, will be chosen in consultation with a faculty advisor in order to ensure a balance between individual interests and traditional graduate expectations. To remain in the program, students must meet GPA and professional standards each year. For more information, contact the director of music education.

A total of 60 credit hours is required for the doctoral degree beyond the master’s level. Courses include:

<table>
<thead>
<tr>
<th>Course</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Music education: research, philosophy, cognition/psychology, curriculum, and assessment</td>
<td>15</td>
</tr>
<tr>
<td>Music: theory, history, applied music</td>
<td>9-12</td>
</tr>
<tr>
<td>Outside cognate</td>
<td>6</td>
</tr>
<tr>
<td>Music education electives</td>
<td>9-12</td>
</tr>
<tr>
<td>Dissertation</td>
<td>18</td>
</tr>
<tr>
<td><strong>Total Units</strong></td>
<td><strong>57-63</strong></td>
</tr>
</tbody>
</table>

A comprehensive examination follows the completion of course work, prior to beginning research for the dissertation. Upon completion of the dissertation, an oral defense is held. The dissertation topic is chosen by the student in consultation with the faculty.

**Doctor of Musical Arts in Historical Performance Practice**

This doctorate is granted in recognition of outstanding performing ability in early music combined with superior scholarly ability in the field of historical performance practice. All programs are formulated to suit the needs of the individual student and require the consent of a faculty advisor.

A minimum of 36 hours of course work, seminars, and tutorials is required. Distribution is as follows:

<table>
<thead>
<tr>
<th>Course</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bibliography and Research</td>
<td>3</td>
</tr>
<tr>
<td>Performance Practices</td>
<td>6-9</td>
</tr>
<tr>
<td>Notation Theory</td>
<td>9</td>
</tr>
<tr>
<td>Doctoral Seminars</td>
<td>3-6</td>
</tr>
<tr>
<td>MUAP 751 Doctoral Lecture-Recital and Document I</td>
<td>0</td>
</tr>
<tr>
<td>MUAP 752 Doctoral Lecture-Recital and Document II</td>
<td>3</td>
</tr>
<tr>
<td>Electives chosen from music history and research (with advisor approval)</td>
<td>3</td>
</tr>
<tr>
<td>MUAP 753 Doctoral Lecture-Recital and Document III</td>
<td>6</td>
</tr>
<tr>
<td><strong>Total Units</strong></td>
<td><strong>33-42</strong></td>
</tr>
</tbody>
</table>

Applied music (0 credits) must be taken every semester the student is on campus. Ensemble participation is required but does not earn credit hours toward the degree.

Examinations include a performance audition; initial placement tests in history and theory; reading tests in two foreign languages pertinent to the student’s field; and a comprehensive examination with history, theory, performance practice, and oral sections. Exceptional students may be admitted to a combined MA/DMA degree program in early music.

**Applied Music**

All Master of Arts and Doctor of Philosophy degree students in the department must satisfy the applied music requirements specified in their degree programs. Graduate students who anticipate private lesson instruction in their programs should consult an advisor before registration. Students register for individual applied music instruction in courses titled Principal Performance Area and Secondary Performance Area.

**Department Faculty**

William I. Bauer, PhD
(Kent State University)

Associate Professor; Director of Graduate Studies in Music Education
Music teacher education; research; technology

L. Peter Bennett, D Phil
(Oxford University)

Associate Professor
17th-century French music; early music performance

Francesca Brittan, PhD
(Cornell University)

Assistant Professor
19th-century France; Romantic aesthetics; popular music

Gary M. Ciepluch, PhD
(University of Wisconsin, Madison)

Associate Professor
Director of bands; conducting; music teacher education

Georgia J. Cowart, PhD
(Rutgers University)

Professor
17th and 18th centuries; music, the arts, and politics
Ross W. Duffin, DMA
(Stanford University)
Fynette H. Kulas Professor of Music; Interim Chair
Early music performance practice; Shakespeare
Paul S. Ferguson, MM
(Eastman School of Music)
Instructor
Jazz studies and contemporary media
Matthew L. Garrett, PhD
(Florida State University)
Assistant Professor
Choral music education; conducting
Daniel Goldmark, PhD
(UCLA)
Associate Professor; Director of Graduate Studies
American popular music; film music; history of the music industry
Stephen E. Hefling, PhD
(Yale University)
Professor
Mahler; 18th and 19th centuries; chamber music; analysis
Kathleen A. Horvath, PhD
(Ohio State University)
Associate Professor; Director of Undergraduate Studies in Music Education
Music teacher education; string education and pedagogy
Lisa L. Koops, PhD
(Michigan State University)
Assistant Professor
Music teacher education; general music
Susan McClary, PhD
(Harvard University)
Professor
Musicology
David J. Rothenberg, PhD
(Yale University)
Associate Professor; Director of Undergraduate Studies, BA Music
Medieval; Renaissance; musical symbolism
Robert Walser, PhD
(University of Minnesota)
Professor
American music; jazz history; popular music studies; implications of recent neuroscience for humanistic scholarship; contemporary music production technology

Full-time Lecturers
Julie Andrijeski, DMA
(Case Western Reserve University)
Director, Case/CIM Baroque Orchestra
Performance practices; dance
Eric Charnofsky, MM
(The Juilliard School)
20th-century music; piano accompanying; keyboard repertoire
Juanita Karp, DMA
(University of Georgia)
Music history; Undergraduate Admission and First-Year Advisor

MUAP Courses
MUAP 10. Progress Jury Examination. 0 Units.
Progress Jury Examination (All BA and BS Music Majors)
MUAP 11. Recital Class. 0 Units.
MUAP 121. Principal Performance Area I. 2 Units.
Limited to music and music education majors. Recommended preparation: Entrance Jury/Audition
MUAP 122. Principal Performance Area II. 2 Units.
Limited to music and music education majors. Prereq: MUTH 003 and MUAP 121. Coreq: MUTH 003.
MUAP 131. Secondary Performance Area I. 1 - 2 Unit.
Open to all university students.
MUAP 132. Secondary Performance Area II. 1 - 2 Unit.
Open to all university students. Prereq: MUAP 131.
MUAP 133. Secondary Performance Area III. 1 - 2 Unit.
Open to all university students. Prereq: MUAP 132.
MUAP 134. Secondary Performance Area IV. 1 - 2 Unit.
Open to all university students. Prereq: MUAP 133.
MUAP 135. Secondary Performance Area V. 1 - 2 Unit.
Open to all university students. Prereq: MUAP 134.
MUAP 136. Secondary Performance Area VI. 1 - 2 Unit.
Open to all university students. Prereq: MUAP 135.
MUAP 20. Level 300 Applied Music Entrance Jury Exam. 0 Units.
Level Jury Examination
MUAP 221. Principal Performance Area III. 2 Units.
Limited to music and music education majors. Prereq: MUTH 107 or MUTH 101/105, MUAP 122, Passed Progress Jury. Coreq: MUTH 107 or MUTH 101/105.
MUAP 222. Principal Performance Area IV. 2 Units.
MUAP 223. Principal Performance Area V. 2 Units.
Limited to music and music education majors. Prereq: MUTH 207 or MUTH 201/205, MUAP 222. Coreq: MUTH 207 or MUTH 201/205.
MUAP 224. Principal Performance Area VI. 2 Units.
Limited to music and music education majors. Prereq: MUTH 208 or MUTH 202/206, MUAP 223. Coreq: MUTH 207 or MUTH 202/206.
MUAP 225. Principal Performance Area VII. 2 Units.
Limited to music and music education majors. Prereq: MUAP 224.
MUAP 226. Principal Performance Area VIII. 2 Units.
Limited to music and music education majors. Prereq: MUAP 225.
MUAP 25. BA Exit Jury Examination. 0 Units.
BA Exit Jury Examination (Audio and General Music Concentrations)

MUAP 26. BA Exit Jury Examination. 0 Units.
BA Exit Jury Examination (Music History, Music Theory, and Early Music Performance Practice)

MUAP 30. BA Performance Exit Jury Examination. 0 Units.
BA Performance Exit Jury Examination

MUAP 321. Principal Level Performance Area V. 2 Units.

MUAP 322. Principal Level Performance Area VI. 2 Units.

MUAP 323. Principal Performance Area VII. 2 Units.
Limited to music performance and music education majors.

MUAP 35. BS Music Education Jury Examination. 0 Units.
BS Music Education Jury Examination

MUAP 421. Principal Level Performance Area VII. 2 Units.
Limited to music and music education majors. Prereq: MUAP 322.

MUAP 422. Principal Level Performance Area VII. 2 Units.
Limited to music and music education majors. Prereq: MUAP 421.

MUAP 521. Principal Performance Area IX. 0 - 3 Units.
Limited to music and music education majors.

MUAP 522. Principal Performance Area IX. 0 - 3 Units.
Limited to music and music education majors.

MUAP 523. Principal Performance Area IX. 0 - 3 Units.
Limited to music and music education majors.

MUAP 524. Principal Performance Area IX. 0 - 3 Units.
Limited to music and music education majors.

MUAP 525. Principal Performance Area IX. 0 - 3 Units.
Limited to music and music education majors.

MUAP 526. Principal Performance Area IX. 0 - 3 Units.
Limited to music and music education majors.

MUAP 531. Secondary Performance Area IX. 0 - 3 Units.
Open to all university students.

MUAP 532. Secondary Performance Area X. 0 - 3 Units.
Open to all university students.

MUAP 533. Secondary Performance Area IX. 0 - 3 Units.
Open to all university students.

MUAP 534. Secondary Performance Area IX. 0 - 3 Units.
Open to all university students.

MUAP 535. Secondary Performance Area IX. 0 - 3 Units.
Open to all university students.

MUAP 536. Secondary Performance Area IX. 0 - 3 Units.
Open to all university students.

MUAP 651. M.A. Lecture - Recital and Document. 3 - 6 Units.
M.A. Lecture - Recital for students in Historical Performance Practice.

MUAP 751. Doctoral Lecture-Recital and Document I. 0 - 3 Units.

MUAP 752. Doctoral Lecture-Recital and Document II. 3 Units.

MUAP 753. Doctoral Lecture-Recital and Document III. 6 Units.

MUAR Courses

MUAR 151B. Case Audio Internship I. 1 Unit.
Development of recording engineering skills through professional level work in the Harkness audio service. Recommended preparation: Open only to audio recording majors.

MUAR 152B. Case Audio Internship II. 1 Unit.
Recommended preparation: MUAR 151B.

MUAR 153B. Case Audio Internship III. 1 Unit.
Recommended preparation: MUAR 152B.

MUAR 154B. Case Audio Internship IV. 1 Unit.
Recommended preparation: MUAR 153B.

MUAR 200. Audio Recording I. 2 Units.
A study of basic recording principles and systems and techniques of recording and editing. Recommended preparation: Audio recording majors only.

MUAR 201. Audio Recording II. 2 Units.
Further study of basic recording principles and systems with an introduction to digital recording. Recommended preparation: MUAR 200.

MUAR 251B. Case Audio Recording Internship I. 0 Units.
Professional level work in the Case Western Reserve University Harkness audio service.

MUAR 252B. Case Audio Recording Internship II. 0 Units.

MUAR 253B. Case Audio Recording Internship III. 0 Units.

MUAR 254B. Case Audio Recording Internship IV. 0 Units.

MUAR 300. Advanced Recording Techniques I. 2 Units.
A study of advanced microphone, recording, and monitoring systems and techniques with an emphasis on two track digital recordings of classical music and critical listening. Recommended preparation: MUAR 201.

MUAR 301. Advanced Recording Techniques II. 2 Units.
Further study of advanced microphone, recording, and monitoring systems and techniques, with an emphasis on two track digital recordings of large ensemble classical music. Recommended preparation: MUAR 300.
MUAR 302. Multitrack Recording Techniques I. 2 Units.
A study of multitrack recording and mixdown techniques. Recommended preparation: MUAR 301. Audio recording majors only.

MUAR 303. Multitrack Recording Techniques II. 2 Units.
Further study of multitrack recording and mixdown techniques, with an emphasis on synchronization to video. Recommended preparation: MUAR 302.

MUAR 310. Recording Studio Maintenance I. 1 Unit.
Study of techniques for optimizing professional recording equipment performance. Recommended preparation: MUAR 201. Audio recording majors only.

MUAR 311. Recording Studio Maintenance II. 1 Unit.

MUAR 320. Acoustics of Music I. 1 Unit.
A seminar in the basic concepts of musical acoustics and research in this area. The students actively participate in experiments exploring various topics in musical acoustics.

MUAR 321. Acoustics of Music II. 1 Unit.
A seminar in the basic concepts of musical acoustics and research in this area. The students actively participate in experiments exploring various topics in musical acoustics.

MUAR 322. Recording Workshop I. 1 Unit.
Recording Workshop provides an increased level of hands-on intensive study of microphone placement. Each week a different instrument or group of instruments will be available for experimentation. Each class represents a recording session centered on a specific instrument, resulting in a comprehensive set of test recordings at the end of each semester. These will provide the basis of reference for future recording decisions. Recommended preparation: MUAR 200.

MUAR 323. Recording Workshop II. 1 Unit.
Recording Workshop provides an increased level of hands-on intensive study of microphone placement. Each week a different instrument or group of instruments will be available for experimentation. Each class represents a recording session centered on a specific instrument, resulting in a comprehensive set of test recordings at the end of each semester. These will provide the basis of reference for future recording decisions. Recommended preparation: MUAR 200.

MUAR 380. Junior Recording Techniques Thesis. 3 Units.

MUAR 385. Recording Studio Internship. 4 Units.

MUAR 390. Senior Recording Tech Thesis/Senior Capstone. 6 Units.
Students will originate, design, organize, and complete a project that will demonstrate and document proficiency with his/her accumulated audio recording technology skills. This project must include evidence of critical thinking, clear planning, and establishment of reasonable goals with an appropriate plan of action. There is a significant written component that requires regular submission of drafts, progress reports, evidence of project advancement, and a final written document. There must also be a public presentation of the project in a venue approved by the department.

MUCP Courses

MUCP 399. Undergraduate Independent Studies. 1 - 3 Unit.
Each student develops a topic of interest to be explored with a faculty member.

MUCP 751. Composition Document-D.M.A.. 3 Units.

MUED Courses

MUED 200A. Basic Skills and Pedagogy: Voice. 1 Unit.
Designed for music education majors to provide the fundamentals of teaching methods for various instruments. Recommended preparation: Music education majors. Non-music majors accepted with consent of department.

MUED 200B. Basic Skills and Pedagogy: Guitar. 1 Unit.
Designed for music education majors to provide the fundamentals of teaching methods for various instruments. Recommended preparation: Music education majors. Non-music majors accepted with consent of department.

MUED 200C. Basic Skills and Pedagogy: Upper Brass. 1 Unit.
Designed for music education majors to provide the fundamentals of teaching methods for various instruments. Recommended preparation: Music education majors. Non-music majors accepted with consent of department.

MUED 200D. Basic Skills and Pedagogy: Lower Brass. 1 Unit.
Designed for music education majors to provide the fundamentals of teaching methods for various instruments. Recommended preparation: Music education majors. Non-music majors accepted with consent of department.

MUED 200E. Basic Skills and Pedagogy: Clarinet and Saxophone. 1 Unit.
Designed for music education majors to provide the fundamentals of teaching methods for various instruments. Recommended preparation: Music education majors. Non-music majors accepted with consent of department.

MUED 200F. Basic Skills and Pedagogy: Double Reeds and Flute. 1 Unit.
Designed for music education majors to provide the fundamentals of teaching methods for various instruments. Recommended preparation: Music education majors. Non-music majors accepted with consent of department.

MUED 200G. Basic Skills and Pedagogy: Violin. 1 Unit.
Designed for music education majors to provide the fundamentals of teaching methods for various instruments. Recommended preparation: Music education majors. Non-music majors accepted with consent of department.

MUED 200H. Basic Skills and Pedagogy: Strings. 1 Unit.
Designed for music education majors to provide the fundamentals of teaching methods for various instruments. Recommended preparation: Music education majors. Non-music majors accepted with consent of department.
MUED 200P. Basic Skills and Pedagogy: Percussion. 1 Unit.
Designed for music education majors to provide the fundamentals of teaching methods for various instruments. Recommended preparation: Music education majors. Non-music majors accepted with consent of department.

MUED 240. Foundations of Music Education. 3 Units.
An introduction to and overview of the music education profession. Philosophical, historical and psychological perspectives on music education in schools, including contemporary topics and trends. Introduction of Ohio academic content standards and curriculum model for music, along with K-12 National Music Standards. Observation of area music teachers and peer-teaching experience. Recommended preparation: Music education major or permission.

MUED 275. Elements of Conducting. 2 Units.
This course is designed to develop the physical tools, and philosophical and aesthetic ideologies necessary for students to conduct in an effective and appropriate manner. Students develop baton technique through systematic physical/pattern exercises, and class and field conducting experiences (elementary through adult). Observations and written evaluations of Cleveland Orchestra rehearsals and concerts, along with video analysis/self-evaluation of personal conducting experiences are among the activities required in this course. Topics and content include: philosophical foundations for the conductor, considerations for selecting repertoire and creating a supportive learning environment; rehearsal techniques; planning for the rehearsal and record keeping; rehearsal management; group motivation; score analysis and preparation; participation in professional activities; effective use of technology for the conductor; and national, state, and professional standards. Clinical/Field experiences (all ages) required.

MUED 276. Advanced Conducting. 2 Units.
This course continues in-depth development of the physical tools, and philosophical and aesthetic ideologies presented in MUED 275. Students develop baton techniques (with experiences in complex and changing time signatures) through systematic physical/pattern exercises, along with continuous evaluations, from their class and field conducting experiences (elementary through adult), observations and written evaluations of Cleveland Orchestra Rehearsals and Concerts, written critiques from historically significant Master Conductors (from videos in the University’s Music Library), along with video analysis of personal class and field conducting, are among the activities required in this course. Topics and content include: philosophical foundations for the conductor, considerations for selecting repertoire and creating a supportive learning environment; rehearsal techniques; planning for the rehearsal and record keeping; rehearsal management; group motivation; score analysis and preparation; participation in professional activities; effective use of technology for the conductor; and national and state standards. Clinical/Field experiences (all ages) required.

MUED 270. Technology Assisted Music Teaching and Learning. 3 Units.
Fundamental concepts and skills for using technology in music teaching and learning. This project-oriented class will develop knowledge and competencies related to electronic musical instruments, MIDI sequencing, music notation software, computer-assisted instruction, digital media, the Internet, information processing, computer systems, and lab management as they relate to music education in K-12 schools. Recommended preparation: MUED 240. Offered as MUED 320 and MUED 420.

MUED 305. World Music in Education. 3 Units.
This course acquaints students with the use of world music, or multicultural music, in the music education classroom. Students are given an overview of the history of world music within American music education, discuss topics related to world music in education, research diverse world music practices, and lead lessons based on this research. Topics and content include: definitions of world/multicultural music; philosophical basis for world music in education; diversity in our Cleveland community; authenticity; ethnomusicology; informal/formal music learning; international perspectives; pedagogical approaches; addressing the State and National Standards through world music in education; and the development of culturally informed music pedagogy based on the study of diverse music. Throughout the course students will become acquainted with the music of diverse cultures and people groups; these will be chosen in part based on student’s own research interests. In addition to the musical cultures chosen by students for study and presentation, the music of The Gambia, West Africa; the Caribbean; and India will be highlighted during in-class activities and lessons. Recommended preparation: MUED 240.

MUED 310. Instrumental and Choral Arranging. 3 Units.
Techniques of writing and arranging for instruments of the band and orchestra and voice. Study of scoring problems for school instrumental and vocal groups of all ages and abilities.

MUED 320. Technology Assisted Music Teaching and Learning. 3 Units.
Fundamental concepts and skills for using technology in music teaching and learning. This project-oriented class will develop knowledge and competencies related to electronic musical instruments, MIDI sequencing, music notation software, computer-assisted instruction, digital media, the Internet, information processing, computer systems, and lab management as they relate to music education in K-12 schools. Recommended preparation: MUED 240. Offered as MUED 320 and MUED 420.

MUED 350. General Music Methods A. 3 Units.
General Music A introduces student to methods and materials for planning and implementing general music experiences for all ages, with concentration on Pre-K through sixth grade children. Topics of the course include: multiple meanings of music for children; characteristics/needs of young children and creating a supportive learning environment; theories of music learning and teaching; learning styles and collaborative learning; assorted teaching methods, rhythm, pitch, listening, movement, performing, composing; curriculum design; technology for music instruction; multicultural music; music for exceptional children; integrating music with the arts and other curricula; motivation and classroom management; lesson planning and record keeping; developing a personal philosophy of music education; national, state, and professional standards; and assessment. Clinical/Field experiences (Clinical-all ages; Field-focus on Pre-K through elementary) required.
MUED 352. Instrumental Methods and Materials. 3 Units.
This course acquaints students with effective ways to develop, organize, and maintain a successful instrumental program for any age group, based on a comprehensive instrumental music education model. Students are given a "womb to tomb" view of the instrumentalists' development, including physiological development and age appropriate instrumental exceptions. Topics and content include: philosophical basis for music education, considerations for selecting repertoire including multicultural music; rehearsal techniques; assessment and record keeping; planning for the rehearsal; recruitment; auditioning; and placement; motivation and classroom management; team teaching and collaborative learning; managing an instrumental program; participation in professional activities; effective use of technology in the instrumental program; philosophy; and national, state, and professional standards. Clinical/Field experiences (all ages) required.

MUED 353. Choral Methods and Materials. 3 Units.
This course acquaints students with effective ways to develop a successful choral program for any age group, based on a comprehensive choral music education model. Students are given a "womb to tomb" view of the singing voice, including physiological development, age appropriate vocal expectations, and establishing and maintaining vocal health. Topics include: philosophical basis for vocal music education; the child voice, the adolescent voice, and the adult voice; vocal tone; considerations for selecting repertoire including ensemble assessment, music evaluation, and multicultural music; rehearsal techniques, collaborative learning, and motivation; planning for the rehearsal; developing conducting technique; recruitment; auditioning; placement; score analysis and preparation; classroom management; managing a choral program; participation in professional activities; effective use of technology in a choral program; and national state, and professional standards. Clinical/Field experiences (all ages) required. Recommended preparation: MUED 276.

MUED 355. Instructional Design in Music Education. 3 Units.
This Music Education Department Seminar brings together all strands of the Music Education program by focusing on curriculum as the organizational element of instruction. Topics and content include: understanding the issues presented by special learners; techniques for integrating special learners into the music teaching environment; developing learning outcomes; designing instruction; planning classroom experiences; defining assessment and measurement; assessment techniques and instruments for the music classroom; and exploring elements of school music program organization and administration. Professional writing and clinical and field experiences will be a large part of the activities in this course. This course is presented in a seminar format that provides for discussions of classroom topics and commentary on field experiences.

MUED 359. Music in Early Childhood. 3 Units.
The goal of the course is to provide students with an understanding of the role of music in early childhood and approaches to music education with young children. Students will experience an overview of selected theories of musical development of young children, discuss the importance of music to various areas of child development, explore cultural perspectives and influences on musical development, evaluate curricular materials and methods used in early childhood music education, observe children's music making in early childhood classrooms, and develop teaching skills for early childhood music settings. Topics and content of this course include: music's role in early childhood development; music aptitude and its measurement; theories of early childhood music learning; early childhood making; evaluating curricular materials for early childhood music; the importance of play in early childhood musical development; incorporating State and National Music Education Standards; designing instruction for early childhood music settings; assessment in early childhood music; cultural perspectives on music in early childhood; cultural influences on musical development; music therapy with young children; benefits of family interaction in music; the role of listening in early childhood musical development; and formal music instruction with young children. The class will participate in a weekly service learning project providing music instruction for young children and parents or caregivers from an underserved population. Offered as MUED 391 and MUED 491.

MUED 396A. Student Teaching in Music Education. 9 Units.
Teaching music in both elementary and secondary schools, full-time five days a week for 15 weeks. Closely supervised field experiences of all types with a wide variety of students. Emphasis on planning lessons and organizing materials, teaching methodologies, motivation, and student assessment. Topics addressed include communications and the arts, technology in learning, interdisciplinary learning, collaborative learning and teaching, creating a supportive environment, and professional development. Development of skills needed for self-assessment as well as student assessment. Clinical/Field experiences (all ages) required. Recommended preparation: Concurrent enrollment in MUED 396B. Offered as MUED 396A and MUED 496A. Prereq: EDUC 255 and MUAP 323 and MUAP 35.

MUED 396B. Student Teaching Seminar in Music Education. 3 Units.
This is the SAGES Senior Capstone requirement for students majoring in Music Education. Taken at the same time as the student teaching experience (MUED 396A/496A), this seminar will guide students through preparation for entering the professional world of music education, and mentor them in their preparation of their Senior Capstone Project and Presentation. Recommended preparation: Concurrent enrollment in MUED 496A. Offered as MUED 396B and MUED 496B.

MUED 399. Undergraduate Independent Studies. 1 - 3 Units.
Each student develops a topic of interest to be explored with a faculty member.

MUED 400. Clinical/Field Experience. 3 Units.
This provides clinical/field experiences with all ages of students in all teaching areas. Students from a variety of socioeconomic and cultural backgrounds are encountered. Clinical/Field experiences (all ages) required.
MUED 420. Technology Assisted Music Teaching and Learning. 3 Units.
Fundamental concepts and skills for using technology in music teaching and learning. This project-oriented class will develop knowledge and competencies related to electronic musical instruments, MIDI sequencing, music notation software, computer-assisted instruction, digital media, the Internet, information processing, computer systems, and lab management as they relate to music education in K-12 schools. Recommended preparation: MUED 240. Offered as MUED 320 and MUED 420.

MUED 441. Philosophical Foundations of Music Education. 3 Units.
In this course, students explore major aesthetic philosophies that have influenced contemporary music education, and discuss current issues central to our field. Among topics included: basic views about art/music; creating art/music; meaning in art/music, experiencing art/music; music and aesthetic education; criticism in music; multicultural music; and critical theories and inquiry regarding music education. Students are asked to assess their own roles in music education, as well as their obligations and potential capacities for leadership in the profession. Students will work toward development of a personal professional philosophy of music education.

MUED 442. Curriculum and Assessment in Music Education. 3 Units.
This course is designed to give graduate music education students thorough knowledge of the overarching role of curriculum and assessment as the organizational elements of instruction. In depth coverage of such topics as: the role of assessment and measurement in teaching; epistemology; scope and sequence; backward design; instructional goals; validity; reliability; performance assessments; measuring assessment; curriculum design; and teaching for understanding. These concepts and procedures will be explored in depth to give daily music instruction a global framework in the larger organizational structure of profession, state, national, and accreditation standards for P-12 and college music settings.

MUED 443. Music Cognition and Learning. 3 Units.
Survey and critical review of the literature as it relates to music teaching and learning, and music performance. Specific topics may include basic psychoacoustical processes, auditory perception, cognitive organization of musical sound, tonal and musical memory, neuromusical research, affective and physiological responses to music, learning theory, musical aptitude, developmental processes, and motivation.

MUED 444. Research in Music Education. 3 Units.
Paradigms and methods in music education research. Specific topics and assignments include research-related resources, tools and materials; research problems; research literature; research procedures, research proposals; qualitative and quantitative research studies; computer-assisted data analysis; and empirical research reports.

MUED 491. Music in Early Childhood. 3 Units.
The goal of the course is to provide students with an understanding of the role of music in early childhood and approaches to music education with young children. Students will experience an overview of selected theories of musical development of young children, discuss the importance of music to various areas of child development, explore cultural perspectives and influences on musical development, evaluate curricular materials and methods used in early childhood music education, observe children’s music making in early childhood classrooms, and develop teaching skills for early childhood music settings. Topics and content of this course include: music’s role in early childhood development; music aptitude and its measurement; theories of early childhood music learning; early childhood making; evaluating curricular materials for early childhood music; the importance of play in early childhood musical development; incorporating State and National Music Education Standards; designing instruction for early childhood music settings; assessment in early childhood music; cultural perspectives on music in early childhood; cultural influences on musical development; music therapy with young children; benefits of family interaction in music; the role of listening in early childhood musical development; and formal music instruction with young children. The class will participate in a weekly service learning project providing music instruction for young children and parents or caregivers from an underserved population. Offered as MUED 391 and MUED 491.

MUED 496A. Student Teaching in Music Education. 9 Units.
Teaching music in both elementary and secondary schools, full-time five days a week for 15 weeks. Closely supervised field experiences of all types with a wide variety of students. Emphasis on planning lessons and organizing materials, teaching methodologies, motivation, and student assessment. Topics addressed include communications and the arts, technology in learning, interdisciplinary learning, collaborative learning and teaching, creating a supportive environment, and professional development. Development of skills needed for self-assessment as well as student assessment. Clinical/Field experiences (all ages) required. Recommended preparation: Concurrent enrollment in MUED 396B. Offered as MUED 396A and MUED 496A. Prereq: EDUC 255.

MUED 496B. Student Teaching Seminar in Music Education. 3 Units.
This is the SAGES Senior Capstone requirement for students majoring in Music Education. Taken at the same time as the student teaching experience (MUED 396A/496A), this seminar will guide students through preparation for entering the professional world of music education, and mentor them in their preparation of their Senior Capstone Project and Presentation. Recommended preparation: Concurrent enrollment in MUED 496A. Offered as MUED 396B and MUED 496B.

MUED 501. Special Reading (M.A. and M.M.). 1 - 18 Unit.

MUED 544. Advanced Research in Music Education. 3 Units.
Advanced studies in models and methods of music education research. Research projects using data analysis. In-depth examination of selected quantitative and/or qualitative research designs according to student interests. Discussion of thesis and dissertation proposal format process. Recommended preparation: MUED 444.
MUEN 591. Music Education Seminar in Conducting. 3 Units.
In this course, students focus on advanced score study, preparation, and analysis. In depth conducting techniques on contemporary music and mixed meter compositions, along with the development of a comprehensive conducting bibliography are the major components in this seminar. Historical research, analytical evaluation, and the practical elements of the physical techniques required for one to conduct a chosen composition are all addressed for each composition studies. Seminar discussions include aesthetic and philosophical ideologies, and the practical issues a conductor faces when put in control of the advanced ensemble.

MUEN 696. College Teaching Practicum. 0 Units.
Prereq: Predoctoral research consent or advanced to Ph.D. candidacy milestone.

MUEN Courses

MUEN 324. Case Percussion Ensemble. 0 - 2 Units.
The Case Percussion Ensemble is open to all interested Case-affiliated individuals who seek to continue their musical development by performing percussion ensemble literature. Membership is contingent on an audition that demonstrates moderate percussion ability and the ability to read music. Audition materials can be acquired through the director. Recommended preparation: Audition required.

MUEN 355. Miscellaneous Ensembles. 0 - 2 Units.

MUEN 356. University Circle Wind Ensemble. 1 Unit.
Designed for the most advanced woodwind, brass, and percussion players. Stresses the single-performance concept utilizing only players needed for a given piece. Audition required.

MUEN 357. New Music Ensemble. 1 - 2 Unit.

MUEN 365. Case Chamber Music. 0 - 1 Units.
This course will utilize wind instruments in different combinations, performing chamber music dating from the Renaissance to the 21st Century. The creation of new works and the adaptations of other repertoire will also be encouraged for unique/non-standard instrumentations. All combinations of Woodwinds, Brass, Voice, Strings, Guitar, Harp, Percussion, and Keyboard instruments will be considered; repertoire will be determined by available instrumentation. Membership is contingent on an audition that demonstrates moderate proficiency and the ability to read music. Audition materials can be acquired through the director.

MUEN 373. Jazz Ensemble I. 0 - 1 Units.
Recommended preparation: Audition required.

MUEN 374. Jazz Ensemble II. 0 - 1 Units.

MUEN 382. Case Concert Choir. 0 - 1 Units.
This select choral group performs a wide variety of a cappella and accompanied choral works. Membership is gained only through an audition with the director. Recommended preparation: Audition required.

MUEN 383. Symphonic Winds. 0 - 1 Units.
Performance of advanced symphonic band repertoire. Open to all Case students, faculty and staff. Audition required for part placement only.

MUEN 384. Spartan Marching Band. 0 - 1 Units.

MUEN 385. Case/University Circle Orchestra. 0 - 1 Units.
The orchestra is comprised of Case students, faculty, staff and community players who play strings, woodwinds, brass and percussion. Recommended preparation: Audition required.

MUEN 386. Case Camerata Chamber Orchestra. 0 - 1 Units.
This chamber string ensemble is open to all interested Case affiliated individuals who seek to continue their music development by performing orchestral literature. Each person is required to audition to determine initial placement, section assignment, and seating. All members are required to perform a minimum of 2 concerts per academic year. Recommended preparation: Audition required.

MUEN 387. University Singers. 0 - 1 Units.
Chorus performing a wide variety of traditional and popular choral works. Open to all Case students. No audition required.

MUEN 389. Keyboard Ensemble. 0 - 1 Units.
Intensive study of the repertory for keyboard instruments, including solo literature, chamber music, and other collaborative genres. Master class format with regular performances by enrolled students. Enrollment limited to CWRU keyboard majors. Must be enrolled in applied lessons.

MUEN 393. Baroque Chamber Ensembles. 0 - 1 Units.
Designed for students interested in exploring baroque music in a chamber setting on historical instruments. Prereq: Audition required.

MUEN 394. Baroque Dance Ensemble. 0 - 1 Units.
This course allows musicians and dancers alike to explore historical dance steps and notation. History of dance and its relationships to music will be emphasized as students learn and perform historical dances. Prereq: MUHI 342 or MUHI 442 or permission of Instructor.

MUEN 395. Collegium Musicum. 0 - 1 Units.
Recommended preparation: Audition required.

MUEN 396. Early Music Singers. 0 - 1 Units.
Recommended preparation: Audition required.

MUEN 397. Baroque Orchestra. 0 - 1 Units.
Recommended preparation: Audition required.

MUEN 398. Cleveland Orchestra Chorus. 0 - 1 Units.
Recommended preparation: Audition required.

MUGN Courses

MUGN 201. Introduction to Music: Listening Experience I. 3 Units.
A flexible approach to the study of the materials and literature of music. Aural and analytical skills primarily for classical music.

MUGN 202. Introduction to Music: Listening Experience II. 3 Units.
Application of the skills developed in MUGN 201 to the understanding of historical and stylistic content of Western music. Focus is on particular works in context of the era of composition. Recommended preparation: MUGN 201 or consent of department.
MUGN 215. History and Styles of Jazz. 3 Units.
Musical styles and structures of jazz and American popular music since 1900. Recommended preparation: MUGN 201.

MUGN 308. Digital Music: Composition and Production. 3 Units.
Course focuses on digital music creation and composition using audio sequencing software. Topics include song writing, synthesizers, recording, editing, mixing, and film scoring. Course is open to music majors, minors, and non-majors with sufficient musical background. Emphasis on group work, creativity, and imagination. All work done on Macintosh computers in The Core, the Department of Music’s multimedia classroom.

MUGN 319. Jazz Skills I. 3 Units.
This class is designed to teach students basic skills in jazz improvisation, jazz keyboard, arranging/composition and pedagogy. Basic theory is required. Students will eventually arrange their own composition for big band, which will feature them as the improvising soloist. Recommended preparation: MUTH 102/MUTH 106, MUHI 108 or permission of instructor.

MUGN 320. Jazz Skills II. 3 Units.
This course will build on the foundational skills developed in Jazz Skills I, providing a more intensive study of jazz harmony, improvisation and melodic construction. It is designed to give students an advanced experiential understanding of the theory and performance of jazz. Recommended preparation: MUGN 319.

MUGN 399. Undergraduate Independent Studies. 1 - 3 Unit.
Each student develops a topic of interest to be explored with a faculty member.

MUGN 501. Special Reading (M.A. and M.M.). 1 - 18 Unit.


MUGN 751. Recital Document I-D.M.A.. 1 - 3 Unit.

MUGN 752. Recital Document II - D.M.A.. 1 - 3 Unit.

MUHI Courses

MUHI 301. History of Western Music I. 3 Units.
Developments in Western music from early Christian times to c1700. Recommended preparation or concurrent enrollment: MUTH 102, MUTH 104, or MUTH 108.

MUHI 302. History of Western Music II. 3 Units.
Developments in Western music from c1700 to c1900. Recommended preparation: MUTH 102, MUTH 104, or MUTH 108.

MUHI 303. History of Western Music III. 3 Units.
Music of the twentieth century, covering history, analysis, and aesthetic issues. Recommended preparation: MUHI 301 or MUHI 302, MUTH 104 or MUTH 108.

MUHI 310. Music Cultures of the World: Music of Asia and Africa. 3 Units.
A one-semester introduction to musics of Asia and Africa, focusing on the relationship of musical traditions and practices to culture and society. Recommended preparation: MUTH 106.

MUHI 311. Music Cultures of the World II: Music of the Americas. 3 Units.
Introduction to selected multicultural musics of North America and Latin America, focusing on the relationship of musical traditions and practices to culture and society. Recommended preparation: MUTH 106.

MUHI 312. History of Rock and Roll: The Deep View. 3 Units.
This course surveys American popular song from the 1890s to the present, with an emphasis on rock ‘n’ roll and pop music of the last sixty years. The relationship of popular song to important currents in American life and culture will be examined. The origins of various styles of song in the cultures of different ethnic and national groups will be discussed, along with the subsequent diffusion and transformation of such music through mass mediation. The characteristics and meanings of music, lyrics, and images will be discussed with the aid of sound recordings, music videos and films. Students taking this course may not receive credit for MUGN 212. Prereq: For Music Majors only.

MUHI 315. History of Jazz and American Popular Music. 3 Units.
Musical styles and structures of jazz and American popular music; emphasis on music since 1900. Recommended preparation: MUTH 202 or MUHI 302.

MUHI 341. Introduction to Historical Performance Practice. 3 Units.
Summary and perspective of the problems and issues associated with the field of historical performance practices. Offered as MUHI 341 and MUHI 441. Prereq: MUHI 301 and MUHI 302.

MUHI 342. Seminar in Historical Performance Practice. 3 Units.
Seminar in a specific instrument and/or vocal area of historical performance practices, such as baroque vocal, instrumental, or keyboard practices. May be repeated because topics vary. Offered as MUHI 342 and MUHI 442. Prereq: MUHI 341 or MUHI 441

MUHI 350. Topics in Music History. 3 Units.
Close study of a theme or aspect of music such as “Music and Gender,” “Symphonies of Mahler,” and “Wagner’s Ring.” Offered as MUHI 350 and MUHI 450.

MUHI 390. Undergraduate Seminar in Music History. 3 Units.
An intensive research seminar in music history for music majors.

MUHI 395. SAGES Capstone for Music Majors. 3 - 6 Units.
Required for music majors, except in the case of double majors or dual degree candidates who opt to fulfill the capstone in the area of the second major. Course consists of projects varying according to the student’s area of study and interests, but each must include a document of appropriate length and scope. The project must be presented publicly in an appropriate forum.

MUHI 399. Undergraduate Independent Studies. 1 - 3 Unit.
Each student develops a topic of interest to be explored with a faculty member.

MUHI 401. Methodologies of Music History. 3 Units.
Introduction to the scholarly study of music, including principles of music bibliography, techniques of library research, and evaluation of editions. Special emphasis given to the relationship between musical performance and research in the history and criticism of music. Attention will also be given to design of program notes and essays. Required of first-year students in the Master of Music degree program.
MUHI 430. Music History for Educators. 3 Units.
Examines the intersections of composers’ musical output as it overlaps with theories of general education, music education, and pedagogy.

MUHI 431. Medieval Music: Early Christian to 1425. 3 Units.
The mass, liturgical drama, and early polyphony through the Ars Nova.

MUHI 432. Music of the Renaissance. 3 Units.
Vocal polyphonic music from the Burgundian school through the Elizabethan madrigal.

MUHI 433. Music of the Baroque. 3 Units.
Musical developments from Monteverdi to Bach and Handel.

MUHI 434. Viennese Classicism. 3 Units.
Development of the symphony, concerto, chamber music, and opera in the works of the Mannheim composers, Haydn, Mozart, and Beethoven.

MUHI 435. Nineteenth Century Music. 3 Units.
Romanticism and other 19th century trends in music up to impressionism.

MUHI 436. Twentieth Century Music. 3 Units.
Critical and analytical study of music since 1900. Examination and discussion of stylistic characteristics and aesthetic aims of contemporary composers.

MUHI 441. Introduction to Historical Performance Practice. 3 Units.
Summary and perspective of the problems and issues associated with the field of historical performance practices. Offered as MUHI 341 and MUHI 441.

MUHI 442. Seminar in Historical Performance Practice. 3 Units.
Seminar in a specific instrument and/or vocal area of historical performance practices, such as baroque vocal, instrumental, or keyboard practices. May be repeated because topics vary. Offered as MUHI 342 and MUHI 442. Prereq: MUHI 341 or MUHI 441.

MUHI 443. Medieval/Renaissance Notation. 3 Units.
Theory of chant, modal, mensural, and tablature notations. Practice in making literal transcriptions, editing, and preparing scores for performances.

MUHI 450. Topics in Music History. 3 Units.
Close study of a theme or aspect of music such as “Music and Gender,” “Symphonies of Mahler,” and “Wagner’s Ring.” Offered as MUHI 350 and MUHI 450.

MUHI 501. Special Reading (M.A. and M.M.). 1 - 18 Unit.

MUHI 590. Seminar in Musicology. 3 Units.
Problems in musical criticism, aesthetics, and analysis, as well as interdisciplinary methodologies.


MUHI 610. Bibliography and Research Methods in Music. 3 Units.
Seminar in research methods and techniques, stressing the analytic and functional approaches to bibliography.

MUHI 611. Doctor of Musical Arts Seminar. 3 Units.
Recommended preparation: MUHI 610.


Prereq: Predoctoral research consent or advanced to Ph.D. candidacy milestone.

MUHI 751. Recital Document I-D.M.A.. 1 - 3 Unit.
MUHI 752. Recital Document II- D.M.A.. 1 - 3 Unit.
MUHI 753. Recital Document III-D.M.A.. 1 - 6 Unit.

MUPM Courses

MUPM 212. History of Rock and Roll. 3 Units.
This course surveys the musical practices of the rock and roll era, broadly defined to include much popular music since the 1950s. Music majors are to enroll in MUHI 312. Prereq: For Non-Music Majors only.

MUTH Courses

MUTH 101. Harmony-Keyboard I. 2 Units.
Scales, intervals, triads, seventh chords, and their inversions. Harmonization of melodies and basses, chorale study, modulation, analysis. Creative use of material. Correlated and taken concurrently with MUTH 105 and 106. Both aspects of the course must be passed in order to complete requirements.

MUTH 102. Harmony-Keyboard II. 2 Units.
(See MUTH 101.)

MUTH 103. Theory I. 3 Units.
Music theory for the nonmusic major. Intervals, scales, rhythmic drill, sight singing, eartraining, keyboard work, and harmony through inversions of triads and seventh chords. Not open to music majors.

MUTH 104. Theory II. 3 Units.
(See MUTH 103.) Recommended preparation: MUTH 103 or consent of department.

MUTH 107. Theory for Music Majors I. 4 Units.
This course is the first of four semesters of music theory requirements for Case music majors. It will include the study of harmony, analysis, eartraining, and keyboard skills. Recommended preparation: Placement exam through department.

MUTH 108. Theory for Music Majors II. 4 Units.
This course is the second of four semesters of music theory for Case music majors. It includes further study of harmony, analysis, eartraining, sightsinging, and keyboard. Recommended preparation: MUTH 107 or placement exam through department.

MUTH 201. Harmony-Keyboard III. 2 Units.
Continuation of MUTH 101 and 102. Chromatically altered triads and 7th chords; 9th, 11th, 13th. Neapolitan and augmented 6th chords, regular and irregular solutions. Correlated and taken concurrently with MUTH 205 and 206. Both aspects of the course must be passed in order to complete requirements. Students cannot earn credit for both MUTH 201/205 and MUTH 207. Recommended preparation: MUTH 102 or placement examination.
MUTH 202. Harmony-Keyboard IV. 2 Units.
(See MUTH 201.) Recommended preparation: MUTH 102 or placement examination.

MUTH 207. Theory for Music Majors III. 4 Units.
This course is the third of four semesters of music theory for music majors. Continued study of harmony, analysis, ear-training, sight-singing, and keyboard, including use of dissonance and chromaticism, diatonic modulation. Students cannot earn credit for both MUTH 201/205 and MUTH 207. Recommended preparation: MUTH 108 or placement exam through department.

MUTH 208. Theory for Music Majors IV. 4 Units.
This course is the fourth of four semesters of music theory for CWRU music majors. Continued study of harmony, analysis, ear-training, sight-singing, and keyboard. Use of dissonance and chromaticism, chromatic voice leading technique, tonal and post-tonal topics. Recommended preparation: MUTH 207 or placement exam through department.

MUTH 311. 16th Century Counterpoint. 2 Units.
Sixteenth century modal counterpoint. Exercises in the five species. Writing of short compositions and motets in two, three and four voices. Recommended preparation: MUTH 202 or MUTH 206.

MUTH 312. Eighteenth Century Counterpoint. 3 Units.
Analysis and writing of inventions in two parts, and fugues in three and four parts. Recommended preparation: MUTH 202 or MUTH 206.

MUTH 320. Form and Analysis. 3 Units.
aural and visual analysis of structural and stylistic features of 16th through 20th century music. Prereq: MUTH 202 and MUTH 206, or MUTH 208.

MUTH 399. Undergraduate Independent Studies. 1 - 3 Unit.
Each student develops a topic of interest to be explored with a faculty member.

MUTH 400A. Review of Musical Structure. 3 Units.
Instruction of fundamentals of form, counterpoint, and four-part harmony. Designed for graduate students; credit not applicable toward degree requirements.

MUTH 400B. Sightsinging and Eartraining Review. 2 Units.
Background in fundamentals of sight singing in four clefs; melodic and harmonic dictation including chromatic harmony and modulation. Designed for graduate students; credit not applicable toward degree requirements.

MUTH 416. Pre-common Practice Theory and Analysis. 3 Units.
An exploration of treatises and analytical methods appropriate to music of the Medieval and Renaissance eras.

MUTH 422. Musical Analysis for Educators. 3 Units.
Musical Analysis for Educators is designed to strengthen the analysis skills of music educators and explore practical application of these skills. Recommended preparation: Placement exam.

MUTH 423. Analysis of Musical Styles. 3 Units.
Analysis of selected musical compositions from various periods of the common practice era. Emphasis on traditional structures, stylistic features, and the relationship of analysis and performance.

MUTH 424. Introduction to Schenkerian Analysis. 3 Units.

MUTH 495. Seminar in Music Theory. 3 Units.

MUTH 501. Special Reading (M.A. and M.M.). 1 - 18 Unit.
Department of Philosophy

The Department of Philosophy offers an undergraduate major leading to the Bachelor of Arts degree. It also offers minor programs for undergraduates as well as graduate-level courses for candidates for the Master of Arts degree in such fields as biomedical ethics, history, English, mathematics, and the sciences.

The department’s course offerings are designed not only to provide knowledge and skills required for students whose main interest is in philosophy, but also to educate students in general about the intellectual issues that a reflective person is likely to encounter in various contexts of civilized life. The department emphasizes the relevance of philosophy to mathematics, computer science, the natural sciences, the social sciences, the humanities and arts, and law.

The major program in philosophy, besides offering a solid foundation for advanced study in philosophy and enriching programs in other disciplines, develops the skills for analytical and critical thinking, effective communication, and rational decision making needed in a wide range of endeavors. The program thus provides majors with unusual flexibility in the choice of subsequent careers, including law, medicine, and management, while complementing the pursuit of career objectives with a greater perspective and a richer quality of intellectual life.

In collaboration with the Department of History, the department participates in an interdisciplinary major program in the history and philosophy of science and technology, leading to the Bachelor of Arts degree. The department also participates in, and contributes courses to, the interdisciplinary minor in artificial intelligence.

Undergraduate Programs

Major

The major consists of 30 hours (ten 3-credit courses) in philosophy, including PHIL 101, 201, 301, 302, and six other elective philosophy courses to be determined in consultation with the department’s undergraduate advisor. However, a student may request permission to take up to 6 hours (two 3-credit courses) of the required 18 hours of philosophy electives in another field or other fields. Such a request should be supported by considerations showing how the substitution(s) would strengthen the student’s major in philosophy. The advisor must approve the substitution(s) in advance.

Major Required Courses

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
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<tbody>
<tr>
<td>PHIL 101</td>
<td>Introduction to Philosophy</td>
<td>3</td>
</tr>
<tr>
<td>PHIL 201</td>
<td>Introduction to Logic</td>
<td>3</td>
</tr>
<tr>
<td>PHIL 301</td>
<td>Ancient Philosophy</td>
<td>3</td>
</tr>
<tr>
<td>PHIL 302</td>
<td>Modern Philosophy</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Six philosophy electives chosen in consultation with advisor. With permission of advisor, up to 6 hours may be taken outside the department. Only 3 units are permitted to be from a University Seminar. Please contact the department for a current list of University Seminars that may be taken for credit towards the Philosophy major.</td>
<td>18</td>
</tr>
</tbody>
</table>

Total Units 30

Departmental Honors

The department offers an honors program for students pursuing a major in philosophy. Students in this program must complete a substantial thesis, pass an oral examination on the thesis, and maintain a B average in philosophy courses. To be eligible for admission, a student should have an overall grade point average of B or better, and a grade of B or better in each philosophy course already taken. A student normally should have taken at least four, and at most seven, philosophy courses at the time of application for admission. An honors student should register for PHIL 399, Directed Study (3), to do honors work. Interested students should apply for admission to the program during the first semester of junior year.

Minor

The department offers a range of possible minor programs, each of which must include PHIL 101 and four other courses in philosophy at the 200 or 300 level (excluding PHIL 390 and 399), chosen to meet the specific needs of students majoring in other fields. The undergraduate advisor will assist students in devising minor programs.

Major Courses

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHIL 101</td>
<td>Introduction to Philosophy</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Four Philosophy electives chosen in consultation with advisor</td>
<td>12</td>
</tr>
</tbody>
</table>

Total Units 15

Philosophy Capstone

Students may fulfill their SAGES capstone requirement in philosophy by registering for PHIL 399 Directed Study after devising a suitable project in consultation with the undergraduate advisor and the supervising faculty member.

Department Faculty

Laura E. Hengehold, PhD
(Loyola University of Chicago)
Associate Professor and Chair
Political and social philosophy; philosophy of feminism; Foucault; contemporary continental philosophy

Jeremy Bendik-Keymer, PhD
(University of Chicago)
Elmer G. Beamer-Hubert H. Schneider Professor in Ethics; Associate Professor
Ethics and moral philosophy; environmental philosophy; philosophy of education; meta-philosophy; history of ethics and moral philosophy

Shannon D. French, PhD
(Brown University)
Inamori Professor of Ethics; Associate Professor
Military ethics; leadership ethics; professional ethics; moral psychology; biomedical and environmental ethics

Chris Haufe, PhD
(Columbia University)
Assistant Professor
Philosophy of science, philosophy of biology

Chin-Tai Kim, PhD
(Harvard University)
Professor
History of philosophy (17th, 18th, and 19th centuries); theory of knowledge; metaphysics; foundations of ethics; phenomenology; comparative philosophy

Colin McLarty, PhD
(Case Western Reserve University)
Truman P. Handy Professor of Philosophy
Logic; philosophy of logic; philosophy of mathematics; philosophy of science; contemporary French philosophy

Adjunct Faculty

Joel Levin, DPhil
(University of Oxford, U.K.)
involved in thinking clearly about these issues. Students will become more informed about the intricacies of scientific language; reductionism; space, time and relativity; philosophical issues about life and death; and "pseudo-science." First half of a year-long sequence. Offered as ENGL 270, HSTY 270, PHIL 270, RLGN 270, SOCI 201, and WGST 201. Prereq: ENGL 150 or passing letter grade in a 100 level first year seminar in USFS, FSCC, FSNA, FSSO, FSSY, FSTS, FSCS.

PHIL 271. Bioethics: Dilemmas. 3 Units.
We have the genetic technology to change nature and human nature, but should we? We have the medical technology to extend almost any human life, but is this always good? Should we clone humans? Should we allow doctor-assisted suicide for the terminally ill? This course invites students from all academic disciplines and fields to examine current and future issues in bioethics--e.g., theory and methods in bioethics; death and dying; organ transplantation; genetics; aging and dementia; fertility and reproduction; distributive justice in health care access. The course will include guest lecturers from nationally-known Bioethics faculty. Offered as BETH 271, PHIL 271.

PHIL 270. Introduction to Gender Studies. 3 Units.
This course introduces women and men students to the methods and concepts of gender studies, women's studies, and feminist theory. An interdisciplinary course, it covers approaches used in literary criticism, history, philosophy, political science, sociology, anthropology, psychology, film studies, cultural studies, art history, and religion. It is the required introductory course for students taking the women's and gender studies major. Offered as ENGL 270, HSTY 270, PHIL 270, RLGN 270, SOCI 201, and WGST 201. Prereq: ENGL 150 or passing letter grade in a 100 level first year seminar in USFS, FSCC, FSNA, FSSO, FSSY, FSTS, FSCS.

PHIL 225. Evolution. 3 Units.
Multidisciplinary study of the course and processes of organic evolution provides a broad understanding of the evolution of structural and functional diversity, the relationships among organisms and their environments, and the phylogenetic relationships among major groups of organisms. Topics include the genetic basis of micro- and macro-evolutionary change, the concept of adaptation, natural selection, population dynamics, theories of species formation, principles of phylogenetic inference, biogeography, evolutionary rates, evolutionary convergence, homology, Darwinian medicine, and conceptual and philosophic issues in evolutionary theory. Offered as ANTH 225, BIOL 225, EEPS 225, HSTY 225, and PHIL 225.

PHIL 221. Indian Philosophy. 3 Units.
A survey of Indian philosophical thought with emphasis on the Vedas, early Hindu, and Jain literature. Offered as PHIL 221 and RLGN 221.

PHIL 201. Introduction to Logic. 3 Units.
Presentation, application, and evaluation of formal methods for determining the validity of arguments. Discussion of the relationship between logic and other disciplines.

PHIL 203. Natural Philosophy I. 3 Units.
Historical and philosophical interpretation of some epochal events in development of science. Copernican revolution, Newtonian mechanics, Einstein's relativity physics, quantum mechanics, and evolutionary theory; patterns of scientific growth; structure of scientific "revolutions;" science and "pseudo-science." First half of a year-long sequence. Offered as HSTY 203 and PHIL 203.

PHIL 204. Natural Philosophy II. 3 Units.
Conceptual, methodological, and epistemological issues about science: concept formation, explanation, prediction, confirmation, theory construction and status of unobservables; metaphysical presuppositions and implications of science; semantics of scientific language; illustrations from special sciences. Second half of a year-long sequence. Offered as HSTY 207 and PHIL 204.

PHIL 206. Contemporary Moral Issues: Experiential. 3 Units.
What is good and how is it different from evil? How do you know when you have done the right thing? Is there an absolute grounding to morality? What is the role of reason in our lives? What is human nature? Are human beings essentially creatures of emotion? What bearing do these questions have on our basic moral determinations of good and evil? How are all these questions related to concerns about personal identity? Using sources from different eras and schools of philosophic thought, students will become more informed about the intricacies involved in thinking clearly about these issues.

Secondary Faculty
Insoo Hyun, PhD
(Brown University)
Associate Professor, Department of Bioethics
Bioethics; moral and political philosophy
Anthony Jack, PhD
(University College London)
Assistant Professor, Department of Cognitive Science
Cross-cultural study of theory of mind and moral reasoning
Deepak Sarma, PhD
(University of Chicago)
Professor, Department of Religious Studies
Hinduism; Indian philosophy; philosophy of religion; method and theory

Courses
PHIL 304. Science and Engineering Ethics. 3 Units.
This course prepares students to recognize ethical problems that commonly arise in the scientific and engineering workplace, to understand ethical concepts, to evaluate ethical arguments, and to critically examine responses to problems and their ethical ramifications. It addresses questions such as: What are the criteria of fairness in crediting contributions to research? How safe is safe enough? What are professional responsibilities, and how do they change over time? What is research misconduct? When is ignorance culpable? What is intellectual property and what protections does it deserve? When is biological testing of workers justified? What are responsible ways of raising concerns, and what supports do good organizations give for raising them? What treatment counts as harassment or as an expression of prejudice? What are good means for controlling it? What are scientists' and engineers' responsibilities for environmental protection? What is a "conflict of interest" and how is it controlled? What protections for human research subjects are warranted? What, if any, use of animals in research is justified? Recommended preparation: PHIL 101 or PHIL 102 or PHIL 205. Offered as PHIL 304 and PHIL 404.

PHIL 305. Ethics. 3 Units.
Analysis of ethical theories and concepts of goodness, right, and obligation. Discussion of nature of justice, problem of justification of moral principles, and relation between facts and values. Recommended preparation: PHIL 101, PHIL 102 or PHIL 205. Offered as PHIL 305 and PHIL 405.

PHIL 306. Mathematical Logic and Model Theory. 3 Units.
Propositional calculus and quantification theory; consistency and completeness theorems; Gödel incompleteness results and their philosophical significance; introduction to basic concepts of model theory; problems of formulation of arguments in philosophy and the sciences. Offered as PHIL 306, MATH 406 and PHIL 406.

PHIL 313. Philosophy of Mathematics. 3 Units.
Logical paradoxes and their effects on foundations of mathematics. Status of mathematical entities and nature of mathematical truths. Formalist, logicist, and intuitionist positions. Recommended preparation: PHIL 101 or PHIL 201. Offered as PHIL 313 and PHIL 413.

PHIL 314. Animal Cognition and Consciousness. 4 Units.
This course examines the notions of intelligence, cognition, reasoning, consciousness, and mental content as they appear in the philosophical views and empirical studies of animals in individual and social contexts. We will review scientific findings that suggest striking likenesses and intriguing differences in the (apparent) thought processes of humans and animals, and ask whether the research techniques that brought us these results are fully adequate to measuring such unobservable entities as conscious experience and thought. Techniques of measurement range from naturalistic observation, to the processing of vocalizations, to memory and problem solving tasks, and the imaging of brain processes through fMRI scans, etc. Students will face the challenges and rewards of practicing these techniques and reworking philosophical theories in the service component of the course. Students will participate in veterinary or shelter work to provide needed animal care while studying animal behavior using cognitive ethological methods. We will compare methods for measuring consciousness and intelligence in animals to those used for human beings, and ask questions about the possibility of machine consciousness and the emergent property of group consciousness. Offered as BIOL 314, COGS 314, PHIL 314 and PHIL 414.

PHIL 315. Selected Topics in Philosophy. 3 Units.
Examination of views of a major philosopher or philosophical school, a significant philosophical topic, or a topic that relates to philosophy and other discipline. Recommended preparation: PHIL 101. Offered as PHIL 315 and PHIL 415.

PHIL 316. African Political Thought. 3 Units.
Introduction to select themes in the work of contemporary African philosophers, with special emphasis on political thought. In this course, students will learn something about factors affecting the creation and flow of knowledge and ideas about Africa and discuss the relative importance of the "nation-state" as an idea in Europe, pre-colonial Africa, and postcolonial Africa. Offered as PHIL 316/416 and ETHS 316/416. Prereq: PHIL 101.

PHIL 317. War and Morality. 3 Units.
The aim of this course is to explore a wide range of ethical issues relating to the decision to take a nation to war, how wars are conducted, and efforts to establish order in the wake of a conflict. Topics include the Just War tradition, pacifism, humanitarian intervention, moral repair and the establishment of a just peace, conduct of war, warrior codes, warrior transitions, and civil-military relations. We will examine the ethics of war from the perspectives of both states and individuals. War is a crucible that strips those caught up in its horrors down to their fundamental selves inspiring acts of both inhuman depravity and seemingly superhuman nobility. This course is presented in a seminar format with lively discussions centering on contemporary readings in military ethics from texts and journals. Offered as PHIL 317 and PHIL 417.

PHIL 320. The Phenomenological Tradition. 3 Units.
The background of phenomenology: Descartes, Kant, and Brentano. The epistemological rationale of Husserl's phenomenology and its ontological implications; the powers and limits of the phenomenological method. Heidegger's transformation of phenomenology to interpretive ontology of human existence. The development of interpretation theory as the foundation of all human existence. The development of interpretation theory as the foundation of all human sciences in Gadamer and Ricoeur. Recommended preparation: PHIL 101, PHIL 320 and PHIL 420.

PHIL 321. Advanced Indian Philosophy. 3 Units.
We will closely examine a limited number of texts in Jain, Hindu, and/or Buddhist philosophy. Our concern will be the methods, presuppositions, arguments, and goals of these schools and trajectories of thought. What were their theories on the nature of the person, the nature of reality, and the nature and process of knowing? What were the debates between the schools and the major points of controversy? We will spend the majority of time analyzing the arguments or positions as they are found in primary texts (in translation). We will rely on the primary sources found in Sarma Introduction to Classical Indian Philosophy as well as PDFs provided by the instructor. Students will read texts out loud in class and will be expected to comment on the passage or passages. Students are expected to use outside sources in their preparations. The goal of the class is to continue to learn how to make and write arguments against (or in support of) the various positions using the prasangika (reductio ad absurdum) method. The papers are rigorous ones and require the student to present the position and then to posit arguments against it, finding internal incoherences. This is a writing-intensive class. Students will continue to learn how to write as per the genre of Indian philosophy. Offered as RLGN 321 and PHIL 321. Prereq: RLGN 221 or PHIL 221.
PHIL 325. Philosophy of Feminism. 3 Units.
Dimensions of gender difference. Definition of feminism. Critical examination of feminist critiques of culture, including especially politics, ideology, epistemology, ethics, and psychology. Readings from traditional and contemporary sources. Offered as PHIL 325 and PHIL 425 and WGST 325. Prereq: PHIL 101.

PHIL 330. Topics in Ethics. 3 Units.
Examination of views in ethics of a major philosopher or philosophical school, a significant philosophical topic in ethics, or a topic that relates ethics to philosophy and another discipline. Recommended preparation: PHIL 101, PHIL 102, or PHIL 205. Offered as PHIL 330 and PHIL 430.

PHIL 332. Classical Jewish Religious Thought. 3 Units.
The thought of some major biblical and Rabbinic writings and of the classic age of medieval Jewish philosophy. Offered as JDST 330, PHIL 332, and RLGN 330.

PHIL 333. Philosophy of Religion. 3 Units.
Topics include: classical and contemporary arguments for God’s existence; divine foreknowledge and human freedom; the problem of evil and theodicy; nature and significance of religious experience; mysticism; varieties of religious metaphysics; knowledge, belief and faith; nature of religious discourse. Readings from traditional and contemporary sources. Recommended preparation for PHIL 433 and RLGN 433: PHIL 101 or RLGN 102. Offered as PHIL 333, RLGN 333, PHIL 433, and RLGN 433.

PHIL 334. Political and Social Philosophy. 3 Units.
Justification of social institutions, primarily political ones. Such distinctions as that between de facto and legitimate authority; analysis of criteria for evaluation, such as social justice and equality; inquiry into theories of justification of the state; theory of democratic government and its alternatives. Readings from classical and contemporary sources. Recommended preparation: PHIL 101. Offered as PHIL 334, POSC 354, PHIL 434, and POSC 454.

PHIL 335. Philosophy of Law. 3 Units.
This is an examination of the general nature of law, the broad concerns of jurisprudence, the study of comparative law, and many of the issues raised in the literature of legal philosophy. Students will examine the principles of legal positivism, mitigated natural law, and rights theory. Selected readings and cases will illustrate these theories, which will also be examined in the context of rule selection by new governments in developing or revolutionary societies. The course also looks at the general nature of legal systems: how politics, morality, and individual views of justice and rights affect particular court cases and the course and development of law generally. Topics will include abortion, obscenity and sin, civil disobedience, affirmative action, surrogatehood, and the death penalty. This is unlike any other of the legal theory or jurisprudence courses, and those who have sampled legal theory elsewhere in a different form are welcome and encouraged to enroll. Recommended preparation: PHIL 101. Offered as LAWS 353, PHIL 335, and PHIL 435.

PHIL 345. Epistemology and Metaphysics. 3 Units.
Traditional problems of epistemology, such as definition of knowledge, justification of belief, nature of evidence and foundationalism, skepticism, the a priori, and the role of sense perception in knowledge. Metaphysical presuppositions and implications of epistemological views. Forms of realism and anti-realism. Recommended preparation: PHIL 101. Offered as PHIL 345 and PHIL 445.

PHIL 355. 19th and Early 20th Century Philosophy. 3 Units.
History of philosophy after Kant up to and including logical empiricism. Interpretation and comparison of important philosophers and philosophical schools of the period in terms of common methods, problems, themes, doctrines, and ideologies. Emphasis on Schopenhauer, Hegel, Kierkegaard, Marx, and Nietzsche. Recommended preparation: PHIL 101. Offered as PHIL 355 and PHIL 455.

PHIL 356. Comparative Philosophy. 3 Units.
Philosophy in the etymological sense of the term, love of wisdom, subsumes ontological, ethical and epistemological inquires addressing fundamental questions about reality, the place of humans in that reality, the values of things and human obligations, and the sources of knowledge. The major purpose of this course is to discover, understand, explicate and articulate the affinities and differences in the way the fundamental questions are addressed in different cultural contexts, thereby to appreciate the cross-cultural kinship among human minds as well as to be challenged by the differences that may engender conflicts. We will explore the possibility of building a trans-cultural meta-cultural meta-discourse in which thinkers from many traditions can participate on equal footing. We will come to face up to the question whether truly universal philosophy is possible, upon what conditions. Representative texts from the Western, Chinese and Buddhist traditions including selected works of Plato, Aristotle, Augustine, Descartes, Kant, Nietzsche, Heidegger, Lao Tzu, Confucius, Chuang Tzu, Dhammapada of the Buddha and D. Suzuki’s Zen Buddhism will be read. Offered as PHIL 356 and PHIL 456. Prereq: PHIL 101 or requisites not met permission.

PHIL 363. Philosophy and Social Neuroscience. 3 Units.
A philosophical examination of recent research in human cognition and emotion at the intersection of the social sciences and neurological sciences. The course provides the student with background knowledge of brain processes underlying such social and cultural phenomena as bonding, aggression, imitation, mind-attribution, language, sexual behavior, moral action, and creativity. The approach of this course is at once scientific (comparing methods, findings and questions as they arise in clinical and experimental neuropsychology, brain imaging, neurolinguistics, and behavioral neuroscience) and humanistic, asking critical questions about the nature and methods of a science of cognition, and surveying moral responses from a neurologic and philosophic perspective. Recommended preparation: PHIL 101 or COGS 201. Offered as COGS 363 and PHIL 363.

PHIL 367. Topics in Evolutionary Biology. 3 Units.
The focus for this course on a special topic of interest in evolutionary biology will vary from one offering to the next. Examples of possible topics include theories of speciation, the evolution of language, the evolution of sex, evolution and biodiversity, molecular evolution. ANAT/ANTH/EEPS/PHIL/PHOL/467/BIOL 468 will require a longer, more sophisticated term paper, and additional class presentation. Offered as ANTH 367, BIOL 368, EEPS 367, PHIL 367, ANAT 467, ANTH 467, BIOL 468, EEPS 467, PHIL 467 and PHOL 467.
PHIL 368. Evolutionary Biology Capstone. 3 Units.
This course focuses on a special topic of interest in evolutionary biology that will vary from one offering to the next. Examples of possible topics include theories of speciation, the evolution of language, the evolution of sex, evolution and biodiversity, molecular evolution. Students will participate in discussions and lead class seminars on evolutionary topics and in collaboration with an advisor or advisors, select a topic for a research paper or project. Each student will write a major research report or complete a major project and will make a public presentation of her/his findings. Offered as ANTH 368, BIOL 369, PHIL 368.

PHIL 373. Intelligence and Cognition. 3 Units.
This course will focus on the notion and meaning of intelligence. What is intelligence? How is it measured, and are these measures adequate to the task? Is there more than one kind of intelligence? What is the relationship between individuals, genetic factors, biological factors, and socio-cultural-economic factors in the development of intelligence? How are language and thought related to intelligence? What is the difference between intelligence and talent? Intelligence seems to be necessary for culture, art, religious belief, the creation of theories and the quest for knowledge, truth and morality; thus intelligence is a necessary condition for the study of itself. To attempt to understand intelligence is an undertaking in which we will ask questions about the self and the common nature of humanity, while simultaneously examining the abilities of animals and machines. What is the mark of intelligence? Recommended preparation: PHIL 101 or COGS 201. Offered as COGS 373 and PHIL 373.

PHIL 375. Issues in Aesthetics. 3 Units.
This course will seek to offer insight into the nature of artistic expression, the role of criticism in the arts, and the place of the arts in society. The term “arts” will be construed broadly to include painting, photography, theater, film, music, dance, poetry, etc. The following are examples of questions we will discuss. What does the term “beautiful” mean? Are there other measures of aesthetic value besides beauty? Do the arts, like the sciences, offer us knowledge of the world? What value do the arts have for society? Can aesthetic value conflict with moral value? Do artists have a responsibility to society? Should art ever be censored? What is the relationship between art and entertainment? Is the meaning and value of an artistic work a matter of individual opinion? What is the purpose of art criticism? How are interpretations and evaluations of art influenced by race, gender, class, etc.? What is creativity in the arts? Does it differ from creativity in the sciences? How important is originality in art? Offered as PHIL 375 and PHIL 475. Prereq: PHIL 101 or requisite not met permission.

PHIL 381. Philosophy and Cognitive Neuroscience. 3 Units.
This course will focus on the various methodologies used in the cognitive neurosciences, and explore their strengths and weaknesses from scientific and philosophical standpoints. We will begin by examining baseline measures (including IQ tests, tasks of cognitive flexibility, verbal and visual memory, causal/sequential thinking and narrative tasks) and their experimental design. Lesion methods will follow, with an eye toward understanding the strength of inferences that can be drawn from such data. The course will also focus on imaging techniques (CAT, PET, SPECT, IMRI, TMS, etc.) as well as measures of electrical activity such as EEG and single-cell recordings. Students will become familiar with many fundamental assumptions necessary for the implementation of each method, and philosophical questions associated with these endeavors and their potential impact on our knowledge and society. Recommended preparation: PHIL 101 or COGS 201. Offered as COGS 381 and PHIL 381.

PHIL 383L. Vocalization and Cognition Lab. 1 Unit.
This is a laboratory section intended to provide hands-on training and experience with sound processing and analysis of animal vocalizations in the context of cognitive science, philosophy, and biology. Students will ask and answer questions surrounding language, meaning, mind, mental states, animal and human cognition. How does a science of content and language actually proceed? How do we measure behavior for use as an indicator of cognition? What pragmatic constraints are found when we explore the natural world? What causes us to interpret certain symbols as systematic? The laboratory work begins with an understanding of different software for sound analysis with an emphasis on the bioacoustic experimental method. Frog vocalization exercises will familiarize students with the process of data categorization, analysis and comparison, and will be the foundation for understanding hypothesis testing within a Darwinian theoretical backdrop. Cetacean vocalization analysis will press students to move beyond comparison and analysis to consider and evaluate the standard evidence types used in cognitive science to measure the mind. Recommended preparation: PHIL 101 or COGS 201. Offered as COGS 383L and PHIL 383L.

PHIL 390. Senior Research Seminars in History and Philosophy of Science. 3 Units.
Directed independent research seminar for seniors who are majors in the History and Philosophy of Science program. The goal of the course is to develop and demonstrate command of B.A.-level factual content, methodologies, research strategies, historiography, and theory relevant to the field of history of science and/or philosophy of science. The course includes both written and oral components. Offered as HSTY 380 and PHIL 390.

PHIL 394. Seminar in Evolutionary Biology. 3 Units.
This seminar investigates 20th-century evolutionary theory, especially the Modern Evolutionary synthesis and subsequent expansions of and challenges to that synthesis. The course encompasses the multidisciplinary nature of the science of evolution, demonstrating how disciplinary background influences practitioners' conceptualizations of pattern and process. This course emphasizes practical writing and research skills, including formulation of testable theses, grant proposal techniques, and the implementation of original research using the facilities on campus and at the Cleveland Museum of Natural History. Offered as ANTH 394, BIOL 394, EEPS 394, HSTY 394, PHIL 394, ANTH 494, BIOL 494, EEPS 494, HSTY 494, and PHIL 494.
PHIL 396. Undergraduate Research in Evolutionary Biology. 3 Units.
Students propose and conduct guided research on an aspect of evolutionary biology. The research will be sponsored and supervised by a member of the CASE faculty or other qualified professional. A written report must be submitted to the Evolutionary Biology Steering Committee before credit is granted. Offered as ANTH 396, BIOL 396, EEPS 396, and PHIL 396.

PHIL 399. Directed Study. 3 Units.
Under faculty supervision, students will undertake a project that demonstrates critical thinking, has clear goals, features periodic reporting of progress, and will result in a final report and public presentation.

PHIL 403. Topics in Philosophy of Science. 3 Units.
In-depth study of selected topics in general philosophy of science or philosophy of physical, biological, or social science. Topics may include: theories of explanation, prediction, and confirmation; semantics of scientific language; reductionism; space, time and relativity; philosophical issues about quantum mechanics; philosophical issues about life sciences (e.g., evolution, teleology, and functional explanation); explanation and understanding in social sciences; value in social science. Recommended preparation: PHIL 101 or PHIL 201 or PHIL 203. Offered as PHIL 303 and PHIL 403.

PHIL 404. Science and Engineering Ethics. 3 Units.
This course prepares students to recognize ethical problems that commonly arise in the scientific and engineering workplace, to understand ethical concepts, to evaluate ethical arguments, and to critically examine responses to problems and their ethical ramifications. It addresses questions such as: What are the criteria of fairness in crediting contributions to research? How safe is safe enough? What are professional responsibilities, and how do they change over time? What is research misconduct? When is ignorance culpable? What is intellectual property and what protections does it deserve? When is biological testing of workers justified? What are responsible ways of raising concerns, and what supports do good organizations give for raising them? What treatment counts as harassment or as an expression of prejudice? What are good means for controlling it? What are scientists’ and engineers’ responsibilities for environmental protection? What is a “conflict of interest” and how is it controlled? What protections for human research subjects are warranted? What, if any, use of animals in research is justified? Recommended preparation: PHIL 101 or PHIL 102 or PHIL 205. Offered as PHIL 304 and PHIL 404.

PHIL 405. Ethics. 3 Units.
Analysis of ethical theories and concepts of goodness, right, and obligation. Discussion of nature of justice, problem of justification of moral principles, and relation between facts and values. Recommended preparation: PHIL 101, PHIL 102 or PHIL 205. Offered as PHIL 305 and PHIL 405.

PHIL 406. Mathematical Logic and Model Theory. 3 Units.
Propositional calculus and quantification theory; consistency and completeness theorems; Gödel incompleteness results and their philosophical significance; introduction to basic concepts of model theory; problems of formulation of arguments in philosophy and the sciences. Offered as PHIL 306, MATH 406 and PHIL 406.

PHIL 413. Philosophy of Mathematics. 3 Units.
Logical paradoxes and their effects on foundations of mathematics. Status of mathematical entities and nature of mathematical truths. Formalist, logicist, and intuitionist positions. Recommended preparation: PHIL 101 or PHIL 201. Offered as PHIL 313 and PHIL 413.

PHIL 414. Animal Cognition and Consciousness. 4 Units.
This course examines the notions of intelligence, cognition, reasoning, consciousness, and mental content as they appear in the philosophical views and empirical studies of animals in individual and social contexts. We will review scientific findings that suggest striking likenesses and intriguing differences in the (apparent) thought processes of humans and animals, and ask whether the research techniques that brought us these results are fully adequate to measuring such unobservable entities as conscious experience and thought. Techniques of measurement range from naturalistic observation, to the processing of vocalizations, to memory and problem solving tasks, and the imaging of brain processes through fMRI scans, etc. Students will face the challenges and rewards of practicing these techniques and reworking philosophical theories in the service component of the course. Students will participate in veterinary or shelter work to provide needed animal care while studying animal behavior using cognitive ethological methods. We will compare methods for measuring consciousness and intelligence in animals to those used for human beings, and ask questions about the possibility of machine consciousness and the emergent property of group consciousness. Offered as BIOL 314, COGS 314, PHIL 314 and PHIL 414.

PHIL 415. Selected Topics in Philosophy. 3 Units.
Examination of views of a major philosopher or philosophical school, a significant philosophical topic, or a topic that relates to philosophy and other discipline. Recommended preparation: PHIL 101. Offered as PHIL 315 and PHIL 415.

PHIL 416. African Political Thought. 3 Units.
Introduction to select themes in the work of contemporary African philosophers, with special emphasis on political thought. In this course, students will learn something about factors affecting the creation and flow of knowledge and ideas about Africa and discuss the relative importance of the “nation-state” as an idea in Europe, pre-colonial Africa, and postcolonial Africa. Offered as PHIL 316/416 and ETHS 316/416.

PHIL 417. War and Morality. 3 Units.
The aim of this course is to explore a wide range of ethical issues relating to the decision to take a nation to war, how wars are conducted, and efforts to establish order in the wake of a conflict. Topics include the Just War tradition, pacifism, humanitarian intervention, moral repair and the establishment of a just peace, conduct of war, warrior codes, warrior transitions, and civil-military relations. We will be examining the ethics of war from the perspectives of both states and individuals. War is a crucible that strips those caught up in its horrors down to their fundamental selves inspiring acts of both inhuman depravity and seemingly superhuman nobility. This course is presented in a seminar format with lively discussions centering on contemporary readings in military ethics from texts and journals. Offered as PHIL 317 and PHIL 417.
PHIL 420. The Phenomenological Tradition. 3 Units.
The background of phenomenology: Descartes, Kant, and Brentano. The epistemological rationale of Husserl’s phenomenology and its ontological implications; the powers and limits of the phenomenological method. Heidegger’s transformation of phenomenology to interpretive ontology of human existence. The development of interpretation theory as the foundation of all human existence. The development of interpretation theory as the foundation of all human sciences in Gadamer and Ricoeur. Recommended preparation: PHIL 101. Offered as PHIL 320 and PHIL 420.

PHIL 425. Philosophy of Feminism. 3 Units.
Dimensions of gender difference. Definition of feminism. Critical examination of feminist critiques of culture, including especially politics, ideology, epistemology, ethics, and psychology. Readings from traditional and contemporary sources. Offered as PHIL 325 and PHIL 425 and WGST 325.

PHIL 430. Topics in Ethics. 3 Units.
Examination of views in ethics of a major philosopher or philosophical school, a significant philosophical topic in ethics, or a topic that relates ethics to philosophy and another discipline. Recommended preparation: PHIL 101, PHIL 102, or PHIL 205. Offered as PHIL 330 and PHIL 430.

PHIL 433. Philosophy of Religion. 3 Units.
Topics include: classical and contemporary arguments for God’s existence; divine foreknowledge and human freedom; the problem of evil and theodicy; nature and significance of religious experience; mysticism; varieties of religious metaphysics; knowledge, belief and faith; nature of religious discourse. Readings from traditional and contemporary sources. Recommended preparation for PHIL 433 and RLGN 433: PHIL 101 or RLGN 102. Offered as PHIL 333, RLGN 333, PHIL 433, and RLGN 433.

PHIL 434. Political and Social Philosophy. 3 Units.
Justification of social institutions, primarily political ones. Such distinctions as that between de facto and legitimate authority; analysis of criteria for evaluation, such as social justice and equality; inquiry into theories of justification of the state; theory of democratic government and its alternatives. Readings from classical and contemporary sources. Recommended preparation: PHIL 101. Offered as PHIL 334, POSC 354, PHIL 434, and POSC 454.

PHIL 435. Philosophy of Law. 3 Units.
This is an examination of the general nature of law, the broad concerns of jurisprudence, the study of comparative law, and many of the issues raised in the literature of legal philosophy. Students will examine the principles of legal positivism, mitigated natural law, and rights theory. Selected readings and cases will illustrate these theories, which will also be examined in the context of rule selection by new governments in developing or revolutionary societies. The course also looks at the general nature of legal systems: how politics, morality, and individual views of justice and rights affect particular court cases and the course and development of law generally. Topics will include abortion, obscenity and sin, civil disobedience, affirmative action, surrogatehood, and the death penalty. This is unlike any other of the legal theory or jurisprudence courses, and those who have sampled legal theory elsewhere in a different form are welcome and encouraged to enroll. Recommended preparation: PHIL 101. Offered as LAWS 353, PHIL 335, and PHIL 435.

PHIL 445. Epistemology and Metaphysics. 3 Units.
Traditional problems of epistemology, such as definition of knowledge, justification of belief, nature of evidence and foundationalism, skepticism, the a priori, and the role of sense perception in knowledge. Metaphysical presuppositions and implications of epistemological views. Forms of realism and anti-realism. Recommended preparation: PHIL 101. Offered as PHIL 345 and PHIL 445.

PHIL 455. 19th and Early 20th Century Philosophy. 3 Units.
History of philosophy after Kant up to and including logical empiricism. Interpretation and comparison of important philosophers and philosophical schools of the period in terms of common methods, problems, themes, doctrines, and ideologies. Emphasis on Schopenhauer, Hegel, Kierkegaard, Marx, and Nietzsche. Recommended preparation: PHIL 101. Offered as PHIL 355 and PHIL 455.

PHIL 456. Comparative Philosophy. 3 Units.
Philosophy in the etymological sense of the term, love of wisdom, subsumes ontological, ethical and epistemological inquires addressing fundamental questions about reality, the place of humans in that reality, the values of things and human obligations, and the sources of knowledge. The major purpose of this course is to discover, understand, explicate and articulate the affinities and differences in the way the fundamental questions are addressed in different cultural contexts, thereby to appreciate the cross-cultural kinship among human minds as well as to be challenged by the differences that may engender conflicts. We will explore the possibility of building a trans-cultural meta-cultural meta-discourse in which thinkers from many traditions can participate on equal footing. We will come to face up to the question whether truly universal philosophy is possible, upon what conditions. Representative texts from the Western, Chinese and Buddhist traditions including selected works of Plato, Aristotle, Augustine, Descartes, Kant, Nietzsche, Heidegger, Lao Tzu, Confucius, Chuang Tzu, Dhammapada of the Buddha and D. Suzuki’s Zen Buddhism will be read. Offered as PHIL 356 and PHIL 456.

PHIL 467. Topics in Evolutionary Biology. 3 Units.
The focus for this course on a special topic of interest in evolutionary biology will vary from one offering to the next. Examples of possible topics include theories of speciation, the evolution of language, the evolution of sex, evolution and biodiversity, molecular evolution. ANAT/ANTH/EEPS/PHIL/PHOL 467/BIOL 468 will require a longer, more sophisticated term paper, and additional class presentation. Offered as ANTH 367, BIOL 368, EEPS 367, PHIL 367, ANAT 467, ANTH 467, BIOL 468, EEPS 467, PHIL 467 and PHOL 467.

PHIL 475. Issues in Aesthetics. 3 Units.
This course will seek to offer insight into the nature of artistic expression, the role of criticism in the arts, and the place of the arts in society. The term “arts” will be construed broadly to include painting, photography, theater, film, music, dance, poetry, etc. The following are examples of questions we will discuss. What does the term “beautiful” mean? Are there other measures of aesthetic value besides beauty? Do the arts, like the sciences, offer us knowledge of the world? What value do the arts have for society? Can aesthetic value conflict with moral value? Do artists have a responsibility to society? Should art ever be censored? What is the relationship between art and entertainment? Is the meaning and value of an artistic work a matter of individual opinion? What is the purpose of art critics? How are interpretations and evaluations of art influenced by race, gender, class, etc.? What is creativity in the arts? Does it differ from creativity in the sciences? How important is originality in art? Offered as PHIL 375 and PHIL 475.
PHIL 494. Seminar in Evolutionary Biology. 3 Units.
This seminar investigates 20th-century evolutionary theory, especially the Modern Evolutionary synthesis and subsequent expansions of and challenges to that synthesis. The course encompasses the multidisciplinary nature of the science of evolution, demonstrating how disciplinary background influences practitioners' conceptualizations of pattern and process. This course emphasizes practical writing and research skills, including formulation of testable theses, grant proposal techniques, and the implementation of original research using the facilities on campus and at the Cleveland Museum of Natural History. Offered as ANTH 394, BIOL 394, EEPS 394, HSTY 394, PHIL 394, ANTH 494, BIOL 494, EEPS 494, HSTY 494, and PHIL 494.

PHIL 699. Advanced Tutorial and Dissertation for Candidates in fields related to Philosophy. 1 - 3 Unit.
This course enables students in departments offering the Ph.D. to pursue intensive directed study with a faculty member in Philosophy, on philosophical aspects of their dissertation topic. Students should consult with the instructor and with their dissertation director before enrolling.
Department of Physics

The Department of Physics offers programs leading to the following undergraduate degrees: Bachelor of Arts, Bachelor of Science in physics, Bachelor of Science in mathematics and physics, and Bachelor of Science in engineering with an engineering physics major. Associated with the Bachelor of Science in physics degree are optional concentrations in mathematical physics and in biophysics. The department also offers the graduate degrees Master of Science and Doctor of Philosophy, as well as a unique master’s degree in entrepreneurship.

All of these programs involve the study of the basic laws of nature and the properties of energy and matter in their various forms. The curriculum reflects the varied interests of the faculty and will prepare students for a wide range of future activities. At the undergraduate level, open electives and engineering physics concentration area courses tailor the programs to the student’s interests and career plans. Employment opportunities at the bachelor’s level include research, development, and technical assistance (engineering, computer programming, management) in industrial, government, and university settings.

A similar flexibility exists in the first few years of graduate study. The research leading to the PhD degree normally centers on a specific area of physics. However, even at this stage, the broad background and training characteristic of a physics degree are emphasized.

BA in Physics | BS in Physics | BSE in Engineering Physics | BS Math and Physics | Minor

Undergraduate Programs

Majors

Course requirements and typical schedules for the majors are summarized in the Plan of Study Grids.

Bachelor of Arts in Physics

The BA physics major includes a large number of elective courses, making it easy for the student to pursue other interests or complete a second major while earning a degree in physics.

Teacher Licensure Option

A teacher certification program (grades 7-12), based on the BA degree, is available for students interested in a career teaching physics at the secondary level. In addition to content (subject area) requirements, a 36 semester-hour sequence in professional education is required, comprising courses taken at Case Western Reserve University and at John Carroll University, and culminating in student teaching. (For details on education course work, see the program description for Teacher Licensure (p. 437) elsewhere in this bulletin.)

Bachelor of Science in Physics

The BS degree has two alternatives to the standard program: a mathematical physics concentration and a biophysics concentration.

BSE Degree in Engineering Physics

The BSE degree in engineering physics supplies an excellent background for graduate studies in physics, but is also designed for students who value an engineering credential and who are considering a career in engineering, either through employment following the BSE or through engineering graduate studies. This degree is awarded by the Case School of Engineering and includes the Engineering Core Curriculum. The technical electives in this program are concentrated in any of sixteen specific engineering areas.

BS in Mathematics and Physics

The BS in mathematics and physics is a single degree for students interested in advanced mathematics and theoretical physics and their relationships. This degree is distinct from the mathematical physics concentration in the BS in physics degree. The program is jointly administered by the Departments of Physics and Mathematics, and students may be advised by faculty members from either department.

All BS, BA, and BSE candidates complete a year-long senior project in which they work one-on-one with a faculty researcher, write a senior thesis, and present their work in public.

Minor

Course requirements for the minor in physics are as follows:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYS 121</td>
<td>General Physics I - Mechanics</td>
<td>4</td>
</tr>
<tr>
<td>or PHYS 116</td>
<td>Introductory Physics II</td>
<td>3</td>
</tr>
<tr>
<td>or PHYS 123</td>
<td>Physics and Frontiers I - Mechanics</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 122</td>
<td>General Physics II - Electricity and Magnetism</td>
<td>6</td>
</tr>
<tr>
<td>or PHYS 116</td>
<td>Introductory Physics II</td>
<td>4</td>
</tr>
<tr>
<td>or PHYS 124</td>
<td>Physics and Frontiers II - Electricity and Magnetism</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 221</td>
<td>Introduction to Modern Physics</td>
<td>3</td>
</tr>
<tr>
<td>Two of the following courses:</td>
<td></td>
<td>17</td>
</tr>
<tr>
<td>PHYS 301</td>
<td>Advanced Laboratory Physics I</td>
<td>4</td>
</tr>
<tr>
<td>or PHYS 310</td>
<td>Classical Mechanics</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 313</td>
<td>Thermodynamics and Statistical Mechanics</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 315</td>
<td>Introduction to Solid State Physics</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 316</td>
<td>Introduction to Nuclear and Particle Physics</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 324</td>
<td>Electricity and Magnetism I</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 326</td>
<td>Physical Optics</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 327</td>
<td>Quantum Electronics</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 328</td>
<td>Cosmology and the Structure of the Universe</td>
<td>4</td>
</tr>
<tr>
<td>or PHYS 336</td>
<td>Modern Cosmology</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 331</td>
<td>Introduction to Quantum Mechanics I</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 332</td>
<td>Introduction to Quantum Mechanics II</td>
<td>4</td>
</tr>
</tbody>
</table>

The Case School of Engineering has a policy stating that “no more than two courses taken for the minor may be used simultaneously to satisfy the requirements of the student’s major field, including departmental requirements, technical electives and the Engineering Core.” Thus, engineering students may have to choose between using physics courses as technical electives or counting them as part of a minor in physics.

Graduate Programs

The Department of Physics offers programs of study and research leading to both the Master of Science and the Doctor of Philosophy degrees. Graduate assistantships are available for the full-time support of qualified students. All MS programs in physics, with or without a thesis, normally can be completed in less than two years. The requirements for the PhD degree in physics include a flexible program of courses that typically is completed within three years, and a concurrent program of directed research with less course work and more research in each succeeding year.
Master of Science in Entrepreneurship

In addition to a traditional physics program, the department has created a Physics Entrepreneurship master’s degree program, which is part of the university’s larger Science and Technology Entrepreneurship Program. This two-year program is designed to empower physicists as entrepreneurs. It enables students and graduates to build on their physics skills to start new high-tech businesses or to launch new product lines in existing companies. The program provides top-level academic instruction and real-world entrepreneurial experience while connecting students with the business executives and leaders, experts, and venture capitalists who are crucial to success in start-up and growing ventures.

Doctor of Philosophy

For the PhD degree, the student is required to pass a general qualifying examination in physics, which is normally taken after the first year of study, and a topical oral examination within one year of joining a research group. The student must then prepare a dissertation based on the results of independent research. There is no foreign language requirement. Research pursuant to any of the graduate degree programs in physics may be carried out in five areas:

Condensed Matter Physics. An extensive experimental and theoretical program in the electronic properties of solids; quantum liquids; mesoscopic physics; localization and quantum Hall effect; the physics of polymers, liquid crystals, and complex fluids; thin films; fluids dynamics; materials synthesis; the physics of surfaces and interfaces; electronic structure of materials and their defects; vibrational properties of solids (phonons); magnetism and magnetic materials; nano- and organic electronics.

Particle/Astrophysics and Cosmology. The experimental efforts in this area include the study of the nature of dark matter in the universe, observations of high-energy gamma rays and cosmic rays, and measurements of the cosmic microwave background. Theoretical studies include the cosmic microwave background, gravitational lensing, dark matter, dark energy, structure formation, neutrino astrophysics, topological defects, phase transitions, inflation, non-gaussianities, gravitational waves, black holes, extra dimensions, modified gravity, and tests of General Relativity.

The Center for Education and Research in Cosmology and Astrophysics (CERCA) comprises groups from the Departments of Physics and Astronomy and the Cleveland Museum of Natural History. The center organizes international conferences, hosts visitors and lectures, and supports students and faculty in their research. As it grows, it will provide postdoctoral research positions and will also prepare public programs on cosmology and astrophysics.

Elementary Particle Physics. Theoretical studies in the strong, weak, and electromagnetic interactions of the elementary particles, and in all areas of particle theory, gravitation, and cosmology.

Optics and Optical Materials. Both experimental and theoretical programs in nonlinear optics, integrated optics, ultrafast optics, and the optical properties of fluids, liquid crystals, polymers, and crystals, including semiconductors, semiconductor mesoscopic systems, photonic crystals, and nanoscopic systems.

Imaging Physics, Biophysics, and Inverse Problems. An experimental and theoretical program in aspects of non-invasive imaging, including magnetic resonance imaging and ultrasound; medical diagnostic techniques to measure iron in the liver; and industrial and medical applications in electromagnetic field modeling.

Requirements Tables for Physics Programs

Bachelor of Arts in Physics

The Bachelor of Arts degree with a physics major requires completion of the Arts and Sciences General Education Requirements (GER) and 120 total credits, of which 59 are specified by the physics department as shown below. Courses specified for this major satisfy the 6-credit Arts and Sciences GER in Sciences and Mathematics.

<table>
<thead>
<tr>
<th>Course ID</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYS 115</td>
<td>Introductory Physics I</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 121</td>
<td>General Physics I - Mechanics</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 123</td>
<td>Physics and Frontiers I - Mechanics</td>
<td>3</td>
</tr>
</tbody>
</table>

All of the following:

<table>
<thead>
<tr>
<th>Course ID</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYS 116</td>
<td>Introductory Physics II</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 122</td>
<td>General Physics II - Electricity and Magnetism</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 124</td>
<td>Physics and Frontiers II - Electricity and Magnetism</td>
<td>3</td>
</tr>
</tbody>
</table>

Two of the following:

<table>
<thead>
<tr>
<th>Course ID</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYS 310</td>
<td>Classical Mechanics</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 324</td>
<td>Electricity and Magnetism I</td>
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</tr>
<tr>
<td>PHYS 315</td>
<td>Introduction to Solid State Physics</td>
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<td>PHYS 316</td>
<td>Introduction to Nuclear and Particle Physics</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 326</td>
<td>Physical Optics</td>
<td>3</td>
</tr>
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<td>PHYS 327</td>
<td>Quantum Electronics</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 328</td>
<td>Cosmology and the Structure of the Universe</td>
<td>2</td>
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<tr>
<td>PHYS 336</td>
<td>Modern Cosmology</td>
<td>2</td>
</tr>
<tr>
<td>PHYS 365</td>
<td>General Relativity</td>
<td>1</td>
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</tbody>
</table>

Total Units: 120
PHYS 303 Advanced Laboratory Physics Seminar + PHYS 352 Senior Physics Project Seminar satisfy the SAGES departmental seminar requirement. PHYS 351 Senior Physics Project is an approved SAGES capstone course.

Students may choose only one of these two courses to satisfy the requirements of the BA degree.

A two-course science sequence chosen from CHEM 105 Principles of Chemistry I and CHEM 106 Principles of Chemistry II; CHEM 111 Principles of Chemistry for Engineers and ENGR 145 Chemistry of Materials; BIOL 214 Genes, Evolution and Ecology and BIOL 215 Cells and Proteins; or another two-course sequence totaling 6 or more credits in a quantitative science (other than physics), with written approval of the physics undergraduate curriculum committee.

Or other approved computational course.

The breadth requirements include 6 hours of Social Sciences and 6 hours of Arts and Humanities. This may increase by 3 credits if the required Global and Cultural Diversity course is not also one of the breadth requirement courses. Courses required for the BA in Physics satisfy the 6-credit GER for Natural Sciences and Mathematics as well as the Quantitative Reasoning course requirement.

The BA degree requires a minimum of 30 semester hours at the 300-400 level, of which only 22 are specified as PHYS courses.

**Typical Schedule**

**First Year**

<table>
<thead>
<tr>
<th>Units</th>
<th>Fall</th>
<th>Spring</th>
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</thead>
<tbody>
<tr>
<td>4</td>
<td>Introductory Physics I (PHYS 115)</td>
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<tr>
<td>3</td>
<td>or General Physics I - Mechanics (PHYS 121)</td>
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<td>3</td>
<td>or Physics and Frontiers I - Mechanics (PHYS 123)</td>
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<tr>
<td>4</td>
<td>Calculus for Science and Engineering I (MATH 121)</td>
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<tr>
<td>3</td>
<td>Intro Science Elective I</td>
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<tr>
<td>4</td>
<td>SAGES First Seminar</td>
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<td>Physics Today and Tomorrow (PHYS 166)</td>
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<tr>
<td>0</td>
<td>PHED Physical Education Activities</td>
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<td>4</td>
<td>Introductory Physics II (PHYS 116)</td>
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<td>3</td>
<td>or General Physics II - Electricity and Magnetism (PHYS 122)</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>or Physics and Frontiers II - Electricity and Magnetism (PHYS 124)</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Calculus for Science and Engineering II (MATH 122)</td>
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<td>Intro Science Elective II</td>
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<td>3</td>
<td>University Seminar</td>
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<tr>
<td>3</td>
<td>Elementary Computer Programming (ENGR 131)</td>
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<tr>
<td>0</td>
<td>PHED Physical Education Activities</td>
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<td>16</td>
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**Second Year**

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<thead>
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<th>Units</th>
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<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Introduction to Modern Physics (PHYS 221)</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Calculus for Science and Engineering III (MATH 223)</td>
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<tr>
<td>3</td>
<td>University Seminar</td>
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<tr>
<td>3</td>
<td>Humanities/Social Science Elective</td>
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<tr>
<td>3</td>
<td>Open Elective</td>
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</tr>
<tr>
<td>3</td>
<td>Computational Methods in Physics (PHYS 250)</td>
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<tr>
<td>3</td>
<td>Physics Elective</td>
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<tr>
<td>3</td>
<td>Elementary Differential Equations (MATH 224)</td>
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<tr>
<td>3</td>
<td>Humanities/Social Science Elective</td>
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**Third Year**

<table>
<thead>
<tr>
<th>Units</th>
<th>Fall</th>
<th>Spring</th>
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</thead>
<tbody>
<tr>
<td>3</td>
<td>Advanced Laboratory Physics I (PHYS 301)</td>
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<tr>
<td>1</td>
<td>Advanced Laboratory Physics Seminar (PHYS 303)</td>
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<tr>
<td>3</td>
<td>Thermodynamics and Statistical Mechanics (PHYS 313)</td>
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<tr>
<td>3</td>
<td>Introduction to Quantum Mechanics I (PHYS 331)</td>
<td></td>
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<td>3</td>
<td>Humanities/Social Science Elective</td>
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<tr>
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<td>Open Elective</td>
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<tr>
<td>3</td>
<td>Physics Elective</td>
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<tr>
<td>3</td>
<td>Global and Cultural Diversity Elective</td>
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<td>Humanities/Social Science Elective</td>
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**Fourth Year**

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<th>Units</th>
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<td>1</td>
<td>Senior Physics Project Seminar (PHYS 352)</td>
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<tr>
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<tr>
<td>3</td>
<td>Year Total:</td>
<td>15</td>
</tr>
</tbody>
</table>

**Total Units in Sequence:** 120

**Bachelor of Science in Physics**

The Bachelor of Science in physics requires completion of the courses listed in the table below as well as the Arts and Sciences General Education Requirements, for a total of 127 credits. Many courses may be taken at times other than those shown in the "Typical Schedule" tables below.

<table>
<thead>
<tr>
<th>Units</th>
<th>Fall</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>PHYS 121 General Physics I - Mechanics</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>or PHYS 123 Physics and Frontiers I - Mechanics</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>PHYS 122 General Physics II - Electricity and Magnetism</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>or PHYS 124 Physics and Frontiers II - Electricity and Magnetism</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>PHYS 221 Introduction to Modern Physics</td>
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</tr>
<tr>
<td>4</td>
<td>PHYS 203 Analog and Digital Electronics</td>
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<tr>
<td>4</td>
<td>PHYS 204 Advanced Instrumentation Laboratory</td>
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<td>PHYS 250 Computational Methods in Physics</td>
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<td>PHYS 310 Classical Mechanics</td>
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<td>PHYS 301 Advanced Laboratory Physics I</td>
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<td>PHYS 303 Advanced Laboratory Physics Seminar</td>
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<tr>
<td>3</td>
<td>PHYS 313 Thermodynamics and Statistical Mechanics</td>
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<td>3</td>
<td>PHYS 331 Introduction to Quantum Mechanics I</td>
<td></td>
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<tr>
<td>3</td>
<td>PHYS 332 Introduction to Quantum Mechanics II</td>
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<td>4</td>
<td>PHYS 302 Advanced Laboratory Physics II</td>
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<td>3</td>
<td>PHYS 324 Electricity and Magnetism I</td>
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<tr>
<td>4</td>
<td>PHYS 351 Senior Physics Project (PHYS 351 is taken twice for 2 credit hours each)</td>
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</tbody>
</table>

1. Students may choose only one of these two courses to satisfy the requirements of the BA degree.

2. The breadth requirements include 6 hours of Social Sciences and 6 hours of Arts and Humanities. This may increase by 3 credits if the required Global and Cultural Diversity course is not also one of the breadth requirement courses. Courses required for the BA in Physics satisfy the 6-credit GER for Natural Sciences and Mathematics as well as the Quantitative Reasoning course requirement.

3. The BA degree requires a minimum of 30 semester hours at the 300-400 level, of which only 22 are specified as PHYS courses.

4. Students may choose only one of these two courses to satisfy the requirements of the BA degree.

5. The breadth requirements include 6 hours of Social Sciences and 6 hours of Arts and Humanities. This may increase by 3 credits if the required Global and Cultural Diversity course is not also one of the breadth requirement courses. Courses required for the BA in Physics satisfy the 6-credit GER for Natural Sciences and Mathematics as well as the Quantitative Reasoning course requirement.

6. The BA degree requires a minimum of 30 semester hours at the 300-400 level, of which only 22 are specified as PHYS courses.

7. Students may choose only one of these two courses to satisfy the requirements of the BA degree.

8. The breadth requirements include 6 hours of Social Sciences and 6 hours of Arts and Humanities. This may increase by 3 credits if the required Global and Cultural Diversity course is not also one of the breadth requirement courses. Courses required for the BA in Physics satisfy the 6-credit GER for Natural Sciences and Mathematics as well as the Quantitative Reasoning course requirement.

9. The BA degree requires a minimum of 30 semester hours at the 300-400 level, of which only 22 are specified as PHYS courses.

10. Students may choose only one of these two courses to satisfy the requirements of the BA degree.

11. The breadth requirements include 6 hours of Social Sciences and 6 hours of Arts and Humanities. This may increase by 3 credits if the required Global and Cultural Diversity course is not also one of the breadth requirement courses. Courses required for the BA in Physics satisfy the 6-credit GER for Natural Sciences and Mathematics as well as the Quantitative Reasoning course requirement.

12. The BA degree requires a minimum of 30 semester hours at the 300-400 level, of which only 22 are specified as PHYS courses.
**Typical Schedule**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
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<tbody>
<tr>
<td>PHYS 352</td>
<td>Senior Physics Project Seminar</td>
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<td></td>
<td>(PHYS 352 is taken twice for 1 credit hour each)</td>
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<tr>
<td>PHYS 315</td>
<td>Introduction to Solid State Physics</td>
<td></td>
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<tr>
<td>PHYS 326</td>
<td>Physical Optics</td>
<td></td>
</tr>
<tr>
<td>PHYS 327</td>
<td>Quantum Electronics</td>
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</table>

Choose one of the following:

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<tr>
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<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYS 316</td>
<td>Introduction to Nuclear and Particle Physics</td>
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</tr>
<tr>
<td>PHYS 328</td>
<td>Cosmology and the Structure of the Universe</td>
<td></td>
</tr>
<tr>
<td>PHYS 336</td>
<td>Modern Cosmology</td>
<td></td>
</tr>
<tr>
<td>PHYS 365</td>
<td>General Relativity</td>
<td></td>
</tr>
<tr>
<td>CHEM 105</td>
<td>Principles of Chemistry I</td>
<td>3-4</td>
</tr>
<tr>
<td>or CHEM 111</td>
<td>Principles of Chemistry for Engineers</td>
<td></td>
</tr>
<tr>
<td>CHEM 106</td>
<td>Principles of Chemistry II</td>
<td>3-4</td>
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<tr>
<td>or ENGR 145</td>
<td>Chemistry of Materials</td>
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</tr>
<tr>
<td>ENGR 131</td>
<td>Elementary Computer Programming</td>
<td>3</td>
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<tr>
<td>MATH 121</td>
<td>Calculus for Science and Engineering I</td>
<td>4</td>
</tr>
<tr>
<td>MATH 122</td>
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<td>or MATH 124</td>
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<tr>
<td>MATH 223</td>
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<tr>
<td>MATH 224</td>
<td>Elementary Differential Equations</td>
<td>3</td>
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<tr>
<td>PHED Physical Education (2 semesters)</td>
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<tr>
<td>SAGES First and University Seminars</td>
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<td>Open Electives</td>
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<td><strong>Total Units</strong></td>
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<td>127-129</td>
</tr>
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</table>

1. PHYS 303 Advanced Laboratory Physics Seminar + PHYS 352 Senior Physics Project Seminar satisfy the SAGES departmental seminar requirement. PHYS 351 Senior Physics Project is an approved SAGES capstone course.

2. Or other approved computational course.

3. The breadth requirements include 6 hours of Social Sciences and 6 hours of Arts and Humanities. This may increase by 3 credits if the required Global and Cultural Diversity course is not also one of the breadth requirement courses. Courses required for the BS in physics satisfy the 6-credit GER for Natural Sciences and Mathematics as well as the Quantitative Reasoning course requirement.

4. The number of open electives may vary, depending on how many credits a student needs to reach the required total of 127.

**Bachelor of Science in Physics with Mathematical Physics Concentration**

Students who are interested in theoretical physics and who have a strong background in mathematics may consider this concentration. The program is based on the BS in physics, but with certain substitutions in the course requirements. Several of the laboratory courses are replaced
by advanced mathematics courses, and some of the undergraduate physics courses are replaced by graduate courses.

This program is not the same as the BS program in mathematics and physics, which provides a coherent and parallel education in both mathematics and physics.

The following table shows the requirements for the Bachelor of Science in physics with mathematical physics concentration.

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYS 121</td>
<td>General Physics I - Mechanics</td>
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</tr>
<tr>
<td>or PHYS 123</td>
<td>Physics and Frontiers I - Mechanics</td>
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<tr>
<td>PHYS 122</td>
<td>General Physics II - Electricity and Magnetism</td>
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<tr>
<td>or PHYS 124</td>
<td>Physics and Frontiers II - Electricity and Magnetism</td>
<td></td>
</tr>
<tr>
<td>PHYS 221</td>
<td>Introduction to Modern Physics</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 203</td>
<td>Analog and Digital Electronics (or M-Group 1)</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 250</td>
<td>Computational Methods in Physics</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 310</td>
<td>Classical Mechanics</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 301</td>
<td>Advanced Laboratory Physics I</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 303</td>
<td>Advanced Laboratory Physics Seminar</td>
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</tr>
<tr>
<td>PHYS 349</td>
<td>Methods of Mathematical Physics I</td>
<td>3</td>
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<tr>
<td>PHYS 313</td>
<td>Thermodynamics and Statistical Mechanics</td>
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<tr>
<td>PHYS 481</td>
<td>Quantum Mechanics I</td>
<td>3</td>
</tr>
<tr>
<td>Choose PHYS 423 or both PHYS 324 &amp; PHYS 325</td>
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<tr>
<td>PHYS 423</td>
<td>Classical Electromagnetism</td>
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<td>PHYS 324</td>
<td>Electricity and Magnetism I</td>
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<td>PHYS 482</td>
<td>Quantum Mechanics II</td>
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<tr>
<td>PHYS 350</td>
<td>Methods of Mathematical Physics II</td>
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<tr>
<td>M-Group 1, 2 &amp; 3</td>
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<td>PHYS 351</td>
<td>Senior Physics Project (PHYS 351 is taken twice for 2 credit hours each)</td>
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<tr>
<td>PHYS 352</td>
<td>Senior Physics Project Seminar (PHYS 352 is taken twice for 1 credit hour each)</td>
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<tr>
<td>Choose one of the following:</td>
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<tr>
<td>PHYS 315</td>
<td>Introduction to Solid State Physics</td>
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<td>PHYS 326</td>
<td>Physical Optics</td>
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<td>PHYS 327</td>
<td>Quantum Electronics</td>
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<tr>
<td>Choose one of the following:</td>
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<td>3</td>
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<tr>
<td>PHYS 316</td>
<td>Introduction to Nuclear and Particle Physics</td>
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<td>PHYS 328</td>
<td>Cosmology and the Structure of the Universe</td>
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<td>CHEM 105</td>
<td>Principles of Chemistry I</td>
<td>3-4</td>
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<tr>
<td>or CHEM 111</td>
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<td>CHEM 106</td>
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<tr>
<td>or ENGR 145</td>
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<td>ENGR 131</td>
<td>Elementary Computer Programming</td>
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<td>MATH 121</td>
<td>Calculus for Science and Engineering I</td>
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<td>MATH 122</td>
<td>Calculus for Science and Engineering II</td>
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<tr>
<td>or MATH 124</td>
<td>Calculus II</td>
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<tr>
<td>MATH 223</td>
<td>Calculus for Science and Engineering III</td>
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<td>or MATH 227</td>
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<td>Elementary Differential Equations</td>
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<td>PHED 2 semesters</td>
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<tr>
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<td>127-129</td>
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</table>

M-group 1, 2 and 3 are to be chosen from among approved advanced mathematics or statistics courses.

PHYS 303 Advanced Laboratory Physics Seminar + PHYS 352 Senior Physics Project Seminar satisfy the SAGES departmental seminar requirement. PHYS 351 Senior Physics Project is an approved SAGES capstone course.

Or other approved computational course.

The breadth requirements include 6 hours of Social Sciences and 6 hours of Arts and Humanities. This may increase by 3 credits if the required Global and Cultural Diversity course is not also one of the breadth requirement courses. Courses required for the BS in physics satisfy the 6-credit GER for Natural Sciences and Mathematics as well as the Quantitative Reasoning course requirement.

The number of open electives may vary, depending on the number of credits a student needs to reach the required total of 127.

Typical Schedule

**First Year**

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<thead>
<tr>
<th>Course</th>
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<tbody>
<tr>
<td>Physics</td>
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<tr>
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<td>General Physics I - Mechanics (PHYS 121)</td>
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<tr>
<td>or Physics</td>
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<tr>
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<td>Physics Today and Tomorrow (PHYS 166)</td>
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<td>General Physics II - Electricity and Magnetism (PHYS 122)</td>
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<td>Principles of Chemistry II (CHEM 106)</td>
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<td>or Chemistry of Materials (ENGR 145)</td>
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**Second Year**

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<tr>
<td>Analog and Digital Electronics (PHYS 203)</td>
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<tr>
<td>Introduction to Modern Physics (PHYS 221)</td>
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<td>3</td>
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<tr>
<td>Calculus for Science and Engineering III (MATH 223)</td>
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<td>3</td>
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<tr>
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<td>3</td>
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<tr>
<td>Humanities/Social Science Elective</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Computational Methods in Physics (PHYS 250)</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Classical Mechanics (PHYS 310)</td>
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<td>3</td>
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<tr>
<td>Elementary Differential Equations (MATH 224)</td>
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<td>3</td>
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<tr>
<td>Humanities/Social Science Elective</td>
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<td>3</td>
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<td>Open Elective</td>
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**Third Year**

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<td>Advanced Laboratory Physics I (PHYS 301)</td>
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<td>Advanced Laboratory Physics Seminar (PHYS 303)</td>
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<td>1</td>
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<tr>
<td>Thermodynamics and Statistical Mechanics (PHYS 313)</td>
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</tbody>
</table>
Methods of Mathematical Physics I (PHYS 349)  3
Quantum Mechanics I (PHYS 481)  3
Humanities/Social Science Elective  3
Methods of Mathematical Physics II (PHYS 350)  3
Quantum Mechanics II (PHYS 482)  3
Global and Cultural Diversity Elective  3
Advanced Mathematics Elective  3
Electricity and Magnetism I (PHYS 324)  3
Year Total:  16  15

Fourth Year

<table>
<thead>
<tr>
<th>Units</th>
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<th>Spring</th>
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<tr>
<td>Senior Physics Project (PHYS 351)</td>
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<tr>
<td>Senior Physics Project Seminar (PHYS 352)</td>
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<td>Condensed Matter Physics Elective</td>
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<td>Advanced Mathematics Elective</td>
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<td></td>
</tr>
<tr>
<td>Electricity and Magnetism II (PHYS 325)</td>
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<td></td>
</tr>
<tr>
<td>Open Elective</td>
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<td></td>
</tr>
<tr>
<td>Senior Physics Project (PHYS 351)</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Senior Physics Project Seminar (PHYS 352)</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Particle/Astrophysics Elective</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Advanced Mathematics Elective</td>
<td>3</td>
<td></td>
</tr>
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<td>Humanities/Social Science Elective</td>
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<td></td>
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<tr>
<td>Open Elective</td>
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<tr>
<td>Year Total:</td>
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<td>16</td>
</tr>
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</table>

Total Units in Sequence: 130-132

Bachelor of Science in Physics with Biophysics Concentration

This concentration is directed towards students interested in the combined study of biology and physics. The degree is a track within the standard BS in physics, in which four physics courses and certain open electives are replaced by a “biogroup” of five courses and a technical elective. All substitutions must be approved by a physics faculty committee.

The following table illustrates the requirements for the Bachelor of Science in physics with biophysics concentration.

| PHYS 121 | General Physics I - Mechanics | 4 |
| or PHYS 123 | Physics and Frontiers I - Mechanics | |
| PHYS 122 | General Physics II - Electricity and Magnetism | 4 |
| or PHYS 124 | Physics and Frontiers II - Electricity and Magnetism | |
| PHYS 221 | Introduction to Modern Physics | 3 |
| PHYS 203 | Analog and Digital Electronics | 4 |
| PHYS 204 | Advanced Instrumentation Laboratory | 4 |
| PHYS 250 | Computational Methods in Physics | 3 |
| PHYS 310 | Classical Mechanics | 3 |
| PHYS 301 | Advanced Laboratory Physics I | 3 |
| PHYS 303 | Advanced Laboratory Physics Seminar | 1 |
| PHYS 313 | Thermodynamics and Statistical Mechanics | 3 |
| PHYS 331 | Introduction to Quantum Mechanics I | 3 |
| PHYS 324 | Electricity and Magnetism I | 3 |
| PHYS 325 | Electricity and Magnetism II | 3 |
| Technical Elective | 3 |
| PHYS 351 | Senior Physics Project (PHYS 351 is taken twice for 2 credit hours each) | 4 |
| PHYS 352 | Senior Physics Project Seminar (PHYS 352 is taken twice for 1 credit hour each) | 2 |
| CHEM 105 | Principles of Chemistry I | 3-4 |
| or CHEM 111 | Principles of Chemistry for Engineers | |

PHYS 303 Advanced Laboratory Physics Seminar + PHYS 352 Senior Physics Project Seminar satisfy the SAGES departmental seminar requirement. PHYS 351 Senior Physics Project is an approved SAGES capstone course.

Suggested technical electives include PHYS 315 Introduction to Solid State Physics, PHYS 316 Introduction to Nuclear and Particle Physics, PHYS 326 Physical Optics, PHYS 327 Quantum Electronics, PHYS 328 Cosmology and the Structure of the Universe, PHYS 336 Modern Cosmology, PHYS 365 General Relativity.

B-group 1-5 are to be chosen from among approved biology, biophysics, biochemistry, and biomedical engineering courses, including certain prerequisites as needed (e.g., chemistry), BIOL 214 Genes, Evolution and Ecology and BIOL 215 Cells and Proteins are suggested for B-group 1 and 2. The listing of credits includes numbers for the most likely choices of courses and, in parentheses, possible alternatives.

The breadth requirements include 6 hours of Social Sciences and 6 hours of Arts and Humanities. This may increase by 3 credits if the required Global and Cultural Diversity course is not also one of the breadth requirement courses. Courses required for the B.S. in physics satisfy the 6-credit GER for Natural Sciences and Mathematics as well as the Quantitative Reasoning course requirement.

The number of open electives may vary, depending on the number of credits a student needs to reach the required total of 127.

Typical Schedule

<table>
<thead>
<tr>
<th>First Year</th>
<th>Units</th>
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<tbody>
<tr>
<td>Fall</td>
<td>Spring</td>
</tr>
<tr>
<td>General Physics I - Mechanics (PHYS 121)</td>
<td>4</td>
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<tr>
<td>or Physics and Frontiers I - Mechanics (PHYS 123)</td>
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<tr>
<td>Calculus for Science and Engineering I (MATH 121)</td>
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</table>
Bachelor of Science in Engineering with Engineering Physics Major

The engineering physics major allows students with strong interests in both physics and engineering to concentrate their studies in the common areas of these disciplines. The major prepares students to pursue careers in industry, either directly after undergraduate studies, or following graduate study in engineering or physics. Many employers value the unique problem-solving approach of physics, especially in industrial research and development.

Students majoring in engineering physics complete the Engineering Core as well as a rigorous course of study in physics. Students select a concentration area from an engineering discipline, and must complete a sequence of at least four courses in this discipline. In addition, a senior research project under the guidance of a faculty member is required. The project includes a written report and participation in the senior seminar and symposium.

### First Year

<table>
<thead>
<tr>
<th>Course Name</th>
<th>Units</th>
<th>Fall</th>
<th>Spring</th>
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</thead>
<tbody>
<tr>
<td>General Physics I - Mechanics (PHYS 121)</td>
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<tr>
<td>Calculus for Science and Engineering I (MATH 121)</td>
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<tr>
<td>Principles of Chemistry for Engineers (CHEM 111)</td>
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### Second Year

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<tr>
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<td>Calculus for Science and Engineering III (MATH 223)</td>
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<td>Advanced Instrumentation Laboratory (PHYS 204)</td>
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<td>University Seminar</td>
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<td>Introduction to Quantum Mechanics I (PHYS 331)</td>
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<td>Electricity and Magnetism I (PHYS 324)</td>
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<td>Global and Cultural Diversity Elective</td>
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<td>Open Elective</td>
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### Fourth Year

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<td>Electricity and Magnetism II (PHYS 325)</td>
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<td>Senior Physics Project Seminar</td>
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<td>Open Elective</td>
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### Total Units in Sequence: 127-129
### Engineering Concentration

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#### Fourth Year

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<table>
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<td>Introduction to Solid State Physics (PHYS 315)</td>
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<td>Senior Physics Project Seminar (PHYS 352)</td>
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<td>Senior Engineering Physics Project (PHYS 353)</td>
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<td>Year Total:</td>
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<tr>
<td>Total Units in Sequence:</td>
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</table>

1. Selected students may be invited to take MATH 123, 124, 227, and 228 in place of MATH 121, 122, 223, and 224.
2. Selected students may be invited to take PHYS 123, 124 (Physics and Frontiers I, II Honors) in place of PHYS 121, 122.
3. Engineering physics concentration courses are flexible, but they must be in a specific engineering discipline or study area and approved by an advisor. Possible concentration areas include aerospace engineering, biomedical engineering “hardware,” biomedical engineering “software,” chemical engineering, civil engineering (solid mechanics, structural and geotechnical, environmental), computer science, computer systems hardware, computer systems software, control systems and automation, electrical engineering, macromolecular science, materials science and engineering, mechanical engineering, signal processing, systems analysis and decision making. PHYS 332, PHYS 327/427, EEAP 321, EEAP 420, EMSE 314, or EMSE. Students may choose to fulfill this requirement in their third year.
4. Either MATH 351 or PHYS 351 will be taken twice.

#### Bachelor of Science in Mathematics and Physics

<table>
<thead>
<tr>
<th>Course</th>
<th>Units</th>
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<tbody>
<tr>
<td>MATH 121 Calculus for Science and Engineering I</td>
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<tr>
<td>MATH 122 Calculus for Science and Engineering II</td>
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<tr>
<td>or MATH 124 Calculus II</td>
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<tr>
<td>PHYS 121 General Physics I - Mechanics</td>
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<td>PHYS 122 General Physics II - Electricity and Magnetism</td>
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<td>or PHYS 124 General Physics II - Electricity and Magnetism</td>
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<td>CHEM 105 Principles of Chemistry I</td>
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<tr>
<td>CHEM 106 Principles of Chemistry II</td>
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<td>or ENGR 145 Chemistry of Materials</td>
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<tr>
<td>ENGR 131 Elementary Computer Programming</td>
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</tr>
<tr>
<td>PHYS 221 Introduction to Modern Physics</td>
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<td>MP Group 1</td>
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<table>
<thead>
<tr>
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<tr>
<td>MATH 223 Calculus for Science and Engineering III</td>
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<td>or MATH 227 Calculus III</td>
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<tr>
<td>MATH 224 Elementary Differential Equations</td>
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<tr>
<td>MATH 308 Introduction to Abstract Algebra II</td>
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<td>PHYS 310 Classical Mechanics</td>
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<td>PHYS 313 Thermodynamics and Statistical Mechanics</td>
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<tr>
<td>PHYS 331 Introduction to Quantum Mechanics I</td>
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<td>or PHYS 481 Quantum Mechanics I</td>
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<tr>
<td>PHYS 332 Introduction to Quantum Mechanics II</td>
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<td>or PHYS 482 Quantum Mechanics II</td>
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<td>MP Group 2</td>
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<td>MP Group 3</td>
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<tr>
<td>MATH 321 Fundamentals of Analysis I</td>
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<td>MATH 322 Fundamentals of Analysis II</td>
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<tr>
<td>MATH 324 Introduction to Complex Analysis</td>
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<tr>
<td>Advanced Physics Elective</td>
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<tr>
<td>MP Group 4</td>
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</table>

1. Other science sequence courses may be substituted if approved by the mathematics and physics (MP) committee.
2. Or other approved computational course
3. The “MP group” of four courses corresponds to two physics courses and two mathematics courses. The physics courses are chosen from PHYS 250 Computational Methods in Physics, PHYS 349 Methods of Mathematical Physics I, and PHYS 350 Methods of Mathematical Physics II. The mathematics courses are subject to approval by the MP committee and are hence referred to as “approved electives.” They may be chosen from the general list of mathematics courses at the 300 level or higher. It may also be possible to choose a course outside the mathematics and physics departments as a substitute in the MP group, subject to approval by the committee.
4. An advanced physics course to be selected from the following list: PHYS 315 Introduction to Solid State Physics, PHYS 316 Introduction to Nuclear and Particle Physics, PHYS 326 Physical Optics, PHYS 327 Quantum Electronics, PHYS 328 Cosmology and the Structure of the Universe, PHYS 336 Modern Cosmology, PHYS 365 General Relativity.
PHYS 303 Advanced Laboratory Physics Seminar + PHYS 352 Senior Physics Project Seminar satisfy the SAGES departmental seminar requirement. PHYS 351 Senior Physics Project is an approved SAGES capstone course.

Students may take either the math or physics SAGES departmental seminar, but must take their SAGES capstone course from the same department. The physics version consists of 1 credit of PHYS 303 Advanced Laboratory Physics Seminar plus two credits of PHYS 352 Senior Physics Project Seminar.

The breadth requirements include 6 hours of Social Sciences and 6 hours of Arts and Humanities. This may increase by 3 credits if the required Global and Cultural Diversity course is not also one of the breadth requirement courses. Courses required for the BS in mathematics and physics satisfy the 6-credit GER for Natural Sciences and Mathematics as well as the Quantitative Reasoning course requirement.

The number of open electives may vary, depending on how many credits the student needs to reach the required total of 126.

### Typical Schedule

#### First Year

<table>
<thead>
<tr>
<th>Units</th>
<th>Fall</th>
<th>Spring</th>
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<tbody>
<tr>
<td>4</td>
<td>General Physics I - Mechanics (PHYS 121) or Physics and Frontiers I - Mechanics (PHYS 123)</td>
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<tr>
<td>4</td>
<td>Calculus for Science and Engineering I (MATH 121)</td>
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<tr>
<td>3-4</td>
<td>Principles of Chemistry I (CHEM 105)</td>
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#### Second Year

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<td>Classical Mechanics (PHYS 310)</td>
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#### Third Year

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<tr>
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#### Fourth Year

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**Total Units in Sequence:** 126-128

### Department Faculty

**Kathleen Kash, PhD**  
(Massachusetts Institute of Technology)  
Professor and Chair  
Experimental condensed matter and mesoscopic physics; synthesis of novel semiconductors

**Daniel S. Akerib, PhD**  
(Princeton University)  
Professor  
Experimental astrophysics

**Jesse Berezovsky, PhD**  
(University of California, Santa Barbara)  
Assistant Professor  
Imaging coherent transport in mesoscopic graphene; optical readout of single spin dynamics in a quantum dot; spin dynamics in layered core/shell nanocrystal quantum dots; measurements of nuclear and electron spin at a ferromagnetic/semiconductor interface; spatio-temporal imaging and simulation of magnetization dynamics in ferromagnetic structures

**Robert W. Brown, PhD**  
(Massachusetts Institute of Technology)  
Distinguished University Professor and Institute Professor  
Medical imaging; industrial physics; particle physics theory; cosmology

**Gary S. Chottiner, PhD**  
(University of Maryland)  
Professor and Director of Undergraduate Studies  
Experimental physics of surfaces and thin films

**Corbin E. Covault, PhD**  
(Harvard University)
Professor
Experimental high-energy astrophysics
Claudia de Rham, PhD
(University of Cambridge)
Assistant Professor
Massive gravity and degravitation; Supersymmetric Large Extra Dimensions (SLED); physics of codimension-2 objects; cosmological perturbations
Diana I. Driscoll, PhD
(Case Western Reserve University)
Instructor
Introductory physics
Xuan Gao, PhD
(Columbia University)
Assistant Professor
Experimental condensed matter physics; nanomaterials; electron transport in nanostructures; correlated electrons in low dimensions
Kenneth L. Kowalski, PhD
(Brown University)
Professor
Theoretical and experimental particle physics
Walter R. Lambrecht, PhD
(University of Ghent)
Professor
Theoretical condensed matter physics; electronic structure-based physics of materials
Michael A. Martens, PhD
(Case Western Reserve University)
Associate Professor
Medical imaging physics, high energy particle physics, accelerator physics
Harsh Mathur, PhD
(Yale University)
Associate Professor
Condensed matter theory, particle-astrophysics theory
Rolfe G. Petschek, PhD
(Harvard University)
Professor
Theoretical condensed matter; optical materials
Charles Rosenblatt, PhD
(Harvard University)
Professor
Experimental condensed matter; liquid crystals and complex fluids
John E. Ruhl, PhD
(Princeton University)
Professor
Experimental astrophysics and cosmology
Jie Shan, PhD
(Columbia University)
Associate Professor
Experimental condensed matter physics; electronic and optoelectronic properties and dynamics of nanoscale materials
Thomas A. Shutt, PhD
(University of California, Berkeley)
Agnar Pytte Professor
Experimental astrophysics
Kenneth D. Singer, PhD
(University of Pennsylvania)
Ambrose Swasey Professor of Physics; Director, Engineering Physics Experimental condensed matter physics; nonlinear optics
Glenn D. Starkman, PhD
(Stanford University)
Professor: Director, Center for Education and Research in Cosmology and Astrophysics (CERCA) Theoretical cosmology, particle physics, astrophysics
Giuseppe Strangi, PhD
(University of Calabria, Italy)
Ohio Research Scholar in Surfaces of Advanced Materials; Professor Opto-Plasmonics of Soft Composite Metamaterials; Liquid Crystal Photonics
Cyrus C. Taylor, PhD
(Massachusetts Institute of Technology)
Albert A. Michelson Professor in Physics; Dean, College of Arts and Sciences Theoretical and experimental particle physics; physics entrepreneurship
Philip L. Taylor, PhD
(University of Cambridge)
Distinguished University Professor and Perkins Professor of Physics Theory of solids, polymers and other materials
Andrew J. Tolley, PhD
(University of Cambridge)
Baldwin Assistant Professor Early universe cosmology; dark energy; gravity; extra dimensions; branes

Secondary Faculty
J. Iwan Alexander, PhD
(Washington State University)
Professor, Department of Mechanical and Aerospace Engineering, Case School of Engineering Fluid dynamics, energy research
Roger H. French, PhD
(Massachusetts Institute of Technology)
F. Alex Nason Professor, Department of Materials Science and Engineering, Case School of Engineering Optical materials and technologies; experimental VIS/UV/VUV optical properties and long range interactions
Mark A. Griswold, PhD
(University of Wuerzburg) Associate Professor, Department of Radiology, School of Medicine Medical imaging, MRI
Eckhard Jankowsky, PhD
(Dresden Institute of Technology) Associate Professor, Department of Biochemistry, School of Medicine Proteins and enzymes; structural biology; regulation of gene expression
R. Earle Luck, PhD
(University of Texas at Austin) Worcester R. and Cornelia B. Warner Professor of Astronomy Stellar and galactic chemical evolution; stellar spectrophotometry
J. Christopher Mihos, PhD
(University of Michigan) Professor, Department of Astronomy
Galaxy formation and evolution; galaxy interactions; clusters of galaxies; observational and computational astrophysics

Heather Morrison, PhD (Australian National University) 
*Professor, Department of Astronomy*
Galactic structure; stellar populations; dark matter

Idit Zehavi, PhD (Hebrew University of Jerusalem) 
*Assistant Professor, Department of Astronomy*
Astrophysics

### Lecturer

Edward M. Caner, MS (Case Western Reserve University) 
*Lecturer; Director, Science and Technology Entrepreneurship Program*
Science entrepreneurship

### Adjunct Faculty

James H. Andrews, PhD (Case Western Reserve University) 
*Adjunct Professor; Professor of Physics, Youngstown State University*
Optical materials

Pierre Carles, PhD, Habilitation (National Polytechnic Institute, Toulouse) 
*Adjunct Associate Professor; Associate Professor, Université Pierre et Marie Curie, Paris*
Fluid mechanics; critical behavior; stability

Craig J. Copi, PhD (University of Chicago) 
*Adjunct Instructor; Senior Research Associate*
Theoretical cosmology; particle physics; astrophysics

Michael R. Dragowsky, PhD (Oregon State University) 
*Adjunct Associate Professor*
Nuclear and particle astrophysics experiment

Jeffrey S. Dyck, PhD (Case Western Reserve University) 
*Adjunct Associate Professor; Associate Professor, John Carroll University*
Experimental condensed matter physics

Karsten Eggert, PhD (RWTH Aachen University) 
*Adjunct Professor*
Experimental particle physics; cosmic ray physics; diffractive physics; TOTEM experiment at CERN

Hiroyuki Fujita, PhD (Case Western Reserve University) 
*Adjunct Professor; President and CEO, Quality Electrodynamics and eQED*
Hardware technology in imaging and renewable energies

Evalyn Gates, PhD (Case Western Reserve University) 
*Adjunct Professor; Executive Director and CEO, Cleveland Museum of Natural History*
Cosmology and particle astrophysics

John T. Giblin, Jr., PhD (Yale University) 
*Adjunct Assistant Professor*
Theoretical cosmology; high energy physics and particle physics; high performance computing and gravitational waves

E. Mark Haacke, PhD (University of Toronto) 
*Adjunct Professor; Professor, Wayne State University*
Physics of imaging; experimental biophysics

Daeseung Kang, PhD (Case Western Reserve University) 
*Adjunct Associate Professor*
Experimental condensed matter; liquid crystal

Peter J. Kernan, PhD (Ohio State University) 
*Adjunct Lecturer; Senior Research Associate*
Cosmology; Astrophysics

Gerald T. Mearini, PhD (Case Western Reserve University) 
*Adjunct Associate Professor; Genvac Aerospace Corporation*
Timothy Peshek, PhD (Case Western Reserve University) 
*Adjunct Assistant Professor*
Experimental semiconductor physics

Andrey Petukhov, PhD (St. Petersberg State Technical University) 
*Adjunct Associate Professor; Associate Professor of Physics, South Dakota School of Mines and Technology*

Irina Shiyanovskaya, PhD (Institute of Physics, National Academy of Science of Ukraine) 
*Adjunct Associate Professor; Kent Displays, Inc.*

Shmaryu Shvartsman, PhD (Tomsk State University) 
*Adjunct Professor; Principal Scientist, ViewRay Inc.*
General physics research and development

Mano Singham, PhD (University of Pittsburgh) 
*Adjunct Associate Professor; Director, University Center for Innovation in Teaching and Education (UCITE)*
Particle physics; physics teaching

Michael Thompson, PhD (Case Western Reserve University) 
*Adjunct Assistant Professor*
Experimental semiconductor physics

Mesfin Tsige, PhD (Case Western Reserve University) 
*Adjunct Associate Professor*
Theory of solids; polymers and other materials

### Visiting Faculty

Jesse M. Kinder, PhD (University of Pennsylvania) 
*Visiting Assistant Professor*
Theoretical solid state physics; nanotechnology; strongly correlated systems; modeling and method development
Research Professors

Ina Martin
(Coordinating Professor of Physics, Faculty of Natural Sciences, Colorado State University)

MORE Center Director of Operations

Thermal management materials; photovoltaic materials

Courses

**PHYS 101. Distinguishing Science from Pseudo-Science.** 3 Units.
There are many current issues arising in popular discourse, ranging from the believability of ESP to reincarnation, to "free energy" machines, which can benefit from simple physical analyses. This course will provide an introduction to the use of basic principles of physics to explore the viabiliy of these ideas. A seminar format will be utilized with specific topics presented by students and by the instructor. Recommended preparation: PHYS 100, PHYS 115, PHYS 121, or PHYS 123.

**PHYS 113A. Principles of Physics Laboratory - Mechanics.** 1 Unit.
The laboratory portion of first semester introductory physics.

**PHYS 113B. Principles of Physics Laboratory - Electricity and Magnetism.** 1 Unit.
The laboratory portion of the second semester of physics.

**PHYS 115. Introductory Physics I.** 4 Units.
First part of a two-semester sequence directed primarily towards students working towards a B.A. in science, with an emphasis on the life sciences. Kinematics; Newton's laws; gravitation; simple harmonic motion; mechanical waves; fluids; ideal gas law; heat and the first and second laws of thermodynamics. This course has a laboratory component.

**PHYS 116. Introductory Physics II.** 4 Units.
Electrostatics, Coulomb's law, Gauss's law; capacitance and resistance; DC circuits; magnetic fields; electromagnetic induction; RC and RL circuits; light; geometrical optics; interference and diffraction; special relativity; introduction to quantum mechanics; elements of atomic, nuclear and particle physics. This course has a laboratory component. Prereq: PHYS 115.

**PHYS 121. General Physics I - Mechanics.** 4 Units.
Particle dynamics, Newton's laws of motion, energy and momentum conservation, rotational motion, and angular momentum conservation. This course has a laboratory component. Recommended preparation: MATH 121 or MATH 123 or MATH 125 or one year of high school calculus.

**PHYS 122. General Physics II - Electricity and Magnetism.** 4 Units.
Electricity and magnetism, emphasizing the basic electromagnetic laws of Gauss, Ampere, and Faraday. Maxwell's equations and electromagnetic waves, interference, and diffraction. This course has a laboratory component. Prereq: PHYS 121 or PHYS 123. Prereq or Coreq: MATH 122 or MATH 124 or MATH 126.

**PHYS 123. Physics and Frontiers I - Mechanics.** 4 Units.
The Newtonian dynamics of a particle and of rigid bodies. Energy, momentum, and angular momentum conservation with applications. A selection of special frontier topics as time permits, including fractals and chaos, special relativity, fluid mechanics, cosmology, quantum mechanics. This course has a laboratory component. Admission to this course is by invitation only.

**PHYS 124. Physics and Frontiers II - Electricity and Magnetism.** 4 Units.
Time-independent and time-dependent electric and magnetic fields. The laws of Coulomb, Gauss, Ampere, and Faraday. Microscopic approach to dielectric and magnetic materials. Introduction to the usage of vector calculus; Maxwell's equations in integral and differential form. The role of special relativity in electromagnetism. Electromagnetic radiation. This course has a laboratory component. Prereq: PHYS 123. Prereq or Coreq: MATH 122 or MATH 124.

**PHYS 137. The Scientific Frontier: Origins, from the Big Bang to Life on Earth.** 3 Units.
This course will provide undergraduates, both science and non-science majors, with a general perspective of the modern state of our physical understanding of the universe, including outstanding puzzles at the forefront of modern science, focusing on the questions of origins: the origin of the universe, of our galaxy, of matter, of life, etc.

**PHYS 166. Physics Today and Tomorrow.** 1 Unit.
This course will provide students with an opportunity to learn about the most exciting and timely research areas in physics, as well as other topics germane to being a professional physicist. These discussions will cover fields such as nanoscience, ultrafast optics, exotic materials, biophysics, cosmology, string theory and the role of physicists in developing new technologies. Each week a member of the faculty will meet with students to discuss a topic of current interest, how a physicist approaches the problem, and how physicists interact with others to find a solution. Other topics germane to being a professional physicist also will be discussed, including the relationship among academic, industrial, and governmental laboratories; ethics, and non-traditional careers for students trained in physics.

**PHYS 203. Analog and Digital Electronics.** 4 Units.
Elements of both analog and digital electronics from the practical viewpoint of the experimental scientist; AC circuits, linear and non-linear operation of op-amps, logic gates, flip-flops, counters, display, memory, transducers, A/D and D/A conversion. Laboratory work involves quantitative investigation of the operation of all these elements, together with projects that explore their combination. Recommended preparation: PHYS 122 or PHYS 212.

**PHYS 203A. Analog and Digital Electronics for B.A..** 2 Units.
This course is the first half of the laboratory requirement for the B.A. degree in Physics and is the first half of PHYS 203. Elements of both analog and digital electronics from the practical viewpoint of the experimental scientist; AC circuits, linear and non-linear operation of op-amps, digital circuits including logic gates. This course includes weekly lecture and laboratory work in electronics; it may also include an additional weekly lecture, associated with PHYS 301, on topics such as error analysis, technical writing and oral presentations. Recommended preparation: PHYS 116, PHYS 122, or PHYS 124.

**PHYS 204. Advanced Instrumentation Laboratory.** 4 Units.
Principles of experimental design; limits of resolution via band-width, thermal noise, background signals; data acquisition and control by computer; computer simulation; signal processing techniques in frequency and time domains, FFT, correlations, and other transform methods; counting techniques. Applications include lock-in amplifiers, digitizing oscilloscopes and data acquisition systems. Recommended preparation: PHYS 203 and PHYS 221.
PHYS 208. Instrumentation and Signal Analysis Laboratory. 4 Units.
AC circuit theory, Fourier series, discrete Fourier series. Fourier integral, discrete Fourier integral; analysis in time and frequency domains, correlation, cross-correlation and other transform techniques; computer control of experiments via IEEE488 interface; advanced instrumentation; DMM, arbitrary waveform generator, multiplexing and digitizing oscilloscopes; experimental design, noise; design, construction, and testing of a lock-in amplifier. Recommended preparation: PHYS 221.

PHYS 221. Introduction to Modern Physics. 3 Units.
Concepts in special relativity, statistical mechanics and quantum mechanics. Applications to atomic structure, and selected topics in nuclear, condensed matter physics, particle physics, and cosmology. Prereq: PHYS 116 or PHYS 122 or PHYS 124.

PHYS 250. Computational Methods in Physics. 3 Units.

PHYS 301. Advanced Laboratory Physics I. 3 Units.
Problem solving approach with a range of available experiments in classical and modern physics. Emphasis on experimental techniques, data and error analysis, and the formal presentation of the work performed. Recommended preparation: PHYS 204. Coreq: PHYS 303.

PHYS 301B. Advanced Laboratory Physics for B.A.. 2 Units.
This course is the second half of the laboratory requirement for the B.A. degree in Physics and is the second half of PHYS 301. Problem solving approach with a range of available experiments in classical and modern physics. Emphasis on experimental technique and data and error analysis, and the formal presentation of the work performed. Recommended preparation: PHYS 203 or PHYS 203A and concurrent enrollment in PHYS 303.

PHYS 302. Advanced Laboratory Physics II. 4 Units.
Several projects using research-quality equipment in contemporary fields of experimental physics. Each requires reading appropriate literature, choosing appropriate instrumentation, performing data acquisition and analysis, and writing a technical paper. Topics include particle counting techniques, neutron activation, gamma-ray spectroscopy, a range of condensed matter experiments including temperature dependent properties between 10 and 350 K, modern optics, ultrahigh vacuum surface science. Recommended preparation: PHYS 301.

PHYS 303. Advanced Laboratory Physics Seminar. 1 Unit.
Students will discuss various issues associated with physics research. These include how to judge the quality of an experiment and data (error analysis), how to present your work in written and oral formats, safety and ethical concerns in the laboratory. Recommended preparation: PHYS 250.

PHYS 310. Classical Mechanics. 3 Units.
Lagrangian formulation of mechanics and its application to central force motion, scattering theory, rigid body motion, and systems of many degrees of freedom. Recommended preparation: PHYS 221 and either MATH 223 or MATH 227.

PHYS 313. Thermodynamics and Statistical Mechanics. 3 Units.

PHYS 315. Introduction to Solid State Physics. 3 Units.
Characterization and properties of solids; crystal structure, thermal properties of lattices, quantum statistics, electronic structure of metals and semiconductors. PHYS 415 for graduate students in engineering and science. (May not be taken for departmental credit by graduate students in the Department of Physics.) Prerequisite may be waived with consent of department. Recommended preparation for PHYS 415: PHYS 331. Offered as PHYS 315 and PHYS 415. Prereq: PHYS 331 or PHYS 481.

PHYS 316. Introduction to Nuclear and Particle Physics. 3 Units.
The physics of nuclei and elementary particles; experimental methods used to determine their properties; models and theories developed to describe their structure. Prereq: PHYS 331 or PHYS 481.

PHYS 317. Engineering Physics Laboratory I. 3 Units.
Laboratory course for engineering physics majors. Emphasis is on experimental techniques, data and error analysis, and written and oral presentation of work. Four experiments drawn from classical and modern physics are carried out. These emphasize condensed matter, material and optical physics. Experiments include electric fields, resistivity of materials, optical interference, chaotic systems, and spectroscopy. Design of data analysis systems and software is required. Prereq: PHYS 208. Coreq: PHYS 303.

PHYS 318. Engineering Physics Laboratory II. 4 Units.
Laboratory course for engineering physics majors. Several projects using research-quality equipment in contemporary fields of experimental physics. Open-ended experiments each require reading appropriate literature, designing the experiment, performing data analysis, and writing a technical paper. Topics are drawn from areas of modern physics, and concentrate on condensed matter, material, and optical physics. Prereq: PHYS 317.

PHYS 324. Electricity and Magnetism I. 3 Units.
First half of a sequence that constitutes a detailed study of the basics of electromagnetic theory and many of its applications. Electrostatics and magnetostatics of free space, conductors, dielectric and magnetic materials; basic theory illustrated with applications drawn from condensed matter physics, optics, plasma physics, and physical electronics. Prereq: PHYS 116 or PHYS 122 or PHYS 124.

PHYS 325. Electricity and Magnetism II. 3 Units.
(Continuation of PHYS 324.) Electrodynamics, Maxwell’s equations, electromagnetic waves, electromagnetic radiation and its interaction with matter, potential formulation of electromagnetism, and relativity. Prereq: PHYS 324.

PHYS 326. Physical Optics. 3 Units.
Geometrical optics and ray tracing, wave propagation, interaction of electromagnetic radiation with matter, interference, diffraction, and coherence. Supplementary current topics from modern optics such as nonlinear optics, holography, optical trapping and optical computing. Prerequisite(s) may be waived with consent of department. Offered as PHYS 326 and PHYS 426. Prereq: PHYS 122 or PHYS 124.
PHYS 327. Quantum Electronics. 3 Units.
An introduction to theoretical and practical quantum electronics covering topics in quantum optics, laser physics, and nonlinear optics. Topics to be addressed include the physics of two-level quantum systems including the density matrix formalism, rate equations, and semiclassical radiation theory; laser operation including oscillation, gain, resonator optics, transverse and longitudinal modes, Q-switching, mode-locking, and coherence; and nonlinear optics including the nonlinear susceptibility, parametric interactions, stimulated processes, and self-action. Recommended preparation for PHYS 427: PHYS 331 or PHYS 481. Offered as PHYS 327 and PHYS 427. Prereq: PHYS 331 or PHYS 481.

PHYS 328. Cosmology and the Structure of the Universe. 3 Units.

PHYS 329. Independent Study. 1 - 4 Unit.
An individual reading course in any topic of mutual interest to the student and the faculty supervisor.

PHYS 331. Introduction to Quantum Mechanics I. 3 Units.
Quantum nature of energy and angular momentum, wave nature of matter, Schroedinger equation in one and three dimensions; matrix methods; Dirac notation; quantum mechanical scattering. Two particle wave functions. Prereq: PHYS 221.

PHYS 332. Introduction to Quantum Mechanics II. 3 Units.
Continuation of PHYS 331. Spin and fine structure; Dirac equation; symmetries; approximation methods; atomic and molecular spectra; time dependent perturbations; quantum statistics; applications to electrons in metals and liquid helium. Prereq: PHYS 331.

PHYS 333. Modern Cosmology. 3 Units.
An introduction to modern cosmology and an exploration of current topics in the field. The first half of the course will cover the mathematical and physical basis of cosmology, while the second will delve into current questions and the observations that constrain them. Offered as PHYS 336 and PHYS 436. Prereq: PHYS 221.

PHYS 339. Seminar. 1 - 3 Unit.
Conducted in small sections with presentation of papers by students and informal discussion. Special problem seminars and research seminars offered according to interest and need, often in conjunction with one or more research groups.

PHYS 349. Methods of Mathematical Physics I. 3 Units.
Analysis of complex functions: singularities, residues, contour integration; evaluation and approximation of sums and integrals; exact and approximate solution of ordinary differential equations; transform calculus; Sturm-Liouville theory; calculus of variations. Additional work required for graduate students. Offered as PHYS 349 and PHYS 449. Prereq: MATH 224.

PHYS 350. Methods of Mathematical Physics II. 3 Units.
(Continuation of PHYS 349/449.) Special functions, orthogonal polynomials, partial differential equations, linear operators, group theory, tensors, selected specials topics. Additional work required for graduate students. Prereq: PHYS 349.

PHYS 351. Senior Physics Project. 2 Units.
A two semester course required for senior BS and BA physics majors. Students pursue a project based on experimental, theoretical or teaching research under the supervision of a physics faculty member, a faculty member from another CWRU department or a research scientist or engineer from another institution. A departmental Senior Project Committee must approve all project proposals and this same committee will receive regular oral and written progress reports. Final results are presented at the end of the second semester as a paper in a style suitable for publication in a professional journal as well as an oral report in a public symposium. Prereq: PHYS 303. Coreq: PHYS 352.

PHYS 352. Senior Physics Project Seminar. 1 Unit.
This two semester seminar is taken concurrently with the student’s two semester senior project. Students meet weekly to discuss their projects and the research experience. The class will include dialogues about professional issues such as ethics, graduate school, jobs, funding, professional organizations, public obligations, writing and speaking. Assignments include proposals, progress reports and posters. Coreq: PHYS 351 or PHYS 353.

PHYS 353. Senior Engineering Physics Project. 2 Units.
A two semester course required for BSE Engineering Physics majors. Students are expected to complete a research project in their concentration area under the supervision of a faculty member in science, engineering, or, with approval, a researcher at another institution or company. The project may be calculational, experimental or theoretical, and will address both the underlying physics and appropriate engineering and design principles. A program Senior Project Committee must approve all project proposals and will receive regular oral and written progress reports. Final results are presented at the end of the second semester as a paper in a style suitable for publication in a professional journal as well as an oral report in a public symposium. Prereq: PHYS 318. Coreq: PHYS 352.

PHYS 355. General Relativity. 3 Units.
This is an introductory course in general relativity. The techniques of tensor analysis will be developed and used to describe the effects of gravity and Einstein’s theory. Consequences of the theory as well as its experimental tests will be discussed. An introduction to cosmology will be given. Additional work required for graduate students. Offered as PHYS 365 and PHYS 465.

PHYS 390. Undergraduate Research in Physics. 3 - 6 Units.
Research conducted under the supervision of a faculty member in the Department of Physics. Arrangements must be made with a faculty member and a written description of these arrangements must be submitted to and approved by the department before a permit will be issued to register for this course. A final report must be supplied to the department at the end of the semester.

PHYS 413. Classical and Statistical Mechanics I. 3 Units.
An integrated approach to classical and statistical mechanics. Lagrangian and Hamiltonian formulations, conservation laws, kinematics and dynamics, Poisson brackets, continuous media, derivation of laws of thermodynamics, the development of the partition function. To be followed by PHYS 414.
PHYS 414. Classical and Statistical Mechanics II. 3 Units.
A continuation of PHYS 413. Noninteracting systems, statistical mechanics of solids, liquids, gases, fluctuations, irreversible processes, phase transformations. Recommended preparation: PHYS 413 or consent of department.

PHYS 415. Introduction to Solid State Physics. 3 Units.
Characterization and properties of solids; crystal structure, thermal properties of lattices, quantum statistics, electronic structure of metals and semiconductors. PHYS 415 for graduate students in engineering and science. (May not be taken for departmental credit by graduate students in the Department of Physics.) Prerequisite may be waived with consent of department. Recommended preparation for PHYS 415: PHYS 331. Offered as PHYS 315 and PHYS 415.

PHYS 423. Classical Electromagnetism. 3 Units.

PHYS 424. Quantum Electrodynamics. 3 Units.
Wave packet methods, bra-ket formalism, renormalization group, QED in vacuum and non-vacuum, vacuum polarization, second quantization, and applications to atomic and nuclear physics. Continuous and discrete symmetries of QED. Recommended preparation: PHYS 422. Offered as PHYS 324 and PHYS 424.

PHYS 426. Physical Optics. 3 Units.
Geometrical optics and ray tracing, wave propagation, interaction of electromagnetic radiation with matter, interference, diffraction, and coherence. Supplementary current topics from modern optics such as nonlinear optics, holography, optical trapping and optical computing. Prerequisite(s) may be waived with consent of department. Offered as PHYS 326 and PHYS 426.

PHYS 427. Quantum Electronics. 3 Units.
An introduction to theoretical and practical quantum electronics covering topics in quantum optics, laser physics, and nonlinear optics. Topics to be addressed include the physics of two-level quantum systems including the density matrix formalism, rate equations, and semiclassical radiation theory; laser operation including oscillation, gain, resonator optics, transverse and longitudinal modes, Q-switching, mode-locking, and coherence; and nonlinear optics including the nonlinear susceptibility, parametric interactions, stimulated processes, and self-action. Recommended preparation for PHYS 427: PHYS 331 or PHYS 481. Offered as PHYS 327 and PHYS 427.

PHYS 428. Cosmology and the Structure of the Universe. 3 Units.

PHYS 431. Physics of Imaging. 3 Units.
Description of physical principles underlying the spin behavior in MR and Fourier imaging in multi-dimensions. Introduction of conventional, fast, and chemical-shift imaging techniques. Spin echo, gradient echo, and variable flip-angle methods. Projection reconstruction and sampling theorems. Bloch equations, T1 and T2 relaxation times, rf penetration, diffusion and perfusion. Flow imaging, MR angiography, and functional brain imaging. Sequence and coil design. Prerequisite may be waived with consent of instructor. Recommended preparation: PHYS 122 or PHYS 124 or EBME 410. Offered as EBME 431 and PHYS 431.

PHYS 436. Modern Cosmology. 3 Units.
An introduction to modern cosmology and an exploration of current topics in the field. The first half of the course will cover the mathematical and physical basis of cosmology, while the second will delve into current questions and the observations that constrain them. Offered as PHYS 336 and PHYS 436.

PHYS 441. Physics of Condensed Matter I. 3 Units.
Crystal structure, x-ray diffraction, band theory and applications. Free electron theory of metals and electrons in magnetic fields.

PHYS 442. Physics of Condensed Matter II. 3 Units.
Continuation of PHYS 441. Lattice vibrations, thermal properties of solids, semiconductors, magnetic properties of solids, and superconductivity. Prerequisite may be waived with consent of department. Recommended preparation: PHYS 441.

PHYS 449. Methods of Mathematical Physics I. 3 Units.
Analysis of complex functions: singularities, residues, contour integration; evaluation and approximation of sums and integrals; exact and approximate solution of ordinary differential equations; transform calculus; Sturm-Liouville theory; calculus of variations. Additional work required for graduate students. Offered as PHYS 349 and PHYS 449.

PHYS 451. Empirical Foundations of the Standard Model. 3 Units.
The experimental basis for modeling the electroweak and strong interactions in terms of fundamental fermions, quarks and leptons, and gauge bosons, photons, the weak bosons, and gluons; particle accelerators and detection techniques; phenomenology of particle reactions, decays and hadronic structure; space, time and internal symmetries; symmetries; symmetry breaking.

PHYS 460. Advanced Topics in NMR Imaging. 3 Units.
Frontier issues in understanding the practical aspects of NMR imaging. Theoretical descriptions are accompanied by specific examples of pulse sequences, and basic engineering considerations in MRI system design. Emphasis is placed on implications and trade-offs in MRI pulse sequence design from real-world versus theoretical perspectives. Recommended preparation: EBME 431 or PHYS 431. Offered as EBME 460 and PHYS 460. Prereq: Graduate standing or Undergraduate with Junior or Senior standing and a cumulative GPA of 3.2 or above.

PHYS 465. General Relativity. 3 Units.
This is an introductory course in general relativity. The techniques of tensor analysis will be developed and used to describe the effects of gravity and Einstein’s theory. Consequences of the theory as well as its experimental tests will be discussed. An introduction to cosmology will be given. Additional work required for graduate students. Offered as PHYS 365 and PHYS 465.

PHYS 472. Graduate Physics Laboratory. 3 Units.
A series of projects designed to introduce the student to modern research techniques such as automated data acquisition. Students will be assessed as to their individual needs and a sequence of projects will be established for each individual. Topics may include low temperature phenomena, nuclear gamma ray detection and measurement and optics.
Several such courses may run concurrently.

Individual or small group instruction on topics of interest to the

PHYS 539. Special Topics Seminar. 1 - 3 Unit.
Session. Prereq: BIOL 493 or CHEM 493 or PHYS 493.

This course provides the advanced tools needed to develop,
articulate, and launch a venture plan for a technology identified
as likely to be successful through a feasibility analysis. Additional
topics include: entrepreneurial strategy, communication, sales,
negotiation, entrepreneurial finance, and leadership in an entrepreneurial
environment. Guest speakers will be featured in nearly every class
session. Prereq: BIOL 493 or CHEM 493 or PHYS 493.

PHYS 539. Special Topics Seminar. 1 - 3 Unit.
Individual or small group instruction on topics of interest to the
department. Topics include, but are not limited to, particle physics,
astrophysics, optics, condensed matter physics, biophysics, imaging.
Several such courses may run concurrently.

PHYS 481. Quantum Mechanics I. 3 Units.
Quantum mechanics with examples of applications. Schroedinger
method; matrix and operator methods. Approximation methods including
WKB, variational and various perturbation methods. Applications to
atomic, molecular and nuclear physics including both bound states and
scattering problems. Applications of group theory to quantum mechanics.

PHYS 482. Quantum Mechanics II. 3 Units.
Continuation of PHYS 481, including quantum field theory. Prerequisite
may be waived with consent of department. Recommended preparation:
PHYS 481 or consent of department.

PHYS 491. Modern Physics for Innovation I. 3 Units.
The first half of a two-semester sequence providing an understanding
of physics as a basis for successfully launching new high-tech ventures.
The course will examine physical limitations to present technologies,
and the use of physics to identify potential opportunities for new venture
creation. The course will provide experience in using physics for
both identification of incremental improvements, and as the basis for
alternative technologies. Case studies will be used to illustrate recent
commercially successful (and unsuccessful) physics-based venture
creation, and will illustrate characteristics for success.

PHYS 492. Modern Physics for Innovation II. 3 Units.
Continuation of PHYS 491, with an emphasis on current and prospective
opportunities for Physics Entrepreneurship. Longer term opportunities for
Physics Entrepreneurship in emerging areas including, but not limited to,
nanoscale physics and nanotechnology; biophysics and applications to
biotechnology; physics-based opportunities in the context of information
technology. Recommended preparation: PHYS 491.

PHYS 493. Feasibility and Technology Analysis. 3 Units.
This course provides the tools scientists need to determine whether a
technology is ready for commercialization. These tools include (but are
not limited to): financial analysis, market analysis, industry analysis,
technology analysis, intellectual property protection, the entrepreneurial
process and culture, an introduction to entrepreneurial strategy and
new venture financing. Deliverables will include a technology feasibility
analysis on a possible application in the student’s scientific area. Offered
as BIOL 493, CHEM 493, and PHYS 493.

PHYS 494. Technology-Based Venture Creation. 3 Units.
This course provides the advanced tools needed to develop,
and launch a venture plan for a technology identified
as likely to be successful through a feasibility analysis. Additional
topics include: entrepreneurial strategy, communication, sales,
negotiation, entrepreneurial finance, and leadership in an entrepreneurial
environment. Guest speakers will be featured in nearly every class
session. Prereq: BIOL 493 or CHEM 493 or PHYS 493.

PHYS 541. Quantum Theory of Solids I. 3 Units.
Elementary excitations in solids, including lattice vibrations, spin waves,
helicons, and polarons. Quasiparticles and collective coordinates.
Conduction electrons in magnetic fields and the quantum Hall effect.
Green function methods of many-body systems. Recommended
preparation: PHYS 442 or consent of department.

PHYS 561. Statistical Methods for Scientific Research. 3 Units.
This course will introduce students to traditional and novel statistical
methods useful for experimental scientists. The emphasis will be on
understanding theory and techniques that are used in research. We
shall consider problems from astronomy, biology and particle-astro
physics. The course will also cover topics of interest to engineers. Current
research problems and techniques, and we will cover some of the
advanced statistical techniques. Topics to be covered include: Measuring
uncertainty and probability distributions (low and high dimensional);
point and interval estimation; curve fitting; likelihood and score type tests
required for an experiment; posterior probabilities; dealing with small
samples (which arise in search experiments); over- and under-coverage
using confidence belts; and Monte Carlo simulation methods for planning
experiments and evaluating the statistical significance of the results.
“Gobi” and “R” open source software will be used for visualization (via
dynamic and interactive graphics) and exploring high-dimensional data.
Offered as BIOL 561 and PHYS 561.

PHYS 566. Cosmology. 3 Units.
Introduction to our current understanding of the origin and evolution
of the Universe and connection between our understanding of
elementary particle physics and cosmology. Specific topics will include:
General Parameters of Cosmology: Expansion, Lifetime, and Density
of the Universe. The Early Universe, Constraints on Elementary
Particles, Dark Matter and Dark Energy, Nucleosynthesis, Cosmic
Microwave Background, Inflation, Stellar Evolution, Gravitational Waves,
Baryogenesis. Some background in general relativity and particle physics
phenomenology is recommended.

PHYS 581. Quantum Mechanics III. 3 Units.
Continuation of PHYS 482. The methods of quantum field theory
applied to the nonrelativistic many-body problem, radiation theory, and
relativistic particle physics. Second quantization using canonical and
path integration techniques, constrained systems, and gauge theories.
Graphical perturbative methods and graphs summation approaches.
Topological aspects of field theories. Recommended preparation: PHYS
482 and consent of department.

PHYS 591. Gauge Field Theory I. 3 Units.
Noether’s theorem, symmetries and conserved currents, functional
integral techniques, quantization, Feynman rules, anomalies, QED,
electroweak interactions, QCD, renormalization, renormalization group,
asymptotic freedom and assorted other topics. Prereq: PHYS 581.

PHYS 592. Gauge Field Theory II. 3 Units.
(See PHYS 591.) Recommended preparation: PHYS 591.

PHYS 601. Research in Physics. 1 - 9 Unit.

PHYS 651. Thesis M.S.. 1 - 9 Unit.

PHYS 666. Frontiers in Physics. 0 Units.
Weekly colloquia given by eminent physicists from around the world on
topics of current interest in physics.
PHYS 701. Dissertation Ph.D.. 1 - 9 Unit.
Prereq: Predoctoral research consent or advanced to Ph.D. candidacy milestone.
Department of Political Science

The study of political science is primarily concerned with the state, governmental structures and processes in world societies, citizen-state relations, and the exercise of political power. Faculty specialties in the department include American politics and governmental institutions; elections and political parties in the United States and abroad; violence and civil disorder; public policy analysis, including environmental policy and economic and welfare state issues; international relations conceived broadly; international political economy; religious and ethnic conflict; state-building; the politics of gender; political strategies; research methods; and comparative politics, with various regional concentrations. In its programs leading to the BA, MA, and PhD, the department makes a strong effort to relate the study of politics to students' needs and concerns and to reflect in its courses both the excitement and seriousness of real-world politics.

The study of political science can build a foundation for many types of future employment. Many political science majors are preparing for graduate study or law school. Others intend to pursue careers in journalism, teaching, or public administration, or in private industry and business. Both the public and private sectors hold career possibilities for the political science major.

Undergraduate Programs

Major

The major in political science leads to the Bachelor of Arts degree. The degree requires 30 hours of course work, distributed as follows:

<table>
<thead>
<tr>
<th>Required Courses:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>POSC 109 The American Political System</td>
<td>3</td>
</tr>
<tr>
<td>Two POSC courses at the 200 level</td>
<td>6</td>
</tr>
<tr>
<td>Six POSC courses at the 300 level</td>
<td>18</td>
</tr>
<tr>
<td>POSC 396 Senior Project SAGES Capstone</td>
<td>3</td>
</tr>
<tr>
<td>Total Units</td>
<td>30</td>
</tr>
</tbody>
</table>

Students select courses based on their specific interests, with approval of the faculty advisor. No more than six hours of independent study (i.e., POSC 395 Special Projects and/or POSC 396 Senior Project SAGES Capstone) may count toward the major. Independent study completed through the Washington Center program is excluded from this limitation.

Departmental Honors

 Majors who maintain a grade point average of at least 3.3 overall on completion of senior year and 3.7 in political science courses, and who earn a grade of A in POSC 396, will be eligible to be nominated to receive their degrees with Honors in Political Science. To be considered for Honors, POSC 396 must be taken no later than the penultimate semester of the senior year, with the prospectus submitted no later than the end of the first week of the semester for late Fall registrants. Faculty will use the following semester to vote on honors. A paper can be considered for honors only if nominated by the project advisor. Two additional readers, who will be appointed by the department chair, must agree with the recommendation for honors. If one reader agrees and the other does not, honors will not be awarded.

Students who entered the university prior to Fall 2011 have the option of earning honors under an equivalent of the rules previously in effect. Under those rules, honors could be earned with an overall departmental GPA of 3.8 and a grade of A in POSC 396.

Integrated Graduate Studies

Application to the Integrated Graduate Studies (IGS) Program (p. 549) in political science must occur no later than the beginning of the second semester of the junior year, but preferably earlier. Upon completion of 90 undergraduate hours, the student must have satisfied all general requirements for the BA, including at least 21 hours in the political science major, the General Education Requirements, and one minor program, and must have a 3.5 grade point average in political science courses and 3.3 overall. If admitted to the IGS program, the student will take 30 hours of graduate-level political science courses during the senior year, adhering to the departmental regulations governing the master’s degree program. If completed successfully, these hours will count simultaneously toward both degrees in political science.

The BA will be awarded upon completion of all requirements for that degree, including total hours. The MA will be awarded upon successful completion of the 30 hours of graduate-level courses and the MA examination.

Minor

Political Science

A minor in political science consists of 15 hours (five courses) in the department, of which 9 hours must be at the 300 level. An elected minor sequence must be approved by a political science faculty advisor.

Public Policy

A minor in public policy is available to undergraduates in the College of Arts and Sciences and to undergraduates in the economics and management programs in the Weatherhead School of Management. Please see the Public Policy Program’s (p. 436) section of the bulletin for details.

Graduate Programs

Master of Arts

Applicants to the Master of Arts program in political science are required to submit their undergraduate transcripts and three letters of recommendation from former instructors. The admission requirements also include a minimum score of 500 on the verbal and quantitative segments of the Graduate Record Examination (GRE) and 4.5 on the analytical section. The department strongly prefers that applicants have a minimum GPA of 3.2 overall and a minimum GPA of 3.4 in political science courses. For students from other countries, the requirements are a minimum score of 550 on the paper version of the Test of English as a Foreign Language (TOEFL), or at least 215 on the computer version of the TOEFL; the minimum GRE scores indicated above; and transcripts of all undergraduate study, indicating completion of a Bachelor of Arts or Bachelor of Science degree program.

The Master of Arts in political science is a broadly based program in which the student is expected to acquire and exhibit general knowledge and skills. Therefore, within the 30 hours of graduate-level course work (400 level and above) required for the master’s, 12 hours must be distributed as follows:

<table>
<thead>
<tr>
<th>A class in the area of American government and politics</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>A class in the area of comparative politics</td>
<td>3</td>
</tr>
<tr>
<td>A class in the area of international relations</td>
<td>3</td>
</tr>
<tr>
<td>POSC 449 Political Science Research Methods</td>
<td>3</td>
</tr>
<tr>
<td>Total Units</td>
<td>12</td>
</tr>
</tbody>
</table>
Students who receive permission (due to special circumstances) from the graduate coordinator may take an alternative research methods course outside the department.

Among the remaining 18 hours of electives, the student may take courses oriented toward a general Master of Arts, covering the four broad areas listed above. Alternatively, the student may specialize in one area—one of these four or some other—approved by the graduate coordinator. A maximum of 9 hours may be taken outside the Department of Political Science, with prior approval from the graduate coordinator, for specialized work related to the master’s degree for which no political science course is appropriate. A maximum of nine hours of independent study (POSC 601 Individual Investigation) may count toward the degree.

A minimum grade point average of 3.0 must be maintained throughout the Master of Arts program. A master’s student who fails to maintain a GPA of 3.0 will be placed on academic probation for one semester. If the GPA is not returned to the 3.0 minimum by the end of the probationary semester, the student will be separated from further study in the department.

Upon completion of no fewer than 30 hours and no more than 42 hours of master’s-level course work, the student must request scheduling of the political science Master of Arts examination. The examination will cover the fields of American government and politics, comparative politics, and international relations.

**Doctor of Philosophy**

Requirements for admission to the Doctor of Philosophy program in political science are the same as for admission to the Master of Arts program, with the following additions. The department strongly prefers that applicants without an MA in political science have a minimum GPA of 3.2 overall and a minimum GPA of 3.4 in undergraduate political science courses, and that applicants with an MA degree in political science have a minimum GPA of 3.4 overall in their MA work. Because the department faculty is small, applicants should determine, prior to applying, whether one or more members of the department faculty are active in the applicant’s field of interest. PhD applications must specify the applicant’s field(s) of interest, as the Graduate Studies Committee will not recommend the admission of an applicant where the department faculty cannot support the applicant’s proposed course of study. Students who are accepted into the department’s MA program and then decide they would like to earn the PhD are expected to apply to the PhD program and meet the admission requirements. All PhD students must complete 45 hours of graduate-level courses, plus at least 18 hours of POSC 701 (Dissertation) credit. The required 45 hours of doctoral courses taken before dissertation credits must be distributed as follows:

<table>
<thead>
<tr>
<th>Course Type</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>12 hours in a primary subfield (American, comparative, or international relations)</td>
<td>12</td>
</tr>
<tr>
<td>9 hours in secondary subfield (one of the remaining two fields)</td>
<td>9</td>
</tr>
<tr>
<td>6 hours in the remaining subfield</td>
<td>6</td>
</tr>
<tr>
<td>6 hours in Research Methods: POSC 449 (Political Science Research Methods)</td>
<td>6</td>
</tr>
<tr>
<td>12 hours of electives</td>
<td>12</td>
</tr>
<tr>
<td><strong>Total Units</strong></td>
<td>45</td>
</tr>
</tbody>
</table>

A maximum of 9 hours of independent study (POSC 601 Individual Investigation) may be undertaken. University regulations require PhD students to spend at least one academic year in full-time residence (two consecutive regular semesters with a minimum of 9 hours’ registration each semester).

Doctoral students whose MA in political science has been certified, and doctoral students with an MA in political science from Case Western Reserve, need complete only 18 of the 45 hours of doctoral course work. The graduate coordinator will set distribution requirements on an individual basis, reflecting the course work completed for the MA. Doctoral students without a completed MA must pass the MA examination. They must take the examination upon completion of no fewer than 30 hours and no more than 36 hours of course work. A student who does not pass this examination may not continue in the PhD program. See the description of the MA examination above for further information.

Upon completion of 45 hours of course work, the student must pass the PhD comprehensive examinations in his or her primary and secondary subfields. After passing the examinations, a student must complete a dissertation, typically 150-400 pages in length, that draws on the student’s original research to make a contribution to the field of political science.

**Dual JD/MA**

Students accepted to the School of Law may pursue a Masters of Arts in Political Science in conjunction with their JD degree. Completion of the program requires 97 hours of course work, and so would be expected to require seven semesters. Students wishing to enroll in the dual-degree program must be separately admitted to each program, but the department will waive the GRE requirement and accept the LSAT within the admissions process. Students must complete a total of 21 hours of credit within the political science department, including at least three credit hours in American politics, comparative politics, international relations, and research methods. Dual-degree students will normally begin study in the law school and defer enrollment in the MA program until their second year. They must pass the MA comprehensive examination upon completion of their political science course work.

**Department Faculty**

Joseph White, PhD  
(University of California, Berkeley)  
*Luxenberg Family Professor of Public Policy and Chair; Director, Center for Policy Studies and Public Policy Program; Professor of Epidemiology and Biostatistics, School of Medicine*  
American government; Congress; public policy; health and welfare policy; comparative politics of rich democracies

Karen Beckwith, PhD  
(Syracuse University)  
*Flora Stone Mather Professor*  
Politics of gender; mass political participation; comparative political movements; democracy and representation

Justin Buchler, PhD  
(University of California, Berkeley)  
*Associate Professor*  
Congress; redistricting; political strategy; parties and elections

Jessica F. Green, PhD  
(Princeton University)  
*Assistant Professor*  
Global governance; international environmental law and policy; international law; international organizations; transnational regulation; qualitative methods

Kathryn C. Lavelle, PhD  
(Northwestern University)  
*Ellen and Dixon Long Professor in World Affairs*  
International relations; international organizations; Congress in world politics; politics of stock markets; governing institutions of national
and international finance; U.S. foreign economic policy; Congress and banking policy

Vincent E. McHale, PhD
(Pennsylvania State University)
M. A. Hanna Professor of Political Science
Comparative politics; Europe; political sociology; methodology

Kelly M. McMann, PhD
(University of Michigan)
Associate Professor; Director, International Studies Program
Comparative politics; Central Asia; Russia and former East Bloc; democratization

Peter W. Moore, PhD
(McGill University)
Associate Professor
Comparative politics and political economy of the Middle East and Africa

Elliot Posner, PhD
(University of California, Berkeley)
Associate Professor
International relations; international and comparative political economy; politics of finance; international organizations; European Union

Laura Y. Tartakoff, JD, MA
(Case Western Reserve University School of Law; Tufts University)
Instructor
Constitutional law; civil liberties; comparative constitutionalism

Secondary Faculty
Jonathan L. Entin, JD
(Northwestern University)
Professor, School of Law
American constitutional law; social science and the law

Adjunct Faculty
Lev Gonick, PhD
(York University, Toronto)
Adjunct Professor, CWRU Vice President for Information Technology
Comparative historical international political economy; technology and government

Karl Kaltenthaler, PhD
(Washington University)
Adjunct Professor
Comparative politics, political behavior/public opinion, political extremism and violence, political economy, Europe

Andrew M. Lucker, PhD
(Case Western Reserve University)
Adjunct Assistant Professor
American government; state politics and government; history of political science

Visiting Faculty
Mark Major, MA
(Rutgers)
Visiting Instructor
American politics, presidency, media

Paul Schroeder, PhD
(Ohio State University)
Visiting Assistant Professor
Politics of China, development, international relations

Courses

POSC 109. The American Political System. 3 Units.
Introduction to the study of American politics, addressing the questions “Who rules?” and “Who benefits?” in the American political system. Explores the nature of constitutional limits, the role of public participation, the impact of pressure groups, and the influence of various governmental institutions on American political life.

POSC 260. Introduction to Comparative Politics. 3 Units.
Comparative politics is the study of processes and institutions within countries. Prompted by real-world puzzles, comparativists investigate broad, theoretical questions: What constitutes a revolution, and why do revolutions occur? How does one country become more democratic than another? Why do relations between some ethnic groups turn violent? This course introduces students to some of the central puzzles and theories of comparative politics in order to help them better understand world events.

POSC 272. Introduction to International Relations. 3 Units.
Survey of the principles of international relations, politics, law and organization; the rise, development and change of the nation-state system; development of international cooperation; methods of studying international relations.

POSC 301. Decision-Making in American Cities. 3 Units.
Localities are the primary interface with government and provide the basic psychological place identification for most Americans. The course will explore this assertion in the context of urban America today. How are decisions made in cities? Who shapes these decisions and why? What role is played by shifting demographics, race, and poverty? What can the individual do to influence local decision-making? Offered as POSC 301 and POSC 401.

POSC 302. State Politics and Policy. 3 Units.
State governments may make more decisions that affect the life of an average citizen than does the federal government. The study of state politics and policy includes the different ways states organize the basic parts of American political systems (such as legislatures, executives, courts and parties); how state cultures, economies, and other factors shape how political institutions work; institutions of state governance that do not exist at the national level (such as the initiative and referendum); and the continual contest between state and federal governments to control policy, shift costs, and avoid blame. Offered as POSC 302 and POSC 402.

POSC 306. Interest Groups in the Policy Process. 3 Units.
Introduction to the institutions and processes that make up the political environment of nonprofit and other organizations in the United States, beginning with an examination of the role of civil society in a democracy and continuing with the framing of issues, role of political entrepreneurs and organized interests, elections, the legislative process and strategies for influencing it, and the roles of executive institutions and the courts. Offered as POSC 306 and POSC 406.
POSC 308. The American Presidency. 3 Units.
The sources of, strategies of, and restraints on presidential leadership in the United States. Emphasis on problems of policy formation, presidential relations with Congress and executive agencies, and the electoral process. Offered as POSC 308 and POSC 408.

POSC 310. The Legislative Process. 3 Units.
Legislative, representative, and other functions of Congress and state legislatures; legislative relations with the executive and with private interests; powers and limitations of the legislature as a policy-making institution. Offered as POSC 310 and POSC 410.

POSC 320B. The U.S. Midterm Elections. 3 Units.
Analysis of the midterm elections in the United States. Covers congressional and state elections in all regions, focusing on the issues, personalities, campaign strategies, and voter trends in this key electoral battle held between presidential elections. Offered every four years in conjunction with the election cycle. Offered as POSC 320B and POSC 420B.

POSC 320C. The Presidential Election. 3 Units.
Analysis of the upcoming presidential election in the United States. Focuses on the issues and personalities, polls and public opinion, campaign strategies, and electoral behavior. Offered every four years in conjunction with the United States presidential election cycle. Offered as POSC 320C and POSC 420C.

POSC 321. News Media and Politics. 3 Units.
Analysis of the political role of the news media in American government and politics. Examines the fascinating relationship between reporters and politicians. Covers the overall structure and legal position of the media as well as the media's impact on the American political system. Offered as POSC 321 and POSC 421.

POSC 322. Political Movements and Political Participation. 3 Units.
Political Movements and Political Participation is concerned with the variety of ways citizens engage in collective activism in the United States and across national boundaries, and with the conditions under which citizens identify common concerns and join together in political movements to bring about change. The course begins with an examination of three general bodies of theory and research on political movements: resource mobilization, political opportunity structures, and cultural framing. We will also investigate frameworks of political participation for understanding the relationships among different expressions of collective activism and representation. In the context of these sometimes competing theories, we will consider 1) the conditions under which political movements are likely to emerge, as well as the circumstances in which collective political action is precluded; 2) how citizens come to recognize collective grievances and shared political identities; 3) the strategies and tactics of organized movements, and their likelihood of political success; and 4) the relationship between political movements, political parties, and the state. Offered as POSC 322 and POSC 422.

POSC 323. Judicial Politics. 3 Units.
Rejecting the view that judges mechanically apply the law, the study of judicial politics seeks to understand the behavior of judges as political actors with policy goals. Topics include judicial selection and socialization, judicial policy change, judicial strategy (especially the strategic interaction of judges on multi-judge panels), the interaction of courts in hierarchical judicial systems, the policy impact of judicial decisions, and the courts' interactions with coordinate branches of government (the executive, Congress, state governments, state courts). Primary focus will be on the federal judiciary, with some discussion of state judicial systems. Offered as POSC 323 and POSC 423.

POSC 325. American Constitutional Law. 3 Units.
An introductory survey of U.S. constitutional law. Special attention given to the historical, philosophical, and political dimensions of landmark Supreme Court cases. Judicial review, federalism, separation of powers, due process, and equal protection. Supreme Court's involvement in major political controversies: the New Deal, abortion, physician-assisted suicide, school desegregation, and affirmative action. Offered as POSC 325 and POSC 425.

POSC 326. Constitutions in Practical Politics. 3 Units.
Overview of ancient Greek and Roman constitution-making, medieval principles, emergence of modern constitutionalism, and the constitutionalist vision of the American and French Revolutions. Examination of contemporary constitutional issues and developments in countries such as Canada, France, Germany, Great Britain, Ethiopia, India, and the United States. Offered as POSC 326 and POSC 426.

POSC 327. Civil Liberties in America. 3 Units.
Supreme Court's interpretation of the First Amendment: liberty of religion through the establishment and free exercise clauses, freedoms of speech and the press, of assembly and association. The "pure tolerance" view examined against subversive speech, "fighting words," libel, and obscenity. Survey of content-neutral regulation, symbolic expression, and current efforts to limit expression (census speech codes and the feminist anti-pornography movement). Offered as POSC 327 and POSC 427.

POSC 328. Topics in Civil Liberties. 3 Units.
Rights of the accused as outlined in the Fourth, Fifth, Sixth, and Eighth Amendments. Topics covered are (1) arrests, searches, and seizures, (2) the privilege against compelled self-incrimination, (3) the rights to counsel, confrontation, and jury trial, and (4) the prohibition against cruel and unusual punishments. Case-specific approach but presents interplay of history, philosophy, and politics as background of each topic. Offered as POSC 328 and POSC 428.

POSC 334. Violence and the Political System. 3 Units.
Empirical analysis of various theories advanced in the cross-cultural explanation of factors which cause and mediate the occurrence of violence—revolutions, terrorism, and civil disorder—within the political system. Offered as POSC 334 and POSC 434.

POSC 341. Elections, Voters, and Political Parties. 3 Units.
Examination of American political parties, their activities, organization, characteristics, and functions. Candidate strategies and electoral history viewed within the context of voter orientations and predispositions, stressing linkages between citizen and party and between party and government. Offered as POSC 341 and POSC 441.
POSC 342. Water. 3 Units.
This seminar will explore the history of the meaning of water—that is, the social, cultural, and/or political significance placed on water by individuals and governments in different times and places. It will also examine how humans have acted upon water, and how it has acted upon humans, with great consequences for human life. This seminar will look at the history of water in the context of science, technology and society; public health; political science; and environmental history. Case studies will be drawn from a wide chronologically and geographically range; from the ancient world to Renaissance Italy, nineteenth century India, modern Britain, Egypt, and the U.S. The course provides a wide perspective on the themes of the history of human-water interactions, but will also focus closely on some critical cases. Seminar participants will write a research paper on the topic of their choice in the environmental history of water. Offered as: HSTY 342, HSTY 442, POSC 342, POSC 442.

POSC 343. Public Opinion and American Democracy. 3 Units.
Examination of theories, concepts and empirical research related to attitudes and the political behavior of mass publics. Offered as POSC 343 and POSC 443.

POSC 346. Women and Politics. 3 Units.
Women and Politics involves a critical examination of the impact of gender on the forms and distributions of power and politics, with primary reference to the experience of women in the United States. Major concerns of the course include what we mean by "sex," "gender," and "politics"; the relationship between women and the state; how women organize collectively to influence state policies; and how the state facilitates and constrains women's access to and exercise of political power. The course is organized around four foci central to the study of women and politics. The first section of the course focuses on what we mean by "women," "gender," and "politics." In this section, we will consider how these concepts intersect and the ways in which each may be used to deepen our understanding of the workings of governments and political systems, and of women's relative political powerlessness. The second section of the course employs these concepts to understand the (re) emergence of the US feminist movement, its meanings, practices, and goals, and its transformation across US political history. In the third section, we turn to conventional electoral politics, focusing on women's candidacies, their campaigns, and women's voting behavior. In the final section of the course, we consider those general factors that might provide for increased gender equality and improved life status for women, in global, comparative perspective. Offered as POSC 346 and POSC 446 and WGST 346.

POSC 348. History of Modern Political and Social Thought. 3 Units.
This course explores the responses of philosophers, economic theorists, culture critics, and public policy makers to changes in western society wrought by industrialization by focusing on their concerns with technological change. Offered as HSTY 348, HSTY 448 and POSC 348.

POSC 349. Political Science Research Methods. 3 Units.
This course examines approaches that political scientists use to understand events and processes. In doing so, the course provides students with skills helpful to completing senior projects, such as the ability to evaluate and conduct research. Through exercises and projects, students will take part in the research process from constructing a question to developing a research design to interpreting results. Students will learn and apply key techniques, including inductive and deductive reasoning, hypothesis construction, operationalization of concepts, measurements, sampling and probability, causal inference, and the logic of controls. They will produce materials common to the discipline, such as research designs. Offered as POSC 349 and POSC 449.

POSC 351. Modern Political Thought. 3 Units.
Examination of a limited topic in the study of modern political thought. Topics vary. Offered as POSC 351 and POSC 451.

POSC 352. American Political Thought. 3 Units.
Examination of the unique contribution to the science of government made by American political thinkers. Offered as POSC 352 and POSC 452.

POSC 354. Political and Social Philosophy. 3 Units.
Justification of social institutions, primarily political ones. Such distinctions as that between de facto and legitimate authority; analysis of criteria for evaluation, such as social justice and equality; inquiry into theories of justification of the state; theory of democratic government and its alternatives. Readings from classical and contemporary sources. Recommended preparation: PHIL 101. Offered as PHIL 334, POSC 354, PHIL 434, and POSC 454.

POSC 355. Modern Political Ideologies. 3 Units.
Substance and nature of ideological thinking in the contemporary world via a survey of political "isms"—for example, liberalism, libertarianism, conservatism, fascism, socialism, and even more recent trends such as feminism, environmentalism, etc. Offered as POSC 355 and POSC 455.

POSC 357. Democratic Politics: Theory and Practice. 3 Units.
Study of the theory and application of democracy. The concept of democracy will be examined from the Athenian model to contemporary debates over participatory and deliberative models. Then the concept will be applied to understanding issues of democratic practice and the study of politics in American, comparative, and international arenas. Finally, the course will address the potential effects, both good and ill, of technological innovation on democratic practices, such as "distance" participation, the Internet, and other communication technology. Offered as POSC 357 and POSC 457.

POSC 358. Political Strategy. 3 Units.
This course examines practical applications of prominent political science theories. It is partly a how-to course covering a broad range of political activities, but the primary objective is to link practical issues with theories to help you understand why events happen the way they do. The course focuses on American politics, but the materials will be applicable to a wide range of situations. The course is a seminar requiring regular student presentations that will generate discussion about the readings and current events. Papers consist of analysis of current events, and require students to analyze the strategies used by prominent figures in the context of the theories we discuss in class. Offered as POSC 358 and POSC 458.
POSC 361. State-Building and State Collapse. 3 Units.
Are nation-states the most effective means of organizing society? This course explores this question by examining the historical rationales behind the development of the nation-state, contemporary challenges to the nation-state, and potential alternatives to the nation-state. Possible challenges to the nation-state include multinational corporations, international humanitarian intervention, and regional integration. Alternative providers of state services include charities, companies, and mercenaries. Offered as POSC 361 and POSC 461.

POSC 362. Politics of Central Asia. 3 Units.
Once an unfamiliar region to many people of the world, Central Asia took center stage in the fall of 2001 as a result of the U.S. campaign against terrorism. This course will introduce students to the politics of Central Asia, focusing on the region today composed of Uzbekistan, Turkmenistan, Tajikistan, Kyrgyzstan, and Kazakhstan. We will review the nationalism, foreign relations, religion, ethnicity, and economics of the region. Offered as ETHS 362, POSC 362, and POSC 462.

POSC 363. Comparative Analysis of Elections and Electoral Systems. 3 Units.
Elections involve more than a simple act of voting to express individual preferences. The rules under which worldwide elections are held determine who controls the executive and how votes are converted into legislative seats. The mechanics of various electoral arrangements will be examined in detail and the consequences for the political system discussed in terms of strategies and desired outcomes on the part of contestants. Students will research individual countries and analyze recent elections from both qualitative and quantitative perspectives, including introduction to geospatial data for mapping variations in electoral behavior. Offered as POSC 363 and POSC 463.

POSC 364. Dictatorship and Democracy in Modern Latin America. 3 Units.
Examination of political leadership in 20th-century Latin America, exploring the nature, causes, and consequences of dictatorship and democracy in the region, moving from the collapse of oligarchic rule and the emergence of populism in the 1930s and 1940s, to the end of democracy and establishment of military regimes in the 1960s and 1970s, and ultimately to the contemporary processes of democratization and economic liberalization. Offered as ETHS 364, POSC 364, and POSC 464.

POSC 365. Science, Technology, and Government. 3 Units.
Traces the development and influence of federal technology and science policies from colonial times to the present, with emphasis on the 20th century. Offered as HSTY 366 and POSC 365.

POSC 366. Government and Politics of Africa. 3 Units.
Comparative analysis of the political forces and organizations currently functioning in Africa, as well as a survey of the formal government institutions. Special emphasis on single-party rule, military rule, and the political ramifications of African socialism, tribalism and the problems of national integration. Offered as ETHS 366, POSC 366, and POSC 466.

POSC 367. Western European Political Systems. 3 Units.
Comparative analysis of sociopolitical systems of selected Western European industrial democracies, using North American systems as a point of comparison. Offered as POSC 367 and POSC 467.

POSC 369. Current Controversies in Latin American Politics and Society. 3 Units.
In addition to questions about race, religion, abortion, the drug industry, immigration, democracy, private property, and free trade, the course will tackle Latin America's apparent shift to the political and ideological left, Chavez's "Imperialism," and Cuba's humanitarian aid. Offered as ETHS 369, POSC 369 and POSC 469.

POSC 370A. Political Economy. 3 Units.
Focus on debates concerning the proper relationship between political and economic systems, including conservative, liberal, and radical perspectives. The politics of international economics and the economics of international politics receive separate attention. The course concludes with study of "modern" political economy and the application of economic theory to the study of political systems. Offered as POSC 370A and POSC 470A.

POSC 370C. The United States and Asia. 3 Units.
Survey and analysis of U.S.-Asia relations in the post-World War II period. Focus specifically is on the interaction of politics and economics in the United States' relations with Japan, China, and Southeast Asian countries. Topics will include the role of Asia in U.S. Cold War policies, the dynamics of U.S.-Japan alliance politics, post-Cold War issues involving U.S. foreign policy toward Asia, a history and analysis of economic conflict cooperation, and an examination of the move toward Asia-Pacific "regionalism." Offered as POSC 370C and POSC 470C.

POSC 370D. The Politics of China. 3 Units.
Now more than ever, the Chinese state and society are facing tremendous economic, social, and political challenges. This course presents an overview of current issues facing the People's Republic, including a changing (or not) political culture, policy processes and outcomes at the national and local levels, reform and economic growth, the resultant societal changes and pressures, and the consequent challenges the Communist Party faces as demand for political reform grows. The class involves a mixture of lectures and discussion and draws on a combination of primary and secondary sources, including current news reports and films. Offered as POSC 370D and POSC 470D.

POSC 370F. Financial Politics in the United States and the World. 3 Units.
This course explores how political institutions make policy in the financial area with particular emphasis on the United States. Using a bureaucratic politics framework, it examines money, banks and the securities industry by integrating a wide range of literature in economics and political science. Specific objectives include familiarizing students with different approaches to the political economy of finance from different disciplines, exploring the historical evolution of finance, examining the changing relationship between public and private authority within the financial system, considering how politics operates in a crisis, and evaluating the role of international financial institutions in the global economy. By taking this course, students will equip themselves for further research into politics and economics, as well as offer them tools to analyze future policy developments as they unfold. Offered as POSC 370F and POSC 470F.
POSC 370G. U.S. Intelligence and National Security. 3 Units.
Examination of the impact of the intelligence process on foreign policy making and superpower relations. Covers the life cycle of United States strategic intelligence from the collection of data to formulation of analytic judgments and the policy-level uses of intelligence. Emphasis on contemporary intelligence issues and processes, but includes the formative period of modern American intelligence in the World War II era. Offered as POSC 370G and POSC 470G.

POSC 370H. China’s Foreign Policy. 3 Units.
The rise of China is evident in the country’s more forward and robust foreign policy that began in 1979. At every turn, nations throughout the world must now consider China wherever their interests are at stake, be it Korea and Northeast Asia, Indochina and Southeast Asia, India/ Pakistan and South Asia, or Afghanistan and Iran in the Middle East, not to mention the many African states that welcome Chinese investment but chafe at China’s presence. Further, China is increasingly aggressive in international trade, a major determinant of its foreign policy. This course describes the key factors that make up Chinese foreign policy, including its cultural tradition, policy-making institutions, the role of the military, and domestic determinants of foreign policy. The course also examines China’s ever-changing foreign policy strategies, from an aggressive posture to charming its neighbors only to become more strident once again. The course will also examine China’s role involving possible mercantilism, currency manipulation, and the hunt for traditional and alternative energy sources. Throughout the course, we will pay attention to how China’s foreign policy relates to international relations theories and what strategies might be used to manage China’s growing role in international affairs. Offered as POSC 370H and POSC 470H.

POSC 370J. International Law and Organizations. 3 Units.
Study of international organizations and international law as two means for regulating and coordinating nation-state behavior. History of the two techniques will be traced, covering 19th century efforts at cooperation, the League of Nations and the United Nations, regional and specialized global organization. The functions of international law in global politics will be stressed, with primary focus on the evolving role of law in dealing with global problems, e.g., war, the environment, economic cooperation, and human rights. Offered as POSC 370J and POSC 470J.

POSC 370K. Nationalism, Ethnicity, and Religion in World Politics. 3 Units.
Examination of the post-Cold War surge in conflicts among nationalisms, ethnic groups, and religions with particular attention to the former Yugoslavia, Ireland, India, Africa, and the Middle East. Offered as ETHS 370K, POSC 370K, and POSC 470K.

POSC 370M. Theories of Political Economy. 3 Units.
This course is a SAGES departmental seminar in political economy that brings a wide range of theoretical perspectives to bear on the relations between market and state in the contemporary world. It focuses on three questions: What have been the major debates concerning the role of the government in the economy? How were these debates resolved in the compromise of embedded liberalism, and What experiences have individual states had with these questions of political economy? To answer these questions, we will read original literature to uncover the connections among politics, economics, and the world of ideas that has resulted in the political debates we confront today. Offered as POSC 370M and POSC 470M.

POSC 371. Natural Resources and World Politics. 3 Units.
Examination of the political causes and ramifications of the uneven distribution of the valuable natural resources for modern industrial societies. Strategic and military issues and the exploitation of the seabed. Examination in some detail of selected commodity issues, including petroleum, copper and uranium. Offered as POSC 371 and POSC 471.

POSC 373. Politics of the European Union. 3 Units.
Study of the origins, operations, and prospects for the European Union. This can include the historical context for the effort to restrict national rivalries (which fueled two world wars) and create common interests; the diplomatic challenges in finding common ground; the tasks and processes of governance within the EU, including its governing institutions, enforcement of terms for European Monetary Union and the operations of its bureaucracies; the social pressures that create policy challenges (such as agriculture policy and immigration); broad tensions within the enterprise (e.g., “broadening” vs. “deepening”), and the EU’s potential place in international politics, especially the efforts to create a common foreign and security policy and the possible implications of the Euro for international political economy. Offered as POSC 373 and POSC 473.

POSC 374. Politics of Development in the Global South. 3 Units.
Exploration of the post-World War II emergence of the Global South nations of Africa, Asia, the Middle East, Latin America, and the Eastern Europe arena. Offered as ETHS 374, POSC 374, and POSC 474.

POSC 376. United States Foreign Policy. 3 Units.
Focus on U.S. foreign policy making with a dynamic network of executive and congressional actors and organizations; analysis of traditional and contemporary U.S. foreign policies from nuclear defense to current economic resource issues; future role of the United States in world affairs. Offered as POSC 376 and POSC 476.

POSC 377. Politics of Russia. 3 Units.
Russia faces three problems: the creation of a sovereign state, the development of a new political system, and the restructuring of its economy. In this course we will challenge the assumption that the outcome of these three transitions will be a strong, democratic, capitalist country. We will ask whether civil war, organized crime, an immature party system, poor social services, and nomenklatura privatization bode poorly for these three transformations. Offered as POSC 377 and POSC 477.

POSC 378. International Relations Theory. 3 Units.
This course is a seminar in international relations theory. As such, we will bring a wide range of theoretical perspectives to bear on issues and debates in the area of international relations by systematically studying the evolution of the world system. The seminar is roughly divided into a first half focusing on war and the political system, and a second half focusing on trade, finance and the economic system. Each section devotes particular attention to ethical problems associated with political and economic issues. This course should develop students’ ability to read and critically evaluate academic literature in the field of international relations, and enable students to produce a scholarly paper on one substantive area of the field. Offered as POSC 378 and POSC 478.
POSC 379. Introduction to Middle East Politics. 3 Units.
This is an introductory course about Middle East Politics, in regional as well as international aspects. In this course we will explore broad social, economic, and political themes that have defined the region since the end of World War Two. Since this is an introductory course, a major goal will be to gain comparative knowledge about the region's states and peoples. The countries that comprise the modern Middle East are quite diverse; therefore, we will only be able to focus on a few cases in depth. A second goal is to use the tools and theories social scientists employ to answer broad questions related to the region, such as: How have colonial legacies shaped political and economic development in the Middle East? How do oil, religion, and identity interact with politics? How have external powers affected the region's political development? What do the uprisings of 2011 hold for the region's future? Offered as POSC 379 and POSC 479.

POSC 380. State and War in Africa and the Middle East. 3 Units.
The Middle East, North Africa, and Sub-Saharan Africa remain the most volatile and conflict prone regions of the world. Traditional approaches to war and state conflict have emphasized systemic variables, such as balance of power, military capabilities, perceptions, the security dilemma, and of course anarchy. While these concepts have generated much academic interest, their ability to explain and understand conflict in the developing world is severely limited. This is due to the basic fact that nearly all conflict in the world today is not between states but is taking place within state boundaries. What drives these conflicts? Are there common factors and patterns within the Middle East and Africa? How does sub-state conflict affect political and economic development? What are the most likely resolution strategies? Recommended preparation: POSC 379.

POSC 381. City as Classroom. 3 Units.
In this course, the city is the classroom. We will engage with the urban terrain. We will meet weekly off-campus, interact with community members, and interface--both literally and figuratively--with the city as a way to examine the linkages between historical, conceptual, and contemporary issues, with particular attention paid to race and class dynamics, inequality, and social justice. This course will have four intersecting components, primarily focusing on American cities since the 1930s: the social and physical construction of urban space, the built environment, life and culture in the city, and social movements and grassroots struggles. Offered as HSTY 381, POSC 381, SOCI 381, HSTY 481, POSC 481, and SOCI 481.

POSC 383. Health Policy and Politics in the United States. 3 Units.
Overview of the principal institutions, processes, social forces, and ideas shaping the U.S. health system. Historical, political, economic, and sociological perspectives on the health system are explored as well as the intellectual context of recent policy changes, challenges, and developments. Students will acquire a sense of how health services are financed and delivered in the U.S. They will also learn how to assess its performance compared to that of other similar countries. Offered as POSC 383 and POSC 483.

POSC 384. Ethics and Public Policy. 3 Units.
Evaluation of ethical arguments in contemporary public policymaking discourse. That is, approaches to evaluating not only the efficiency of policy (Will this policy achieve its end for the least cost?) but also the ethics of policy (Are a policy's intended ends ethically justified or "good," and are our means to achieve those ends moral or "just"). Overview of political ideologies that supply U.S. political actors with their ethical or moral arguments when proposing and implementing public policy, followed by an application of these differing perspectives to selected policy areas such as welfare, euthanasia, school choice, drug laws, censorship, or others. Offered as POSC 384 and POSC 484.

POSC 385. U.S. Bureaucratic Politics. 3 Units.
Bureaucracy is one of civilization's most important inventions. It is a way of coordinating very large numbers of people so as to do work, make decisions, and exercise power. Without it, much of modern life would be impossible. Yet "bureaucracy" is normally seen, in public discussion, as a problem, instead of as a solution. This course will consider both the reasons for and pathologies of bureaucratic organization. Its special focus is bureaucracy in American government. The course therefore will provide some introduction to the study of American public administration, but with special emphasis on how the work and performance of public bureaucracies in the United States is shaped by the specific tasks they are given and the distribution of power in the American political arena. Offered as POSC 385 and POSC 485.

POSC 386. Making Public Policy. 3 Units.
Politics is about who wins, who loses, and why. Policy, by contrast, is often depicted as more "neutral:" policies are the means through which political decisions are carried out. In this class, we examine the notion that policy is the rational, impartial counterpart to the political arena. We will ask: How are public policies made? Why do some issues make it on to the agenda, while others do not? Can we separate facts from values, or are both always contested? We will examine how decision-making in a group introduces distinct challenges for policymaking. The course focuses on widely applicable themes of policymaking, drawing on both domestic and international examples. Offered as POSC 386 and POSC 486.

POSC 388. Politics, Policy, and the Global Environment. 3 Units.
This course examines the law, politics and policy surrounding global environmental challenges such as climate change. The course aims to provide a broad overview of the key concepts, actors, debates, and issues in global environmental politics. It aims to illustrate the complexities of addressing environmental problems-from the proliferation of global institutions and international actors, to the absence of central enforcement mechanisms. We examine the causes of environmental degradation and competing views on the gravity of the problem. Using concepts from political science and economics, we investigate the challenges in getting states to act jointly to address environmental problems. We examine the actors and institutions of global environmental politics, to understand how conditions are defined as problems and responses are chosen and implemented. The course concludes by applying the tools and concepts to the case of climate change. Offered as POSC 388, ESTD 388, POSC 488.

POSC 389. Special Topics in American Politics and Policy. 3 Units.
Specific topic will vary but will consist of an in-depth investigation of a particular policy area or political phenomenon. Topics will involve policy controversies of some current interest. Offered as POSC 389 and POSC 489.
POS 395. Special Projects. 1 - 6 Unit.
Study of a topic of particular interest, or an approved internship. The student must submit to the departmental office a project prospectus form, approved and signed by the faculty supervisor, no later than the end of the second week of classes. The prospectus must outline the goals of the project and the research methodology to be used and is part of the basis for grading. The prospectus form is available from the departmental office of from the department’s Web page.

POS 396. Senior Project SAGES Capstone. 3 Units.
Capstone experience for political science majors or senior POSC minors as part of the SAGES program, providing opportunity to do an in-depth paper on a topic of particular interest to them. Students must obtain approval from a faculty project advisor and list that advisor on the registration form. The advisor must sign and student submit to department a prospectus including goals, schedule, and research methodology. This paper should demonstrate, and ideally even extend, the skills and expertise developed over the course of study in the department. Upon completion of the capstone, students will be expected to present their work in a public forum. Recommended preparation: Junior or Senior political science major or senior political science minor and departmental prospectus form.

POS 401. Decision-Making in American Cities. 3 Units.
Localities are the primary interface with government and provide the basic psychological place identification for most Americans. The course will explore this assertion in the context of urban America today. How are decisions made in cities? Who shapes these decisions and why? What role is played by shifting demographics, race, and poverty? What can the individual do to influence local decision-making? Offered as POSC 301 and POSC 401.

POS 402. State Politics and Policy. 3 Units.
State governments may make more decisions that affect the life of an average citizen than does the federal government. The study of state politics and policy includes the different ways states organize the basic parts of American political systems (such as legislatures, executives, courts and parties); how state cultures, economies, and other factors shape how political institutions work; institutions of state governance that do not exist at the national level (such as the initiative and referendum); and the continual contest between state and federal governments to control policy, shift costs, and avoid blame. Offered as POSC 302 and POSC 402.

POS 406. Interest Groups in the Policy Process. 3 Units.
Introduction to the institutions and processes that make up the political environment of nonprofit and other organizations in the United States, beginning with an examination of the role of civil society in a democracy and continuing with the framing of issues, role of political entrepreneurs and organized interests, elections, the legislative process and strategies for influencing it, and the roles of executive institutions and the courts. Offered as POSC 306 and POSC 406.

POS 408. The American Presidency. 3 Units.
The sources of, strategies of, and restraints on presidential leadership in the United States. Emphasis on problems of policy formation, presidential relations with Congress and executive agencies, and the electoral process. Offered as POSC 308 and POSC 408.

POS 410. The Legislative Process. 3 Units.
Legislative, representative, and other functions of Congress and state legislatures; legislative relations with the executive and with private interests; powers and limitations of the legislature as a policy-making institution. Offered as POSC 310 and POSC 410.

POS 420B. The U.S. Midterm Elections. 3 Units.
Analysis of the midterm elections in the United States. Covers congressional and state elections in all regions, focusing on the issues, personalities, campaign strategies, and voter trends in this key electoral battle held between presidential elections. Offered every four years in conjunction with the election cycle. Offered as POSC 320B and POSC 420B.

POS 420C. The Presidential Election. 3 Units.
Analysis of the upcoming presidential election in the United States. Focuses on the issues and personalities, polls and public opinion, campaign strategies, and electoral behavior. Offered every four years in conjunction with the United States presidential election cycle. Offered as POSC 320C and POSC 420C.

POS 421. News Media and Politics. 3 Units.
Analysis of the political role of the news media in American government and politics. Examines the fascinating relationship between reporters and politicians. Covers the overall structure and legal position of the media as well as the media’s impact on the American political system. Offered as POSC 321 and POSC 421.

POS 422. Political Movements and Political Participation. 3 Units.
Political Movements and Political Participation is concerned with the variety of ways citizens engage in collective activism in the United States and across national boundaries, and with the conditions under which citizens identify common concerns and join together in political movements to bring about change. The course begins with an examination of three general bodies of theory and research on political movements: resource mobilization, political opportunity structures, and cultural framing. We will also investigate frameworks of political participation for understanding the relationships among different expressions of collective activism and representation. In the context of these sometimes competing theories, we will consider 1) the conditions under which political movements are likely to emerge, as well as the circumstances in which collective political action is precluded; 2) how citizens come to recognize collective grievances and shared political identities; 3) the strategies and tactics of organized movements, and their likelihood of political success; and 4) the relationship between political movements, political parties, and the state. Offered as POSC 322 and POSC 422.

POS 423. Judicial Politics. 3 Units.
Rejecting the view that judges mechanically apply the law, the study of judicial politics seeks to understand the behavior of judges as political actors with policy goals. Topics include judicial selection and socialization, judicial policy change, judicial strategy (especially the strategic interaction of judges on multi-judge panels), the interaction of courts in hierarchical judicial systems, the policy impact of judicial decisions, and the courts’ interactions with coordinate branches of government (the executive, Congress, state governments, state courts). Primary focus will be on the federal judiciary, with some discussion of state judicial systems. Offered as POSC 323 and POSC 423.
POSC 425. American Constitutional Law. 3 Units.
An introductory survey of U.S. constitutional law. Special attention given to the historical, philosophical, and political dimensions of landmark Supreme Court cases. Judicial review, federalism, separation of powers, due process, and equal protection. Supreme Court's involvement in major political controversies: the New Deal, abortion, physician-assisted suicide, school desegregation, and affirmative action. Offered as POSC 325 and POSC 425.

POSC 426. Constitutions in Practical Politics. 3 Units.
Overview of ancient Greek and Roman constitution-making, medieval principles, emergence of modern constitutionalism, and the constitutionalist vision of the American and French Revolutions. Examination of contemporary constitutional issues and developments in countries such as Canada, France, Germany, Great Britain, Ethiopia, India, and the United States. Offered as POSC 326 and POSC 426.

POSC 427. Civil Liberties in America. 3 Units.
Supreme Court's interpretation of the First Amendment: liberty of religion through the establishment and free exercise clauses, freedoms of speech and the press, of assembly and association. The "pure tolerance" view examined against subversive speech, "fighting words," libel, and obscenity. Survey of content-neutral regulation, symbolic expression, and current efforts to limit expression (campus speech codes and the feminist anti-pornography movement). Offered as POSC 327 and POSC 427.

POSC 428. Topics in Civil Liberties. 3 Units.
Rights of the accused as outlined in the Fourth, Fifth, Sixth, and Eighth Amendments. Topics covered are (1) arrests, searches, and seizures, (2) the privilege against compelled self-incrimination, (3) the rights to counsel, confrontation, and jury trial, and (4) the prohibition against cruel and unusual punishments. Case-specific approach but presents interplay of history, philosophy, and politics as background of each topic. Offered as POSC 328 and POSC 428.

POSC 429. Courts, Public Policy, and Social Change. 2 Units.
Examines the social impact of law and use of social research in the legal process, assesses efforts to use law to effect social reform, and empirical studies of legal processes and institutions. Recommended preparation: Graduate standing or consent of department. Offered as LAWS 285 and POSC 429.

POSC 434. Violence and the Political System. 3 Units.
Empirical analysis of various theories advanced in the cross-cultural explanation of factors which cause and mediate the occurrence of violence--revolutions, terrorism, and civil disorder--within the political system. Offered as POSC 334 and POSC 434.

POSC 441. Elections, Voters, and Political Parties. 3 Units.
Examination of American political parties, their activities, organization, characteristics, and functions. Candidate strategies and electoral history viewed within the context of voter orientations and predispositions, stressing linkages between citizen and party and between party and government. Offered as POSC 341 and POSC 441.

POSC 442. Water. 3 Units.
This seminar will explore the history of the meaning of water--that is, the social, cultural, and/or political significance placed on water by individuals and governments in different times and places. It will also examine how humans have acted upon water, and how it has acted upon humans, with great consequences for human life. This seminar will look at the history of water in the context of science, technology and society; public health; political science; and environmental history. Case studies will be drawn from a wide chronological and geographical range; from the ancient world to Renaissance Italy, nineteenth century India, modern Britain, Egypt, and the U.S. The course provides a wide perspective on the themes of the history of human-water interactions, but will also focus closely on some critical cases. Seminar participants will write a research paper on the topic of their choice in the environmental history of water. Offered as: HSTY 342, HSTY 442, POSC 342, POSC 442.

POSC 443. Public Opinion and American Democracy. 3 Units.
Examination of theories, concepts and empirical research related to attitudes and the political behavior of mass publics. Offered as POSC 343 and POSC 443.

POSC 444. Women and Politics. 3 Units.
Women and Politics involves a critical examination of the impact of gender on the forms and distributions of power and politics, with primary reference to the experience of women in the United States. Major concerns of the course include what we mean by "sex," "gender," and "politics"; the relationship between women and the state; how women organize collectively to influence state policies; and how the state facilitates and constrains women's access to and exercise of political power. The course is organized around four foci central to the study of women and politics. The first section of the course focuses on what we mean by "women," "gender," and "politics." In this section, we will consider how these concepts intersect and the ways in which each may be used to deepen our understanding of the workings of governments and political systems, and of women's relative political powerlessness. The second section of the course employs these concepts to understand the (re) emergence of the US feminist movement, its meanings, practices, and goals, and its transformation across US political history. In the third section, we turn to conventional electoral politics, focusing on women's candidacies, their campaigns, and women's voting behavior. In the final section of the course, we consider those general factors that might provide for increased gender equality and improved life status for women, in a global, comparative perspective. Offered as POSC 346 and POSC 446 and WGST 346.

POSC 449. Political Science Research Methods. 3 Units.
This course examines approaches that political scientists use to understand events and processes. In doing so, the course provides students with skills helpful to completing senior projects, such as the ability to evaluate and conduct research. Through exercises and projects, students will take part in the research process from constructing a question to developing a research design to interpreting results. Students will learn and apply key techniques, including inductive and deductive reasoning, hypothesis construction, operationalization of concepts, measurements, sampling and probability, causal inference, and the logic of controls. They will produce materials common to the discipline, such as research designs. Offered as POSC 349 and POSC 449.

POSC 451. Modern Political Thought. 3 Units.
Examination of a limited topic in the study of modern political thought. Topics vary. Offered as POSC 351 and POSC 451.
POSC 452. American Political Thought. 3 Units.
Examination of the unique contribution to the science of government made by American political thinkers. Offered as POSC 352 and POSC 452.

POSC 454. Political and Social Philosophy. 3 Units.
Justification of social institutions, primarily political ones. Such distinctions as that between de facto and legitimate authority; analysis of criteria for evaluation, such as social justice and equality; inquiry into theories of justification of the state; theory of democratic government and its alternatives. Readings from classical and contemporary sources. Recommended preparation: PHIL 101. Offered as PHIL 334, POSC 354, PHIL 434, and POSC 454.

POSC 455. Modern Political Ideologies. 3 Units.
Substance and nature of ideological thinking in the contemporary world via a survey of political "isms"--for example, liberalism, libertarianism, conservatism, fascism, socialism, and even more recent trends such as feminism, environmentalism, etc. Offered as POSC 355 and POSC 455.

POSC 457. Democratic Politics: Theory and Practice. 3 Units.
Study of the theory and application of democracy. The concept of democracy will be examined from the Athenian model to contemporary debates over participatory and deliberative models. Then the concept will be applied to understanding issues of democratic practice and the study of politics in American, comparative, and international arenas. Finally, the course will address the potential effects, both good and ill, of technological innovation on democratic practices, such as "distance" participation, the Internet, and other communication technology. Offered as POSC 357 and POSC 457.

POSC 458. Political Strategy. 3 Units.
This course examines practical applications of prominent political science theories. It is partly a how-to course covering a broad range of political activities, but the primary objective is to link practical issues with theories to help you understand why events happen the way they do. The course focuses on American politics, but the materials will be applicable to a wide range of situations. The course is a seminar requiring regular student presentations that will generate discussion about the readings and current events. Papers consist of analysis of current events, and require students to analyze the strategies used by prominent figures in the context of the theories we discuss in class. Offered as POSC 358 and POSC 458.

POSC 459. Economic Systems. 3 Units.
Examination of economic systems, including introduction to geospatial data for mapping variations in recent elections from both qualitative and quantitative perspectives, including introduction to geospatial data for mapping variations in electoral behavior. Offered as POSC 363 and POSC 463.

POSC 464. Dictatorship and Democracy in Modern Latin America. 3 Units.
Examination of political leadership in 20th-century Latin America, exploring the nature, causes, and consequences of dictatorship and democracy in the region, moving from the collapse of oligarchic rule and the emergence of populism in the 1930s and 1940s, to the end of democracy and establishment of military regimes in the 1960s and 1970s, and ultimately to the contemporary processes of democratization and economic liberalization. Offered as ETHS 364, POSC 364, and POSC 464.

POSC 466. Government and Politics of Africa. 3 Units.
Comparative analysis of the political forces and organizations currently functioning in Africa, as well as a survey of the formal government institutions. Special emphasis on single-party rule, military rule, and the political ramifications of African socialism, tribalism and the problems of national integration. Offered as ETHS 366, POSC 366, and POSC 466.

POSC 467. Western European Political Systems. 3 Units.
Comparative analysis of sociopolitical systems of selected Western European industrial democracies, using North American systems as a point of comparison. Offered as POSC 367 and POSC 467.

POSC 469. Current Controversies in Latin American Politics and Society. 3 Units.
In addition to questions about race, religion, abortion, the drug industry, immigration, democracy, private property, and free trade, the course will tackle Latin America's apparent shift to the political and ideological left, Chavez's "Imperialism," and Cuba's humanitarian aid. Offered as ETHS 369, POSC 369 and POSC 469.

POSC 470A. Political Economy. 3 Units.
Focus on debates concerning the proper relationship between political and economic systems, including conservative, liberal, and radical perspectives. The politics of international economics and the economics of international politics receive separate attention. The course concludes with study of "modern" political economy and the application of economic theory to the study of political systems. Offered as POSC 370A and POSC 470A.

POSC 470C. The United States and Asia. 3 Units.
Survey and analysis of U.S.-Asia relations in the post-World War II period. Focus specifically is on the interaction of politics and economics in the United States' relations with Japan, China, and Southeast Asian countries. Topics will include the role of Asia in U.S. Cold War policies, the dynamics of U.S.-Japan alliance politics, post-Cold War issues involving U.S. foreign policy toward Asia, a history and analysis of economic conflict cooperation, and an examination of the move toward Asia-Pacific "regionalism." Offered as POSC 370C and POSC 470C.
POSC 470D. The Politics of China. 3 Units.
Now more than ever, the Chinese state and society are facing tremendous economic, social, and political challenges. This course presents an overview of current issues facing the People’s Republic, including a changing or not) political culture, policy processes and outcomes at the national and local levels, reform and economic growth, the resultant societal changes and pressures, and the consequent challenges the Communist Party faces as demand for political reform grows. The class involves a mixture of lectures and discussion and draws on a combination of primary and secondary sources, including current news reports and films. Offered as POSC 370D and POSC 470D.

POSC 470F. Financial Politics in the United States and the World. 3 Units.
This course explores how political institutions make policy in the financial area with particular emphasis on the United States. Using a bureaucratic politics framework, it examines money, banks and the securities industry by integrating a wide range of literature in economics and political science. Specific objectives include familiarizing students with different approaches to the political economy of finance from different disciplines, exploring the historical evolution of finance, examining the changing relationship between public and private authority within the financial system, considering how politics operates in a crisis, and evaluating the role of international financial institutions in the global economy. By taking this course, students will equip themselves for further research into politics and economics, as well as offer them tools to analyze future policy developments as they unfold. Offered as POSC 370F and POSC 470F.

POSC 470G. U.S. Intelligence and National Security. 3 Units.
Examination of the impact of the intelligence process on foreign policy making and superpower relations. Covers the life cycle of United States strategic intelligence from the collection of data to formulation of analytic judgments and the policy-level uses of intelligence. Emphasis on contemporary intelligence issues and processes, but includes the formative period of modern American intelligence in the World War II era. Offered as POSC 370G and POSC 470G.

POSC 470H. China’s Foreign Policy. 3 Units.
The rise of China is evident in the country’s more forward and robust foreign policy that began in 1979. At every turn, nations throughout the world must now consider China wherever their interests are at stake, be it Korea and Northeast Asia, Indochina and Southeast Asia, India/ Pakistan and South Asia, or Afghanistan and Iran in the Middle East, not to mention the many African states that welcome Chinese investment but chafe at China’s presence. Further, China is increasingly aggressive in international trade, a major determinant of its foreign policy. This course describes the key factors that make up Chinese foreign policy, including its cultural tradition, policy-making institutions, the role of the military, and domestic determinants of foreign policy. The course also examines China’s ever-changing foreign policy strategies, from an aggressive posture to charming its neighbors only to become more strident once again. The course will also examine China’s role involving possible mercantilism, currency manipulation, and the hunt for traditional and alternative energy sources. Throughout the course, we will pay attention to how China’s foreign policy relates to international relations theories and what strategies might be used to manage China’s growing role in international affairs. Offered as POSC 370H and POSC 470H.

POSC 470J. International Law and Organizations. 3 Units.
Study of international organizations and international law as two means for regulating and coordinating nation-state behavior. History of the two techniques will be traced, covering 19th century efforts at cooperation, the League of Nations and the United Nations, regional and specialized global organization. The functions of international law in global politics will be stressed, with primary focus on the evolving role of law in dealing with global problems, e.g., war, the environment, economic cooperation, and human rights. Offered as POSC 370J and POSC 470J.

POSC 470K. Nationalism, Ethnicity, and Religion in World Politics. 3 Units.
Examination of the post-Cold War surge in conflicts among nationalisms, ethnic groups, and religions with particular attention to the former Yugoslavia, Ireland, India, Africa, and the Middle East. Offered as ETHS 370K, POSC 370K, and POSC 470K.

POSC 470M. Theories of Political Economy. 3 Units.
This course is a SAGES departmental seminar in political economy that brings a wide range of theoretical perspectives to bear on the relations between market and state in the contemporary world. It focuses on three questions: What have been the major debates concerning the role of the government in the economy? How were these debates resolved in the compromise of embedded liberalism, and What experiences have individual states had with these questions of political economy? To answer these questions, we will read original literature to uncover the connections among politics, economics, and the world of ideas that has resulted in the political debates we confront today. Offered as POSC 370M and POSC 470M.

POSC 471. Natural Resources and World Politics. 3 Units.
Examination of the political causes and ramifications of the uneven distribution of the valuable natural resources for modern industrial societies. Strategic and military issues and the exploitation of the seabed. Examination in some detail of selected commodity issues, including petroleum, copper and uranium. Offered as POSC 371 and POSC 471.

POSC 473. Politics of the European Union. 3 Units.
Study of the origins, operations, and prospects for the European Union. This can include the historical context for the effort to restrict national rivalries (which fueled two world wars) and create common interests; the diplomatic challenges in finding common ground; the tasks and processes of governance within the EU, including its governing institutions, enforcement of terms for European Monetary Union and the operations of its bureaucracies; the social pressures that create policy challenges (such as agriculture policy and immigration); broad tensions within the enterprise (e.g., “broadening” vs. “deepening”), and the EU’s potential place in international politics, especially the efforts to create a common foreign and security policy and the possible implications of the Euro for international political economy. Offered as POSC 373 and POSC 473.

POSC 474. Politics of Development in the Global South. 3 Units.
Exploration of the post-World War II emergence of the Global South nations of Africa, Asia, the Middle East, Latin America, and the Eastern Europe arena. Offered as ETHS 374, POSC 374, and POSC 474.
POSC 476. United States Foreign Policy. 3 Units.
Focus on U.S. foreign policy making with a dynamic network of executive and congressional actors and organizations; analysis of traditional and contemporary U.S. foreign policies from nuclear defense to current economic resource issues; future role of the United States in world affairs. Offered as POSC 376 and POSC 476.

POSC 477. Politics of Russia. 3 Units.
Russia faces three problems: the creation of a sovereign state, the development of a new political system, and the restructuring of its economy. In this course we will challenge the assumption that the outcome of these three transitions will be a strong, democratic, capitalist country. We will ask whether civil war, organized crime, an immature party system, poor social services, and nomenklatura privatization bode poorly for these three transformations. Offered as POSC 377 and POSC 477.

POSC 478. International Relations Theory. 3 Units.
This course is a seminar in international relations theory. As such, we will bring a wide range of theoretical perspectives to bear on issues and debates in the area of international relations by systematically studying the evolution of the world system. The seminar is roughly divided into a first half focusing on war and the political system, and a second half focusing on trade, finance and the economic system. Each section devotes particular attention to ethical problems associated with political and economic issues. This course should develop students' ability to read and critically evaluate academic literature in the field of international relations, and enable students to produce a scholarly paper on one substantive area of the field. Offered as POSC 378 and POSC 478.

POSC 479. Introduction to Middle East Politics. 3 Units.
This is an introductory course about Middle East Politics, in regional as well as international aspects. In this course we will explore broad social, economic, and political themes that have defined the region since the end of World War Two. Since this is an introductory course, a major goal will be to gain comparative knowledge about the region's states and peoples. The countries that comprise the modern Middle East are quite diverse; therefore, we will only be able to focus on a few cases in depth. A second goal is to use the tools and theories social scientists employ to answer broad questions related to the region, such as: How have colonial legacies shaped political and economic development in the Middle East? How do oil, religion, and identity interact with politics? How have external powers affected the region's political development? What do the uprisings of 2011 hold for the region's future? Offered as POSC 379 and POSC 479.

POSC 480. Public Policy and Aging. 3 Units.
Overview of aging and the aged. Concepts in the study of public policy. Policies on aging and conditions that they address. The politics of policies on aging. Emergent trends and issues. Offered as ANTH 498, BETH 496, EPBI 408, GERO 496, HSTY 480, MPHP 408, NURS 479, NURS 579, POSC 480, and SOCI 496.

POSC 481. City as Classroom. 3 Units.
In this course, the city is the classroom. We will engage with the urban terrain. We will meet weekly off-campus, interact with community members, and interface—both literally and figuratively—with the city as a way to examine the linkages between historical, conceptual, and contemporary issues, with particular attention paid to race and class dynamics, inequality, and social justice. This course will have four intersecting components, primarily focusing on American cities since the 1930s: the social and physical construction of urban space, the built environment, life and culture in the city, and social movements and grassroots struggles. Offered as HSTY 381, POSC 381, SOCI 381, HSTY 481, POSC 481, and SOCI 481.

POSC 483. Health Policy and Politics in the United States. 3 Units.
Overview of the principal institutions, processes, social forces, and ideas shaping the U.S. health system. Historical, political, economic, and sociological perspectives on the health system are explored as well as the intellectual context of recent policy changes, challenges, and developments. Students will acquire a sense of how health services are financed and delivered in the U.S. They will also learn how to assess its performance compared to that of other similar countries. Offered as POSC 383 and POSC 483.

POSC 484. Ethics and Public Policy. 3 Units.
Evaluation of ethical arguments in contemporary public policymaking discourse. That is, approaches to evaluating not only the efficiency of policy (Will this policy achieve its end for the least cost?) but also the ethics of policy (Are a policy's intended ends ethically justified or "good," and are our means to achieve those ends moral or "just"?). Overview of political ideologies that supply U.S. political actors with their ethical or moral arguments when proposing and implementing public policy, followed by an application of these differing perspectives to selected policy areas such as welfare, euthanasia, school choice, drug laws, censorship, or others. Offered as POSC 384 and POSC 484.

POSC 485. U.S. Bureaucratic Politics. 3 Units.
Bureaucracy is one of civilization's most important inventions. It is a way of coordinating very large numbers of people so as to do work, make decisions, and exercise power. Without it, much of modern life would be impossible. Yet "bureaucracy" is normally seen, in public discussion, as a problem, instead of as a solution. This course will consider both the reasons for and pathologies of bureaucratic organization. Its special focus is bureaucracy in American government. The course therefore will provide some introduction to the study of American public administration, but with special emphasis on how the work and performance of public bureaucracies in the United States is shaped by the specific tasks they are given and the distribution of power in the American political arena. Offered as POSC 385 and POSC 485.

POSC 486. Making Public Policy. 3 Units.
Politics is about who wins, who loses, and why. Policy, by contrast, is often depicted as more "neutral;" policies are the means through which political decisions are carried out. In this class, we examine the notion that policy is the rational, impartial counterpart to the political arena. We will ask: How are public policies made? Why do some issues make it on to the agenda, while others do not? Can we separate facts from values, or are both always contested? We will examine how decision-making in a group introduces distinct challenges for policymaking. The course focuses on widely applicable themes of policymaking, drawing on both domestic and international examples. Offered as POSC 386 and POSC 486.
**POSC 488. Politics, Policy, and the Global Environment. 3 Units.**
This course examines the law, politics and policy surrounding global environmental challenges such as climate change. The course aims to provide a broad overview of the key concepts, actors, debates, and issues in global environmental politics. It aims to illustrate the complexities of addressing environmental problems—from the proliferation of global institutions and international actors, to the absence of central enforcement mechanisms. We examine the causes of environmental degradation and competing views on the gravity of the problem. Using concepts from political science and economics, we investigate the challenges in getting states to act jointly to address environmental problems. We examine the actors and institutions of global environmental politics, to understand how conditions are defined as problems and responses are chosen and implemented. The course concludes by applying the tools and concepts to the case of climate change. Offered as POSC 388, ESTD 388, POSC 488.

**POSC 489. Special Topics in American Politics and Policy. 3 Units.**
Specific topic will vary but will consist of an in-depth investigation of a particular policy area or political phenomenon. Topics will involve policy controversies of some current interest. Offered as POSC 389 and POSC 489.

**POSC 495. Independent Study. 3 Units.**
Graduate level independent study taken for a grade.

**POSC 601. Individual Investigation. 1 - 6 Unit.**
The student must submit to the departmental office a project prospectus form, approved and signed by the faculty project supervisor, no later than the end of the second week of classes. The prospectus must outline the goals of the project and the research methodology to be used and is part of the basis for grading. The prospectus form is available from the departmental office. Prereq: Departmental prospectus form, graduate standing, and consent of department.

**POSC 701. Dissertation Ph.D.. 1 - 9 Unit.**
Prereq: Predoctoral research consent or advanced to Ph.D. candidacy milestone.
Department of Psychological Sciences

Communication Sciences Program I Psychology Program

The Department of Psychological Sciences combines the areas of study found in many psychology departments with those typically found in communication sciences departments. Our distinctive department offers undergraduate majors and minors in communication sciences and in psychology. We also offer a minor in health communications. For graduate students, our psychology program offers accredited doctoral training in clinical psychology and in experimental psychology. Our accredited Communication Sciences Program offers a master’s degree in speech-language pathology as well as a doctorate in communication sciences.

Communication Sciences

Cleveland Hearing & Speech Center, 11635 Euclid Ave, Room 333
Phone: 216.368.2470

The Department of Psychological Sciences offers courses of study in communication sciences leading to Bachelor of Arts, Master of Arts, and Doctor of Philosophy degrees. The Communication Sciences Program prepares undergraduate and graduate students to address broad issues of human communication processes and disorders through the application of cutting-edge technology and rigorous clinical training. We provide a comprehensive foundation in normal and disordered human communication and combine it with innovative interdisciplinary experiences that capitalize on the extensive resources of the university and the surrounding medical community. The department enjoys a particularly close relationship with Cleveland Hearing & Speech Center (http://bulletin.case.edu/collegeofartsandsciences/psychology/http://www.chsc.org), an outstanding independent, nonprofit provider of care in speech-language pathology and audiology; in fact, the program is housed within the center.

Many students pursue undergraduate study in communication disorders as preparation for further study in other fields or in conjunction with study in other fields. For example, one can combine a major in communication disorders with a major in sociology or psychology or with a minor in gerontological studies. Professionals in human services fields such as medicine, social work, nursing, or education often work with persons with communication disorders. For students interested in academic or research careers, investigation in the field of communication disorders is often done alongside investigation of normal human behavior. For example, one might study the word learning of children with normal language as well as that of children with language impairment.

Psychology

103 Mather Memorial Building
Phone: 216.368.2686

The Psychology Program offers the combined advantages of a strong liberal arts college and a major university. There are classes in all major areas of the psychology field. We encourage close student-faculty relationships and offer many opportunities for individualized study and research.

Psychology is the study of the mind and behavior. The discipline embraces all aspects of the human experience: from the functions of the brain to the actions of neurons, from child development to care for the aged. In settings ranging from scientific research centers to mental health care services, "the understanding of behavior" is the enterprise of psychologists. An undergraduate major in psychology offers a student preparation for a wide variety of careers. Many majors find psychology to be an excellent preparation for such service-oriented professions as social work, counseling and guidance, special education, and management. Those who pursue graduate work in one of the many fields of psychology often seek positions in teaching and research or applied human services. In addition, the study of psychology provides a knowledge and an understanding of behavior that has applications in professions such as nursing, medicine, law, teaching, business, and public relations.

Communication Sciences Program | Psychology Program

Communication Sciences

Major

The major in communication sciences leads to the Bachelor of Arts degree. For many students, a BA in communication sciences is a pre-professional degree in preparation for graduate study in speech-language pathology or audiology. The undergraduate course work emphasizes the basic processes and acquisition of normal communication in children and adults. Graduate study then focuses on the study of disordered communication. (Please see the description of the Integrated Graduate Studies Program below.)

Students pursuing the BA are required to take 45 credit hours of course work which includes study in communication sciences and disorders, psychology, and English/linguistics, as well as in statistics and research design. A recommended course sequence is shown below. Please note, however, that an individual student’s sequence may differ from this one. For example, undergraduate students may elect to take 400- or 500-level graduate courses with departmental/instructor permission.

Suggested Sequence of Required Courses for the Bachelor of Arts Degree (45 credits)

<table>
<thead>
<tr>
<th>First Year</th>
<th>Units</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Psychology I (PSCL 101)</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Introduction to Communication Disorders (COSI 109)*</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Year Total:</td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Second Year</th>
<th>Units</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phonetics and Phonology (COSI 211)</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Multicultural Aspects of Human Communication (COSI 260)</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Child Psychology (PSCL 230)</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Introduction to American Sign Language I (COSI 220)</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Quantitative Methods in Psychology (PSCL 282)</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Introduction to Linguistics (COSI 355)</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Year Total:</td>
<td>9</td>
<td>9</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Third Year</th>
<th>Units</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Language Development (COSI 313)</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Anatomy and Physiology of Speech and Hearing Mechanism (COSI 325)</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Research Design and Analysis (PSCL 375)</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Speech and Hearing Science (COSI 321)</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Year Total:</td>
<td>9</td>
<td>3</td>
</tr>
</tbody>
</table>
Integrated Graduate Studies

The Integrated Graduate Studies (IGS) Program (p. 549) is intended for undergraduate students who are interested in obtaining a graduate degree in communication disorders (speech-language pathology). Qualified students may be accepted for admission to the School of Graduate Studies after completing 90 hours of undergraduate course work.

Typically, a master’s degree requires two additional years of study beyond the bachelor’s degree. Through the IGS Program, however, a student can complete an undergraduate degree in communication disorders and a master’s degree in communication disorders in five years. The recommended undergraduate sequence for students interested in the IGS Program is somewhat different from the recommended sequence presented above. Students should consult their academic advisor and the Office of Undergraduate Studies for additional information concerning IGS requirements.

Minor in Communication Sciences

The minor in communication sciences requires a minimum of 15 credit hours. It focuses on normal processes of speech, language, and hearing, as well as on the speech, language, and hearing disorders that result from breakdowns in these processes. Interested students should meet with an advisor for specific course requirements.

<table>
<thead>
<tr>
<th>Course</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>COSI 109 Introduction to Communication Disorders</td>
<td>3</td>
</tr>
<tr>
<td>COSI 313 Language Development</td>
<td>3</td>
</tr>
<tr>
<td>COSI 325 Anatomy and Physiology of Speech and Hearing Mechanism</td>
<td>3</td>
</tr>
<tr>
<td>Two of the following courses:</td>
<td>6</td>
</tr>
<tr>
<td>COSI 211 Phonetics and Phonology</td>
<td></td>
</tr>
<tr>
<td>COSI 220 Introduction to American Sign Language I</td>
<td></td>
</tr>
</tbody>
</table>

Minor in Health Communication

The minor in health communication offers introductory and advance study in theoretical and practical application of communication within a health context. It includes a variety of additional courses that students can choose according to their specific areas of interest. The course work is designed to appeal to students in such fields as pre-med, nursing, pre-law, public policy, public health, communication disorders, gerontological studies, nutrition, health management, and social work.

The minor requires 15 credit hours of course work, of which 9 credit hours come from required courses:

<table>
<thead>
<tr>
<th>Course</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>COSI 101 Introduction to Health Communication</td>
<td>3</td>
</tr>
<tr>
<td>COSI 109 Introduction to Communication Disorders</td>
<td>3</td>
</tr>
<tr>
<td>COSI 340 Health Communication</td>
<td>3</td>
</tr>
<tr>
<td>Two of the following:</td>
<td>6</td>
</tr>
<tr>
<td>COSI 200 Interpersonal Communication</td>
<td></td>
</tr>
<tr>
<td>COSI 260 Multicultural Aspects of Human Communication</td>
<td></td>
</tr>
<tr>
<td>COSI 280 Organizational Communication</td>
<td></td>
</tr>
<tr>
<td>COSI 332 Persuasion</td>
<td></td>
</tr>
<tr>
<td>COSI 345 Communication and Aging</td>
<td></td>
</tr>
</tbody>
</table>

Total Units: 15

Psychology

Undergraduate Programs

Major

Psychology majors must complete 30 hours of course work in the department.

Required Courses

<table>
<thead>
<tr>
<th>Course</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSCL 101 General Psychology I</td>
<td>3</td>
</tr>
<tr>
<td>PSCL 282 Quantitative Methods in Psychology</td>
<td>3</td>
</tr>
<tr>
<td>Three of the following:</td>
<td>9</td>
</tr>
<tr>
<td>PSCL 315 Social Psychology</td>
<td></td>
</tr>
<tr>
<td>PSCL 352 Physiological Psychology</td>
<td></td>
</tr>
<tr>
<td>PSCL 353 Psychology of Learning</td>
<td></td>
</tr>
<tr>
<td>PSCL 355 Sensation and Perception</td>
<td></td>
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<tr>
<td>PSCL 357 Cognitive Psychology</td>
<td></td>
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<tr>
<td>PSCL 370 Human Intelligence</td>
<td></td>
</tr>
<tr>
<td>PSCL 375 Research Design and Analysis</td>
<td></td>
</tr>
<tr>
<td>PSCL 382 Psychological Measurement</td>
<td></td>
</tr>
<tr>
<td>PSCL 393 Experimental Child Psychology</td>
<td></td>
</tr>
</tbody>
</table>

Minimum of 15 credit hours of elective course work chosen in consultation with advisor. * 15

Total Units: 30

* No more than 9 hours of practicum courses may be applied to the major.

Departmental Honors

Junior majors with a 3.0 overall GPA and a 3.25 GPA in psychology are encouraged to apply to the department’s honors program. This program consists of one three-credit course, PSCL 395 Capstone and Honors Program, in which students carry out, under faculty supervision, an independent project in their area of interest. Satisfactory completion of a paper based on this research qualifies students to receive their degree with honors in psychology noted on their academic transcript. PSCL 375
Research Design and Analysis is a prerequisite to PSCL 395 Capstone
and Honors Program.

Integrated Graduate Studies
The Department of Psychology participates in the Integrated Graduate
Studies Program (p. 549). Interested students should note the general
requirements and the admission procedures in this bulletin and may
consult the department for further information.

Minor
Required Courses:

<table>
<thead>
<tr>
<th>Course</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSCL 101</td>
<td>3</td>
</tr>
<tr>
<td>Four electives chosen in consultation with advisor</td>
<td>12</td>
</tr>
<tr>
<td>Total Units</td>
<td>15</td>
</tr>
</tbody>
</table>

Communication Sciences Program | Psychology Program

Communication Sciences

Master of Arts
The principal goal of the Master of Arts program is to develop clinical
scientists who are skilled in the management of individuals with speech
and language disorders. The master’s program is accredited by the
Council on Academic Accreditation of the American Speech-Language-
Hearing Association (ASHA). Upon successful completion of the Master
of Arts degree, students will also meet the academic and clinical
practicum requirements for certification by ASHA and licensure in the
State of Ohio.

Degree requirements include completion of 42 credit hours of course
work, including a clinical practicum in communication disorders. In
addition, students must satisfactorily complete a clinical research project
or write a master’s thesis.

Clinical Opportunities in Speech, Language, and
Hearing Disorders
The program is affiliated with, and located in, Cleveland Hearing &
Speech Center (CHSC), a nonprofit agency that serves children and
adults with communication disorders. CHSC serves as the primary
training site for graduate students enrolled in clinical practice. Its
personnel and facilities provide exceptional clinical experiences for
students seeking clinical certification in speech-language pathology.

The program also draws on clinical resources in University Circle and
the Greater Cleveland area. In addition to clinical practicum experiences
at CHSC, graduate students complete at least two externships at
sites including University Hospitals of Cleveland, Rainbow Babies and
Children’s Hospital, MetroHealth Medical Center, Cuyahoga County
Board of Mental Retardation and Developmental Disabilities, Cleveland
Clinic Center for Autism, Legacy Health Services, and Western Reserve
Speech and Language Partners.

Doctor of Philosophy
The Doctor of Philosophy is awarded in recognition of (1) mastery,
at an advanced level, of a body of knowledge in the disciplines
of communication sciences and speech-language pathology, and (2) a
demonstrated ability to perform independent research and communicate
the results of that research. With the major advisor, the student designs
an individual plan of study based on his/her professional goals and
previous experience. Doctoral students choose a content area (such
as communication and aging, medically based speech disorders, or
child language development and disorders) as their primary focus of
study. However, they are also encouraged to enhance their scholarly
preparation by completing course work outside of their primary content
area.

In addition to course work within the department, doctoral students
may choose courses from graduate programs in other departments of
the College of Arts and Sciences, as well as from several professional
schools at the university, including the School of Medicine (e.g.,
nervescience, genetics), the Case School of Engineering (e.g.,
biomedical engineering), the School of Dental Medicine, the
Weatherhead School of Management, and the Mandel School of Applied
Social Sciences.

Requirements for the doctoral program include course work, research
rotations, a supervised classroom teaching experience, written and oral
comprehensive examinations, and a dissertation.

• A minimum of 36 hours of course work is required, including 9 credit
hours in statistics and research design and 3 credit hours of directed
study and research. Fifteen credit hours in the primary content area
are required.

• Two research rotations are required. One rotation is completed in the
primary content area with the major advisor. The second rotation is
completed with a faculty member other than the major advisor. The
dissertation research is not included in either of the two research
rotations.

• A supervised classroom teaching experience is completed under the
guidance of a faculty member in the program.

• Written and oral examinations are taken after all course work and
research rotations are completed.

• A dissertation prospectus is prepared under the guidance of a
committee consisting of the dissertation advisor and two additional
faculty members. A defense of the dissertation prospectus is required
prior to commencing the dissertation study.

• An oral defense of the dissertation takes place at the end of the
doctoral program.

Additional information about graduate work in communication sciences is
available on the program’s website (http://www.case.edu/artsci/cosi).

Psychology
The Department of Psychological Sciences offers full-time programs
leading to a PhD in clinical or experimental psychology. These programs
give students a thorough grounding in basic areas of psychological fact
and theory and prepare them for careers as researchers, teachers, and
practitioners. The Master of Arts degree can be earned in the department
as part of work toward a doctorate.

Clinical Psychology. The department’s program in clinical psychology,
which has been approved by the American Psychological Association,
emphasizes the scientist-practitioner model. Students participate in an
integrated curriculum of basic and applied courses, research activities,
and practicum and pre-internship placements. The program’s goal is to
prepare students to make meaningful contributions to the science and
profession of psychology by instructing them in broad applications of
clinical skills and research methods.

Experimental Psychology. Doctoral training in experimental psychology
prepares the student for an academic career in teaching and research.
It offers concentrations in developmental psychology, adulthood and
aging, cognitive psychology, mental retardation research, and social
psychology. Faculty members help students develop flexible programs of
study, according to individual interests.
Additional information about graduate work in psychology is available on the program’s website (http://psychology.case.edu).

**Department Faculty**

Lee A. Thompson, PhD  
(University of Colorado, Boulder)  
**Professor and Chair**  
Human behavior genetics; child development

Patrizia Bonaventura, PhD  
(The Ohio State University)  
**Assistant Professor**  
Simulation of speech production and biomechanical modeling of the vocal tract; motor control mechanisms in normal and disordered speech production; speech technology applications

Angela Hein Ciccia, PhD  
(Case Western Reserve University)  
**Assistant Professor**  
Neuroscience of communication and communication disorders in adolescents/adults, with focus on traumatic brain injury

Arin M. Connell, PhD  
(Emory University)  
**Jesse Hauk Shera Assistant Professor**  
Internalizing problems; coping skills during adolescence

Heath A. Demaree, PhD  
(Virginia Tech)  
**Professor**  
Cerebral and psychophysiological bases of emotion

Douglas K. Detterman, PhD  
(University of Alabama, Tuscaloosa)  
**Louis D. Beaumont University Professor**  
Human intelligence and intellectual disability

Anastasia Dimitropoulos, PhD  
(Vanderbilt University)  
**Assistant Professor**  
Genetic syndromes involving intellectual disabilities; compulsive behavior in MR/DD; functional neuroimaging

Julie J. Exline, PhD  
(State University of New York, Stony Brook)  
**Associate Professor**  
Social relationships; transgression; moral and religious issues

Joseph F. Fagan III, PhD  
(University of Connecticut)  
**Lucy Adams Leffingwell Professor**  
Development of and individual differences in cognition, perception, and intelligence

Norah C. Feeny, PhD  
(Bryn Mawr College)  
**Professor**  
Evaluation of interventions for anxiety (e.g., post-traumatic stress disorder) and mood disorders

Grover C. Gilmore, PhD  
(Johns Hopkins University)  
**Professor; Dean, Mandel School of Applied Social Sciences**  
Perceptual development and aging; visual information processing; memory; psychophysics

Robert L. Greene, PhD  
(Yale University)  
**Professor**  
Human memory and cognition

Barbara Lewis, PhD  
(Case Western Reserve University)  
**Professor**  
Familial and genetic bases of speech/language

T. J. McCallum, PhD  
(University of Southern California)  
**Associate Professor**  
Older adults; caregiving; ethnicity; stress and coping

James C. Overholser, PhD  
(Ohio State University)  
**Professor**  
Adult psychopathology; depression; suicide; personality disorders

Amy Przeworski, PhD  
(Pennsylvania State University)  
**Assistant Professor**  
Anxiety disorders; emotion regulation; cultural factors in family interactions

Kathryn (Krya) Rothenberg, PhD  
(Kent State University)  
**Instructor**  
Health communication

Sandra W. Russ, PhD  
(University of Pittsburgh)  
**Professor**  
Creativity; affective development in children; personality assessment; coping mechanisms in children

Elizabeth J. Short, PhD  
(University of Notre Dame)  
**Professor**  
Cognitive psychology; applied developmental; learning disabilities

Jennell Vick, PhD  
(University of Washington)  
**Assistant Professor**  
Study of movements of the face, lips, and tongue that generate speech; acquisition and development of speech in typically developing infants and children; impact of various disorders on speech acquisition, development, and production

**Lecturers**

Jennifer L. Butler, PhD  
(Case Western Reserve University)  
Social psychology

Patricia O. Carothers, MS, CCC-A  
(Ithaca College)  
Fluency disorders

Kathryn (Kay) McNeal, MS, CCC-SLP  
(Purdue University)  
**Clinical Program Director**  
Speech-language pathology

Jean Nisenboum, MA  
(Miami University)  
Dysphagia, Diagnosis of speech
Adjunct Faculty

Melissa Baker, MS, CCC-SLP
(Bowling Green State University)
Adjunct Instructor; Monarch Center for Autism
Speech-language pathology

Rachel Berkowitz, MA, CCC-SLP
(University of Cincinnati)
Adjunct Instructor, Mayfield Schools
Speech-language pathology

Laura Brady, MA, CCC-A
(Kent State University)
Adjunct Instructor; Cleveland Hearing & Speech Center
Audiology

Lisa Bruening, MS, CCC-SLP
(University of Wisconsin)
Adjunct Instructor; ALS Association, Northern Ohio Chapter
Speech-language pathology

Jane R. Buder-Shapiro, PhD
Adjunct Assistant Professor; private practice

Michelle Burnett, MA, CCC-SLP
(Michigan State University)
Adjunct Instructor; Cleveland Hearing & Speech Center
Speech-language pathology

Cameron Camp, PhD
Adjunct Professor; Myers Research Institute

Sandra Caramela-Miller, PhD
Adjunct Assistant Professor; Cuyahoga County Coroner's Office

Barbara Choudhury, MA, CCC-SLP
(Case Western Reserve University)
Adjunct Instructor; Cleveland Hearing & Speech Center
Speech-language pathology

Margaret Duff, MA, CCC-SLP
(Kent State University)
Adjunct Instructor; Cleveland Hearing & Speech Center
Speech-language pathology

Nicole Gerami, MA, CCC-SLP
(Case Western Reserve University)
Adjunct Instructor; private practice
Speech-language pathology

Robert Goldberg, PhD
Adjunct Associate Professor; Louis Stokes Cleveland VA Medical Center

Bernard P. Henri, PhD
(Northwestern University)
Adjunct Associate Professor; Director, Cleveland Hearing & Speech Center

Fluency disorders; professional issues in speech-language pathology; health care management

Douglas Hicks, PhD
(Vanderbilt University)
Adjunct Professor; Cleveland Clinic Foundation

Voice disorders

Vanessa Jensen, PhD
Adjunct Assistant Professor; Cleveland Clinic

Karen Kantzes, AuD, CCC-A
(A.T. Still University)
Adjunct Instructor, Cleveland Hearing & Speech Center
Audiology

Susan M. Knell, PhD
Adjunct Assistant Professor; Spectrum Psychological Associates

Marilyn Malkin, PhD
Adjunct Assistant Professor; private practice

Lauren Masuga, MA, CCC-SLP
(Miami University)
Adjunct Instructor; Cleveland Hearing & Speech Center
Speech-language pathology

Darlene Moenter-Rodriguez, PhD
(Ohio State University)
Adjunct Assistant Professor; Louis Stokes Cleveland VA Medical Center
Auditory potentials

Shirley Prok
Adjunct Instructor; Sign Language Instructor, Cleveland Hearing & Speech Center

Aarti Pyati, PhD
Adjunct Assistant Professor; University Counseling Services

Philip Safford, PhD
Adjunct Professor; Emeritus, Kent State University

Ethan Schafer, PhD
Adjunct Assistant Professor; Spectrum Psychological Associates

Jeremy Shapiro, PhD
Adjunct Assistant Professor; Director, University Counseling Services

Harry Sivec, PhD
Adjunct Assistant Professor; Northcoast Behavioral Healthcare

Kenneth Weiss, PhD
Adjunct Assistant Professor; Louis Stokes Cleveland VA Medical Center

Brigid Whitford, AuD, CCC-A
(A.T. Still University)
Adjunct Instructor; Cleveland Hearing & Speech Center
Audiology

Lucene Wisniewski, Ph.D.
Adjunct Assistant Professor; Cleveland Center for Eating Disorders

Eric Youngstrom, PhD
Adjunct Professor; Associate Professor of Psychology, University of North Carolina Chapel Hill

Secondary Faculty

Richard E. Boyatzis, PhD
Professor of Organizational Behavior, Weatherhead School of Management

Alan Castro, PhD
Senior Instructor; University Hospitals Case Medical Center
Howard Hall, PsyD, PhD  
Associate Professor, School of Medicine/Rainbow Babies and Children’s Hospital

Rebecca Hazen, PhD  
Assistant Professor, School of Medicine/Rainbow Babies and Children’s Hospital

Leslie L. Heinberg, PhD  
Associate Professor, The Cleveland Clinic Lerner College of Medicine

Carolyn Landis, PhD  
Associate Professor, School of Medicine/Rainbow Babies and Children’s Hospital

Britt A. Nielsen, PhD  
Assistant Professor, Department of Psychiatry, School of Medicine

Lynn Singer, PhD  
Professor, School of Medicine/University Hospitals

Terry Stancin, PhD  
Professor, School of Medicine/MetroHealth Medical Center

Thomas P. Swales, PhD  
Assistant Professor, School of Medicine/MetroHealth Medical Center

Gerry Taylor, PhD  
Professor, Department of Pediatrics, School of Medicine

Carol Sue White, PhD  
Associate Professor, School of Medicine/MetroHealth Medical Center

Abraham Wolf, PhD  
Professor, Department of Psychiatry, School of Medicine

James M. Yokely, PhD  
Assistant Professor, Department of Psychiatry, School of Medicine

Richard Pazol, PhD  
Clinical Instructor; University Counseling Services

Joy Pengilly-Wyatt, PhD  
Clinical Instructor; University Counseling Services

David Pincus, DMH  
Clinical Assistant Professor, Department of Psychiatry, School of Medicine

Robert Smith, PhD  
Clinical Assistant Professor; Behavioral Management Associates, Inc.

Terry Tobias, PhD  
Clinical Assistant Professor; Private Practice

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**COSI Courses**

**COSI 101. Introduction to Health Communication. 3 Units.**  
An introductory examination of the influences associated with the functions of human life, communication processes, and research related to health and the health care industry from interpersonal, cultural, and organizational communication perspectives. The course will include a review of the history and development of health communication and the understanding and application of communication theories.

**COSI 109. Introduction to Communication Disorders. 3 Units.**  
Forty-two million Americans have some type of communication disorder. How does a person with a communication disorder cope with the challenges of daily living? This course will examine the characteristics of communication disorders via first hand and fictionalized accounts in books, films, and simulated communication disorders experiences. Topics will include disorders of speech, language, and hearing in children and adults. Effects of communication disorders on families.

**COSI 200. Interpersonal Communication. 3 Units.**  
Communication is a primary means of initiating, maintaining, and dissolving relationships. Managing interpersonal relationships is a human concern across several contexts. Interpersonal communication is a highly interactive course whereby participants investigate the foundations, processes, and issues associated with communication in relationships. The student will become sensitized to theories and processes via traditional lectures and textbook readings. The student is also expected to participate in group discussions. The result is a continuous dialogue with others about communication processes, and outcomes. The goal of this course is to provide a forum for both investigation and increased competence.

**COSI 211. Phonetics and Phonology. 3 Units.**  
Theoretical and applied study of the speech sounds of language. The use of the international phonetic alphabet as a tool for characterizing normal and deviant sound patterns. The linguistic structure and function of speech sound systems of both the adult and developing child.

**COSI 220. Introduction to American Sign Language I. 3 Units.**  
This course offers basic vocabulary training and conversational interaction skills in American Sign Language. Syntactic and semantic aspects of American Sign Language will be addressed.
COSI 221. Introduction to American Sign Language II. 3 Units.
This class is taught without voice, using functional, whole language approaches and in situ experiences, emphasizing communicative competency. It emphasizes sentence structure development, classifiers, and conversational regulating behaviors. It also covers inflection, role shifting, adverbial non-manual behaviors, temporal aspects, sequencing, and includes a brief introduction to ASL English diglossia and biolinguistic aspects. There will be opportunities for discussion of deaf culture. Prereq: COSI 220.

COSI 260. Multicultural Aspects of Human Communication. 3 Units.
Introduces intercultural/interracial communication by discussing specific communication principles and by putting theory into practice by exploring differences in perception, and verbal and nonverbal communication messages. Course emphasizes relationship between communication, race, culture; nature of race and culture; and how they influence the communication process. Various theories and approaches to study of intercultural/interracial communication will be discussed, along with significant concepts, processes and considerations. Practical outcomes of intercultural/interracial encounters also will be discussed.

COSI 280. Organizational Communication. 3 Units.
This course includes a review of the development of organizational communication theories and how application of theories enhances our understanding of various types of organizations. COSI 280 addresses the communication challenges faced by contemporary organizational leaders and members. Knowledge of the theories and development of analytical skills should improve students’ chances for successful interactions in diverse organizational situations and cultures.

COSI 301. Professional Speaking. 3 Units.
This course is designed to introduce students to theories and practices and to develop their abilities to speak effectively in public. Students will develop skills in organization and presentation of ideas for public and conference forums, in critical listening, and in proper use of technology. Students demonstrate abilities via written assignments, skill building exercises, oral presentations, rhetorical analysis, and group projects. The expectations in this course include high levels of participation and interaction. This is a departmental seminar course with a focus on formal presentation in settings related to health care. This course will be beneficial to students planning professions in the health sciences where responsibilities include public instruction and exposition and for those preparing for capstone presentations in the Department of Psychological Sciences programs. Activities include: 1. Readings from McKerrow et al. text, 2. Class discussions related to communication competence in differing communication settings, 3. Application opportunities to give speeches, to work in groups, and relate with others in one-on-one situations, 4. Written assignments. Prereq: Completion of 100 level first year seminar in USFS, FSCC, FSNA, FSSO, FSSY, or FSCS and either COSI 109 or PSCL 101.

COSI 302. Instrumental Measurements in Speech Sciences. 3 Units.
This course will provide hands on experience on techniques for instrumental measurements of speech and voice parameters, for applications to assessment and diagnosis of speech and voice disorders, to linguistic analysis of speech parameters (prosodic and segmental), and to speech production modeling. In particular, instrumental measures of voice parameters will be carried out by Electroglottography; evaluation of Voice Range Profile and of perturbation of frequency (jitter) and amplitude (shimmer) of the laryngeal waveform, by dedicated KayPentax software (Visi-pitch and Voice Range Profile) and by Praat software; spectrographic analyses will be carried out by Praat software, and articulographic measurements will be performed by an AG200 Electromagnetic Articulograph. Nasalance will be measured by a KapyPentax nasometer. Emphasis on use rather than theory. All instrumentation is available at the Case Speech Production Lab. Recommended preparation: COSI 211, COSI 321/421, and COGS 203, or bases in phonetics, linguistics and speech science; also Physics and Engineering instrumentation courses are good preliminaries to this course. Offered as COSI 302 and COSI 402.

COSI 305. Neuroscience of Communication and Communication Disorders. 3 Units.
The course focus is neuroanatomy and neurophysiology related to motor control and cognition, particularly aspects of cognition involved in language functions. Topics to be addressed include: principles of neurophysiology and neurochemistry; functional neuroanatomy of the central and peripheral nervous systems; neurological and neuropsychological assessment of communication; neurodiagnostic methods. In part, the course material will be presented in a problem-based learning format. That is, normal aspects of human neuroscience will be discussed in the context of neurological disorders affecting communication. COSI 405 is an introduction to COSI 557 and COSI 561. Offered as BIOL 379 and COSI 305 and COSI 405.

COSI 313. Language Development. 3 Units.
Language acquisition theory and stages of development of syntax, semantics, pragmatics, and phonology in children. Contributions of biological, social, cognitive and environmental factors to process of language development. Information on language variation in multicultural populations. Open to majors and non-majors. Recommended prerequisite: Child Psychology. Offered as COSI 313 and COSI 413.

COSI 321. Speech and Hearing Science. 3 Units.
The course will focus on the aspects of normal speech production and perception and hearing perception. The purpose of this course is to provide a foundation in normal aspects of oral communication that will prepare students for advance study in the assessment and management of disorders of speech and hearing perception. Topics to be covered include motor speech control, aeromechanics, basic acoustics, phonatory acoustics, speech and hearing acoustics, psychoacoustics, and speech and hearing perception. Recommended preparation: COSI 325. Offered as COSI 321 and COSI 421.
COSI 325. Anatomy and Physiology of Speech and Hearing Mechanism. 3 Units.
The course will focus on normal anatomy and physiology of the body systems involved in the processes of speech, language, hearing, and swallowing including the following: the auditory, respiratory, phonatory, articulatory, resonatory, and nervous systems. In part, the course material will be presented in a problem-based learning format. That is, normal aspects of human anatomy and physiology will be discussed in the context of the disorders that affect the processes of human communication and swallowing.

COSI 332. Persuasion. 3 Units.
This survey course explores the history, theories, and dynamics of persuasion. There is an extensive focus on theoretical models of attitude change. Persuasion also plays a strong role in everyday aspects of our culture. Along these lines, we will investigate persuasion activities in everyday life from compliance gaining to media campaigns. Learning is conveyed through lecture, activities, and observation of the student’s everyday life. At the end of the semester, the astute student will be literate in a variety of persuasion strategies and dynamics.

COSI 340. Health Communication. 3 Units.
Various communication processes assume a central role in the acquisition and enactment of health care. This course examines communication activity across a broad range of health care contexts. Attention will be given to provider-client communication, communication, and ethical concerns, persuasive health promotion efforts, media impact on health, and basics in health communication methodology and research. Students will consider source, message, and receiver aspects of health communication as well as cultural and illness-specific issues. Prerequisite of COSI 101 for 300-level only. Offered as COSI 340 and COSI 440. Prereq: COSI 101.

COSI 345. Communication and Aging. 3 Units.
The normal and abnormal psychobiological changes that occur during aging and their effects on communication are addressed, as are communicative interaction styles, disordered communication, and rehabilitation practices. Graduate students are given an opportunity to incorporate information from their own disciplines in a special project, where appropriate. Offered as COSI 345 and COSI 445.

COSI 352. Introduction to Clinical Practice in Speech-Language Pathology. 3 Units.
Clinical assessment and teaching procedures as well as the role of research/theory in clinical practice. Procedures to observe, measure, analyze communication skills. Practical application through case studies. Students complete 25 hours of observation of speech/language assessment and intervention. Prereq: COSI 211 or COSI 313.

COSI 355. Introduction to Linguistics. 3 Units.
This course provides an introduction to linguistics, with application to clinical assessment, diagnosis and therapy of language disorders. In particular, the course provides an introduction to theory and methods of linguistics: universal properties of human language; phonetic, phonological, morphological, syntactic, and semantic structures and analysis; nature and form of grammar.

COSI 357. Acquired Neurogenic Communication Disorders. 3 Units.
This course is designed to provide knowledge about the theoretical foundations, etiologies, and characterizations of acquired language-based and cognitive-communication disorders in adults. The organization of the course is designed so that we will discuss communication disorders typically associated with left hemisphere lesions (e.g., aphasia), right hemisphere lesions (e.g., RHD), frontal lobe lesions (e.g., traumatic brain injury) and mesial temporal lesions (e.g., dementia). This course is intended to provide students with a framework for considering communication disorders of diverse medical etiologies rather than specific impairment types. The course is meant to provide information that can be used as a foundation for a clinically applied course in acquired language disorders. The course will focus on critical thinking, professional presentation (both oral and written), and critical consumption of research. Recommended preparation: Instructor consent for COSI 457 only. Offered as COSI 357 and COSI 457. Prereq: COSI 109.

COSI 370. Introduction to Audiology. 3 Units.
Disorders of hearing, assessment of hearing; including behavioral and objective measures; intervention strategies; and identification programs. Offered as COSI 370 and COSI 470. Prereq: COSI 325.

COSI 390. Independent Study. 1 - 6 Unit.
Individual study, under the guidance of a faculty member, involving specific programs of reading, research and special projects.

COSI 395. Honors Program. 3 Units.
Student completes an independent project in the student’s area of interest under the supervision of a faculty member. Prereq: STAT 201 or PSCL 282, and PSCL 375.

COSI 402. Instrumental Measurements in Speech Sciences. 3 Units.
This course will provide hands on experience on techniques for instrumental measurements of speech and voice parameters, for applications to assessment and diagnosis of speech and voice disorders, to linguistic analysis of speech parameters (prosodic and segmental), and to speech production modeling. In particular, instrumental measures of voice parameters will be carried out by Electroglottography; evaluation of Voice Range Profile and of perturbation of frequency (jitter) and amplitude (shimmer) of the laryngeal waveform, by dedicated KayPentax software (Visi-pitch and Voice Range Profile) and by Praat software; spectrographic analyses will be carried out by Praat software, and articulographic measurements will be performed by an AG200 Electromagnetic Articulograph. Nasalance will be measured by a KapyPentax nasometer. Emphasis on use rather than theory. All instrumentation is available at the Case Speech Production Lab. Recommended preparation: COSI 211, COSI 321/421, and COGS 203, or bases in phonetics, linguistics and speech science; also Physics and Engineering instrumentation courses are good preliminaries to this course. Offered as COSI 302 and COSI 402.
COSI 405. Neuroscience of Communication and Communication Disorders. 3 Units.
The course focus is neuroanatomy and neurophysiology related to motor control and cognition, particularly aspects of cognition involved in language functions. Topics to be addressed include: principles of neurophysiology and neurochemistry; functional neuroanatomy of the central and peripheral nervous systems; neurological and neuropsychological assessment of communication; neurodiagnostic methods. In part, the course material will be presented in a problem-based learning format. That is, normal aspects of human neuroscience will be discussed in the context of neurological disorders affecting communication. COSI 405 is an introduction to COSI 557 and COSI 561. Offered as BIOL 379 and COSI 305 and COSI 405.

COSI 413. Language Development. 3 Units.
Language acquisition theory and stages of development of syntax, semantics, pragmatics, and phonology in children. Contributions of biological, social, cognitive and environmental factors to process of language development. Information on language variation in multicultural populations. Open to majors and non-majors. Recommended prerequisite: Child Psychology. Offered as COSI 313 and COSI 413.

COSI 421. Speech and Hearing Science. 3 Units.
The course will focus on the aspects of normal speech production and perception and hearing perception. The purpose of this course is to provide a foundation in normal aspects of oral communication that will prepare students for advance study in the assessment and management of disorders of speech and hearing perception. Topics to be covered include motor speech control, aeromechanics, basic acoustics, phonatory acoustics, speech and hearing acoustics, psychoacoustics, and speech and hearing perception. Recommended preparation: COSI 325. Offered as COSI 321 and COSI 421.

COSI 440. Health Communication. 3 Units.
Various communication processes assume a central role in the acquisition and enactment of health care. This course examines communication activity across a broad range of health care contexts. Attention will be given to provider-client communication, communication, and ethical concerns, persuasive health promotion efforts, media impact on health, and basics in health communication methodology and research. Students will consider source, message, and receiver aspects of health communication as well as cultural and illness-specific issues. Prerequisite of COSI 101 for 300 - level only. Offered as COSI 340 and COSI 440.

COSI 445. Communication and Aging. 3 Units.
The normal and abnormal psychobiological changes that occur during aging and their effects on communication are addressed, as are communicative interaction styles, disordered communication, and rehabilitation practices. Graduate students are given an opportunity to incorporate information from their own disciplines in a special project, where appropriate. Offered as COSI 345 and COSI 445.

COSI 452A. Graduate Clinical Practicum I: Case Management. 1 Unit.
Addresses professional issues in speech-language pathology including case management, clinical effectiveness, counseling and working with families from diverse backgrounds. Four to ten hours of clinic contact per week at the Cleveland Hearing and Speech Center. (Maximum of 2 credits.) Recommended preparation: COSI 352 and COSI 413.

COSI 452B. Graduate Clinical Practicum II: Professional Issues. 1 Unit.
Addresses professional issues in speech-language pathology including case management, managed health care, ethics and interviewing. Four to ten hours of clinic contact per week at the Cleveland Hearing and Speech Center. (Maximum of 2 credits.) Recommended preparation: COSI 352, COSI 413, COSI 452A, and COSI 453.

COSI 452C. Graduate Clinical Practicum III: Special Populations. 1 Unit.
Addresses professional issues in speech-language pathology including case management, special clinical populations, collaborating with other professionals, teaming, leadership, and use of technology. Fifteen to thirty hours of clinic contact per week at area skilled nursing facilities, hospitals, rehab centers, early intervention centers, centers for developmentally disabled, private practices, etc. (Maximum of 2 credits.) Recommended preparation: COSI 352, COSI 452A, COSI 452B, COSI 453, and COSI 456.

COSI 452E. Graduate Clinical Practicum V: Medical Speech Pathology. 1 Unit.
Addresses professional issues in speech-language pathology including case management, special clinical populations, collaborating with other professionals, documentation, managed health care, and use of technology. Fifteen to thirty hours of clinic contact per week at area skilled nursing facilities, hospitals. (Maximum of 2 credits.) Recommended preparation: COSI 352, COSI 452A, COSI 452B, COSI 452C, COSI 453, and COSI 456.

COSI 453. Articulation and Phonology Disorders. 3 Units.
Overview of normal speech sound development and characterization of children with speech sound disorders. Distinctions between phonology and articulation are drawn. Theoretical as well as assessment and treatment issues are addressed.

COSI 455. Fluency Disorders. 3 Units.
Stuttering and related disorders of rhythm and prosody in terms of the symptomatology, etiology, measurement, and treatment of nonfluent speaking behavior.

COSI 456. Child Language Disorders. 3 Units.
COSI 457. Acquired Neurogenic Communication Disorders. 3 Units.
This course is designed to provide knowledge about the theoretical foundations, etiologies, and characterizations of acquired language-based and cognitive-communication disorders in adults. The organization of the course is designed so that we will discuss communication disorders typically associated with left hemisphere lesions (e.g., aphasia), right hemisphere lesions (e.g., RHD), frontal lobe lesions (e.g., traumatic brain injury) and mesial temporal lesions (e.g., dementia). This course is intended to provide students with a framework for considering communication disorders of diverse medical etiologies rather than specific impairment types. The course is meant to provide information that can be used as a foundation for a clinically applied course in acquired language disorders. The course will focus on critical thinking, professional presentation (both oral and written), and critical consumption of research. Recommended preparation: Instructor consent for COSI 457 only. Offered as COSI 357 and COSI 457.

COSI 463. Language and Literacy Across Content Areas. 3 Units.
This course focuses on research-based theories of reading, cognition, language, and learning. The student will use the content of their area (art, music, or speech-language pathology) as the target for organizing explicit instruction and strategies for word skills, reading comprehension, oral expression, vocabulary, and written language development as they apply to the culturally and linguistically diverse populations present in today’s schools. Curriculum planning and assessment strategies for instructional purposes are addressed. Federal legislation pertaining to the education of children with disabilities is included.

COSI 464. Case Studies in Communication Disorders: Diagnosis and Treatment. 3 Units.
Diagnosis as a clinical skill involving scientific hypothesis testing with clinical problem solving. The course includes academic learning combined with diagnostic clinic experiences. Overview of psychometric principles, survey of psychological communication tests, and measurements. Section on non-biased assessment. Instruction and practice in effective family interviewing techniques. Prereq: COSI 453 and COSI 456

COSI 470. Introduction to Audiology. 3 Units.
Disorders of hearing, assessment of hearing; including behavioral and objective measures; intervention strategies; and identification programs. Offered as COSI 370 and COSI 470. Prereq: COSI 325.

COSI 497. Methods of Research. 3 Units.
Pure and applied research design for speech language pathologists. Focus on evaluation of research methodology and the formulation of testable research questions.

COSI 556. Language Disorders 2: Language and Literacy. 3 Units.
This course focuses on research-based theories of reading, cognition, language, and learning disorders in the school-age and adolescent student. Language development of the older child during the school age and adolescent years will be reviewed. Topics include the development of metalinguistic skills, the expanding lexicon, narration and discourse, and advances in syntax and morphology. The relationship of spoken language to literacy will be discussed. The course will examine common language, literacy and learning disabilities during the school age years. The student will explore interventions for word skills, reading decoding and comprehension, oral expression, vocabulary, and written languages as they apply to the Speech Language Pathologist. Assessment and intervention strategies for the school-age child and adolescent with a language/learning disorder are included. The class format includes lectures, discussions of case studies, and experiential learning through the observation of therapy with the school age/adolescent student. Prereq: COSI 456.

COSI 557. Acquired Adult Language Disorders. 3 Units.
A model relating communication impairment to activities of daily living and quality of life will serve as the study of acquired neurogenic communication disorders in adults. The focus will be on dementia, aphasia, and the communication disorders associated with traumatic brain injury and right hemisphere stroke. Knowledge about the biological basis of neurogenic communication disorders will be applied in discussion on assessment and intervention for these disorders. Prereq: COSI 405 or equivalent.

COSI 560. Medical Aspects of Speech Pathology I: Voice Disorders. 3 Units.
Aspects of normal and abnormal voice production, evaluation and management of various voice and resonance disorders.

COSI 561. Med Aspects of Speech Path II: Neuromotor and Craniofacial Anomalies. 3 Units.
Speech disorders resulting from conditions acting on motor speech production including dysarthria and apraxia will be discussed. The speech production system, diseases and acquired and congenital neuropathological conditions that affect motor process and resulting speech disorders of phonation, articulation, resonance and prosody will be reviewed. Also covered will be the speech, language and hearing disorders stemming from craniofacial anomalies: cleft lip and palate. Principles and methods of assessment and treatment within an interdisciplinary rehabilitation framework will be reviewed for both types of disorders. Prereq: COSI 321 or COSI 421 and COSI 405 or equivalent.

COSI 562. Medical Aspects of Speech Pathology III: Dysphagia. 3 Units.
Course relates to medical speech-language pathology and includes analysis of clinical problems involving dysphagia in high risk populations. Course focus is on the anatomy and physiology of the normal swallow, dysphagia, early identification and prevention, the clinical swallow assessment, instrumental assessment and intervention in pediatric and adult populations.

COSI 580. Aural Rehabilitation. 3 Units.
The effects of hearing impairment, especially related to speech perception and language processing. Remediation and intervention strategies for hearing impaired children and adults, including speech reading, auditory training, and the use of hearing aids.
PSCL Courses

PSCL 101. General Psychology I. 3 Units.
Methods, research, and theories of psychology. Basic research from such areas as psychophysiology, sensation, perception, development, memory, learning, psychopathology, and social psychology.

PSCL 102. General Psychology II. 3 Units.
The applications of psychological research in normal problems of adjustment. Topics include: coping with anxiety, romance and marriage, and interpersonal behavior.

PSCL 230. Child Psychology. 3 Units.
Basic facts and principles of psychological development from the prenatal period through adolescence. Recommended preparation: PSCL 101.

PSCL 282. Quantitative Methods in Psychology. 3 Units.
The theory and application of basic methods used in the analysis of psychological data. Not available for credit to students who have completed STAT 201 or ANTH 319.

PSCL 313. Psychology of Personality. 3 Units.
The development and organization of personality; theories of personality and methods for assessing the person; problems of personal adjustment.

PSCL 315. Social Psychology. 3 Units.

PSCL 317. Health Psychology. 3 Units.
Examines psychological processes that affect physical health. Covers the physiological factors affecting the immune system, chronic physical disorders, pain, compliance with prescribed medical treatments, the effects of stress and coping, the effects of the patient-physician interaction, and the psychological aspects of the hospital and the health care systems. Recommended preparation: PSCL 101.

PSCL 321. Abnormal Psychology. 3 Units.

PSCL 325. Psychotherapy and Personality Change. 3 Units.
Three methods of psychotherapy (behavioral, psychoanalytic, and client-centered) are discussed. The therapy techniques and the manner by which personality change is effected are examined. Recommended preparation: PSCL 101.

PSCL 329. Adolescence. 3 Units.
Psychological perspectives on physical, cognitive, and social development. Recommended preparation: PSCL 101.

PSCL 334C. Seminar and Practicum: Hospitalized Children. 3 Units.
Supervised field placement and attendance at staff conferences in various child and adolescent settings. Regular seminar meetings. Prereq: PSCL 230.

PSCL 335C. Seminar and Practicum: Hospitalized Child. 3 Units.
Supervised field placement and attendance at staff conferences in various child and adolescent settings. Regular seminar meetings. Prereq: PSCL 230 and Junior or Senior Status.

PSCL 338. Seminar and Practicum in Adolescents. 3 Units.
Supervised field placement and attendance in early childhood, child, and adolescent settings including preschools, schools, hospitals, and neighborhood centers. This class is used to fulfill requirements by the Ohio Department of Education teacher licensure program. Recommended preparation: PSCL 101, EDUC 301, EDUC 304, and permission of program director. Offered as EDUC 338, PSCL 338, and SOCI 338.

PSCL 344. Developmental Psychopathology. 3 Units.
This course will focus on the interplay of biological, psychological, familial, and social determinants of disorders ranging from autism to delinquency and bulimia. Recommended preparation: PSCL 230 or PSCL 321. Offered as PSCL 344 and PSCL 444.

PSCL 350. Behavior Genetics. 3 Units.
Examines the impact of both nature and nurture on human behavior. Basic quantitative genetic methodology will be covered. Current family, twin and adoption studies in the areas of personality, intelligence, alcoholism, criminality, and psychopathology will be reviewed. Recommended preparation: PSCL 101.

PSCL 352. Physiological Psychology. 3 Units.
This course is designed to teach the fundamentals of neural communication and central nervous system structure. Special attention is placed on common neurological illnesses and their psychopharmacological treatments. Neural systems underlying sensory/perceptual, motor, and higher-order cognitive processes are also explored. Prereq: PSCL 101.

PSCL 353. Psychology of Learning. 3 Units.
The basic methods in the study of learning. The major theories proposed to account for the learning process. Development of the fundamental concepts and principles governing the learning process in both humans and lower animal. Recommended Preparation: PSCL 101.

PSCL 355. Sensation and Perception. 3 Units.
PSCL 357. Cognitive Psychology. 3 Units.

PSCL 369. Adult Development and Aging. 3 Units.
An overview of concepts and research relating to adult development and aging. The lifespan perspective will be used in examining major developmental paradigms. Personality and cognitive lines of development will be traced across the lifespan. Data from both longitudinal and cross-sectional studies will be analyzed. Both normal and pathological aging will be discussed. Special emphasis will be given to areas of cognitive deterioration in aging. Implications for optimal adult development and aging will also be discussed.

PSCL 370. Human Intelligence. 3 Units.
Survey of individual differences in human intellect including construction and administration of intelligence tests, theories and models of intelligence, and the role of heredity and environment in intelligence and the development of intelligence. This course will also examine the relationships of cognitive abilities to intelligence and human to artificial intelligence. Recommended preparation: PSCL 101.

PSCL 375. Research Design and Analysis. 3 Units.

PSCL 379. Neurodevelopmental Disabilities. 3 Units.
Ways in which neurobehavioral development can go awry, the causes of such deviations, and their consequences. The course builds on basic psychological and neuroscience concepts to explore the manner in which developmental disabilities occur, ways of preventing disabilities, and approaches to ameliorating and managing disabling conditions. Recommended preparation: PSCL 101 and PSCL 230.

PSCL 382. Psychological Measurement. 3 Units.

PSCL 388. Human Sexual Behavior. 3 Units.
Sex is approached as a form of personal and interpersonal behavior. A broad range of theories from social psychology will be used to explain human sexual behavior, and these will be evaluated by using facts and findings from recent research studies. Topics include sexual relationships, gender differences, promiscuity, rape and coercion, finding and choosing sex partners, sexual risk-taking, harassment, sexual identity and orientation, cultural influences and differences, evolution of sexual motivations, prostitution, pornography, and love. Prereq: PSCL 101 and PSCL 315.

PSCL 389. Emotion and Emotion Regulation. 3 Units.
This course will focus on academic research associated with emotional processes and emotion regulation. Specifically, we will answer questions like: What are emotions, and why are they important? How are emotions communicated, and how do researchers measure them? How do emotions influence one’s thinking ability, and visa-versa? What is emotion regulation? How do people differ in terms of their overall happiness and well-being, the degree to which they seek/avoid positive/negative experiences, and how they try to control their emotions? And what brain mechanisms are involved in emotional processing and emotion regulation? This course is also intended to help students read research in a thorough, critical manner, which may have a positive impact on students considering an academic career. Prereq: PSCL 101 and PSCL 352.

PSCL 390. Seminars in Psychology. 1 - 3 Unit.
Surveys of special subject areas. Topics vary in response to faculty and student interests. Small group discussion. Prerequisite depends on content.

PSCL 391. Psychology Capstone Research Using Data Archives. 3 Units.
In this course, each student will derive and address a research question by identifying and analyzing archived publicly available data. Successful completion of the course will require: training in ethical research involving human participants; a critical review of the literature on a specific area of psychology with the goal of creating a research question; identification of a set of variables in a publicly available data set that can be used to address the research question, a final written research report in a format acceptable for publication in a psychological research journal, and an oral presentation of the research. Prereq: PSCL 101 and PSCL 282 or equivalent (ANTH 319, STAT 201), and PSCL 375.

PSCL 393. Experimental Child Psychology. 3 Units.
The development of behavior from birth to adolescence. Growth of basic processes such as perception, learning, memory, intelligence, and language in the light of current theoretical models. Recommended preparation: PSCL 101.

PSCL 394. Psychology Capstone Seminar: Current Problems. 3 Units.
This seminar course will revolve around the identification and critical examination of current problems in society. Insights gained from psychological research will be applied to better understand these problems. Successful completion of the course will require critical analysis of published research, integration of information from different areas of psychology and from different disciplines, an oral presentation, and a final written research report including a literature review. Prereq: PSCL 375.

PSCL 395. Capstone and Honors Program. 3 Units.
Supervision in carrying out an independent research study in the student’s area of interest. Prereq: PSCL 375.

PSCL 396. Anxiety and Depression: Symptoms, Etiology, and Treatment. 3 Units.
A research-based and writing-intensive presentation of current knowledge regarding the symptoms, etiology, and treatment of anxiety disorders and mood disorders.
PSCL 397. Independent Study. 1 - 3 Unit.
Individual study involving specific programs of reading, research, and special projects. Prereq: PSCL 101.

PSCL 398C. Child Policy Externship and Capstone. 3 Units.
Externships offered through CHST/ANTH/PSCL 398C give students an opportunity to work directly with professionals who design and implement policies that impact the lives of children and their families. Agencies involved are active in areas such as public health, including behavioral health, education, juvenile justice, childcare and/or child welfare. Students apply for the externships, and selected students are placed in local public or nonprofit agencies with a policy focus. Each student develops an individualized learning plan in consultation with the Childhood Studies Program faculty and the supervisor in the agency. Offered as CHST 398C, ANTH 398C, and PSCL 398C. Prereq: CHST 301.

PSCL 401. Sensation and Perception. 3 Units.
Role of sensory and perceptual processes in adjustment. Theories and experimental work dealing with such topics as nativism vs. empiricism, perception without awareness, perception and personality, effects of drugs on personality, effects of drugs on perception, pathology of perception. Limited to graduate students.

PSCL 402. Cognition and Information Processing. 3 Units.
Aspects of cognition beyond the area of sensation and perception, involving symbolic processes, especially problems of meaning, conceiving, reasoning, judging, and thinking.

PSCL 403. Physiological Foundations of Behavior. 3 Units.
Fundamental neurological processes controlling behavior.

PSCL 404. Learning Theory. 3 Units.
The research literature in learning; theoretical formulations of contemporary learning theorists. Limited to graduate students.

PSCL 405. Personality Theory. 3 Units.
General problems and systematic points of view in the analysis of personality. Limited to graduate students.

PSCL 407. Research Design and Quantitative Analysis I. 3 Units.
Intermediate research design and statistical analysis used in psychological research. Statistical inference from single variables, elementary principles of probability, correlation and regression. Recommended preparation: PSCL 282.

PSCL 408. Research Design and Quantitative Analysis II. 3 Units.

PSCL 409. Advanced Social Psychology. 3 Units.
Major theories, methods, and problem areas of social psychology. Psychological development of the individual group structures and dynamics.

PSCL 410. Developmental Psychology. 3 Units.
The research literature and theoretical formulation in the area of developmental psychology. Limited to graduate students.

PSCL 412. Measurement of Behavior. 3 Units.

PSCL 418. History and Systems. 3 Units.
Historical antecedents of modern psychology.

PSCL 424. Clinical Interviewing. 3 Units.
Introduction to diagnostic and therapeutic interviewing.

PSCL 425. Methods of Assessment I. 3 Units.
Limited to graduate students in clinical psychology. Recommended preparation: Graduate standing in psychology with department permission.

PSCL 426. Methods of Assessment II. 3 Units.
Methods of psychological assessment, emphasizing personality and family function in childhood and adulthood. Recommended preparation: Limit to Grad students in Clinical Psychology. Requires approval of the Director of Clinical Training.

PSCL 429. Practicum in Assessment I. 1 Unit.

PSCL 430. Practicum in Assessment II. 1 Unit.
Recommended preparation: Approval of the Director of Clinical Training or concurrent enrollment in PSCL 426.

PSCL 431. Supervised Field Placement Year 2. 0 Units.
Supervised training in clinical psychology in agency, hospital, or university settings. Required in Fall and Spring terms of all second year students in the clinical psychology training program. Recommended preparation: PSCL 425, PSCL 426.

PSCL 444. Developmental Psychopathology. 3 Units.
This course will focus on the interplay of biological, psychological, familial, and social determinants of disorders ranging from autism to delinquency and bulimia. Recommended preparation: PSCL 230 or PSCL 321. Offered as PSCL 344 and PSCL 444.

PSCL 451. Special Topics in Psychology. 1 Unit.
These 1 credit mini-courses should provide enjoyable opportunities for students to explore interesting material related to clinical psychology that has not been covered in other required courses. A primary goal is to stimulate interest and discussion in the area. Thus, students will not be expected to write term papers or take any exams. In terms of background reading, students should be provided with roughly one journal article per hour of class meeting. The course is graded pass/no pass, and grading will be based on class attendance and class participation.

PSCL 453. Seminars in Psychology. 1 - 3 Unit.
A special problem or topic. Content varies with student and faculty interest. Recent offerings: creative thinking in research, community psychological, evaluation of community processes, experimental and computer methods, consultation, and psychoanalytic ego psychology.

PSCL 469. Psychology of Aging. 3 Units.
Normal psychological development in later life; psychological development in the oldest old; definitions and assessment of successful aging.
PSCL 497. Graduate Independent Study. 1 - 3 Unit.
Independent research and reading programs with individual members of the faculty.

PSCL 501. Seminar: Pediatric Psychology. 1 - 3 Unit.
Seminar on current research topics, research design and methodological issues related to pediatric psychology. Introductory lectures provide an overview of research populations, methods, and practical issues appropriate to research with pediatric populations.

PSCL 502. Seminar: Pediatric Psychology. 1 - 3 Unit.
Seminar examining specific topics in pediatric psychology. Topics will deal with issues of infant development. Infants at risk for disability, neuropsychology and learning disabilities, and childhood psychopathology. Recommended preparation: Limited to Graduate students in Psychology department.

PSCL 510. Psychology and Diversity. 3 Units.
Diversity and multiculturalism in psychological theory, research and practice.

PSCL 524. Advanced Psychopathology. 3 Units.
Theoretical issues and current research data bearing on major patterns of psychological disturbance.

PSCL 525. Ethical and Professional Issues in Psychology. 3 Units.
Consideration of legal and ethical principles in research and practice in clinical psychology and contemporary controversies in professional psychology. Recommended preparation: Graduate standing in Psychology

PSCL 529A. Practicum in Intervention I: Behavior Therapy. 1 Unit.
Recommended Preparation: Graduate standing in clinical psychology.

PSCL 529C. Practicum in Intervention I: Psychodynamic. 1 Unit.
Recommended preparation: Graduate standing in clinical psychology.

PSCL 530A. Practicum in Intervention II: Behavior Therapy. 1 Unit.
Recommended preparation: Graduate standing in clinical psychology.

PSCL 530C. Practicum in Intervention II: Psychodynamic. 1 Unit.
Recommended preparation: Graduate standing in clinical psychology.

PSCL 531A. Seminar in Intervention I: Behavior Therapy. 2 Units.
Theoretical issues and research on psychological interventions. Recommended preparation: Graduate standing in clinical psychology.

PSCL 531C. Seminar in Intervention I: Psychodynamic. 2 Units.
Theoretical issues and research on psychological interventions. Recommended preparation: Graduate standing in clinical psychology.

PSCL 532A. Seminar in Intervention II: Behavior Therapy. 2 Units.
Theoretical issues and research on psychological interventions. Recommended preparation: Graduate standing in clinical psychology.

PSCL 532C. Seminar in Intervention II: Psychodynamic. 2 Units.
Theoretical issues and research on psychodynamic intervention. Recommended preparation: PSCL 531C and graduate standing in clinical psychology.

PSCL 535. Child and Family Intervention. 2 Units.
A course for advanced clinical graduate students that covers psychodynamic and cognitive behavioral approaches for working with children and adolescents and systems approaches for working with families.

PSCL 536. Advanced Child and Family Intervention. 2 Units.
A course for advanced clinical graduate students that covers evidence-based approaches to child and family therapy as well as parent training. Special emphasis on empirically guided treatment planning and outcome evaluation.

PSCL 537. Child and Family Case Seminar I. 1 Unit.
Clinical graduate students in child and family field placements present and receive group supervision on ongoing cases.

PSCL 538. Child and Family Case Seminar II. 1 Unit.
Clinical graduate students in child and family field placements present and receive group supervision on ongoing cases.

PSCL 539. Supervised Field Placement Year 3. 0 Units.
Supervised training in clinical psychology in agency, hospital, or university settings. Required in Fall and Spring terms of all third year students in the clinical psychology training program. Recommended preparation: PSCL 531A, PSCL 532A.

PSCL 540. Supervised Field Placement Year 4. 0 Units.
Supervised training in clinical psychology in agency, hospital, or university settings. Required in Fall and Spring terms of all fourth year students in the clinical psychology training program. Recommended preparation: PSCL 531A, PSCL 532A.

PSCL 601. Special Problems. 1 - 18 Unit.
(Credit as arranged.)

PSCL 651. Thesis M.A.. 1 - 18 Unit.
(Credit as arranged.)

PSCL 700. Internship. 0 Units.
Full-time predoctoral internship in clinical psychology. Required of all students in clinical psychology program. Registration requires written consent of director of clinical psychology training and must be for one calendar year.

(Credit as arranged.) Prereq: Predoctoral research consent or advanced to Ph.D. candidacy milestone.
Department of Religious Studies

The academic study of religion at Case Western Reserve University is multicultural, non-sectarian, and both disciplinary and interdisciplinary. Students examine a range of past and present cultures and societies using methods and approaches drawn from the humanities, arts, social sciences, and sciences, all of which sharpen critical and evaluative skills. Religious beliefs, institutions, and practices are studied with emphasis placed on the critical problems and possibilities inherent in current theories, methods, and technologies.

The Department of Religious Studies offers both undergraduate (Bachelor of Arts) and graduate (Master of Arts) degrees. Undergraduates may pursue either a major or minor in the department; outstanding students may apply for the departmental honors program. Both the major and minor programs acquaint students with significant religious texts and traditions and with the cultures and societies in which these traditions are grounded. Majors are encouraged to participate in study abroad programs.

Where appropriate, courses are designed to utilize Internet and other technological resources, cultural institutions in University Circle, and the cultural diversity of Greater Cleveland. Several 300-level courses may be taken for graduate credit by fulfilling additional course requirements. The Department of Religious Studies also contributes courses to and supports a number of the college’s interdisciplinary programs and centers, such as Asian Studies, Environmental Studies, Ethnic Studies, Women’s and Gender Studies, International Studies, and Judaic Studies.

The academic study of religion, combined with appropriate courses in other fields, provides an excellent background for any professional career that involves interaction with diverse populations—including law, engineering, medicine and health care professions, journalism, and social work—and for graduate studies in a number of fields. A major in religious studies provides a well-rounded liberal arts education or can be combined conveniently with a second major. A minor in religious studies complements and broadens any field chosen as a major.

Undergraduate Programs

Major

Students majoring in religious studies must complete a minimum of 30 semester hours. Requirements for the major are as follows:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>RLGN 102</td>
<td>Introduction to the Study of Religion</td>
<td>3</td>
</tr>
<tr>
<td>RLGN 299</td>
<td>Method and Theory in the Study of Religion</td>
<td>6</td>
</tr>
<tr>
<td>&amp; RLGN 399</td>
<td>and Major/Minor Seminar</td>
<td></td>
</tr>
</tbody>
</table>

Seven courses dealing with the academic study of religion  **  21

Total Units  30

* RLGN 102 Introduction to the Study of Religion introduces students to various approaches to the academic study of religion, including (but not limited to) sociological approaches, cultural/anthropological approaches, and psychological approaches. It also introduces students to at least four different religious traditions.

** Subsequent course selections (totaling 21 credit hours) will be determined in consultation with the student’s major advisor and should display some diversity in themes and topics. Up to six of these credit hours may be taken outside the Department of Religious Studies, provided that the courses relate to the overall character of the major.

Departmental Honors

Majors who have an overall grade point average of 3.5 and a grade point average of 3.5 in religious studies courses may apply for the honors program. Such students should take RLGN 299 Method and Theory in the Study of Religion in the fall semester and RLGN 395 Honors Research II (instead of RLGN 399) in the spring semester of the senior year. During the fall semester, the student will work with an honors advisor to prepare a proposal to be approved by the department no later than the end of the first semester. Departmental honors are awarded upon completion and satisfactory defense of the senior project before a faculty committee, provided that the required grade point averages are maintained.

Minor

A minor in religious studies requires at least 18 credit hours, to include the following:

<table>
<thead>
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</tr>
</thead>
<tbody>
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</tr>
<tr>
<td>&amp; RLGN 399</td>
<td>and Major/Minor Seminar</td>
<td></td>
</tr>
</tbody>
</table>

Nine hours of elective credit  *  9

Total Units  18

* The nine hours of elective credit hours are chosen in consultation with a departmental advisor. The courses should demonstrate study of diverse religious traditions.

General Information

The department offers a graduate program leading to a Master of Arts degree in Religious Studies. This two-year program concentrates on method and theory in the study of religion. The MA is designed to give students from a variety of backgrounds a solid foundation in the methods used in the contemporary study of religion.

Program Curriculum

First Year

<table>
<thead>
<tr>
<th>Course Details</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foundational Readings in Religious Studies (RLGN 401) (A reading course based on the major formative works of the field. Bibliography to be worked out by graduate advisor in consultation with the student. Students will demonstrate familiarity with the literature through written examination.)</td>
<td>3</td>
</tr>
<tr>
<td>One 400-level RLGN course</td>
<td>3</td>
</tr>
<tr>
<td>An elective dealing with the method and theory in the study of religion</td>
<td>3</td>
</tr>
<tr>
<td>An elective dealing with method and theory in the study of religion</td>
<td>3</td>
</tr>
</tbody>
</table>

Units Fall  Spring
Independent Study with thesis advisor to prepare proposal. To be approved by the graduate faculty by the beginning of the third semester.

<table>
<thead>
<tr>
<th>Course</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>One 400-level RLGN course</td>
<td>3</td>
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</tbody>
</table>

Year Total:

<table>
<thead>
<tr>
<th></th>
<th>Fall</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thesis M.A. (RLGN 651) (or elective)</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Thesis M.A. (RLGN 651)</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Year Total</td>
<td>9</td>
<td>3</td>
</tr>
</tbody>
</table>

Total Units in Sequence: 30

**Courses**

**RLGN 102. Introduction to the Study of Religion. 3 Units.**
Introduction to the academic study of religion and of the religious dimensions of life. Open to all students but prerequisite for majors and minors in religious studies.

**RLGN 190. Sacred Space in Western Religions. 3 Units.**
A significant problem facing all three of the great western religious traditions -- Judaism, Christianity and Islam -- is how to establish a sacred space on earth for the worship of a deity which cannot be contained. In many ways, architectural and artistic decisions about the location, internal layout, orientation and other features of such sacred spaces reflect deep presuppositions in each religion about the divine and how worship is to be effected in a human context. This course will be based around visits to a number of religious buildings to examine how one might understand and interpret such spaces.

**RLGN 204. Introduction to Asian Religions. 3 Units.**
Principal Asian religious traditions based on a study of classical sources. Classical Chinese thought, Hinduism, and Buddhism. Readings include selections from the works of Confucius, Mencius, Mo Tzu, Lao Tzu, Chuang Tzu, the Mahabharata, the Bhagaavad Gita, and the early Buddhist canon.

**RLGN 206. Religion and Ecology. 3 Units.**
Historical and cross-cultural introduction to religious perspectives on nature and ecology, including Jewish, Christian, Hindu, Buddhist, and Native American texts and ritual practices. Themes include: ecology of chaos and complexity, urban ecology, wilderness, and ecological crises.

**RLGN 207. Women and Religion. 3 Units.**
Examination of feminist perspectives on religion, such as the status of women in Western and non-Western religions, the nature and purpose of religious beliefs and practices from the standpoints of religious and non-religious feminists, the current status of feminist philosophies of religion, and the efforts of feminists to transform traditional religions and to create new religions. Offered as RLGN 207 and WGST 207.

**RLGN 208. Introduction to Western Religions. 3 Units.**
Basic introduction to the three great monotheistic religions of the Western World: Christianity, Judaism, and Islam. All three of these religious traditions trace their roots to the faith of biblical Israel as revealed by a series of prophets including Noah, Abraham, and Moses. Each absorbed the philosophy and science of the Greco-Roman world and went on both to influence and struggle with each other. Many of the religious problems of the contemporary world, from Afghanistan to the Middle East to Yugoslavia, can be traced to tension within and between these religious groups. Offered as RLGN 208 and JDST 208.

**RLGN 209. Introduction to Biblical Literature. 3 Units.**
This course is an introduction to the academic study of biblical literature, including Hebrew Scriptures ("Old Testament") and the New Testament. The literature will be studied in light of both ancient and contemporary historical contexts, with a particular emphasis on the roles it plays in American culture and politics today. Class sessions will be discussion oriented and will involve close, careful analysis and interpretation of texts. No background in religion is necessary. Evaluation will be based on class preparation and participation, regular short writing assignments, two exams, and a major paper.
RLGN 211. Great Books of Western Religion. 3 Units.
Students will engage with the major writings that have shaped Western religious traditions (Christianity, Judaism, Islam) from their earliest expressions until the present day. Readings include the foundational Scriptures (Hebrew Bible, New Testament, Quran) of each tradition, religious poetry and other writings from the Middle Ages, and modern writers on spiritually and religiously within each of these traditions. The course will be conducted as a seminar, in which students will read the selected original texts and will discuss their religious and spiritual meaning and significance in class. Each student will also prepare a final project based on the assigned authors or readings. Offered as RLGN 211 and JDST 211.

RLGN 212. Introduction to Christianity. 3 Units.
An introduction to the history, thought and culture of Christianity and its diverse traditions. Course will include field research with local Christian religious institutions.

RLGN 215. Religion In America. 3 Units.
Survey of religious histories in North America, from the trans-Bering migrations to the present. Drawing from a variety of approaches such as social history, ritual studies, and institutional and doctrinal histories, this course charts the religious development of various groups including Native Americans, African Americans, Euro-Americans, and others.

RLGN 216. Hinduism I: The Vedic, Epic and Puranic Periods. 3 Units.
This course will provide an introduction to the Vedic, Epic and Puranic periods in the development of Hinduism. We will read a range of primary sources produced during these times. These texts were composed between 1500 BCE and the 5th century CE. The course has an emphasis on research and writing. We will not be examining contemporary issues or practice. The goal of the class is to gain detailed understanding of the kind of world(s) that were envisioned in these forms of early "Hinduism."

RLGN 217. Buddhism. 3 Units.
The development of Buddhism. The life and teaching of the Buddha, the formation of the early Buddhist church, the schools of Hinayana Buddhism and Abhidharma philosophy, Nagarguna and the emergence of Mahayana Buddhism, the spread of Buddhism to China, the transformation of Buddhist thought in China, Zen Buddhism, the spread of Buddhism to the West. 

RLGN 218. Islam: Faith and Politics. 3 Units.
An overview of the relationship between Islam as a religion and Islam as a political system and the effects of this relationship on Islamic society from its origin to the present time.

RLGN 221. Indian Philosophy. 3 Units.
A survey of Indian philosophical thought with emphasis on the Vedas, early Hindu, and Jain literature. Offered as PHIL 221 and RLGN 221.

RLGN 222. African-American Religions. 3 Units.
This course is an exploration of the rich diversity of African American religions from the colonial period to the present. Attention will be given to key figures, institutional expressions, and significant movements in African American religious history. Major themes include African traditions in African American religions, slavery and religion, sacred music, social protest, Black Nationalism in religion, Islam, African American women and religion, and black and womanist theologies. Course requirements will include field trips to local religious sites. Offered as ETHS 222 and RLGN 222.

RLGN 223. Religious Roots of Conflict in the Middle East. 3 Units.
The course is about the rhetoric and symbols used by various voices in the Middle East in the ongoing debate about the future shape of the region. For historical and cultural reasons, much of the discourse draws on religious symbolism, especially (although not exclusively) Islamic, Jewish and Christian. Because of the long and complex history of the region and the religious communities in it, virtually every act and every place is fraught with meaning. The course examines the diverse symbols and rhetorical strategies used by the various sides in the conflict and how they are understood both by various audiences within each community and among the different communities.

RLGN 231. Jews in the Modern World. 3 Units.
Investigation of the impact of modernity on the Jewish community. In particular, the course will examine the influence of the Enlightenment in the social situation of the Jews in Europe and America and the corresponding changes in Judaic religion, philosophy, social structure, and culture. Attention will be paid to the creation of a modern Jewish identity in the secular culture of the post-Modern world. Offered as HSTY 238, JDST 231, and RLGN 231.

RLGN 233. DESI: Diaspora, Ethnicity, Southas(n), Interrogate. 3 Units.
In this class we will interrogate the cultural Identity(ies) and imagined community(ies) of the "South Asian" Diaspora. We will first examine taxonomy and categorization itself, as a methodical, philosophical, and political enterprise. We will then examine how such contrived categories have been applied to the so-called desis, loosely and broadly understood as members of the South Asian Diaspora. To this end we will scrutinize the development of American(ized)) "Hinduism." the imagined location that desis have in North American racial and ethnic hierarchies, and the construction of assimilated, enculturated, and transnational imagined desi communities. Offered as RLGN 232, ETHS 232 and HSTY 232

RLGN 235. Religion and Visual Culture. 3 Units.
Cross-cultural introduction to complex relations between religion and seeing. Study of visual culture, sacred iconography, calligraphy, film, mass media, and avant-garde fashion. Extensive use of cultural resources in University Circle.

RLGN 237. Religion and Dance in South Asia. 3 Units.
This is an experimental interdisciplinary course in religion, dance, and South Asian studies. We will explore the performance of religion in bharata natyam, one storytelling dance form from South Asia. This dance style draws upon Hindu devotional (bhakti) allegories of sacred and profane love in its choreography. Lover and beloved, as the ideal relationship between God and the human, becomes the model for the performed relationship between heroes and heroines (nayaka-nayaki) danced on stages and, more recently, Bollywood screens. To this end we will examine primary and secondary sources on bharata natyam and aesthetic theory/classical dramatics. We will also observe dance performances in the greater Cleveland area. Offered as RLGN 237 and DANC 237.
RLGN 238. Alternative Altars: Folk Religion in America. 3 Units.
Taking a multidisciplinary approach, students will become familiar with the distinction between conventional and unconventional religions, with the history and personalities associated with new belief systems in America, and with the means, motivations and methods of generating faith communities. Students will come to understand the role of cultural anxieties, new technologies, changing roles, globalization and other social tensions in the formation and duration of alternative altars.

RLGN 240. The Heavens in Religion and Science. 3 Units.
Review of the relationships between scientific descriptions of the natural world and the religious and ethical implications drawn from those in Western civilizations. Introduction to the close cooperation between religion and science in the West until the modern period and review of the breakdown of that relationship in the past 200 years.

RLGN 251. Perspectives in Ethnicity, Race, Religion and Gender. 3 Units.
This course is designed to introduce students to the study of ethnicity. Basic concepts such as race, gender, class, and identity construction will be examined. Students are encouraged to use the tools and perspectives of several disciplines to address the experiences of ethnic groups in the United States. Offered as ETHS 251 and RLGN 251.

RLGN 254. The Holocaust. 3 Units.
This class seeks to answer fundamental questions about the Holocaust: the German-led organized mass murder of nearly six million Jews and millions of other ethnic and religious minorities. It will investigate the origins and development of racism in modern European society, the manifestations of that racism, and responses to persecution. An additional focus of the course will be comparisons between different groups, different countries, and different phases during the Nazi era. Offered as HSTY 254, RLGN 254, ETHS 254, and JDST 254.

RLGN 260. Introduction to the Qur'an. 3 Units.
This course explains the complexities of the Qur'an and provides an entree into a text that has shaped the lives of millions for centuries. In addition to a comprehensive introduction to the Qur'an, the course will examine problems of translation and the major subjects addressed in the Qur'an: Muhammad and revelation, God and the Last Judgment, prophets in general, and the Qur'an as a law book. Also discussed will be the relations of Muslims to the other Peoples of the Book, namely Jews and Christians.

RLGN 268. Women in the Bible: Ethnographic Approaches to Rite and Ritual, Story, Song, and Art. 3 Units.
Examination of women in Jewish and Christian Biblical texts, along with their Jewish, Christian (and occasionally Muslim) interpretations. Discussion of how these traditions have shaped images of, and attitudes toward, women in western civilization. Offered as RLGN 268, WGST 268, and JDST 268.

RLGN 270. Introduction to Gender Studies. 3 Units.
This course introduces women and men students to the methods and concepts of gender studies, women's studies, and feminist theory. An interdisciplinary course, it covers approaches used in literary criticism, history, philosophy, political science, sociology, anthropology, psychology, film studies, cultural studies, art history, and religion. It is the required introductory course for students taking the women's and gender studies major. Offered as ENGL 270, HSTY 270, PHIL 270, RLGN 270, SOCI 201, and WGST 201. Prereq: ENGL 150 or passing letter grade in a 100 level first year seminar in USFS, FSCS, FSNA, FSSO, FSSY, FSTS, FSCS.

RLGN 272. Morality and Mind. 3 Units.
Recent research in cognitive science challenges ethical perspectives founded on the assumption that rationality is key to moral knowledge or that morality is the product of divine revelation. Bedrock moral concepts like free will, rights, and moral agency also have been questioned. In light of such critiques, how can we best understand moral philosophy and religious ethics? Is ethics primarily informed by nature or by culture? Or is ethics informed by both? This course examines 1) ways in which cognitive science--and related fields such as evolutionary biology--impact traditional moral perspectives, and 2) how the study of moral philosophy and comparative ethics forces reconsideration of broad cognitive science theories about the nature of ethics. The course examines the concept of free will as a case study in applying these interpretive viewpoints. Interdisciplinary readings include literature from moral philosophy, religious ethics, cognitive science, and evolutionary biology. Offered as COGS 272, RLGN 272.

RLGN 273. Religion and Healing in the United States. 3 Units.
A cross-cultural exploration of the relationships between religion, health and healing in the United States. Through an interdisciplinary approach that includes religious studies, medical anthropology and ethnic/gender studies, the course investigates how persons interpret illness and suffering. Attention is also paid to how different groups utilized, or are served by, the health care system.

RLGN 280. Religion and Politics in the Middle East. 3 Units.
An in-depth look at the relationship between politics and religion in the Middle East. Students will spend the first week on the CWRU campus and the last three weeks in Israel, where time will be divided between classroom teaching, guest lectures, and “field trips” to important sites. Students will have the opportunity to interact directly with members of the region’s diverse religious groups within the political, social, and cultural contexts in which they live. A final research paper will be required. Knowledge of Hebrew is not necessary. Offered as JDST 280 and RLGN 280.

RLGN 283. Muhammad: The Man and the Prophet. 3 Units.
The life of the Prophet Muhammad (c.470-632 CE) which was as crucial to the unfolding Islamic ideal as it is today. An examination of how he attempted to bring peace to war-torn Arabia by evolving an entirely new perspective of the human situation, guidance for human lives, and humans’ relationship with God. The course will include Western perceptions of Islam, especially in light of September 11, 2001.
RLGN 284. Jesus Through Islamic Lens. 3 Units.
An introduction to an image of Jesus little known outside Arabic Islamic culture. It is an image that might be of interest to those who wish to understand how Jesus was perceived by a religious tradition which greatly revered him but rejected his divinity. The course will draw from various Islamic texts to provide a comprehensive selection of excerpts pertaining to the life and moral teachings of Jesus. Approaching Christ from an Islamic perspective, this course will offer the students a rare opportunity to understand the significance of Jesus in Islam and to gain a better understanding of the Islamic faith, not only as it contrasts with Christianity but also as it compares.

RLGN 299. Method and Theory in the Study of Religion. 3 Units.
This is an advanced course in method and theory in the study of religion and is designed for majors in religious studies. The goal is to strengthen the foundation in religious studies first obtained in RLGN 102 and to prepare students for projects to be completed and presented during the second semester in RLGN 399. (or RLGN 395 for honors). Class time will be devoted to lectures and discussions of a variety of authors, methods and topics. Particular readings will be assigned by the designated instructor. Students are expected to attend class regularly, complete assigned reading and participate in class discussions. Prereq: RLGN 102 and 9 credits in other RLGN courses.

RLGN 301. Ritual in Religion. 3 Units.
Drawing from a broad range of approaches and academic fields, this seminar offers an introduction to the study of ritual. The course has three main goals: (1) to help students become familiar with important theories of and approaches to ritual studies; (2) to explore a number of ritual practices from different cultures, from ancient priestly rites in the Bible to contemporary cockfights in Bali; and (3) to study and discuss several representations of ritual in contemporary literature and film.

RLGN 305. Sanskrit Religious Texts. 3 Units.
Introduction to the Sanskrit language and culture through the reading of selected texts taken from the ancient religions of South Asia. Offered as CLSC 305 and RLGN 305.

RLGN 306. Interpreting Buddhist Texts. 3 Units.
Readings in translation of major texts from the Buddhist tradition. Special emphasis on problems of textual interpretation, historical context, Buddhist conceptions of the sacred, and Buddhist ethics.

RLGN 309. Advanced Sanskrit Religious Texts. 3 Units.
This class is a continuation of RLGN 305/CLSC 305, the introduction to the Sanskrit language and culture. In RLGN 309/CLSC 309 students will learn advanced Sanskrit grammar and syntax. Previous knowledge of Sanskrit is required. We will finish the lessons from Devavanipravesika that we began in the introductory course. We will then translate sections for the Bhagavad Gita. Offered as CLSC 309 and RLGN 309. Prereq: RLGN 305 or CLSC 305.

RLGN 311. Representations of Black Religion in Film. 3 Units.
In this course we will explore cinematic representations of black religion in the Americas and the Caribbean. Each week we will view a film representing diverse religious traditions such as Christianity, Candomble, Santeria, Vodou, and Islam. Films will include Cabin in the Sky, The Color Purple, Black Orpheus, The Serpent and the Rainbow, Malcolm X, Eve’s Bayou, and The Princess and the Frog. Throughout the course we will analyze the ways in which notions of gender, the history of colonialism, modern notions of race, and geographical landscapes have informed representations of black religion in film. In addition, we will discuss how these representations, in turn, have influenced cultural ideas of black religion in the Americas. Offered as RLGN 311, ETHS 311, and RLGN 411. Prereq: RLGN 222 or ETHS 251 or ENGL 367 or by permission of Instructor.

RLGN 312. The Mythical Trickster. 3 Units.
Few literary figures have as wide a distribution, and as long a history, as the mythical Trickster. He is at once sacred and profane, creator and destroyer; an incorrigible duper who is always duped. Free of social and moral restraints he is ruled instead by passions and appetites, yet it is through his unprincipled behavior that morals and values come into being. How are we to interpret this amazing creature? Using folkloristic theories and ethnographic methods, we will come to understand the social functions and symbolic meanings of the cross-cultural Trickster, over time and across space.

RLGN 313. Topics in Biblical Literature:. 3 Units.
A departmental "topics" seminar focused on advanced textual analysis and interpretation of particular biblical (including apocryphal) texts and the critical issues of method, theory, theology, and history that pertain to those texts. Reading assignments will be divided between close, exegetical analysis of small units of texts and the study of scholarly criticism of the same texts (commentaries, journal articles, critical notes). Evaluation will be based on class preparation and participation, weekly short papers, an exegetical paper focused on a particular pericope of the student’s choice, and an interpretive paper based on exegesis of several related passages. Graduate students enrolled in the course as RLGN 413 will have the following additional requirements: (a) preliminary academic reading on the biblical material; (b) leadership/teaching of one seminar session on an academic theoretical or theological approach to the biblical text, including an additional meeting with the professor in preparation for that session; and (c) a longer final paper that critical engages the approach that was the focus of the seminar session s/he leads (15-20 pages, suitable for publication at an academic conference). Offered as RLGN 313 and RLGN 413. Prereq: RLGN 209 or permission of instructor.

RLGN 315. Heresy and Dissidence in the Middle Ages. 3 Units.
Survey of heretical individuals and groups in Western Europe from 500 - 1500 A.D., focusing on popular rather than academic heresies. The development of intolerance in medieval society and the problems of doing history from hostile sources will also be explored. Offered as HSTY 315 and RLGN 315.

RLGN 319. The Crusades. 3 Units.
This course is a survey of the history of the idea of "crusade," the expeditions of Western Europeans to the East known as crusades, the Muslim and Eastern Christian cultures against which these movements were directed, as well as the culture of the Latin East and other consequences of these crusades. Offered as HSTY 319 and RLGN 319.
The major focus of this seminar will range from the ongoing questions of peace and justice in Israel and occupied Palestine to the land and border questions; Green line, crossing points, the wall; to interpretations from biblical to contemporary texts, reflecting a multiplicity of agendas. Our primary focus will be the analysis of recent research and scholarship on issues of mass violence, contested space and land, gender, race and ethnicity, religious sectarianism, colonialism/imperialism. Through our readings we will identify the bias and concerns of various interpretive communities involved in the ongoing struggles in this very small area. With two peoples claiming the same land for different reasons, can this conflict ever be resolved? Recommended preparation: One course about the Middle East. Offered as ETHS 359 and RLGN 320.

RLGN 321. Advanced Indian Philosophy. 3 Units.
We will closely examine a limited number of texts in Jain, Hindu, and/or Buddhist philosophy. Our concern will be the methods, presuppositions, arguments, and goals of these schools and trajectories of thought. What were their theories on the nature of the person, the nature of reality, and the nature and process of knowing? What were the debates between the schools and the major points of controversy? We will spend the majority of time analyzing the arguments or positions as they are found in primary texts (in translation). We will rely on the primary sources found in Sarma Introduction to Classical Indian Philosophy as well as PDFs provided by the instructor. Students will read texts out loud in class and will be expected to comment on the passage or passages. Students are expected to use outside sources in their preparations. The goal of the class is to continue to learn how to make and write arguments against (or in support of) the various positions using the prasangika (reductio ad absurdum) method. The papers are rigorous ones and require the student to present the position and then to posit arguments against it, finding internal incoherences. This is a writing-intensive class. Students will continue to learn how to write as per the genre of Indian philosophy. Offered as RLGN 321 and PHIL 321. Prereq: RLGN 221 or PHIL 221.

RLGN 325. Justice, Religion, and Society. 3 Units.
The ways in which several 20th-century American religious figures, both North and South American, have interpreted their religion as requiring them to struggle for a better society by using direct action to deal with issues of poverty, peace, and social justice. Introduction to writings of prominent social justice activists such as Dorothy Day, Daniel Berrigan, Thomas Merton, and others. Course includes service learning within the Cleveland area via association with structured institutions and programs engaged in social justice and urban poverty issues in order to investigate these from the inside.

RLGN 330. Classical Jewish Religious Thought. 3 Units.
The thought of some major biblical and Rabbinic writings and of the classic age of medieval Jewish philosophy. Offered as JDST 330, PHIL 332, and RLGN 330.

RLGN 333. Philosophy of Religion. 3 Units.
Topics include: classical and contemporary arguments for God’s existence; divine foreknowledge and human freedom; the problem of evil and theodicy; nature and significance of religious experience; mysticism; varieties of religious metaphysics; knowledge, belief and faith; nature of religious discourse. Readings from traditional and contemporary sources. Recommended preparation for PHIL 433 and RLGN 433: PHIL 101 or RLGN 102. Offered as PHIL 333, RLGN 333, PHIL 433, and RLGN 433. Prereq: PHIL 101 or RLGN 102.

RLGN 338. Black Women and Religion. 3 Units.
This course is an exploration of the multidimensional religious experiences of black women in the United States. These experiences will be examined within particular historical periods and across diverse social and cultural contexts. Course topics and themes include black women and slave religion, spirituality and folk beliefs, religion and feminist/womanist discourse, perspectives on institutional roles, religion and activism, and spirituality and the arts. Offered as: ETHS 339 and RLGN 338 and WGST 339.

RLGN 342. Mysticism: Sources, Methods, and Traditions. 3 Units.
Through an interdisciplinary approach that includes literary, historical and sociological methods, the course examines the history of Christian mysticism and the selected writings of mystics from diverse Christian traditions. We will explore the social and religious contexts in which these mystics speak, write and act; their impact on social, religious and political movements; and how perceptions of gender, race and power legitimate or delegitimate their claims of mystic knowledge. The course will highlight specific themes, issues and concepts such as religious practice, ritual, mystical itinerary, monasticism, disease and distress, delification, healing, asceticism, art, music, dance, ecology and the role of the body.

RLGN 345. Religion and Horror. 3 Units.
This seminar explores relations among religion, horror, and the monstrous in ancient scripture and contemporary horror. Course readings, discussions, and research projects approach the subject from two distinct but related directions: first, a focus on elements of horror and the monstrous in biblical and related ancient mythic and ritual texts; second, an examination of religious dimensions in the modern horror, especially as found in representations of monstrosity in literature and film. Offered as RLGN 345 and RLGN 445. Prereq: RLGN 102.

RLGN 349. Biocultural Approaches to Religion. 3 Units.
This course studies religious beliefs and rituals from a biocultural perspective. A biocultural approach to religion is based on the idea that human religiosity is informed by both our evolutionary biological makeup and by our ability to construct culture to adapt to variable social worlds and environments. According to a biocultural view, humans are biologically constrained but have the cultural capacity to adapt to the world in a variety of ways. Thus, a biocultural approach to religion asserts that biology and culture operate in tandem and that both biological and cultural insights are required in order to understand and explain religious beliefs and practices. This course explores these assumptions and examines them against specific religious data. This course introduces students to major ideas, concepts, and questions that motivate biocultural approaches to religion. The course requires students to apply course material to a final research project that explores particular religious beliefs and/or practices in terms of the intersection of cultural choices and biological constraints. Students will present their research findings to the class. Students who take this course under the COGS designation are expected to engage substantively with the contemporary scientific study of the human mind in their research project and other course work. Offered as RLGN 349, RLGN 449 and COGS 349.
RLGN 350. Jewish Ethics. 3 Units.
An exploration of Jewish moral and ethical discourse. The first half of the course will be devoted to studying the structure and content of classical Jewish ethics on issues including marriage, abortion, euthanasia, and social justice. Students will read and react to primary Jewish religious texts. The second half of the course will focus on various modern forms of Judaism and the diversity of moral rhetoric in the Jewish community today. Readings will include such modern thinkers as Martin Buber and Abraham Joshua Heschel. Offered as JDST 350, RLGN 350, and RLGN 450.

RLGN 352. Language, Cognition, and Religion. 3 Units.
This course utilizes theoretical approaches found in cognitive semantics -- a branch of cognitive linguistics -- to study the conceptual structures and meanings of religious language. Cognitive semantics, guided by the notion that conceptual structures are embodied, examines the relationship between conceptual systems and the construction of meaning. We consider such ideas as conceptual metaphor theory, conceptual blending, image schemas, cross-domain mappings, metonymy, mental spaces, and idealized cognitive models. We apply these ideas to selected Christian, Buddhist, and Chinese religious texts in order to understand ways in which religious language categorizes and conceptualizes the world. We examine both the universality of cognitive linguistic processes and the culturally specific metaphors, conceptual blends, image schemas, and other cognitive operations that particular texts and traditions utilize. Offered as RLGN 352, RLGN 452, COGS 352 and COGS 452.

RLGN 371. Jews under Islam and Christianity. 3 Units.
This course examines the social and political status of Jews under Muslim and Christian rule since the Middle Ages. Themes include interfaith relations, Islamic and Christian beliefs regarding the Jews, Muslim and Christian regulation of Jewry, and the Jewish response. Offered as HSTY 371, JDST 371 and RLGN 371.

RLGN 373. History of the Early Church: First Through Fourth Centuries. 3 Units.
Explores the development of the diverse traditions of Christianity in the Roman Empire from the first through the fourth centuries C.E. A variety of New Testament and extra-Biblical sources are examined in translation. Emphasis is placed on the place of Christianity in the larger Roman society, and the variety of early Christian ideals of salvation, the Church, and Church leadership. Offered as HSTY 303 and RLGN 373.

RLGN 374. Reformation Europe, 1500-1650. 3 Units.
Origins and development of Protestantism, the Catholic Counter-Reformation, and the interaction between secular power and religious identity in Christian Europe. Offered as HSTY 309 and RLGN 374.

RLGN 388. Topics in Religion. 3 Units.
Critical assessment of selected topics of historical or current interest. Project must be accepted by a member of the department faculty prior to registration. Offered as RLGN 388 and RLGN 488.

RLGN 392. Independent Study. 1 - 3 Unit.
Up to three semester hours of independent study may be taken in a single semester. Must have prior approval of faculty member directing the project.

RLGN 394. Honors Research I. 3 Units.
Intensive study of a topic or problem leading to the writing of an honors thesis. Requires RLGN 102 plus 9 RLGN credits and department approval. Prereq: RLGN 102 plus 9 RLGN credits.

RLGN 395. Honors Research II. 3 Units.
Intensive study of a topic or problem leading to the writing of an honors thesis. By department approval only. Prereq: RLGN 394 and by departmental approval.

RLGN 399. Major/Minor Seminar. 3 Units.
Capstone course primarily for majors and minors in religious studies. Allows students to interact with peers and faculty, reflect critically, and integrate their learning experiences. Prepares students to continue their learning in the discipline and in the liberal arts. Subject matter varies according to student and faculty needs and perspectives. May be repeated once for up to six credit hours. Prereq: RLGN 299.

RLGN 401. Foundational Readings in Religious Studies. 3 Units.
Structured as an Independent Study, this course is meant to familiarize the student with the major classical works and thinkers that have shaped the modern field of Religious Studies. Students will meet on a regular basis with the Instructor to discuss the theories and methods described in the literature.

RLGN 410. Cognitive Science of Religion. 3 Units.
This course introduces theories and methods in the cognitive science of religion. Particular emphasis is placed on applying cognitive scientific concepts and theories to such religious issues as belief in deities, religious ritual, and morality. We examine such topics as the relationship of religious studies to evolution and cognition, cognitive theories or religious ritual, anthropomorphism and religious representation, religion as an evolutionary adaptation, and cognitive semantics and religious language. Course work includes student-led discussions, a research-intensive journal-length essay on a topic chosen in consultation with the Instructor, and presentation of research findings to the class. Course readings are taken from the humanities, the social sciences, and natural sciences.

RLGN 411. Representations of Black Religion in Film. 3 Units.
In this course we will explore cinematic representations of black religion in the Americas and the Caribbean. Each week we will view a film representing diverse religious traditions such as Christianity, Candomble, Santeria, Vodou, and Islam. Films will include Cabin in the Sky, The Color Purple, Black Orpheus, The Serpent and the Rainbow, Malcolm X, Eve’s Bayou, and The Princess and the Frog. Throughout the course we will analyze the ways in which notions of gender, the history of colonialism, modern notions of race, and geographical landscapes have informed representatives of black religion in film. In addition, we will discuss how these representations, in turn, have influenced cultural ideas of black religion in the Americas. Offered as RLGN 311, ETHS 311, and RLGN 411.
RLGN 413. Topics in Biblical Literature. 3 Units.
A departmental "topics" seminar focused on advanced textual analysis and interpretation of particular biblical (including apocryphal) texts and the critical issues of method, theory, theology, and history that pertain to those texts. Reading assignments will be divided between close, exegetical analysis of small units of texts and the study of scholarly criticism of the same texts (commentaries, journal articles, critical notes). Evaluation will be based on class preparation and participation, weekly short papers, an exegetical paper focused on a particular pericope of the student's choice, and an interpretive paper based on exegesis of several related passages. Graduate students enrolled in the course as RLGN 413 will have the following additional requirements: (a) preliminary academic reading on the biblical material; (b) leadership/teaching of one seminar session on an academic theoretical or theological approach to the biblical text, including an additional meeting with the professor in preparation for that session; and (c) a longer final paper that critical engages the approach that was the focus of the seminar session s/he leads (15-20 pages, suitable for publication at an academic conference). Offered as RLGN 313 and RLGN 413.

RLGN 420. Structuralism and Anthropology of Religion. 3 Units.
The anthropological study of religion attempts to understand individual religions as social constructs. As such, it investigates the phenomenon of religion as a general pattern of human behavior. It asks, among other things, why there are religions at all and what common characteristics, if any, religions share. Among the central concepts are notions of the sacred and the way the sacred is marked through individual behaviors and communal structures. This course introduces the philosophical and cognitive background to the anthropological study of religion and traces the ways in which this method has evolved and been applied over the last century and a half. Special emphasis will be placed on more recent developments, such as Structuralism, which focuses especially on the underlying structures of religions and religious organizations.

RLGN 430. Genealogies of Religious Otherness. 3 Units.
Concepts of otherness pervade recent theories of religion. More or less related to one another, many of these concepts are borrowed from fields other than academic religious studies. This seminar explores the genealogies of otherness in theoretical discourse as they relate to religion. In the course of this seminar, our researches and discussions will address several key issues in academic religious studies, including: psychological and sociological processes of projection and their roles in the construction and deconstruction of religious identity; the significance of gender, sexuality, and ethnicity to these projections; concepts of otherness in mystical religious thought and experience; and the interrelations of order and chaos, figuring and disfiguring within religious ideas, institutions, and practices, interrelations that challenge common theoretical perspectives that treat religion primarily if not exclusively as a means of establishing order against chaos and as a force of social and ideological structure legitimation.

RLGN 433. Philosophy of Religion. 3 Units.
Topics include: classical and contemporary arguments for God's existence; divine foreknowledge and human freedom; the problem of evil and theodicy; nature and significance of religious experience; mysticism; varieties of religious metaphysics; knowledge, belief and faith; nature of religious discourse. Readings from traditional and contemporary sources. Recommended preparation for PHIL 433 and RLGN 433: PHIL 101 or RLGN 102. Offered as PHIL 333, RLGN 333, PHIL 433, and RLGN 433.

RLGN 440. Insiders and Outsiders in the Study of Religion. 3 Units.
This course will provide an introduction to one of the most important theoretical and methodological issues in the social sciences and in religious studies, namely, the epistemic authority of the insider and of the outsider. We will read books and articles, both classical and contemporary, on the topic. My goal is to place students at the center of a contemporary debate in the study of religion. We will also examine both hypothetical and actual communities that uphold insider epistemologies.

RLGN 445. Religion and Horror. 3 Units.
This seminar explores relations among religion, horror, and the monstrous in ancient scripture and contemporary horror. Course readings, discussions, and research projects approach the subject from two distinct but related directions: first, a focus on elements of horror and the monstrous in biblical and related ancient mythic and ritual texts; second, an examination of religious dimensions in the modern horror, especially as found in representations of monstrosity in literature and film. Offered as RLGN 345 and RLGN 445.

RLGN 449. Biocultural Approaches to Religion. 3 Units.
This course studies religious beliefs and rituals from a biocultural perspective. A biocultural approach to religion is based on the idea that human religiosity is informed by both our evolutionary biological makeup and by our ability to construct culture to adapt to variable social worlds and environments. According to a biocultural view, humans are biologically constrained but have the cultural capacity to adapt to the world in a variety of ways. Thus, a biocultural approach to religion asserts that biology and culture operate in tandem and that both biological and cultural insights are required in order to understand and explain religious beliefs and practices. This course explores these assumptions and examines them against specific religious data. This course introduces students to major ideas, concepts, and questions that motivate biocultural approaches to religion. The course requires students to apply course material to a final research project that explores particular religious beliefs and/or practices in terms of the intersection of cultural choices and biological constraints. Students will present their research findings to the class. Students who take this course under the COGS designation are expected to engage substantively with the contemporary scientific study of the human mind in their research project and other course work. Offered as RLGN 349, RLGN 449 and COGS 349.

RLGN 450. Jewish Ethics. 3 Units.
An exploration of Jewish moral and ethical discourse. The first half of the course will be devoted to studying the structure and content of classical Jewish ethics on issues including marriage, abortion, euthanasia, and social justice. Students will read and react to primary Jewish religious texts. The second half of the course will focus on various modern forms of Judaism and the diversity of moral rhetoric in the Jewish community today. Readings will include such modern thinkers as Martin Buber and Abraham Joshua Heschel. Offered as J DST 350, RLGN 350, and RLGN 450.
RLGN 452. Language, Cognition, and Religion. 3 Units.
This course utilizes theoretical approaches found in cognitive semantics -- a branch of cognitive linguistics -- to study the conceptual structures and meanings of religious language. Cognitive semantics, guided by the notion that conceptual structures are embodied, examines the relationship between conceptual systems and the construction of meaning. We consider such ideas as conceptual metaphor theory, conceptual blending, Image schemas, cross-domain mappings, metonymy, mental spaces, and idealized cognitive models. We apply these ideas to selected Christian, Buddhist, and Chinese religious texts in order to understand ways in which religious language categorizes and conceptualizes the world. We examine both the universality of cognitive linguistic processes and the culturally specific metaphors, conceptual blends, image schemas, and other cognitive operations that particular texts and traditions utilize. Offered as RLGN 352, RLGN 452, COGS 352 and COGS 452.

RLGN 460. Approaches to the Study of Urban Religion. 3 Units.
This course will introduce students to basic concepts and tools used in sociology of religion drawing upon works from various theorists and sociologists of religion such as Nancy Ammerman, Peter Berger, and Robert Wuthnow. The course analyze the relationship between the role and structure of religion in North America and the larger historical, cultural and social landscape. Utilizing the city of Cleveland as a resource, students will apply the tools and concepts learned to explicate how religious organizations impact, and are impacted by, urban environments.

RLGN 488. Topics in Religion. 3 Units.
Critical assessment of selected topics of historical or current interest. Project must be accepted by a member of the department faculty prior to registration. Offered as RLGN 388 and RLGN 488.

RLGN 601. Special Research. 1 - 6 Unit.
Project must be accepted by a member of the department faculty prior to registration. Prereq: Graduate standing.

RLGN 651. Thesis M.A.. 1 - 9 Unit.
Project must be accepted by a member of the department faculty prior to registration.
Department of Sociology

The Department of Sociology offers programs leading to the Bachelor of Arts, Master of Arts, and Doctor of Philosophy degrees.

Sociologists investigate human and social processes in a complex and rapidly changing world, addressing important and fascinating questions about many aspects of social life. Our department is especially devoted to research and graduate education in the sociology of health and medicine and the sociology of age and the life course. Our undergraduate program also offers concentrations in crime and delinquency, gender and family, health and aging, and social inequality.

Many sociology majors participate in field-based learning experiences, both through their classes and through their involvement in faculty research projects. The department encourages interaction between students and faculty by offering many opportunities for individualized study and research. It has a long history of combining leadership in research with a friendly, student-centered culture, for both graduate and undergraduate students.

Especially with the increase in diversity in our society, many employers look favorably on the breadth of knowledge and perspective provided by majoring in sociology. Graduates of our program are working in interesting jobs in research institutions, private industry, and the public sector. A sociology degree is also excellent preparation for graduate or professional study, whether in sociology or in such fields as medicine, law, public health, and social work.

Undergraduate Programs

Major

The major in sociology has been designed to serve the different educational goals of undergraduates: general education, pre-professional training, postgraduate employment, and preparation for graduate school. The major requires a minimum of 30 hours of course work. All majors complete the common core requirements, plus electives:

- SOCI 101 Introduction to Sociology 3
- SOCI 300 Modern Sociological Thought 3
- SOCI 303 Social Research Methods 3
- STAT 201 Basic Statistics for Social and Life Sciences 3
- or PSCL 282 Quantitative Methods in Psychology 3
- An additional 18 hours of electives, consisting of any six courses in sociology 18

Total Units 30

SOCl 375 Independent Study is available to selected majors in their junior or senior year.

Majors have the option of choosing a general sociology curriculum or one of four concentrations:

1. Crime and Delinquency
2. Gender, Work and Family
3. Health and Aging
4. Social Inequality

Students may choose four courses within any of the following specializations for a concentration in that area:

Crime and Delinquency Concentration

- SOCI 204 Criminology 3
- SOCI 320 Delinquency and Juvenile Justice 3
- SOCI 328 Urban Sociology 3

Sociology of Deviant Behavior 3
Social Inequality 3
The Sociology of Law 3

Gender, Work and Family Concentration

- SOCI 201 Introduction to Gender Studies 3
- SOCI 208 Dating, Marriage, and Family 3
- SOCI 222 Gender in U.S. Society 3
- SOCI 228 Sociology of Sexuality 3
- SOCI 275 Lives in Medicine: Becoming and Being a Physician 3
- SOCI 326 Gender, Inequality, and Globalization 3
- SOCI 370 Sociology of the Family 3
- SOCI 372 Work and Family: U.S. and Abroad 3

Health and Aging Concentration

- SOCI 203 Human Development: Medical and Social 3
- SOCI 262 Disability and Society 3
- SOCI 275 Lives in Medicine: Becoming and Being a Physician 3
- SOCI 311 Health, Illness, and Social Behavior 3
- SOCI 313 Sociology of Stress and Coping 3
- SOCI 319 Sociology of Institutional Care 3
- SOCI 345 Sociology of Mental Illness 3
- SOCI 361 The Life Course 3
- SOCI 365 Health Care Delivery 3
- SOCI 369 Aging in American Society 3
- SOCI 377 Population Dynamics and Changing Societies 3

Social Inequality Concentration

- SOCI 113 Critical Problems in Modern Society 3
- SOCI 201 Introduction to Gender Studies 3
- SOCI 203 Human Development: Medical and Social 3
- SOCI 228 Sociology of Sexuality 3
- SOCI 302 Race and Ethnic Minorities in American Society 3
- SOCI 320 Delinquency and Juvenile Justice 3
- SOCI 326 Gender, Inequality, and Globalization 3
- SOCI 347 Sociology of Education 3
- SOCI 349 Social Inequality 3
- SOCI 372 Work and Family: U.S. and Abroad 3
- SOCI 374 Using Law to Designate Public-Private Boundaries for Social Policies 3

SAGES Participation

In conjunction with the SAGES program, the department offers two special seminars, SOCI 325 Departmental Seminar in Sociology: Great Books and SOCI 392 Senior Capstone Experience. These seminars fulfill SAGES requirements but are NOT requirements for the major. They may, however, be counted toward the 30 hours for the sociology major or the 15 hours for the minor.

Departmental Honors

Juniors majoring in sociology with a 3.4 overall GPA and a 3.6 GPA in sociology are invited to apply for the department’s honors program, which consists of an intensive, year-long investigation of a research problem under the guidance of a faculty member. Students will earn credit through registration in SOCI 397 Honors Studies and SOCI 398 Honors Studies. Admission to honors work is by faculty approval.

The opportunity to join Alpha Kappa Delta (AKD), the national sociology honors fraternity, is available to junior or senior sociology majors. Membership requires a 3.3 GPA in sociology and a 3.0 GPA overall.
Integrated Graduate Studies

The Department of Sociology participates in the Integrated Graduate Studies Program (p. 549). Students in the program are able to obtain BA and MA degrees simultaneously. Interested students should note the general requirements and the admission procedures in the appropriate section of this bulletin and may consult the department for further information.

Minor

The minor consists of 15 credit hours in sociology, including:

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<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
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<tr>
<td>SOCI 101</td>
<td>Introduction to Sociology</td>
<td>3</td>
</tr>
<tr>
<td>SOCI 300</td>
<td>Modern Sociological Thought</td>
<td>3</td>
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<td></td>
<td>Three additional electives, at least two of which must be 300-level courses</td>
<td>9</td>
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<td></td>
<td><strong>Total Units</strong></td>
<td><strong>15</strong></td>
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Graduate Programs

The Department of Sociology offers graduate training leading to the Doctor of Philosophy degree. Students may petition for a Master of Arts degree once they fulfill the requirements outlined below. Sociology of Age and the Life Course, Medical Sociology, and Research Methods are the major areas of emphasis in the department.

Master of Arts

To receive the Master of Arts degree, a student must successfully complete 27 credit hours of course work.

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<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
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<tbody>
<tr>
<td>SOCI 400</td>
<td>Development of Sociological Theory</td>
<td>3</td>
</tr>
<tr>
<td>SOCI 406</td>
<td>Sociological Research Methods I</td>
<td>3</td>
</tr>
<tr>
<td>SOCI 469</td>
<td>Aging in American Society</td>
<td>3</td>
</tr>
<tr>
<td>SOCI 443</td>
<td>Medical Sociology</td>
<td>3</td>
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<td>One of the following:</td>
<td>3</td>
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<tr>
<td>SOCI 401</td>
<td>Contemporary Sociological Theory</td>
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<tr>
<td>SOCI 407</td>
<td>Sociological Research Methods II</td>
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<tr>
<td></td>
<td>Four general electives in sociology</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td><strong>Total Units</strong></td>
<td><strong>27</strong></td>
</tr>
</tbody>
</table>

In addition, the student must pass one written comprehensive examination in Sociology of Age and the Life Course, Medical Sociology, or Research Methods.

Doctor of Philosophy

The Doctor of Philosophy degree is awarded upon the completion of all requirements of the School of Graduate Studies and the following departmental requirements: Completion of 63 credit hours beyond the Bachelor of Arts degree, including 18 credits of SOCI 701 Dissertation Ph.D. (dissertation hours).

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
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<tbody>
<tr>
<td>SOCI 400</td>
<td>Development of Sociological Theory</td>
<td>3</td>
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<tr>
<td>SOCI 401</td>
<td>Contemporary Sociological Theory</td>
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<tr>
<td>SOCI 406</td>
<td>Sociological Research Methods I</td>
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<tr>
<td>SOCI 407</td>
<td>Sociological Research Methods II</td>
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<tr>
<td>SOCI 443</td>
<td>Medical Sociology</td>
<td>3</td>
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<tr>
<td>SOCI 469</td>
<td>Aging in American Society</td>
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<td></td>
<td>Two electives in research methods</td>
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<td>Two electives in medical sociology</td>
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<td>Two electives in aging</td>
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<td></td>
<td>Three general electives in sociology</td>
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<tr>
<td></td>
<td>18 credit hours of dissertation</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td><strong>Total Units</strong></td>
<td><strong>63</strong></td>
</tr>
</tbody>
</table>

In addition, the student must pass two written comprehensive examinations in Sociology of Age and the Life Course, Medical Sociology, or Research Methods and successfully defend the dissertation.

A predoctoral training program in Health Research and Aging, sponsored by the National Institute of Aging, has been offered in conjunction with the Elderly Care Research Center of the Department of Sociology.

Research Programs

The Elderly Care Research Center

The Elderly Care Research Center (ECRC) funds research projects focusing on theory-based and public policy-relevant issues in aging and medical sociology. Current projects relate to physical and mental health outcomes of stress, coping, cancer survivorship, and adaptation to frailty in late life. Research projects have been funded by the National Institute of Aging (NIA), the National Cancer Institute (NCI), and the National Institute of Nursing Research. In addition to conducting quantitative surveys and in-depth qualitative interviews with community-dwelling elders, researchers at the ECRC are also engaged in an NCI-funded intervention to help elderly patients communicate more effectively with their doctors.

The Center has been the recipient of an NIA Merit Award for a long-term study of very old residents of a retirement community. This research seeks to understand health promotion, proactive adaptation, and maintenance of wellness in late life. ECRC serves as a laboratory for student research. Collaborative and cross-national research involves colleagues from multiple disciplines at universities in Israel, Hungary, Britain, and Germany.

Cancer Survivors Research Program

The Cancer Survivors Research Program (CSRP) investigates important research issues in psychological oncology. Formally started in September 1998, the CSRP had been funded for ten years by the National Cancer Institute. Gary Deimling serves as program director and principal investigator and is assisted by colleagues in the Department of Sociology and the Case School of Medicine. As with many other research programs within the department and the university at large, the CSRP also serves as a teaching facility, training graduate students in the many methodological and theoretical aspects of sociomedical research. The program enables graduate students in sociology to gain hands-on experience in a formal research setting while putting their course work into practice.

Comparative-Historical Analysis of Children’s Rights: Introducing the Children’s Rights Index

The Children’s Rights Index (CRI), developed by Brian Gran, is an innovative measure of the status of children’s rights in more than 190 countries for 2004. With funding from the National Science Foundation, this project is now replicating the CRI for five-year intervals during the period 1984 to 2009.

Past studies of children’s rights have focused on violations of particular rights, and on specific countries where children’s rights are frequently or severely violated. What has been lacking is systematic scholarship on the various kinds of children’s rights that exist, across countries and over time. This project will examine factors that promote or hinder children’s rights. A short-term objective is to provide evidence on the status of children’s rights. A long-term objective is to use the CRI to determine whether stronger rights lead to superior outcomes for children.
FreshLink: Increasing Access to Healthy Foods in Disadvantaged Neighborhoods

The Prevention Research Center for Healthy Neighborhoods (PRCHN), a Centers for Disease Control and Prevention initiative housed in the Case Western Reserve University School of Medicine, conducts research to improve health and prevent chronic disease in Cleveland neighborhoods. Recognizing that obesity and poor nutrition are the primary drivers of chronic disease at all ages, Principal Investigator Jessica Kelley-Moore is conducting FreshLink, an intervention study designed to change the neighborhood food environment by increasing access to healthier food options and to education about nutrition. FreshLink is one of the few intervention projects seeking to change the food environment instead of focusing on individual behavior change. This multidimensional study is working in four primary venues: food retail, schools, community gardens, and community centers. Go here for more information about FreshLink and the PRCHN (http://prchn.org/FreshLink_home.aspx).

Cumulative Dis/Advantage Research Group: Trajectories of Inequality Across the Life Course

Across the entire society, old people are probably the most diverse of any age category of the population. Inequality also appears greatest among older people. How does such inequality come about? The Cumulative Dis/Advantage (CDA) Research Group analyzes the life-course processes – economic, political, interactional and demographic – that contribute to this phenomenon, and the efficacy of social policies designed to ameliorate the effects of social processes that contribute to CDA. Data sources for this project range from large-scale, longitudinal data sets such as the Health and Retirement Survey and the National Longitudinal Study of Youth to ethnographic work.

Learning from Those Who Know: Action Research and Reform Efforts in Long-term Care

This project responds to the need to reform and restructure long-term care by incorporating the perspectives, insights, and expertise of those whom such reforms are intended to serve, yet who often have little voice in the reform process: the residents themselves. Using the method of participatory action research, the project assembles research groups consisting of residents, staff, family members, and researchers who meet weekly to discuss life in the facility and to identify areas where change could benefit those who live (or work) there.

Department Faculty

Dale Dannefer, PhD
(Rutgers University)

Selah Chamberlain Professor of Sociology and Department Chair
Aging and the life course; theory; work and family; research methods

Timothy Black, PhD
(University of Massachusetts-Amherst)
Associate Professor
Social inequality; poverty; urban sociology; qualitative research methods

Gary Deimling, PhD
(Bowling Green State University)
Professor
Family sociology; sociology of aging; medical sociology; research methods

Mary Patrice Erdmans, PhD
(Northwestern University)
Associate Professor
Ethnicity; immigration; qualitative research methods; gender

Brian Gran, PhD, JD
(Northwestern University; Indiana University-Bloomington)
Associate Professor
Sociology of law; political sociology; comparative sociology; health care policy

Susan W. Hinze, PhD
(Vanderbilt University)
Associate Professor
Medical sociology; social inequality, sex and gender; work and family

Eva Kahana, PhD
(University of Chicago)
Distinguished University Professor and Pierce T. and Elizabeth D. Robson Professor of the Humanities
Sociology of aging; medical sociology; social factors in stress and coping

Jessica Kelley-Moore, PhD
(Purdue University)
Associate Professor
Health disparities; sociology of disability; sociology of the life course; race/ethnicity

Emilia McGucken, PhD
(University of Akron)
Senior Instructor
Criminology; juvenile delinquency; deviance; theory; urban sociology

Secondary Faculty

David E. Biegel, PhD
(University of Maryland, Baltimore)

Henry Zucker Professor, Mandel School of Applied Social Sciences
Family; social networks; caregiving; mental health

Kathleen Smyth, PhD
(Case Western Reserve University)
Associate Professor, Department of Epidemiology and Biostatistics, School of Medicine
Medical sociology; research methods; sociology of aging

Kurt Stange, MD, PhD
(University of North Carolina)
Professor, Department of Epidemiology and Biostatistics, School of Medicine
Epidemiology; preventive health care; biostatistics; disability prevention in the elderly

Aloen Townsend, PhD
(University of Michigan)
Professor, Mandel School of Applied Social Sciences
Adult development and aging; research methods and statistics; mental health; families and formal service systems

Adjunct Faculty

Gunhild Hagestad, PhD
(University of Minnesota)

Professor of Sociology, Agder University College; Senior Researcher, NOVA (Norwegian Social Research)
Life course; gender; social policy

Linda Noekler, PhD
(Case Western Reserve University)
Associate Director of Research, Benjamin Rose Institute on Aging
Sociology of aging; family sociology; sex and gender

Carol Whitlatch, PhD
(The Pennsylvania State University)
Assistant Director and Senior Research Scientist II, Benjamin Rose
Institute on Aging
Sociology of aging

Courses

SOCI 101. Introduction to Sociology. 3 Units.
This course examines the basic principles that underlie how sociologists look at the world: "The Sociological Imagination". It addresses the basic questions: How is social order possible and how does change occur? The course is designed as a foundation for further study in field of sociology and related disciplines. It introduces the student to the role that culture and social institutions play in modern society and examines important concepts such as socialization, deviance, social control, patterned inequalities and social change. These concepts are discussed in the context of both contemporary and historical social theories. Additionally, the student will be introduced to the methods of inquiry used by practicing sociologists.

SOCI 113. Critical Problems in Modern Society. 3 Units.
Focus is on major social problems present in large, complex, industrial societies. Topics include environmental problems, poverty, drug addiction, social deviance, and alienation.

SOCI 201. Introduction to Gender Studies. 3 Units.
This course introduces women and men students to the methods and concepts of gender studies, women's studies, and feminist theory. An interdisciplinary course, it covers approaches used in literary criticism, history, philosophy, political science, sociology, anthropology, psychology, film studies, cultural studies, art history, and religion. It is the required introductory course for students taking the women's and gender studies major. Offered as ENGL 270, HSTY 270, PHIL 270, RLGN 270, SOCI 201, and WGST 201. Prereq: ENGL 150 or passing letter grade.

SOCI 203. Human Development: Medical and Social. 3 Units.
Social influences on health and illness across the lifespan. Social determinants of health and health behavior, and delivery of health care. Guest lecturers from the medical school and other health care providers address professional practice issues across the lifespan. Issues include: new approaches to birth; adolescent substance abuse: myths and realities of AIDS; risk factors of diseases in middle age; menopause, cognition and aging-Alzheimer's disease; problems in care of elderly; medical ethic of death and dying.

SOCI 204. Criminology. 3 Units.
What is crime and to what extent does crime affect you? This course will investigate the nature and extent of crime, theories on the causes of crime, types of crime and criminals, and the efforts society makes to cope with and prevent criminal behavior.

SOCI 208. Dating, Marriage, and Family. 3 Units.
What is the family today? How has it changed over the last century? How will it change in the future? This course aims to answer these questions as it explores the influences of work, education, government, health and religion on today's changing families. The course considers the factors that affect mate selection. It also examines parenting, roles of husbands and wives, and family dysfunction, and divorce.

SOCI 222. Gender in U.S. Society. 3 Units.
The focus of this course is on unique and convergent experiences of men and women in U.S. society. Different social expectations and opportunities encountered by men and women in the context of marriage and the family, work settings, and in informal organizations will be addressed. Legislation and social policy dealing with gender issues will be considered. Offered as SOCI 222 and WGST 222.

SOCI 228. Sociology of Sexuality. 3 Units.
This course analyzes the issues of sex and sexuality from a sociological point of view. It is centered on the notion that what we consider to be 'normal' or 'natural' about sex and sexuality is, in reality, socially constructed. One's viewpoint on the issues surrounding sexuality are influenced by the social context in which they live, as opposed to the purely biological viewpoint that presupposes some sense of normalcy or naturalness regarding sexual relations. A range of topics will be covered, including readings that discuss the variations of sexuality and the notions of sexual "deviance" in order to explore the cultural and societal variation that exists along the lines of gender, race, ethnicity, sexual orientation, age and disability. Offered as SOCI 228 and WGST 228.

SOCI 255. Special Topics. 1 - 3 Unit.
Courses taught as special topics seminars focus on selected areas of study in sociology. They tend to be more specialized and emphasis is placed upon a sociological examination of one social institution (such as the media) or on one historical period (such as the '60s).

SOCI 262. Disability and Society. 3 Units.
This course considers and examines the relationship between disability and society. The course covers how we define, represent, and react to disability in modern society. This includes an analysis of stigma and discrimination. We also explore the timing and experience of disability from a life-course perspective. Finally, we examine the political, social, and economic influences on disability, including the Disability Rights movement.

SOCI 269. Young and Old Face the 21st Century. 3 Units.
Examines prospects and problems of the young and old as a window into the 21st century. An intergenerational perspective is used to highlight opportunities for cooperation and conflict between young and old who face the future together. This approach represents a shift in thinking about aging as relevant only to the old, to a view that aging is relevant to the future of all individuals, families, and societies.
SOCI 275. Lives in Medicine: Becoming and Being a Physician. 3 Units.
This course applies a sociological approach to medical profession. Medical sociology emerged as a distinct field of study in the 1950s in part due to prominent studies of medical education such as The Student Physician by Robert K. Merton and Howard Becker’s Boys in White. Since then, sociologists and other social scientists have written extensively about how issues of race, gender, aging and ethnicity are tied to issues of medical education, medical training, medical socialization and physician decision-making. Using a life course perspective, this course will examine how lives in medicine change over time; in particular, we’ll study changing workforce patterns, physician satisfaction, and burnout. Other topics to be covered include contemporary ethical issues and alternative professional health careers. The course provides an overview of how medicine and medical practice have a profound influence on--- and are influenced by---social, cultural, political and economic forces. In short, you’ll become familiar with how scholars outside of medicine cast a sociological gaze on the profession.

SOCI 300. Modern Sociological Thought. 3 Units.
The most profound commentary of industrial society began in the middle of the nineteenth century with thinkers such as Durkheim, Marx, and Max Weber. Students will read the work of these scholars as it appeared in the original sources. They thoughtfully address concepts such as social integration and alienation, crime and punishment, and the social impact of modernization. The course is of special relevance to students in the social sciences, but is also recommended for students in other fields who wish to understand the social context in which professional lives will be conducted. Prereq: SOCI 101 and Sophomore standing.

SOCI 302. Race and Ethnic Minorities in American Society. 3 Units.
Has the United States become a melting pot of ethnic groups or does it remain a salad bowl? American society is uniquely diverse in its ethnic and racial composition. This diversity has influenced much of American history and had substantial impact on the structure of social organization of present day society. This course familiarizes students with basic concepts of race and ethnicity, relevant theories and their applications to critical issues. Prereq: SOCI 101.

SOCI 303. Social Research Methods. 3 Units.
Principles of making causal inferences about human behavior; problem formulation and research design; measurement of sociological concepts; data collection and analysis methods; evaluation of research findings. Prereq: SOCI 101 and Sophomore standing.

SOCI 305A. Seminar and Practicum: School-Based Peer Court Justice. 3 Units.
Regular Seminar Meetings, and occasional supervised field placements at local high schools. Study and practice for Case undergraduate students and a select group of High School students all of whom will be introduced to the practical application of the "Restorative Peer Court Justice" system as an alternative to traditional school disciplinary intervention. The training, mentoring, and mutual collaboration in the design and implementation of this project provide active learning experiences leading to a better understanding of the offending High School student’s misbehavior, the possibility of reducing the level of reoffending, restoring relationships, and enhancing the social cohesion of the school community. Prereq: SOCI 204 or SOCI 320.

SOCI 306. The Individual in Society. 3 Units.
This course focuses on the relationship between individuals and the societies in which they live. Influences of values and culture on individuals' selves and identities are discussed as well as how individuals attach meaning to personal life experiences and histories in the context of society at large. Offered as SOCI 310 and SOCI 410. Prereq: SOCI 101.

SOCI 311. Health, Illness, and Social Behavior. 3 Units.
This course considers the role of social factors (e.g., poverty, occupational and family structure) on health and illness. Discussion will concentrate on the role of health promotion (e.g., anti-smoking campaigns), social behavior and lifestyle in health and health care use. Considerable attention is given to understanding health careers and professions and their role in the health of societies and individuals. Offered as SOCI 311 and SOCI 411. Prereq: SOCI 101 and Sophomore standing.

SOCI 313. Sociology of Stress and Coping. 3 Units.
This course will focus attention on human stress throughout the lifespan and its role in personal health and well-being. There have been exciting advances in recent years in understanding the nature of stress in everyday life as well as elements of extreme stress. Trauma is experienced by many people due to normative events such as illness and bereavement or natural and man-made disasters such as crime or war. Coping strategies and social supports which ameliorate negative impact of stress will be considered. Offered as SOCI 313 and SOCI 413. Prereq: SOCI 101 and Sophomore standing.

SOCI 319. Sociology of Institutional Care. 3 Units.
This course focuses on converging issues of theory, research, and practice in general hospitals, mental hospitals, nursing homes, hospices, and correctional institutions. The ecology of institutions and the adaptation of individuals within institutions will also be considered. There will be field trips to institutional facilities. Offered as SOCI 319 and SOCI 419. Prereq: SOCI 101 and Sophomore standing.

SOCI 320. Delinquency and Juvenile Justice. 3 Units.
The primary focus of this course is on acquainting the student with the nature and the extent of juvenile delinquency. Accordingly, theoretical approaches to delinquency causation and the prevention, control, and treatment of delinquent behavior in society are addressed. Important aspects of juvenile justice procedures, policy, and practice are examined, and the early history of the juvenile justice system and the many changes occurring over the years are discussed. Prereq: SOCI 101.
SOCI 325. Departmental Seminar in Sociology: Great Books. 3 Units.
This course fulfills the SAGES requirement of a Departmental Seminar. It focuses on close readings of contemporary classics in sociology, analytical writing and intensive seminar-type discussion. The course examines theoretical perspectives and methodological issues in sociology such that students are able to investigate, analyze and present research findings in written form. Research is always an inherently collaborative process and thus the course will focus on topics germane to a critical reading of books that inform our understanding of large and small group processes as well as individual experiences. Students will be introduced to the sociological imagination as an overarching framework to examine groundbreaking classical and contemporary books on topics such as health and aging, gender, work and family, social inequality and crime and delinquency, guided by the instructor of record. Readings will provide a sociological perspective for understanding and assessing macro- and micro-level interactions as well as encourage and stimulate critical thinking.

SOCI 326. Gender, Inequality, and Globalization. 3 Units.
Using a sociological perspective, this course examines how major societal institutions, including the economy, polity, medicine, religion, education and family, are structured to reproduce gendered inequalities across the globe. Attention is given to the intersections of race/ethnicity, social class, gender and sexuality in social systems of power and privilege. Critical importance is how gender figures in the relationship between Economic North and Economic South countries. We will elucidate how gender norms vary by culture and exert profound influence on the daily, lived experiences of women and men. The course will be informed by recent scholarship on feminism, women’s movements, and globalization. Offered as SOCI 326 and WGST 326. Prereq: SOCI 101 or permission of program director.

SOCI 328. Urban Sociology. 3 Units.
The goal of this course is to acquaint the student with the realities and the possibilities of our urban society. Theories and applications of urban sociology interpreting city life and structure are reviewed. The transformation of the urban landscape, the emergence of cities, urban life, urban problems, and urban planning are explored. Issues related to finances, schooling, transportation, the infrastructure of the city, growth and decline, urban poverty, the homeless, crime, pollution, as well as the policy issues and questions such concerns provoke are studied. Key aspects of social science theories and research findings about the nature of spatial, economic and social relationships in cities in developed and developing countries will be analyzed, illuminating some of the processes of urban growth, social transition, and change. Prereq: SOCI 101.

SOCI 333. Sociology of Deviant Behavior. 3 Units.
Sociological approaches to causes of deviant behavior, and social psychology of deviance are studied. Illustrations range from juvenile delinquency to scientific misconduct and cover both criminal and noncriminal forms of deviance. Prereq: SOCI 101.

SOCI 336. Institutional Care: Research and Reform. 3 Units.
This course is designed to provide an introduction to the nature of long term care in the USA and to contemporary issues of reform and culture change. It also provides an introduction to techniques for studying nursing home culture, and for assessing culture changes. The issues and problems of long term care are well documented and the need for changing practices of long-term care is so widely recognized and deeply felt that several initiatives for “changing the culture” of long term care have gained national notoriety and rapid momentum. While laudatory, such efforts are inevitably criticized on numerous grounds, including cost, philosophy and vision, and lack of research evidence to support claims of success. The course is designed to provide an introduction to these debates in the scientific literature and in popular culture, and will provide an opportunity to develop skills in structured observation and action research. Offered as SOCI 336 and SOCI 436.

SOCI 338. Seminar and Practicum in Adolescents. 3 Units.
Supervised field placement and attendance in early childhood, child, and adolescent settings including preschools, schools, hospitals, and neighborhood centers. This class is used to fulfill requirements by the Ohio Department of Education teacher licensure program. Recommended preparation: PSCL 101, EDUC 301, EDUC 304, and permission of program director. Offered as EDUC 338, PSCL 338, and SOCI 338.

SOCI 345. Sociology of Mental Illness. 3 Units.
Focus is on social construction of mental health and illness and sociology of emotions. Social determinants of psychological distress will be discussed along with social stigma associated with mental illness. Institutional and community options for care of the mentally ill will be considered along with the impact of recent social movements of deinstitutionalization and independent living. Offered as SOCI 345 and SOCI 445. Prereq: SOCI 101 and junior/senior standing.

SOCI 347. Sociology of Education. 3 Units.
This course provides an introduction to the field of sociology of education, which might be more properly called sociology of schooling. We will examine the development of schools historically and competing paradigms for understanding the place of school in society. Major theoretical perspectives concerning the nature and consequences of schools for individuals and for societies will be reviewed. Issues of individual opportunity - including how it is organized by race, class, and gender - will be covered, as well as issues institutional dynamics - including tracking, testing and so-called crisis and reform. Offered as SOCI 347 and SOCI 447. Prereq: SOCI 101 and junior or senior standing.

SOCI 349. Social Inequality. 3 Units.
Theory and research on contemporary inequality is considered in terms of income, wealth, education, occupational standing, occupational prestige, status categories, ethnic, religious, age, and gender groupings. Offered as SOCI 349 and SOCI 449. Prereq: SOCI 101 and Sophomore standing.

SOCI 355. Special Topics. 3 Units.
One or more sections each semester focusing on selected areas of study in sociology. Offered as SOCI 335 and SOCI 455.
SOCI 360. The Sociology of Law. 3 Units.
This course will focus on the role of rights in the U.S. legal system and society. In particular, we will consider three questions. The first is how do rights fit in the legal system and society? Second, how have different social groups used and thought about rights? Third, how do legal actors like judges and lawyers think about rights compared to non-lawyers? Offered as SOCI 360 and SOCI 460. Prereq: SOCI 101 and Sophomore standing.

SOCI 361. The Life Course. 3 Units.
Individual experiences and transitions over the life course are considered as the result of societal, cultural, psychological, biological, and historical influences. Developmental issues of childhood, adolescence, young adulthood, middle years and late life are discussed in the context of social expectations, challenges, and opportunities. Emphasis is placed on theoretical readings. Offered as SOCI 361 and SOCI 461. Prereq: SOCI 101 and Sophomore standing.

SOCI 365. Health Care Delivery. 3 Units.
Health care in the U.S. may be approaching a critical cross-road. Limiting care to older persons and the chronically ill has been proposed as a means to combat rising costs and limited access to health care. What are the alternatives to health care rationing? National health insurance? This course deals with issues of cost, quality, and access to health care in the United States and other societies. It considers how solutions by other societies can provide directions for the organization of health care in the U.S. Offered as SOCI 355 and SOCI 455. Prereq: SOCI 101 and Sophomore standing.

SOCI 369. Aging in American Society. 3 Units.
Considers the position and participation of aged adults in American society. Sociological perspectives through which to interpret the aging process and old age; social policies; intergenerational relations; lifestyles and how they affect participation of the aged in American society; dying and death serve as major themes. Offered as SOCI 369 and SOCI 469. Prereq: SOCI 101 and Sophomore standing.

SOCI 370. Sociology of the Family. 3 Units.
This course provides the theoretical and methodological foundation for conducting family research. It also reviews the most current research in the sociology of the family arena such as intergenerational issues, ethnicity and gender, and family transitions. Offered as SOCI 370 and SOCI 470. Prereq: SOCI 101 and Sophomore standing.

SOCI 372. Work and Family: U.S. and Abroad. 3 Units.
Covers the impact on human lives of the interface between work and family; the different ways gender structures the experience of work and family depending upon racial and ethnic background, social class, age, and partner preference; the impact of historical context on work-family experiences; work-family policies in the United States and other countries. Offered as SOCI 372, WGST 372, and SOCI 472. Prereq: SOCI 101 and Sophomore standing.

SOCI 374. Using Law to Designate Public-Private Boundaries for Social Policies. 3 Units.
This course studies law and the public-private dichotomy. With a basis in important research on the sociology of law, it considers three questions: 1) What is the impact of "law" on the boundary separating the public and private sectors? 2) How does "law" designate which actors and institutions belong to the public and private sectors? 3) Is the public-private dichotomy adequate for sociological analyses of law and its influences? If not, what alternatives to the public-private dichotomy can we offer? Offered as SOCI 374 and SOCI 474. Prereq: SOCI 101.

SOCI 375. Independent Study. 1 - 3 Unit.
Prereq: SOCI 101 and SOCI 300.

SOCI 377. Population Dynamics and Changing Societies. 3 Units.
Population and social structure are inextricably linked, as changes in one elicit changes in the other. Social demography, as a discipline, examines these linkages through the systematic study of size, composition and distribution of populations and their relationship to the social, political and economic organization of societies. This course will pay particular attention to mortality, morbidity and health, fertility, family and household organization, and migration as the major processes of population change. The population dynamics of the United States will be emphasized, with select comparisons to developing and developed countries. Offered as SOCI 377 and SOCI 477. Prereq: SOCI 101 or equivalent; 9 hours in SOCI, ANTH, or ECON.

SOCI 381. City as Classroom. 3 Units.
In this course, the city is the classroom. We will engage with the urban terrain. We will meet weekly off-campus, interact with community members, and interface--both literally and figuratively--with the city as a way to examine the linkages between historical, conceptual, and contemporary issues, with particular attention paid to race and class dynamics, inequality, and social justice. This course will have four intersecting components, primarily focusing on American cities since the 1930s: the social and physical construction of urban space, the built environment, life and culture in the city, and social movements and grassroots struggles. Offered as HSTY 381, POSC 381, SOCI 381, HSTY 481, POSC 481, and SOCI 481.

SOCI 392. Senior Capstone Experience. 3 Units.
SOCI 392 represents the completion of an independent study paper involving exploration of a sociology topic to be chosen in consultation with the student's capstone advisor. The student will interact regularly with the faculty advisor who will review their progress on the project. This project allows for original thought and for the tailoring of the research to the student's interests. The student will integrate theory, methods and social issues as he/she applies critical thinking skills and insights to the analysis of some aspects of a subject chosen from any of the following subfields and concentrations: Gerontology, Social Inequality, Medical Sociology, Crime and Delinquency, The Life Course, Education, Work and Family, Sociology of Law, and Deviance. The Capstone Project has both a written and an oral component. Following the submission of the Capstone paper, the student will give a presentation of the project at the Senior Capstone fair, or another forum chosen by the department. Prereq: SOCI 101, SOCI 300, SOCI 303, and STAT 201 or PSCL 282.

SOCI 397. Honors Studies. 3 Units.
Intensive investigation of research or conceptual problem; original work under supervision of faculty member. Limited to senior majors. Prereq: Senior status.
SOCI 398. Honors Studies. 3 Units.
Intensive investigation of research on conceptual problems; original work under supervision of faculty member. Limited to senior majors.

SOCI 400. Development of Sociological Theory. 3 Units.
This course examines in detail the works of the major social theorists of the 19th and 20th centuries. It is intended to integrate their ideas with the social and historical milieu from which they were born. Questions of intergroup conflict vs. cooperation, interactions between economic, familial, religious, and political institutions, and the development of the self as a function of larger social processes are addressed. Such celebrated figures as Marx, Weber, and Durkheim, as well as modern thinkers will be presented and discussed. Prereq: Graduate standing.

SOCI 401. Contemporary Sociological Theory. 3 Units.
Current viewpoints in sociological theory are explored using contrasting theoretical perspectives.

SOCI 406. Sociological Research Methods I. 3 Units.
The first of a two-semester series in social research methodology. Students will learn how to interpret and conduct social science research. The two-semester course covers problem formulation, the logic of causal inference, measurement models, research designs, sampling, data collection, and data analysis.

SOCI 407. Sociological Research Methods II. 3 Units.
The second of a two-semester series in social research methodology. (See SOCI 406.) Prereq: SOCI 406.

SOCI 410. The Individual in Society. 3 Units.
This course focuses on the relationship between individuals and the societies in which they live. Influences of values and culture on individuals' selves and identities are discussed as well as how individuals attach meaning to personal life experiences and histories in the context of society at large. Offered as SOCI 310 and SOCI 410.

SOCI 411. Health, Illness, and Social Behavior. 3 Units.
This course considers the role of social factors (e.g., poverty, occupational and family structure) on health and illness. Discussion will concentrate on the role of health promotion (e.g., anti-smoking campaigns), social behavior and lifestyle in health and health care use. Considerable attention is given to understanding health careers and professions and their role in the health of societies and individuals. Offered as SOCI 311 and SOCI 411.

SOCI 413. Sociology of Stress and Coping. 3 Units.
This course will focus attention on human stress throughout the lifespan and its role in personal health and well-being. There have been exciting advances in recent years in understanding the nature of stress in everyday life as well as elements of extreme stress. Trauma is experienced by many people due to normative events such as illness and bereavement or natural and man-made disasters such as crime or war. Coping strategies and social supports which ameliorate negative impact of stress will be considered. Offered as SOCI 313 and SOCI 413.

SOCI 414. Qualitative Methods/Field Research. 3 Units.
Students explore the theoretical foundations of qualitative social research. The course is designed to introduce and provide experience with a range of data generation strategies and analytic skills. The ethnographic techniques of semi-structured interviewing and participant-observation receive particular attention.

SOCI 419. Sociology of Institutional Care. 3 Units.
This course focuses on converging issues of theory, research, and practice in general hospitals, mental hospitals, nursing homes, hospices, and correctional institutions. The ecology of institutions and the adaptation of individuals within institutions will also be considered. There will be field trips to institutional facilities. Offered as SOCI 319 and SOCI 419.

SOCI 436. Institutional Care: Research and Reform. 3 Units.
This course is designed to provide an introduction to the nature of long term care in the USA and to contemporary issues of reform and culture change. It also provides an introduction to techniques for studying nursing home culture, and for assessing culture changes. The issues and problems of long term care are well documented and the need for changing practices of long-term care is so widely recognized and deeply felt that several initiatives for "changing the culture" of long term care have gained national notoriety and rapid momentum. While laudatory, such efforts are inevitable criticized on numerous grounds, including cost, philosophy and vision, and lack of research evidence to support claims of success. The course is designed to provide an introduction to these debates in the scientific literature and in popular culture, and will provide an opportunity to develop skills in structured observation and action research. Offered as SOCI 336 and SOCI 436.

SOCI 443. Medical Sociology. 3 Units.
Course covers theories, research methods, and problems in sociology of medicine. Topics include social epidemiology, health and illness behavior, and sick role. Structures and functions of delivery systems and their interrelationships with other social institutions are discussed.

SOCI 445. Sociology of Mental Illness. 3 Units.
Focus is on social construction of mental health and illness and sociology of emotions. Social determinants of psychological distress will be discussed along with social stigma associated with mental illness. Institutional and community options for care of the mentally ill will be considered along with the impact of recent social movements of deinstitutionalization and independent living. Offered as SOCI 345 and SOCI 445.

SOCI 447. Sociology of Education. 3 Units.
This course provides an introduction to the field of sociology of education, which might be more properly called sociology of schooling. We will examine the development of schools historically and competing paradigms for understanding the place of school in society. Major theoretical perspectives concerning the nature and consequences of schools for individuals and for societies will be reviewed. Issues of individual opportunity - including how it is organized by race, class, and gender - will be covered, as well as issues institutional dynamics - including tracking, testing and so-called crisis and reform. Offered as SOCI 347 and SOCI 447.

SOCI 449. Social Inequality. 3 Units.
Theory and research on contemporary inequality is considered in terms of income, wealth, education, occupational standing, occupational prestige, status categories, racial, ethnic, religious, age, and gender groupings. Offered as SOCI 349 and SOCI 449.

SOCI 455. Special Topics. 3 Units.
One or more sections each semester focusing on selected areas of study in sociology. Offered as SOCI 355 and SOCI 455.
SOCI 481. City as Classroom. 3 Units.
In this course, the city is the classroom. We will engage with the urban terrain. We will meet weekly off-campus, interact with community members, and interface--both literally and figuratively--with the city as a way to examine the linkages between historical, conceptual, and contemporary issues, with particular attention paid to race and class dynamics, inequality, and social justice. This course will have four intersecting components, primarily focusing on American cities since the 1930s: the social and physical construction of urban space, the built environment, life and culture in the city, and social movements and grassroots struggles. Offered as HSTY 381, POSC 381, SOCI 381, HSTY 481, POSC 481, and SOCI 481.

SOCI 496. Public Policy and Aging. 3 Units.
Overview of aging and the aged. Concepts in the study of public policy. Policies on aging and conditions that they address. The politics of policies on aging. Emergent trends and issues. Offered as ANTH 498, BETH 496, EPBI 408, GERO 496, HSTY 480, MHPH 408, NURS 479, NURS 579, POSC 480, and SOCI 496.

SOCI 509. Problems of Data Analysis. 3 Units.
Research in social epidemiology, health service research and other applied fields increasingly demands an understanding of social research methodology. This seminar exposes students to state of the art analyses of social science data including: data preparation, factor analysis, regression and structural equation modeling. Students are provided the opportunity to interpret and critically evaluate the methodology used in journal articles, with an emphasis on data analytical techniques. Students will analyze data sets using SPSS and EQS. Prereq: STAT 401 or SOCI 406, and SOCI 407.

SOCI 601. Reading and Research. 1 - 9 Unit.
Individual study and/or project work.

Prereq: Predoctoral research consent or advanced to Ph.D. candidacy milestone.
Department of Statistics

Statistics links mathematics to other disciplines in order to understand uncertainty and probability in the abstract and in the context of actual applications to science, medicine, actuarial science, social science, management science, business, engineering, and contemporary life. As technology brings advances, the statistical theory and methodology required to do them justice becomes more challenging: higher dimensional, dynamic, or computer-intensive. The field of statistics is rapidly expanding to meet the three facets of these challenges: the underlying mathematical theory, the data analysis and modeling methodology, and the interdisciplinary collaborations and new fields of application.

Undergraduate Programs

Students in statistics begin with a foundation in mathematics. Then they add statistical theory, plus intensive modern data analysis and a concentration in a field of their choice. The goal is to develop an appreciation of each facet of the discipline and a mastery of technical skills. This prepares students to enter a growing profession with opportunities in the academic, governmental, actuarial, and industrial spheres.

For the undergraduate student looking toward graduate school, the course of study within these guidelines easily incorporates additional mathematics in preparation for graduate courses. The more specialized option in actuarial science expands the basic program in statistics to incorporate topics from operations research and numerical analysis which are fundamental to actuarial theory and computation. This actuarial option includes the course work necessary to prepare for Courses 1-3 of the Society of Actuaries Exams.

All undergraduate majors begin with a foundation in mathematics and a core of courses in theoretical statistics, courses in statistical methodology, and courses in modern data analysis. Each student’s program is individualized by: (1) the choice of an applied field of concentration according to the student’s own talents and interests, and (2) the choice of appropriate statistics electives, drawn from offerings by the statistics department and from suitable offerings by other departments at the university. The senior project option allows students to work in a research setting or to participate either in interdisciplinary collaboration or in industrial consulting along with a statistics faculty member.

Majors

Bachelor of Arts

The BA degree offers flexibility and the chance to pursue a wider range of interests than the BS degree allows. It also offers students the possibility of expanding the interdisciplinary aspect of the program by completing a second major. For example, students may combine statistics with computer science, biology (molecular, organismal, or ecological), psychology, economics, accounting, or management science.

The BA degree in statistics requires a minimum of 56 hours of approved course work, including 27 hours in statistics and the remainder in related disciplines and a substantive field of application. The specific requirements are as follows:

<table>
<thead>
<tr>
<th>Required courses</th>
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<tbody>
<tr>
<td>MATH 121 Calculus for Science and Engineering I 4</td>
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<tr>
<td>MATH 122 Calculus for Science and Engineering II 4</td>
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<tr>
<td>or MATH 124 Calculus II</td>
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Total Units 56

Bachelor of Science

The BS degree adds a laboratory science requirement. For students seriously interested in basic science, a natural science is the logical choice as a focus for the application, and the BS degree is the logical choice of program.

The BS degree in statistics requires a minimum of 68 hours of approved course work, including 27 hours in statistics and the remainder in related disciplines and a substantive field of application.

<table>
<thead>
<tr>
<th>Required courses</th>
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</thead>
<tbody>
<tr>
<td>MATH 121 Calculus for Science and Engineering I 4</td>
</tr>
<tr>
<td>MATH 122 Calculus for Science and Engineering II 4</td>
</tr>
<tr>
<td>or MATH 124 Calculus II</td>
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</table>

Total Units 56

Students are strongly encouraged to include advanced expository or technical writing courses in their programs.
Bachelor's Degree Option in Actuarial Science

The actuarial program leading to either a BA or a BS in statistics requires 30 hours in statistics and actuarial studies and must satisfy the requirements for the appropriate degree program, with the following in addition to required courses.

- At least 12 hours in statistical methodology, to be chosen from courses numbered 300 and higher offered by the statistics department, or approved courses taught in EPBI, EECS, ECON, MATH, OPRE, etc. At least 6 hours must be in STAT courses; STAT 243 Statistical Theory with Application I and STAT 244 Statistical Theory with Application II may be counted.
- STAT 317 Actuarial Science I and STAT 318 Actuarial Science II. Students ordinarily can expect to be prepared to take Courses 1-3 of the Society of Actuaries Exams upon graduation.

Minor

A minor in statistics requires a minimum of 15 hours of approved course work. The minor must satisfy the requirements below and must include a minimum of 9 credits in courses from statistics department offerings.

Required courses

One of the following sequences: 6

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>STAT 243 &amp; STAT 244</td>
<td>Statistical Theory with Application I</td>
<td>6</td>
</tr>
<tr>
<td>or other approved sequence</td>
<td></td>
<td></td>
</tr>
<tr>
<td>STAT 345 &amp; STAT 346</td>
<td>Theoretical Statistics I and Theoretical Statistics II</td>
<td>6</td>
</tr>
</tbody>
</table>

Total Units 15

Graduate Programs

The department offers programs leading to the Master of Science and to the Doctor of Philosophy degrees. Graduate assistantships, both with teaching responsibilities and with research duties, are available to qualified applicants. The dual core of the MS program is mathematical statistics and modern data analysis, with the option of a special Entrepreneurial Track. Expanding from this core, students develop technical facility in a variety of statistical methodologies. This breadth of competence is designed to equip graduates to go beyond the appropriate choice of method for implementation and to be able to adapt these techniques and to construct new methods to meet the specific objectives and constraints of new situations.

Master of Science

The MS degree in statistics requires a minimum of 27 hours of approved course work in statistics and related disciplines and an MS research project or a thesis. Each student’s program is developed in consultation with the director of graduate studies or a senior faculty mentor and must satisfy the following requirements:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>STAT 425 &amp; STAT 426</td>
<td>Data Analysis and Linear Models</td>
<td>6</td>
</tr>
<tr>
<td>or STAT 445 &amp; STAT 446</td>
<td>and Multivariate Analysis and Data Mining</td>
<td>6</td>
</tr>
<tr>
<td>or STAT 445 &amp; STAT 446</td>
<td>Theoretical Statistics I and Theoretical Statistics II</td>
<td>6</td>
</tr>
</tbody>
</table>

Total Units 27

The goals of this program are:

1. to give each student a balanced view of statistical theory and the application of statistics in practice or in substantive research
2. to have the student develop a broad competence in statistical methodology.

The required core course work reflects this balance. The first two requirements are for full-year sequences in data analysis and theory; the third develops the theory underlying linear modeling. The requirement for applications of statistics will be satisfied through intensive participation in the consulting forum; the selection of an MS research project provides additional exposure. Graduate students are also required to participate in a forum or seminar to gain experience in written and oral presentation.

The remainder of each student’s program is individualized to address the more specialized statistical demands of the selected field of concentration or the focus of multidisciplinary work. Each student may choose either the applied research project or the thesis option, depending on individual interests. In either case, the student can expect to work with a faculty mentor in undertaking a significant task, the results of which will be suitable for publication or for presentation at professional society meetings.

A student coming to school from a position as a professional statistician might choose a statistical problem arising in the workplace as the basis for an MS research project. A student intending to continue graduate work toward a PhD might choose an MS research project to explore the intimate relationship of statistics to substantive fields. Alternatively, either student might choose the thesis option to tailor a methodology to a new setting or to make a first essay at mathematical statistical research.

Entrepreneurial Track

The Master of Science in Statistics-Entrepreneurial Track (MSS-ET) is a professional degree designed to provide training in statistics focused on developing data analysis and decision-making skills in industrial, government, and consulting environments where uncertainties and related risks are present. It expands our master’s program in statistics by creating a professional track that includes some business training. The Entrepreneurial Track provides instruction and real-world business experience to students who have a background in statistics and a vision for new and growing ventures. The MSS-ET program requires a minimum of 27 hours.

The required New Venture Creation and Technology Entrepreneurship courses will be offered by the Weatherhead School of Management. Students on internships will sign up for the consulting forum sequence. In addition, students are required to participate in an intensive (up to 30 hours) one-week annual workshop on the industrial use of statistics from the management perspective. This non-credit workshop will take place during the fall or spring undergraduate breaks.

Doctor of Philosophy

The doctoral program focuses on research, with a plan of study devoted to the development of statistical methodology or theory with innovative applications. Graduates will be able both to extend the theoretical basis for statistics and to bring statistical thought to scientific research.
in other fields. The objective of preparing students to collaborate in interdisciplinary work demands breadth as well, so advanced knowledge of a substantive field and participation in the collaborative experience are also integral to the program.

Students planning to enter the doctoral program in statistics should obtain information from the departmental office. Plans of study are prepared individually by the graduate student and a faculty advisor to develop the talents and interests of each student.

Department Faculty

Jill E. Korbin, PhD
(University of California-Los Angeles)
Interim Chair; Professor of Anthropology

Jiayang Sun, PhD
(Stanford University)
Professor
Simultaneous inference; biased sampling; mixtures and measurement errors; data mining and bioinformatics; semiparametrics and nonparametrics; imaging; general statistics and statistics in interdisciplinary and cutting-edge research

Patricia Williamson, PhD
(Bowling Green University)
Instructor
Bayesian analysis; estimation; hypothesis testing

Wojbor Woyczynski, PhD
(Wroclaw University, Poland)
Professor
Stochastic models; probability; random fields; time series; dynamics of chaotic processes; nonlinear diffusion; turbulence

Lecturers

Paula FitzGibbon, MS
(Miami University)
General statistics and applications; program evaluation for nonprofit organizations; survey questionnaire design

Danhong Song, PhD
(Bowling Green University)
Statistical genetics; linkage analysis and association study

Adjunct Faculty

Manfred Denker, PhD
(University of Erlangen)
Adjunct Professor
Nonparametric statistics; probability theory; complex dynamics

Harold S. Haller, PhD
(Case Western Reserve University)
Adjunct Professor
Statistical quality control; experimental design

Bo Hu, PhD
(University of Wisconsin-Madison)
Adjunct Assistant Professor
Model selection; longitudinal analysis

Hemant Ishwaran, PhD
(Yale University)
Adjunct Associate Professor
Data mining; mixture models; nonparametric Bayes; genomic data

Mary Rieger, PhD
(University of California, Berkeley)
Adjunct Professor
Statistical education

Yaomin Xu, PhD
(Case Western Reserve University)
Adjunct Assistant Professor
Statistical Genetics and Bioinformatics

Courses

STAT 201. Basic Statistics for Social and Life Sciences. 3 Units.
Designed for undergraduates in the social sciences and life sciences who need to use statistical techniques in their fields. Descriptive statistics, probability models, sampling distributions. Point and confidence interval estimation, hypothesis testing. Elementary regression and analysis of variance. Not for credit toward major or minor in Statistics.

STAT 208. Statistics for Business and Management Science II. 3 Units.

STAT 243. Statistical Theory with Application I. 3 Units.

STAT 244. Statistical Theory with Application II. 3 Units.

STAT 312. Basic Statistics for Engineering and Science. 3 Units.
For advanced undergraduate students in engineering, physical sciences, life sciences. Comprehensive introduction to probability models and statistical methods of analyzing data with the object of formulating statistical models and choosing appropriate methods for inference from experimental and observational data and for testing the model’s validity. Balanced approach with equal emphasis on probability, fundamental concepts of statistics, point and interval estimation, hypothesis testing, analysis of variance, design of experiments, and regression modeling. Note: Credit given for only one (1) of STAT 312, 313, 333, 433. Prereq: MATH 122 or equivalent.
STAT 313. Statistics for Experimenters. 3 Units.
For advanced undergraduates in engineering, physical sciences, life sciences. Comprehensive introduction to modeling data and statistical methods of analyzing data. General objective is to train students in formulating statistical models, in choosing appropriate methods for inference from experimental and observational data and to test the validity of these models. Focus on practicalities of inference from experimental data. Inference for curve and surface fitting to real data sets. Designs for experiments and simulations. Student generation of experimental data and application of statistical methods for analysis. Critique of model; use of regression diagnostics to analyze errors. Note: Credit given for only one (1) of STAT 312, 313, 333, 433. Prereq: MATH 122 or equivalent.

STAT 317. Actuarial Science I. 3 Units.
Practical knowledge of the theory of interest in both finite and continuous time. That knowledge should include how these concepts are used in the various annuity functions, and apply the concepts of present and accumulated value for various streams of cash flows as a basis for future use in: reserving, valuation, pricing, duration, asset/liability management, investment income, capital budgeting, and contingencies. Valuation of discrete and continuous streams of payments, including the case in which the interest conversion period differs from the payment period will be considered. Application of interest theory to amortization of lump sums, fixed income securities, depreciation, mortgages, etc., as well as annuity functions in a broad finance context will be covered. Topics covered include areas examined in the American Society of Actuaries Exam 2. Offered as STAT 317 and STAT 417. Prereq: MATH 122 or MATH 126 or requisites not met permission.

STAT 318. Actuarial Science II. 3 Units.
Theory of life contingencies. Life table analysis for simple and multiple decrement functions. Life and special annuities. Life insurance and reserves for life insurance. Statistical issues for prediction from actuarial models. Topics covered include areas examined in the American Society of Actuaries Exam 3. Offered as STAT 318 and STAT 418. Prereq: STAT 317 and STAT 207, or STAT 312, or STAT 345 or requisites not met permission.

STAT 325. Data Analysis and Linear Models. 3 Units.
Basic exploratory data analysis for univariate response with single or multiple covariates. Graphical methods and data summarization, model-fitting using S-plus computing language. Linear and multiple regression. Emphasis on model selection criteria, on diagnostics to assess goodness of fit and interpretation. Techniques include transformation, smoothing, median polish, robust/resistant methods. Case studies and analysis of individual data sets. Notes of caution and some methods for handling bad data. Knowledge of regression is helpful. Offered as STAT 325 and STAT 425. Prereq: STAT 207 or STAT 243 or STAT 312 or EPBI 431 or EPBI 441 or EPBI 458.

STAT 326. Multivariate Analysis and Data Mining. 3 Units.

STAT 332. Statistics for Signal Processing. 3 Units.
For advanced undergraduate students or beginning graduate students in engineering, physical sciences, life sciences. Introduction to probability models and statistical methods. Emphasis on probability as relative frequencies. Derivation of conditional probabilities and memoryless channels. Joint distribution of random variables, transformations, autocorrelation, series of irregular observations, stationarity. Random harmonic signals with noise, random phase and/or random amplitude. Gaussian and Poisson signals. Modulation and averaging properties. Transmission through linear filters. Power spectra, bandwidth, white and colored noise. ARMA processes and forecasting. Optimal linear systems, signal-to-noise ratio, Wiener filter. Completion of additional assignments required from graduate students registered in this course. Offered as STAT 332 and STAT 432. Prereq: MATH 122.

STAT 333. Uncertainty in Engineering and Science. 3 Units.
Phenomena of uncertainty appear in engineering and science for various reasons and can be modeled in different ways. The course integrates the mainstream ideas in statistical data analysis with models of uncertain phenomena stemming from three distinct viewpoints: algorithmic/computational complexity; classical probability theory; and chaotic behavior of nonlinear systems. Descriptive statistics, estimation procedures and hypothesis testing (including design of experiments). Random number generators and their testing. Monte Carlo Methods. Mathematica notebooks and simulations will be used. Note: Credit given for only one (1) of STAT 312, 313, 333, 433. Graduate students are required to do an extra project. Offered as STAT 333 and STAT 433. Prereq: MATH 122 or MATH 223.

STAT 345. Theoretical Statistics I. 3 Units.
Topics provide the background for statistical inference. Random variables; distribution and density functions; transformations, expectation. Common univariate distributions. Multiple random variables; joint, marginal and conditional distributions; hierarchical models, covariance. Distributions of sample quantities, distributions of sums of random variables, distributions of order statistics. Methods of statistical inference. Offered as STAT 345, STAT 445, and EPBI 481. Prereq: MATH 122 or MATH 223 or Coreq: EPBI 431.

STAT 346. Theoretical Statistics II. 3 Units.
Point estimation: maximum likelihood, moment estimators. Methods of evaluating estimators including mean squared error, consistency, "best" unbiased and sufficiency. Hypothesis testing; likelihood ratio and union-intersection tests. Properties of tests including power function, bias. Interval estimation by inversion of test statistics, use of pivotal quantities. Application to regression. Graduate students are responsible for mathematical derivations, and full proofs of principal theorems. Offered as STAT 346,STAT 446, and EPBI 482. Prereq: STAT 345 or STAT 445 or EPBI 481.

STAT 395. Senior Project in Statistics. 3 Units.
An individual project done under faculty supervision involving the investigation and statistical analysis of a real problem encountered in university research or an industrial setting. Written report.
STAT 412. Statistics for Design and Analysis in Engineering and Science. 3 Units.
For graduate students (primarily) and advanced undergraduates in engineering, physical sciences, and life sciences. After basic statistical concepts are reviewed, the remainder of the course consists of a comprehensive introduction to statistical methods of designing experiments and analyzing data. The general objective is to train students in statistical modeling and in the choice of experimental designs to use in scientific investigations. A variety of experimental designs are covered, and regression analysis is presented as the primary technique for analyzing data from designed experiments, and in discriminating between various possible statistical models. The course is oriented toward graduate students engaged in or embarking on research. Prereq: MATH 122.

STAT 417. Actuarial Science I. 3 Units.
Practical knowledge of the theory of interest in both finite and continuous time. That knowledge should include how these concepts are used in the various annuity functions, and apply the concepts of present and accumulated value for various streams of cash flows as a basis for future use in: reserving, valuation, pricing, duration, asset/liability management, investment income, capital budgeting, and contingencies. Valuation of discrete and continuous streams of payments, including the case in which the interest conversion period differs from the payment period will be considered. Application of interest theory to amortization of lump sums, fixed income securities, depreciation, mortgages, etc., as well as annuity functions in a broad finance context will be covered. Topics covered include areas examined in the American Society of Actuaries Exam 2. Offered as STAT 317 and STAT 417. Prereq: MATH 122 or MATH 126 or requisites not met permission.

STAT 418. Actuarial Science II. 3 Units.
Theory of life contingencies. Life table analysis for simple and multiple decrement functions. Life and special annuities. Life insurance and reserves for life insurance. Statistical issues for prediction from actuarial models. Topics covered include areas examined in the American Society of Actuaries Exam 3. Offered as STAT 318 and STAT 418. Prereq: STAT 317 and STAT 207, or STAT 312, or STAT 345 or requisites not met permission.

STAT 425. Data Analysis and Linear Models. 3 Units.
Basic exploratory data analysis for univariate response with single or multiple covariates. Graphical methods and data summarization, model-fitting using S-plus computing language. Linear and multiple regression. Emphasis on model selection criteria, on diagnostics to assess goodness of fit and interpretation. Techniques include transformation, smoothing, median polish, robust/resistant methods. Case studies and analysis of individual data sets. Notes of caution and some methods for handling bad data. Knowledge of regression is helpful. Offered as STAT 325 and STAT 425.

STAT 426. Multivariate Analysis and Data Mining. 3 Units.

STAT 427. Statistical Computing. 3 Units.
Basic topics in statistical computing: floating point arithmetic; seminumerical computation including generation and test of random numbers, Monte Carlo methods, variance reduction methods, stochastic models and simulation studies; numerical computation including numerical linear algebra, optimization and root-finding, numerical integration; some graphical and symbolic computations, special topics in statistical computing: resampling methods, EM algorithms, Gibbs sampling and projection pursuit. Prereq: STAT 345 or STAT 425 or permission of department.

STAT 432. Statistics for Signal Processing. 3 Units.

STAT 433. Uncertainty in Engineering and Science. 3 Units.
Phenomena of uncertainty appear in engineering and science for various reasons and can be modeled in different ways. The course integrates the mainstream ideas in statistical data analysis with models of uncertain phenomena stemming from three distinct viewpoints: algorithmic/computational complexity; classical probability theory; and chaotic behavior of nonlinear systems. Descriptive statistics, estimation procedures and hypothesis testing (including design of experiments). Random number generators and their testing. Monte Carlo Methods. Mathematica notebooks and simulations will be used. Note: Credit given for only one (1) of STAT 312, 313, 333, 433. Graduate students are required to do an extra project. Offered as STAT 333 and STAT 433. Prereq: MATH 122 or MATH 223.

STAT 437. Stochastic Models: Time Series and Markov Chains. 3 Units.
STAT 439. Integrated Numerical and Statistical Computations. 3 Units.
This course will embed numerical methods into a Bayesian framework. The statistical framework will make it possible to integrate a priori information about the unknowns and the error in the data directly into the most efficient numerical methods. A lot of emphasis will be put on understanding the role of the priors, their encoding into fast numerical solvers, and how to translate qualitative or sample-based information—or lack thereof—into a numerical scheme. Confidence on computed results will also be discussed from a Bayesian perspective, at the light of the given data and a priori information. The course should be of interest to anyone working on signal and image processing statistics, numerical analysis and modeling. Recommended Preparation: MATH 431. Offered as MATH 439 and STAT 439.

STAT 445. Theoretical Statistics I. 3 Units.
Topics provide the background for statistical inference. Random variables; distribution and density functions; transformations, expectation. Common univariate distributions. Multiple random variables; joint, marginal and conditional distributions; hierarchical models, covariance. Distributions of sample quantities, distributions of sums of random variables, distributions of order statistics. Methods of statistical inference. Offered as STAT 345, STAT 445, and EPBI 481. Prereq: MATH 122 or MATH 223 or Coreq: EPBI 431.

STAT 446. Theoretical Statistics II. 3 Units.
Point estimation: maximum likelihood, moment estimators. Methods of evaluating estimators including mean squared error, consistency, "best" unbiased and sufficiency. Hypothesis testing; likelihood ratio and union-intersection tests. Properties of tests including power function, bias. Interval estimation by inversion of test statistics, use of pivotal quantities. Application to regression. Graduate students are responsible for mathematical derivations, and full proofs of principal theorems. Offered as STAT 346, STAT 446 and EPBI 482. Prereq: STAT 345 or STAT 445 or EPBI 481.

STAT 448. Bayesian Theory with Applications. 3 Units.
Principles of Bayesian theory, methodology and applications. Methods for forming prior distributions using conjugate families, reference priors and empirically-based priors. Derivation of posterior and predictive distributions and their moments. Properties when common distributions such as binomial, normal or other exponential family distributions are used. Hierarchical models. Computational techniques including Markov chain, Monte Carlo and importance sampling. Extensive use of applications to illustrate concepts and methodology. Recommended preparation: STAT 445.

STAT 455. Linear Models. 3 Units.
Theory of least squares estimation, interval estimation and tests for models with normally distributed errors. Regression on dummy variables, analysis of variance and covariance. Variance components models. Model diagnostics. Robust regression. Analysis of longitudinal data. Prereq: MATH 201 and STAT 346 or STAT 446

STAT 491. Graduate Student Seminar. 1 - 2 Unit.
Seminar run collaboratively by graduate students to investigate an area of current research, the topic chosen each semester. All graduate students participate in presentation of material each semester. Satisfies requirement for every full-time graduate student to enroll in a participatory seminar every semester while registered in any graduate degree program. Recommended preparation: Graduate standing.

STAT 495A. Consulting Forum. 1 - 3 Unit.
This course unifies what students have learned in their course work to apply their knowledge in consulting. It recognizes the fact that the essence of the statistical profession is continuing interaction with practitioners in the sciences, engineering, medicine, economics, etc. The course presents the views of prominent experts in the field as obtained from the literature and other sources. The responsibilities of the consultant and the client are discussed. Sample consulting problems are presented and strategies for solving them are provided. Prereq: STAT 325 or STAT 425.

STAT 495B. Consulting Forum With Practicum. 3 Units.
This course is designed to provide a hands-on experience with statistical consulting under the guidance of the instructor. It will include discussion of practical aspects of consulting such as the entrepreneurial nature of this activity. The students will become involved in actual consulting projects generated in a collaborative environment. Statistical problems, together with their substantive background, will be presented by individuals from the private sector (e.g., from industry) and/or CWRU faculty and students. Selected problems will be addressed in a collaborative fashion; i.e., by a team involving graduate students from the Statistics Department, the course instructor, and scientists. Some of these problems may lead to collaborative research or entrepreneurial ventures. Prereq: STAT 495A, STAT 325, or STAT 425 or consent of department.

STAT 525. Advanced Data Analysis. 3 Units.
Topics drawn from resampling methods (including bootstrapping), MCMC (Gibbs sampling), nonparametric curve and surface fitting, kernel density estimation, projection pursuit, mixture models, time series (time permitting), approaches to model uncertainty, models for repeated measures and structural-functional models, statistical inference for large systems, modern data analysis techniques. Recommended preparation: STAT 426 or permission of department.

STAT 527. Advanced Statistical Computing. 3 Units.
Special topics drawn from statistical computing, complex system and dynamic computation. Oriented to research. Prereq: STAT 427.

STAT 538. Stochastic Models: Diffusive Phenomena and Stochastic Differential Equations. 3 Units.
Introduction to stochastic modeling of data. Emphasis on models and statistical analysis of data with significant temporal and/or spatial structure. This course will analyze time and space dependent random phenomena from two perspectives: Brownian motion and diffusive processes: Classification of stochastic processes, finite dimensional distributions, random walks and their scaling limits, Brownian motion and its paths properties, general diffusive processes, Fokker-Planck-Kolmogorov equations, Poisson and point processes, heavy tail diffusions, Levy processes, tempered stable diffusions. Stochastic calculus and stochastic differential equations: Wiener random integrals, mean-square theory, Brownian stochastic integrals and Ito formula, stochastic integrals for Levy processes, martingale property, basic theory and applications of stochastic differential equations. This course is related to STAT 437 but can be taken independently of it. Prereq: STAT 312 or equivalent.
STAT 545. Advanced Theory of Statistics I. 3 Units.

STAT 571. Advanced Topics in Statistics. 1 - 3 Unit.
For advanced graduate students. Topics in specialized areas of statistical theory and methodology, with emphasis on recent advances in theory, developments of new methodology and definition of new research questions. Topics may change from year to year. Number of credit hours for the class will be predetermined each semester based on the material to be presented.

STAT 576. Advanced Topics in Modeling. 1 - 3 Unit.
Advanced topics in specialized areas of statistics and stochastic modeling designed to define new research directions drawing on recent advances in theory and model formulation. Focus on statistical issues arising in the application of statistical or stochastic models to new substantive research efforts. Topics may change from year to year. Number of credit hours for the class will be predetermined each semester based on the material to be presented.

STAT 601. Reading and Research. 1 - 9 Unit.
Individual study and/or project work.

STAT 621. M.S. Research Project. 1 - 9 Unit.
Completion of statistical design and/or analysis of a research project in a substantive field which requires substantial and/or nonstandard statistical techniques and which leads to results suitable for publication. Written project report must present the context of the research, justify the statistical methodology used, draw appropriate inferences and interpret these inferences in both statistical and substantive scientific terms. Oral presentation of research project may be given in either graduate student seminar or consulting forum.

STAT 651. Thesis M.S.. 1 - 18 Unit.
(Credit as arranged.) May be used as alternative to STAT 621 (M.S. Research Project) in fulfillment of requirements for M.S. degree in Statistics.

(Credit as arranged.) Prereq: Predoctoral research consent or advanced to Ph.D. candidacy milestone.
Department of Theater

The Department of Theater offers education and participation in all aspects of drama, with course offerings in acting, stagecraft, costume, scene design, directing, and playwriting. Students have the opportunity to perform on stage as well as to serve on the technical crews in main-stage theatrical productions each year. The high ratio of faculty to students ensures that students will be able to work closely with highly skilled professionals. The department treats all performances as educational experiences and welcomes the participation of all students regardless of their academic majors and career goals.

Actor education in the theater program prepares majors for acting career opportunities in the American theater. Graduates are currently employed nationally and regionally. The MFA Acting Program, a collaboration between the university and The Cleveland Play House, represents a unique alliance between one of the oldest theater programs in the United States and the nation’s first regional theater.

The department is affiliated with the National Theater Institute (NTI) in Waterford, Connecticut, one of many collaborations that afford opportunities to our students. This prestigious program offers students the best in concentrated theater training, and its Moscow semester provides a singular cultural perspective as well. Students may participate in NTI programs during the fall or spring semester; full credit is available with no loss of financial aid.

Many of our students go abroad for either one semester at the British American Drama Academy (BADA) or a full year in other programs. BADA offers a conservatory-based intensive program in all aspects of actor training, with full credit transfer and no loss of financial aid. For more information on this and other opportunities, consult Jeffrey Ullom, director of undergraduate theater studies.

Undergraduate Programs

The Bachelor of Arts program in theater offers concentrations in acting, design/technical theater, dramatic writing, and directing.

The basic course requirements for all theater majors are as follows:

<table>
<thead>
<tr>
<th>Performance courses</th>
<th>15</th>
</tr>
</thead>
<tbody>
<tr>
<td>THTR 110 Introduction to Theater</td>
<td></td>
</tr>
<tr>
<td>THTR 101 Acting I For Minors</td>
<td></td>
</tr>
<tr>
<td>THTR 102 Acting I for Majors</td>
<td></td>
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<tr>
<td>THTR 103 Acting II</td>
<td></td>
</tr>
<tr>
<td>THTR 330 Play Directing I</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Design courses</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>THTR 111 Introduction to Design</td>
<td></td>
</tr>
<tr>
<td>THTR 223 Introduction to Scenic Design</td>
<td></td>
</tr>
<tr>
<td>THTR 224 Introduction to Lighting Design</td>
<td></td>
</tr>
<tr>
<td>THTR 225 Costume Design</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Theatre history courses</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td>THTR 218 Development of Theater: Beginnings to English Renaissance</td>
<td></td>
</tr>
<tr>
<td>THTR 219 Development of Theater: Renaissance to Romanticism</td>
<td></td>
</tr>
<tr>
<td>THTR 327 American Theater and Playwrights</td>
<td></td>
</tr>
<tr>
<td>THTR 328 Dramatic Literature</td>
<td></td>
</tr>
</tbody>
</table>

Tech credit hours (minimum of 3 hours) | 3 |

Students are required to enroll in 385 for credit three times. Students are allowed to enroll in 386 if they are cast in shows, but 386 will now be an elective. Students can enroll in 385 or 386 a maximum of four times.

<table>
<thead>
<tr>
<th>Elective Courses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students must take a minimum of 42 hours beyond the 100-level required courses to complete the major. Below is a listing of all the possible options for students to take to fulfill that requirement.</td>
</tr>
</tbody>
</table>

| THTR 100 Introduction to Acting | 3 |
| THTR 105 Introduction to Stagecraft | 3 |
| THTR 201 Movement for the Actor | 3 |
| THTR 223 Introduction to Scenic Design | 3 |
| THTR 224 Introduction to Lighting Design | 3 |
| THTR 225 Costume Design | 3 |
| THTR 226 Stage Makeup | 3 |
| THTR 227 Stage Management | 3 |
| THTR 231 Acting III: Contemporary Technique | 3 |
| THTR 232 Acting IV: Classical Technique | 3 |
| THTR 306 Acting V: Camera Technique | 3 |
| THTR 311 Audition Laboratory | 1 |
| THTR 312 Playwriting | 3 |
| THTR 314 Advanced Playwriting | 3 |
| THTR 316 Screenwriting | 3 |
| THTR 323 Topics in Design | 3 |
| THTR 334 Shakespeare: Histories and Tragedies | 3 |
| THTR 335 Shakespeare: Comedies and Romances | 3 |
| THTR 375 Voice for the Stage I | 3 |
| THTR 376 Voice for the Stage II | 3 |
| THTR 385 Rehearsal and Production | 1 |
| THTR 386 Rehearsal and Performance | 1 |
| THTR 387 Honors Studies I | 3 |
| THTR 388 Honors Studies II | 3 |
| THTR 399 Independent Study in Theater Arts | 1 |

<table>
<thead>
<tr>
<th>Acting Emphasis: Additional Classes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students must take one of the following:</td>
</tr>
</tbody>
</table>

| THTR 231 Acting III: Contemporary Technique | 3 |
| THTR 232 Acting IV: Classical Technique | 3 |
| THTR 306 Acting V: Camera Technique | 3 |
| THTR 311 Audition Laboratory | 1 |
| THTR 375 Voice for the Stage I | 3 |
| THTR 376 Voice for the Stage II | 3 |
| THTR 382 Crossing Bridges: The Public Role of Artist in Understanding Disease | 3 |

<table>
<thead>
<tr>
<th>Total Units</th>
<th>19</th>
</tr>
</thead>
</table>

Total hours, not including THTR 385 Rehearsal and Production /THTR 386 Rehearsal and Performance: 43

<table>
<thead>
<tr>
<th>Design/Technical Emphasis: Additional Classes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students must take one of the following:</td>
</tr>
</tbody>
</table>

| THTR 223 Introduction to Scenic Design | 3 |
| THTR 224 Introduction to Lighting Design | 3 |
| THTR 225 Costume Design | 3 |
| THTR 226 Stage Makeup | 3 |
| THTR 227 Stage Management | 3 |
| THTR 323 Topics in Design | 3 |

| Total Units | 18 |
Total hours, not including THTR 385 Rehearsal and Production/THTR 386 Rehearsal and Performance: 42

### Dramatic Writing Emphasis: Additional Classes

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>THTR 312</td>
<td>Playwriting</td>
<td>3</td>
</tr>
<tr>
<td>THTR 314</td>
<td>Advanced Playwriting</td>
<td>3</td>
</tr>
<tr>
<td>THTR 316</td>
<td>Screenwriting</td>
<td>3</td>
</tr>
<tr>
<td>THTR 399</td>
<td>Independent Study in Theater Arts</td>
<td>1</td>
</tr>
</tbody>
</table>

Total Units: 10-12

Total hours, not including /THTR 385 Rehearsal and Production/THTR 386 Rehearsal and Performance: 42

### Directing Emphasis: Additional Classes

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>THTR 331</td>
<td>Play Directing II</td>
<td>3</td>
</tr>
</tbody>
</table>

And two other courses to be determined with the advisor

Total Units: 3

Total hours, not including THTR 385 Rehearsal and Production/THTR 386 Rehearsal and Performance: 42

### Departmental Honors in Theater

Majoring in theater must make written application to the director of undergraduate theater studies no later than May 1 of their junior year. Students must have a minimum 3.25 overall grade point average and a minimum 3.75 grade point average in theater. Acceptance into the honors program is contingent upon faculty support and recommendation by the director of undergraduate theater studies and the department chair.

Those accepted register for THTR 397 Honors Studies I and THTR 398 Honors Studies II during their senior year, for a total of 6 hours. The honors project is defined as a production project in acting, design, playwriting, directing, or management/outrich. A supporting paper discussing the concept, execution, and performance of the project must be filed with the director of undergraduate theater studies no later than one week following the project presentation. Preparation of the project will be supervised by a department faculty member.

This project may be accepted for honors only if it receives a grade of A from both the project advisor and the director of undergraduate theater studies. The grade of A must be received both semesters. Students who qualify will receive the notation “Departmental Honors in Theater” on their diplomas. Information about the structure and specific requirements of the honors project is available from the director of undergraduate theater studies.

### Minor

A minor in theater requires 18 hours. The requirements for each concentration are as follows:

### General Theater

#### Required Courses:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>THTR 101</td>
<td>Acting I For Minors</td>
<td>3</td>
</tr>
<tr>
<td>THTR 102</td>
<td>Acting I for Majors</td>
<td>3</td>
</tr>
<tr>
<td>THTR 228</td>
<td>Development of Theater: Beginnings to English Renaissance</td>
<td>3</td>
</tr>
<tr>
<td>THTR 229</td>
<td>Development of Theater: Renaissance to Romanticism</td>
<td>3</td>
</tr>
<tr>
<td>THTR 231</td>
<td>Acting III: Contemporary Technique</td>
<td>3</td>
</tr>
</tbody>
</table>

One of the following:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>THTR 223</td>
<td>Introduction to Scenic Design</td>
<td>3</td>
</tr>
<tr>
<td>THTR 224</td>
<td>Introduction to Lighting Design</td>
<td>3</td>
</tr>
<tr>
<td>THTR 327</td>
<td>American Theater and Playwrights</td>
<td>3</td>
</tr>
<tr>
<td>or THTR 329</td>
<td>Dramatic Literature</td>
<td>3</td>
</tr>
</tbody>
</table>

Total Units: 18

### Acting

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>THTR 101</td>
<td>Acting I For Minors</td>
<td>3</td>
</tr>
<tr>
<td>THTR 102</td>
<td>Acting I for Majors</td>
<td>3</td>
</tr>
<tr>
<td>THTR 231</td>
<td>Acting III: Contemporary Technique</td>
<td>3</td>
</tr>
<tr>
<td>THTR 228</td>
<td>Development of Theater: Beginnings to English Renaissance</td>
<td>3</td>
</tr>
<tr>
<td>THTR 229</td>
<td>Development of Theater: Renaissance to Romanticism</td>
<td>3</td>
</tr>
<tr>
<td>THTR 375</td>
<td>Voice for the Stage I</td>
<td>3</td>
</tr>
</tbody>
</table>

Total Units: 18

### Design/ Tech

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>THTR 105</td>
<td>Introduction to Stagecraft</td>
<td>3</td>
</tr>
<tr>
<td>THTR 228</td>
<td>Development of Theater: Beginnings to English Renaissance</td>
<td>3</td>
</tr>
<tr>
<td>THTR 229</td>
<td>Development of Theater: Renaissance to Romanticism</td>
<td>3</td>
</tr>
<tr>
<td>THTR 312</td>
<td>Playwriting</td>
<td>3</td>
</tr>
<tr>
<td>THTR 323</td>
<td>Introduction to Scenic Design</td>
<td>3</td>
</tr>
<tr>
<td>THTR 224</td>
<td>Introduction to Lighting Design</td>
<td>3</td>
</tr>
</tbody>
</table>

One of the following:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>THTR 329</td>
<td>Dramatic Literature</td>
<td>3</td>
</tr>
<tr>
<td>THTR 327</td>
<td>American Theater and Playwrights</td>
<td>3</td>
</tr>
</tbody>
</table>

Total Units: 18

### Dramatic Writing

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>THTR 101</td>
<td>Acting I For Minors</td>
<td>3</td>
</tr>
<tr>
<td>THTR 228</td>
<td>Development of Theater: Beginnings to English Renaissance</td>
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<td>THTR 229</td>
<td>Development of Theater: Renaissance to Romanticism</td>
<td>3</td>
</tr>
<tr>
<td>THTR 312</td>
<td>Playwriting</td>
<td>3</td>
</tr>
<tr>
<td>THTR 327</td>
<td>American Theater and Playwrights</td>
<td>3</td>
</tr>
<tr>
<td>THTR 330</td>
<td>Play Directing I</td>
<td>3</td>
</tr>
</tbody>
</table>

Total Units: 18

### Directing

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>THTR 228</td>
<td>Development of Theater: Beginnings to English Renaissance</td>
<td>3</td>
</tr>
<tr>
<td>THTR 229</td>
<td>Development of Theater: Renaissance to Romanticism</td>
<td>3</td>
</tr>
<tr>
<td>THTR 223</td>
<td>Introduction to Scenic Design</td>
<td>3</td>
</tr>
<tr>
<td>or THTR 224</td>
<td>Introduction to Lighting Design</td>
<td>3</td>
</tr>
<tr>
<td>THTR 327</td>
<td>American Theater and Playwrights</td>
<td>3</td>
</tr>
<tr>
<td>THTR 330</td>
<td>Play Directing I</td>
<td>3</td>
</tr>
<tr>
<td>THTR 331</td>
<td>Play Directing II</td>
<td>3</td>
</tr>
</tbody>
</table>

Total Units: 18

### Graduate Programs

#### Master of Fine Arts in Acting

In 1996, The Cleveland Play House and Case Western Reserve University joined forces to create a new Master of Fine Arts program in acting. The students begin their involvement with the Play House in their first semester, and their level of involvement steadily increases until, in the third year, they become professional apprentices in the Play House company.

The MFA in acting is a terminal pre-professional degree. Candidacy for the program requires an undergraduate degree with (ideally) a major in theater, equivalent training and experience, or demonstrable potential for work at the MFA level. In addition, candidates must provide evidence of technical skill and creative ability.

At the end of each semester in residence, the student’s skill and creative ability are evaluated in light of his or her work in the department. Only students who have clearly demonstrated growth and excellence are permitted to remain in the program. The award of the MFA degree is contingent upon the student’s academic progress and upon the
assessment on the part of the faculty that the candidate possesses the potential to work in the field of theater on a professional level.

Requirements for the MFA degree include:

1. A minimum of 60 semester hours of graduate work beyond the bachelor’s degree
2. A cumulative grade point average of 3.0 for all course work on the graduate level
3. Completion of the course requirements for the MFA Thesis Portfolio
4. Successful completion of the Third Year Internship at The Cleveland Play House

Course requirements for the MFA in acting are as follows:

Courses in acting, including script analysis, implementation of acting theory, characterization, modernist playwrights, and Shakespeare

Courses in movement, chosen from mask work, period styles, stage combat, and commedia

Courses in voice, chosen from voice production, articulation, and interpretation

Courses in speech, using Edith Skinner techniques, dialects, verse and lyric drama, and Shakespeare

Courses in performance theory, projects, and professional seminars

Two of the following courses in creative thesis:

THTR 401 Advanced Stage Movement I
THTR 402 Advanced Stage Movement II
THTR 403 Advanced Stage Movement III
THTR 404 Advanced Stage Movement IV
THTR 473 Graduate Voice Technique I
THTR 474 Graduate Voice Technique II
THTR 475 Voice for Stage: Shakespeare
THTR 479 American Stage Speech
THTR 501 Text Analysis for the Actor
THTR 509 Seminar: Introduction to Performance Theory
THTR 512 Graduate Audition Lab
THTR 530 Ensemble Technique
THTR 531 Acting: Research and Performance I
THTR 532 Acting: Research and Performance II
THTR 533 Acting: Research and Performance III
THTR 534 Acting: Research and Performance IV
THTR 540 The Business of the Business
THTR 579 American Stage Speech II
THTR 580 Stage Dialects
THTR 581 Classical Speech and Text
THTR 601 Special Projects
THTR 610 Professional Internship
THTR 620 Advanced Role Analysis Preparation I
THTR 630 Performance Studio
THTR 642 Thesis Portfolio I
THTR 643 Thesis Portfolio II

Total Units: 57-60

Department Faculty

Ron Wilson, BGS (Wichita State University)
Katharine Bakeless Nason Professor of Theater and Drama; Chair; Director, Case/Cleveland Play House MFA Acting Program

Movement for the actor; acting; acting for the camera; playwriting; performance theory

Catherine Albers, MFA (University of Minnesota)
Professor; Director of Recruitment

Acting; audition laboratory; business of the business; acting for the camera

Jill Davis, MFA (Temple University)
Assistant Professor

Scene design; scene painting; stage management

Angelina M. Herin, MFA (University of South Carolina)
Assistant Professor

Costume, hair and makeup design

Shanna Beth McGee, MFA (University of Georgia)
Associate Professor

Voice

Jerrold Scott, MFA (University of South Carolina)
Associate Professor; Artistic Director, Eldred Theater

Acting; speech; directing

Jeffrey Ullom, PhD (University of Illinois, Champaign-Urbana)
Associate Professor; Director of Undergraduate Theater Studies

Dramatic literature, history

Adjunct Faculty

Michael Bloom, PhD (Stanford University)
Adjunct Associate Professor; Artistic Director, The Cleveland Play House

Donald Carrier (Webber Douglas Academy of Dramatic Art)
Adjunct Associate Professor; Associate Director, MFA Acting Program

Acting; script analysis

Courses

THTR 100. Introduction to Acting. 3 Units.
A course designed to provide the non-major or undeclared liberal arts major experience with a basic understanding of acting and performance. Fundamentals in improvisation, vocabulary, and scene study are stressed. This course fulfills THTR 101 or THTR 102 should the undeclared student select theater as his or her major or minor. Students may receive credit for only one of THTR 100, THTR 101, or THTR 102.

THTR 101. Acting I For Minors. 3 Units.
This course is designed to expose the theater minor to the development of the actor’s basic tools. Relaxation, concentration, and improvisation are taught along with basic scene study work. Students may receive credit for only one of THTR 100, THTR 101, or THTR 102.

THTR 102. Acting I For Majors. 3 Units.
This course is designed to expose the theater major to the development of the actor’s basic tools. Relaxation, concentration, and improvisation are taught along with basic scene study work. Students may receive credit for only one of THTR 100, THTR 101, or THTR 102.
THTR 103. Acting II. 3 Units.
This course continues the work begun in THTR 101 or THTR 102 with emphasis on action, emotional life, and text analysis as the essential elements of the actor’s work. Prereq: THTR 100, THTR 101, or THTR 102.

THTR 105. Introduction to Stagecraft. 3 Units.
An introduction to scenic construction and painting, hands-on oriented to workshop skills.

THTR 106. Mr. Kiss Kiss Bang Bang - James Bond and Popular Culture. 3 Units.
The twenty-one films of James Bond have become part of popular culture, and the figure of the superspy has become mythic in proportion. This series, from its first installment in 1963 to the latest reinvention of James Bond in 2006, not only depicts one dashing man’s efforts to save the world from disaster again and again, but also traces the development of our popular culture. Issues of violence, sex, the presentation and treatment of women, racial stereotypes, and spectacle among other topics can be discussed after viewing each film, providing an opportunity to explore the changing expectations of American audiences and the developing form of contemporary cinema. Students who have taken USSO 286D may not receive credit for this class.

THTR 107. Development of Theater: Beginnings to English Renaissance. 3 Units.
An introduction to theater through established theories and knowledge of the theater as a physical space. Approaches practical problems of scenic design as well as professional potential of the field.

THTR 108. Movement for the Actor. 3 Units.
The course focuses on developing a kinesthetic awareness of the body and its use as a theatrically expressive instrument. Exercises will encompass development of flexibility, strength building, alignment, motor skills, and concentration. Prereq: THTR 101 or THTR 102.

THTR 109. Stage Management. 3 Units.
Designed to acquaint student with the numerous aspects of stage management.

THTR 110. Introduction to Theater. 3 Units.
THTR 110 is a fundamental study of theatre from the standpoint of developing the critical acumen of a potential audience. It covers each ingredient of the theatrical experience--audience, playwrighting, acting, directing, theatre architecture, design and technology--and attempts to help students define a reasonable set of standards to judge that part of the experience as an audience member and to clearly communicate their feelings and thoughts regarding that experience. The primary textbook is Edward Wilson’s The Theatre Experience, former theatre critic for The Wall Street Journal. Readings in this text are augmented by the reading of specific plays that represent different periods, genres, conventions, and dramatic styles. Representative plays (typically six each semester) include Oedipus Rex (Sophocles), Hamlet (Shakespeare), Tartuffe (Moliere), Uncle Vanya (Chekhov), Waiting for Godot (Beckett), and Angels in America (Kushner). Many of these plays are supplemented by short films prepared by Films for the Humanities so that students can see examples of various dramatic and theatrical styles in performance. In addition to class discussions, lectures, and readings, students are also required to attend two live theatre productions offered by Case Western Reserve University’s Department of Theater each semester. The students write critical essays about their experience as an audience member in relation to a particular aspect of the performance. Students also have an opportunity to complete in-class projects in which they gain experience functioning as a theatre practitioner. These projects and the accompanying written assignment are designed to increase the student’s understanding of the function and interdependence of various theatre artists.

THTR 111. Introduction to Design. 3 Units.
This course offers the opportunity to learn, develop, and practice the art of set, costume, and lighting design by concentrating specifically on the processes, skills, and disciplines of design for performance. Furthermore, students will read several plays and examine ways in which theatre design can suggest meaning and interpretation of the script. Students will learn basic design elements and principles of composition through interactive, collaborative projects and exercises in addition to critically analyzing other designers’ works from a broad spectrum of design styles. Emphasis will be placed on creativity, discovery, analysis, and collaboration.

THTR 201. Movement for the Actor. 3 Units.
The course focuses on developing a kinesthetic awareness of the body and its use as a theatrically expressive instrument. Exercises will encompass development of flexibility, strength building, alignment, motor skills, and concentration. Prereq: THTR 101 or THTR 102.
THTR 229. Development of Theater: Renaissance to Romanticism. 3 Units.
THTR 229 explores the many developments in playwriting, design, acting, and theater architecture across the world. Students read a wide variety of plays in order to obtain a comprehensive understanding of the history of the art form, but also learn how theater has played an integral societal function as a medium of political, economic, and cultural commentary. Development of Theater II not only explores the development of theatrical conventions in Spain, England, Italy, France and other European countries that lead to the creation of modern drama, but the course also offers an in-depth look at the history and conventions of theater in India, Korea, China, and Japan. Offered as THTR 229 and WLIT 229. Prereq: Sophomore standing.

THTR 231. Acting III: Contemporary Technique. 3 Units.
An exploration of advanced contemporary acting technique based on the work of Michael Chekhov. Provides advanced acting students with the tools necessary to work effectively and consistently with contemporary texts, with emphasis placed on psychological gesture and gesture. Prereq: THTR 101 and THTR 102.

THTR 232. Acting IV: Classical Technique. 3 Units.
An exploration of techniques to approach classical theater, with emphasis on the works of Shakespeare. Presents the challenges of working with heightened language in classical texts, and provides skills necessary to transfer modern acting methods to these more poetic plays. Prereq: THTR 102.

THTR 306. Acting V: Camera Technique. 3 Units.
Acting for the Camera class with emphasis on how it differs from onstage work. Interviews, scenes, and exercises will be used to highlight the differences and similarities. Emphasis on contemporary works. Prereq: THTR 231 or THTR 232.

THTR 311. Audition Laboratory. 1 Unit.
A discussion and practicum exploring the problems faced by an actor in various audition situations. Development of an audition repertory for the actor for stage, video and film. Prereq: Senior Theater major.

THTR 312. Playwriting. 3 Units.
Theory and practice of dramatic writing, in the context of examples, classic and contemporary. Recommended preparation: ENGL 203 or ENGL 213 or ENGL 214 or ENGL 303 or ENGL 304. Offered as ENGL 305 and THTR 312.

THTR 314. Advanced Playwriting. 3 Units.
Theory and practice of dramatic writing with special focus on the craft of writing a full-length play. Offered as ENGL 314 and THTR 314. Prereq: ENGL 305 or THTR 312.

THTR 316. Screenwriting. 3 Units.
A critical exploration of the craft of writing for film, in which reading and practicum assignments will culminate in the student submitting an original full-length screenplay. Offered as ENGL 316 and THTR 316. Prereq: THTR 312.

THTR 323. Topics in Design. 3 Units.
This course will examine various topics related to theatre design and technology not covered in other design courses. Students will be provided with practical and theoretical knowledge on a specific topic in order to increase their design and/or technical skills. In addition, each course offering will have its own stated objectives. This course may be repeated by students with each new topic. Prereq: THTR 111 or instructor permission.

THTR 327. American Theater and Playwrights. 3 Units.
Designed to provide students an overview of the development of theater in the United States and to familiarize them with the works and themes of selected American playwrights. Offered as AMST 327 and THTR 327.

THTR 329. Dramatic Literature. 3 Units.
Dramatic text analyzed in the context of theatrical production. Major analytical tools introduced.

THTR 330. Play Directing I. 3 Units.
This course will begin a two-semester study of the art and craft of stage direction of plays. Topics covered will include history of the profession, directorial theory and practice, development of skills such as text analysis, design and concept, and general problem solving. Prereq: THTR 101 and THTR 102, and upperclass status.

THTR 331. Play Directing II. 3 Units.
This course will continue with the basic concepts learned in THTR 330 and will expand them in regard to actual production. Topics will include directing mechanics, ground planning, blocking, and visualization, staging and working with actors. The course will culminate in a faculty supervised directing project for public performance. There are three evening labs for this course. Prereq: THTR 330, and upperclass status.

THTR 334. Shakespeare: Histories and Tragedies. 3 Units.
Close reading of a selection of Shakespeare’s tragedies and history plays (e.g., “Richard the Third,” “Julius Caesar,” “Hamlet,” “King Lear”). Topics of discussion may include Renaissance drama as a social institution, the nature of tragedy, national history, gender roles, sexual politics, the state and its opponents, theatrical conventions. Assessment may include opportunities for performance. Offered as ENGL 324, ENGL 424, and THTR 334. Prereq: ENGL 150 or passing letter grade in a 100 level first year seminar in USFS, FSCC, FSNA, FSSO, FSSY, FSTS, FSCS.

THTR 335. Shakespeare: Comedies and Romances. 3 Units.
Close reading of selected plays of Shakespeare in the genres of comedy and romance (e.g., “The Merchant of Venice,” “Twelfth Night,” “Measure for Measure,” “The Tempest”). Topics of discussion may include issues of sexual desire, gender roles, marriage, the family, genre conventions. Assessment may include opportunities for performance. Offered as ENGL 325, ENGL 425, and THTR 335. Prereq: ENGL 150 or passing letter grade in a 100 level first year seminar in USFS, FSCC, FSNA, FSSO, FSSY, FSTS, FSCS.

THTR 375. Voice for the Stage I. 3 Units.
Development of the actor’s vocal instrument. Work in articulation, range, and flexibility. Prereq: Theater major or consent of department.

THTR 376. Voice for the Stage II. 3 Units.
Continuation of THTR 375. Prereq: THTR 375.
**THTR 382. Crossing Bridges: The Public Role of Artist in Understanding Disease. 3 Units.**
An in-depth look at the role of the artist in public life and in creating theatrical performance from life experience. The students interact with patients in medical treatment for catastrophic illness and as they understand the experience of disease, they help transform that experience into a performance that gives a voice to the unvoiced in our society. The approved service learning course is offered only as a Senior Capstone and is a demanding challenge for the serious student of theater. Prereq: Acting concentration or consent of department.

**THTR 385. Rehearsal and Production. 1 - 3 Unit.**
Practicum for students participating in production work in the Department of Theater and Dance. Supervised laboratory experience in technical theater, construction techniques, scenery, costumes, lighting, and props; production; ticket office operations, promotion, publicity and public relations; house management; wardrobe responsibilities; stage management; assistant directing; and other production positions relating to the mainstage performances in Eldred Theater. Students are recommended to take one credit hour per performance, with a maximum of 8 credit hours allowed during their undergraduate career.

**THTR 386. Rehearsal and Performance. 1 Unit.**
Practicum for students participating in performance in the Department of Theater and Dance, relating to the mainstage productions at Eldred Theater. This course may be repeated, for a maximum total of 2 credits.

**THTR 390. Theater Design and Technology Capstone. 3 Units.**
This is a SAGES Capstone course designed to provide an opportunity for advanced Design/Technical Theater Undergraduates to undergo a thorough theatrical design experience as would be expected in the professional theater. The project requires a specific play or performance piece to be chosen or assigned and researched thoroughly. The research would culminate in a production concept which should be presented in written and oral form with a great deal of visual support. The production concept leads to the design, either scenic, costume, lighting or sound, which then must be executed. In professional theater, execution first means preparing all of the drafting, renderings, and paperwork necessary for a production team to create the set or costumes, or prepare the necessary lighting or sound equipment in the venue. The final portion of the design execution will be the performance of the actual piece on stage. It could be appropriate for a scenic or costume design project to be complete at this stage as the vast majority of the work must be done before the actual performance and the realization of the design is executed by a production team. Lighting and sound designers must finish the execution of their designs in the technical rehearsal phase of production. Their work is dependent on integration with the other elements of production. However, theater is a collaborative art form, and the final execution of every design on stage is the ultimate goal of the designers, and when possible, it would be preferable to have every capstone project culminate in a fully realized production. Due to budget constraints and the logistics of allowing every design/technical senior to be able to participate in a fully realized production, students can choose to pursue a more research intensive project in which the student could study specific designers, movements in design or the development of technology in theatrical design. These projects would be presented in a more traditional oral presentation with visual support.

**THTR 393. Senior Capstone: Dramaturgy. 3 Units.**
This course introduces students to theories of textual analysis and contextual research within the framework of theatrical performance. Students will investigate the history and methodologies of dramaturgy, and then apply the best practices of the profession to the study and production of contemporary plays. Because dramaturgy is a collaborative endeavor, students will participate with others in the production of a theoretical adaptation from a non-dramatic source, as well as the creation of an interdisciplinary theatre event and a multi-media performance project. By course end, students will be able to support their theatrical interests with dramaturgical insights and to work collaboratively to create productions that reflect the cultural and aesthetic diversity of the 21st century. Prereq: Senior standing.

**THTR 396. Non-Verbal Theatrical Text. 3 Units.**
This is a SAGES capstone course. It has been constructed to provide an opportunity for advanced Design/Technical Theater Undergraduates to examine and explore the roots and current trends of post-modern, contemporary theater as well as to investigate current design outside of its traditional decorative role. Rather, as in current movements described as "action design" or "affective space theory", design will be used to create a text which combines with the spoken word in production for the purpose of audience perception of meaning. As a starting point, this course will examine the advent of realism on stage and follow this study by subsequent significant movements departing from realism. Through extensive use of video and live presentation, students will select movements in theater production for written and oral analysis. As a class, we will define post-modern as a term to describe contemporary theater and further explore the possibilities of theatrical presentation form a written dramatic source. This course will culminate in the production, whether group or individualized, of a creative design, based on a work written for the stage, but exploring non-verbal communication of an author's or director's intent. This exploration of theater language might combine non-verbal characteristics inclusive of images, relationships, activity, song, music, properties, objects, color, costume, movement, light, silence, sounds, presence or gesture. Goals of the seminar will be to find a process for textual analysis through an in-depth examination of the chosen text, to create a focus upon the action which drives this text, to discover a process for imagery that will give the text dimension and finally, to embody and realize ideas which impart to that text its intellectual content. A public presentation within Eldred's black box, Mather's dance studio space, or a public performing space within the CWRU campus will be integral to this process. Weekly discussion, analysis and critique will be a critical element of the course, as well as expository writing. Weekly participatory assignments will also be prescribed from a mandatory and suggested reading list. Prereq: Theater Majors with Design Tech Emphasis.

**THTR 397. Honors Studies I. 3 Units.**
Individual projects in acting, dance, and directing.

**THTR 398. Honors Studies II. 3 Units.**
Individual projects in acting, design, playwriting, and directing.

**THTR 399. Independent Study in Theater Arts. 1 - 3 Unit.**
Independent research and project work in areas of acting, design, voice, theater history, playwriting, directing, or theater management.
THTR 401. Advanced Stage Movement I. 3 Units.
This beginning class focuses on developing flexibility, alignment, strength, concentration and basic motor skills and serves as a base for the remaining three semesters. Yoga and Tai Chi exercises are used to develop flexibility and a relaxation of the breath. Elements of Decroux based corporeal mime technique will strengthen the student’s physical instrument as well as address alignment problems. Motor skills (articulations, inclinations and design work) will be developed with Decroux, as well as LeCoq based exercises. Prereq: Must be candidate in M.F.A. Acting program.

THTR 402. Advanced Stage Movement II. 3 Units.
Continuation of THTR 401. The course focuses on simplifying and empowering the physical actor by continuing to connect breath to action to discover relaxation within the given task, and beginning work in characterization. Strength, flow, energy and the shedding of intrusive mannerisms will be gained from a study of Tai Chi form, and LeCoq based neutral mask work. Following the neutral mask work, students will progress to character work through the use of Physical Acting techniques. Stage combat work continues. Prereq: THTR 401.

THTR 403. Advanced Stage Movement III. 3 Units.
The class focuses on expanding the actor’s physical and imaginative range which will enable students to support larger and bolder physical choices in characterization. Building upon the Neutral Mask work from the previous semester, the student will experience, through LeCoq based techniques, Basel and Expressive Masks. Stage combat work continues. Prereq: THTR 402.

THTR 404. Advanced Stage Movement IV. 3 Units.
This class gives the actor the advanced physical skills and techniques needed to encompass the demands of historical dramatic texts. The work will center around period movement for the theater. The actor will experience the philosophies of carriage and deportment; religious, scientific thought and art from particular historic periods most often encountered in the professional theater. Stage combat work continues. Prereq: THTR 403.

THTR 473. Graduate Voice Technique I. 3 Units.
Assessment of students’ current vocal and alignment skills. Laboratory for exploring new vocal and alignment habits supportive of healthy vocal functioning. Exploration of the body and voice as it relates to breath, resonance, and the healthy exhalation of sound. Prereq: Must be candidate in M.F.A. Acting program.

THTR 474. Graduate Voice Technique II. 3 Units.
Continued laboratory for the exploration of alignment and vocal skills supportive of healthy vocal functioning. Continued exploration of the body and voice as it relates to breath, articulation, resonance, and the healthy exhalation of sound. Emphasis on the physical and energetic skills needed to produce full-bodied, healthy sound capable of being heard and understood while acting in theatrical productions. Required of M.F.A. candidates in the Acting program. Prereq: THTR 473.

THTR 475. Voice for Stage: Shakespeare. 3 Units.
Development of skills needed to address the specific needs of Shakespeare and Classical texts in performance, including vocal skills, the use of breath, using imagery, and textual studies. Required of M.F.A. candidates in the Acting program.

THTR 477. American Stage Speech. 2 Units.
Designed to evaluate the graduate student actors’ current speech skills, to teach them a stage-appropriate dialect using the Skinner narrow IPA set, and to achieve a level of mastery over articulation and diction. Prereq: Course limited to first-year M.F.A. candidates in Acting Program.

THTR 501. Text Analysis for the Actor. 2 Units.
An introduction to the craft of reading a theatrical text from an actor’s point of view. Methods for analyzing the action and dialogue of a play will be applied to dramatic text so that the actor can learn to transform a one-dimensional text into a three-dimensional performance.

THTR 509. Seminar: Introduction to Performance Theory. 2 Units.
Research seminar designed to acquaint the theater student with the major theoretical writings of performance theory. Readings on the creative process and archetypal mythology. Exploration of anthropological, psychological, and cultural sources of art and the theatrical impulse.

THTR 512. Graduate Audition Lab. 1 - 2 Unit.
THTR 530. Ensemble Technique. 1 - 2 Unit.
A practicum course structured to explore the use of ensemble dynamic techniques in a rehearsal/performance environment, as well as to develop a set of exercises which encourage and sustain the actor’s channels of interpersonal communication during a range of rehearsal and performance situations. Prereq: Must be candidate in M.F.A. Acting program.

THTR 531. Acting: Research and Performance I. 3 Units.
The various elements of the actor’s process considered on advanced levels. Integration of rehearsal discoveries into a practical performance situation. Limited to M.F.A. candidates.

THTR 532. Acting: Research and Performance II. 3 Units.
The various elements of the actor’s process considered on advanced levels. Exploration of rehearsal techniques for characterization. Limited to M.F.A. candidates.

THTR 533. Acting: Research and Performance III. 3 Units.
Sequential courses designed to explore the various elements of the actor’s process on advanced levels and to integrate the discoveries made into a practical performance situations. Limited to M.F.A. candidates. Prereq: THTR 531 or THTR 532.

THTR 534. Acting: Research and Performance IV. 3 Units.
Sequential courses designed to explore the various elements of the actor’s process on advanced levels and to integrate the discoveries made into a practical performance situation. Prereq: THTR 531 or THTR 532 or THTR 533.

THTR 540. The Business of the Business. 2 Units.
This course covers the basic knowledge needed for an actor to plan and manage a career in the theater. Included is discussion of union rules and applications for AEA, AFTRA, and SAG. Discussion of basic marketing techniques, including development of an individual marketing plan for each student. Guest lecturers might include IRS experts on the actor’s special needs, casting directors, and commercial agents.
THTR 579. American Stage Speech II. 3 Units.
This course will continue the work begun in THTR 479 American Stage Speech, continuing the work on IPA, articulation, and general speech clarity for the stage. Exercises from the Berry and Rodenberg Schools of thought will be used in addition to the speech basics of Skinner. Prereq: THTR 479.

THTR 580. Stage Dialects. 2 Units.
This survey course will examine the use and application of major stage dialects in the American theatre using a phonetic tool set as a basis for understanding sound substitutions. The student will also study the ways in which rhythmic changes and resonance and tension shifts affect the dialects. Prereq: Graduate standing.

THTR 581. Classical Speech and Text. 2 Units.
This course will study ways in which the actor’s speech instrument is used differently in classical texts, particularly those of Shakespeare. Students will study tools for analyzing a line of text in order of understand how to use the words and sound of the line.

THTR 601. Special Projects. 1 - 3 Unit.
(Credit as arranged.)

THTR 610. Professional Internship. 1 - 4 Unit.
Involvement in intensive internships with professional theaters in the Cleveland area bridging academic and professional lives. Internships range from six weeks to one semester.

THTR 620. Advanced Role Analysis Preparation I. 3 Units.
Study and performance of scenes involving methods of approaching various types of plays and the specific problems they present to the individual actor. Analysis, action, characterization, and subtext. Open only to M.F.A. Acting students.

THTR 630. Performance Studio. 3 Units.
A performance laboratory, ensemble-based practicum in which the student works to integrate effectively a wide range of performance skills culminating in a studio production. May be taken two times in the last two semesters of graduate study. Prereq: THTR 534.

THTR 642. Thesis Portfolio I. 1 Unit.
Course designed specifically for candidates in the Master of Fine Arts program in Acting. Graduate students enroll for the course during their third year of study, although work spans three years of study, based on roles the M.F.A. actor has created. A portfolio is prepared, according to requirements set forth in the department’s M.F.A. Handbook, and is presented to the faculty during the spring semester of the third year, in a formal oral defense. Satisfactory completion of the portfolio and its oral defense are among the requirements for awarding the Master of Fine Arts degree. Course limited to M.F.A. candidates in the Acting program.

THTR 643. Thesis Portfolio II. 1 Unit.
Course designed specifically for candidates in the Master of Fine Arts program in Acting. Graduate students enroll for the course during their third year of study, although work spans three years of study, based on roles the M.F.A. actor has created. A portfolio is prepared, according to requirements set forth in the department’s M.F.A. Handbook, and is presented to the faculty during the spring semester of the third year, in a formal oral defense. Satisfactory completion of the portfolio and its oral defense are among the requirements for awarding the Master of Fine Arts degree. Course limited to M.F.A. candidates in the Acting program.

THTR 644. M.A. Project. 1 - 12 Unit.
Research and development of a Master of Arts project in Theater.
Environmental Studies Program

Environmental Studies is a multidisciplinary program that introduces students to the societal determinants and implications of environmental problems. The program emphasizes the moral, cultural, and political dimensions of environmental problems and solutions that arise from scientific understanding of the environment, bringing to bear the issues and methods of the humanities and social sciences as well as those of the sciences and the professions. The program is designed to serve the needs of students seeking a liberal education or a broad intellectual base for more technical training in environmental sciences. Students can pursue a major or a minor in environmental studies.

Undergraduate Programs

Major

The Environmental Studies Program offers a major (30 credit hours) leading to the Bachelor of Arts degree. However, it may be elected only as a second major. The double major is required so that the program's multidisciplinary perspective will be complemented by a concentrated disciplinary major. Students may apply up to six credits from required and elective courses in their first major to the environmental studies major. None of the required courses may be taken pass/no pass.

The required courses are:

**Required courses**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
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</thead>
<tbody>
<tr>
<td>ESTD 101</td>
<td>Introduction to Environmental Thinking</td>
<td>3</td>
</tr>
<tr>
<td>ESTD 398</td>
<td>Seminar in Environmental Studies</td>
<td>3</td>
</tr>
<tr>
<td>or ESTD 399</td>
<td>Departmental Seminar in Environmental Studies</td>
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</tbody>
</table>

One course from each of the following disciplinary groups:

**Humanities**

- RLGN 206 Religion and Ecology
- HSTY 292 Energy and Environment in American History 1750-2010
- HSTY 327 Comparative Environmental History
- HSTY 378 North American Environmental History
- PHIL 330 Topics in Ethics

**Social Policy**

- ESTD 303 Environmental Law
- ESTD 388 Politics, Policy, and the Global Environment
- ECON 367 Energy Economics and Engineering Solutions
- ECON 368 Environmental Economics

**Science and Engineering**

- ESTD 202 Global Environmental Problems
- BIOL 351 Principles of Ecology
- EECS 342 Introduction to Global Issues

Six additional hours chosen in consultation with the departmental advisor. 6

Total Units: 30

If a required course is not offered, substitution of a course to fulfill the distribution requirement is possible only with permission of the program director.

Minor

The minor in environmental studies (15 credit hours) consists of:

**Required course:**

<table>
<thead>
<tr>
<th>Course</th>
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<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESTD 101</td>
<td>Introduction to Environmental Thinking</td>
<td>3</td>
</tr>
</tbody>
</table>

One course from two of the following disciplinary groups: 6

**Humanities**

- RLGN 206 Religion and Ecology

Program Faculty

Peter L. McCall, JD, PhD  
Professor, Department of Geological Sciences; Director, Environmental Studies Program

Jeremy Bendik-Keymer, PhD  
Elmer G. Beamer-Hubert H. Schneider Professor in Ethics; Associate Professor, Department of Philosophy

John Broich, PhD  
Assistant Professor, Department of History

Jessica Green, PhD  
Assistant Professor, Department of Political Science

Gerald Matisoff, PhD  
Professor, Department of Geological Sciences

John Ruhl, PhD  
Professor, Department of Physics

Peter Shulman, PhD  
Assistant Professor, Department of History

Theodore Steinberg, PhD  
Adeline Barry Daviee Distinguished Professor of History; Professor, Case Western Reserve University School of Law

Courses

**ESTD 101. Introduction to Environmental Thinking. 3 Units.**

Critical comparison of scientific, historical, religious, and literary conceptions of nature. Theories of environmental ethics, legal, and economic conceptions of environmental goods. Current controversies concerning human population growth, energy use, the consumer society, and attitudes towards animals.
ESTD 202. Global Environmental Problems. 3 Units.
Global Environmental Problems is a course designed to provide students with an understanding of, and an appreciation for, human-influenced environmental changes that are global in scope. Accordingly, much of the material will focus on the nature and structure of natural global systems, how and where in those systems human influences occur, and will delve deeply into a few particular problems and solutions of current interest, such as population growth, climate change, ozone depletion, and fisheries, from a variety of viewpoints. Offered as ESTD 202 and EEPS 202.

ESTD 303. Environmental Law. 3 Units.
Introduction to treatment of environmental issues in legal proceedings. Sources of environmental law, legal procedure, common law remedies (toxic torts and human health, nuisance, contract law), statutes and regulations, endangered species, public lands, toxics regulation, nuclear power, coal. The course employs the case method of reading and recitation of appellate judicial opinions. We read both classic cases in environmental law as well as current controversies. Offered as ESTD 303 and EEPS 303.

ESTD 388. Politics, Policy, and the Global Environment. 3 Units.
This course examines the law, politics and policy surrounding global environmental challenges such as climate change. The course aims to provide a broad overview of the key concepts, actors, debates, and issues in global environmental politics. It aims to illustrate the complexities of addressing environmental problems-from the proliferation of global institutions and international actors, to the absence of central enforcement mechanisms. We examine the causes of environmental degradation and competing views on the gravity of the problem. Using concepts from political science and economics, we investigate the challenges in getting states to act jointly to address environmental problems. We examine the actors and institutions of global environmental politics, to understand how conditions are defined as problems and responses are chosen and implemented. The course concludes by applying the tools and concepts to the case of climate change. Offered as POSC 388, ESTD 388, POSC 488.

ESTD 398. Seminar in Environmental Studies. 3 Units.
Small group discussion and student presentations concerning the cultural determinants of environmental attitudes. Each student presents two seminars on current environmental issues, one local and one global. Recommended preparation: ESTD 101.

ESTD 399. Departmental Seminar in Environmental Studies. 3 Units.
Discussion and critique of recent publications in Environmental Studies. Students write weekly short essays on readings and participate in weekly group discussion. Reading list changes annually and is typically comprised of 7-9 books that center on a few unifying themes for that year (food, energy, futures, toxic torts, attitudes toward animals, consumer culture, climate crises for example). Students research, write, and defend a critical review of academic literature concerning some topic contained in the readings. Prior enrollment in ESTD 101 is recommended but not required. Students may not enroll in both ESTD 399 and 398 in the same year.
Ethnic Studies Program

The goal of the Ethnic Studies Program is to expand and enhance the university’s course offerings on ethnicity and race in the United States and around the world. The program’s objectives are:

1. to examine relationships among racial/ethnic groups, the processes of racial/ethnic formation, and their intersections with class, gender, and sexuality at the personal and collective levels
2. to foster the development of research skills in a broad range of disciplines in the humanities
3. to contribute to an interdisciplinary knowledge of the challenges and contributions of ethnic minorities in the United States
4. to impart to students a deep knowledge of the cultures of Africa and Latin America
5. to help students develop competencies for working with people of different racial/ethnic backgrounds and to foster an understanding of racial/ethnic diversity
6. to support students and faculty in the transmission of knowledge, in the discovery and development of new ideas, and in research and writing in the field of ethnic studies
7. to inculcate in students an understanding of the complexity and challenges of multiethnic societies, and to prepare them for careers in education, business, law, government service, social work, social welfare, health care, teaching, public policy, law enforcement, urban and community development, and the arts.

Ethnic Studies is an interdisciplinary program. The program aims to develop fundamental skills in critical and global thinking and in comparative analysis, as well as an understanding of the interactions of race, class, gender, and sexuality in the experiences of a range of social groups. It is designed to bring together a community of students, faculty, and staff devoted to the transmission of knowledge and the discovery of new ideas in the field of ethnic studies. Ethnic Studies also offers diverse perspectives that challenge monolithic thinking about the formation of identities and societies.

The program’s core courses focus on the exploration and comparison of the cultures, history, politics, and economics of Africa, Latin America, and their diasporas. Program offerings explore ethnicity and cross-cultural exchange globally and in postcolonial frames. Ethnic Studies supports research pertinent to the field and encourages cultural and academic exchange among scholars and students.

The program is part of the university’s mission to enhance the recruitment, retention, and excellence of a diverse faculty and student body. Our long-term goals are to extend program offerings to encompass other ethnic minority groups and to develop a center that will foster an appreciation of ethnic diversity and difference in the learning and research communities of Case Western Reserve University.

Undergraduate Program

Minor

The Ethnic Studies minor is open to all undergraduate students. It requires a minimum of 15 credit hours. Students are required to take 6 credits from among Ethnic Studies core courses and 9 credits in their chosen areas of concentration. Community projects are strongly recommended, and students are encouraged to carry out field research in their areas of concentration.

The core courses are designed to introduce students to the interdisciplinary field of ethnic studies. Courses may be individually or team taught and will sometimes be conducted in seminar format. Students are encouraged to use the tools and perspectives of several disciplines (history, literature, art history, anthropology, film, sociology, and political science, for example) to address the experiences of African-Americans and Latino/a Americans. Courses center on the examination of social, cultural, political, and economic structures that shape the life of these ethnic minorities in the United States. They examine how race, class, and gender have impacted their identities as well as their economic, social, political, and cultural productions. Assignments and courses make maximum use of the archives and collections of University Circle institutions.

Concentrations

African Studies Concentration

Any three of the following courses: 9

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
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<tbody>
<tr>
<td>COSI 260</td>
<td>Multicultural Aspects of Human Communication</td>
</tr>
<tr>
<td>ECON 375</td>
<td>Economics of Developing Countries</td>
</tr>
<tr>
<td>ETHS 235</td>
<td>Theater and Identity</td>
</tr>
<tr>
<td>ETHS 251A</td>
<td>Oral Performances and Ethnic Identities</td>
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<tr>
<td>ETHS 252A</td>
<td>Introduction to African-American Studies</td>
</tr>
<tr>
<td>ETHS 394</td>
<td>The Subaltern and The Poetics of War in Africa</td>
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<tr>
<td>FRCH/ETHS 338</td>
<td>The Cameroon Experience</td>
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<tr>
<td>FRCH/FRCH 295</td>
<td>The Francophone World</td>
</tr>
<tr>
<td>FRCH/FRCH 308</td>
<td>The Paris Experience</td>
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<tr>
<td>POSC 366</td>
<td>Government and Politics of Africa</td>
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Total Units: 9

African-American Studies Concentration

Any three of the following courses: 9

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<tr>
<td>ECON 375</td>
<td>Economics of Developing Countries</td>
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<tr>
<td>ENGL 360N</td>
<td>Topics in African-American Literature</td>
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<tr>
<td>ETHS 222</td>
<td>African-American Religions</td>
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<td>HSTY 260</td>
<td>U.S. Slavery and Emancipation</td>
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<tr>
<td>HSTY 261</td>
<td>African-American History 1865-1945</td>
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<tr>
<td>HSTY 262</td>
<td>African-American History since 1945</td>
</tr>
<tr>
<td>HSTY 318</td>
<td>History of Black Women in the U.S.</td>
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Total Units: 9

Latin American and Caribbean Studies Concentration

Any three of the following courses: 9

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<tr>
<td>ECON 375</td>
<td>Economics of Developing Countries</td>
</tr>
<tr>
<td>ETHS 287</td>
<td>State, War, Drugs, and Coffee in Colombia: History of Modern Colombia</td>
</tr>
<tr>
<td>ETHS 336</td>
<td>The Struggle for Justice in Latin America</td>
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<tr>
<td>POSC 364</td>
<td>Dictatorship and Democracy in Modern Latin America</td>
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<tr>
<td>SPAN 322</td>
<td>Latin American Short Story</td>
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<td>SPAN 326</td>
<td>The Fantastic in Latin American Prose</td>
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<tr>
<td>SPAN 336</td>
<td>Chicana/o Literature</td>
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</tbody>
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Total Units: 9
Courses

ETHS 218. Jews in Early Modern Europe. 3 Units.
This course surveys the history of Jews in Europe and the wider world from the Spanish expulsion through the French Revolution. Tracking peregrinations out of the Iberian Peninsula to the British Isles, France, Holland, Italy, Germany, Poland-Lithuania, the Ottoman Empire, and the American colonies, it examines the diverse ways Jews organized their communities, interacted with their non-Jewish neighbors, and negotiated their social, economic, and legal status within different states and empires. What role did Jews play and what symbolic place did they occupy during a period of European expansion, technological innovation, artistic experimentation, and religious and political turmoil? What internal and external dynamics affected Jewish experiences in the sixteenth, seventeenth, and eighteenth centuries? Through a selection of inquisitorial transcripts, government records, memoirs, and historical literature, we will explore topics such as persecution, conversion, messianism, toleration, emancipation, and assimilation. Offered as HSTY 218, JDST 218, and ETHS 218.

ETHS 222. African-American Religions. 3 Units.
This course is an exploration of the rich diversity of African American religions from the colonial period to the present. Attention will be given to key figures, institutional expressions, and significant movements in African American religious history. Major themes include African traditions in American religions, slavery and religion, sacred music, social protest, Black Nationalism in religion, Islam, African American women and religion, and black and womanist theologies. Course requirements will include field trips to local religious sites. Offered as ETHS 222 and RLGN 222.

ETHS 223. DESI: Diaspora, Ethnicity, Southasia(n), Interrogate. 3 Units.
In this class we will interrogate the cultural identity(ies) and imagined community(ies) of the “South Asian” Diaspora. We will first examine taxonomy and categorization itself, as a methodical, philosophical, and political enterprise. We will then examine how such contrived categories have been applied to the so-called desis, loosely and broadly understood as members of the South Asian Diaspora. To this end we will scrutinize the development of American(ized) “Hinduism.” the imagined location that desis have in North American racial and ethnic hierarchies, and the construction of assimilated, enculturated, and transnational imagined desi communities. Offered as RLGN 232, ETHS 232 and HSTY 232.

ETHS 234. France and Islam. 3 Units.
This seminar examines French encounters with the Muslim world from the Middle Ages to the present. Over the last millennium, France has viewed Saracens, Moriscos, Turks, Berbers, and Arabs with admiration and fear, disdain and incomprehension. Between the eleventh and thirteenth centuries, French soldiers battled in the Holy Land; for several hundred years after that, France and the Ottoman Empire exchanged diplomats, traders and slaves. The colonial occupation of Algeria that began in 1830 ended violently in 1962. By then, the empire that struck back had also come home through large waves of immigration. Today, the social and economic status, religious affiliation, political significance and cultural impact of French citizens of North African descent are the subject of burning national debate. Taking a long view on Franco-Muslim relations, the course will explore such topics as the Crusades, Mediterranean piracy and captivity, Napoleon’s Egyptian campaign, the Algerian War of Independence, the “veil affair,” riots in the suburbs of Paris and World Cup soccer. Offered as ETHS 234, HSTY 234.
ETHS 235. Theater and Identity. 3 Units.
This course aims at surveying identities in dramatic and performance texts in the modern era. It will help students develop skills to study plays and related theatrical forms, to analyze images for their social and political meanings, to investigate issues of identity, to appreciate the complexities of identity and images of self and other as related in theater, media and the larger political and social contexts. African and African-American identities, Latina/o-American and Latin American identities, Native-American identities, Asian-American and Asian identities, Gender identities will be examined.

ETHS 251. Perspectives in Ethnicity, Race, Religion and Gender. 3 Units.
This course is designed to introduce students to the study of ethnicity. Basic concepts such as race, gender, class, and identity construction will be examined. Students are encouraged to use the tools and perspectives of several disciplines to address the experiences of ethnic groups in the United States. Offered as ETHS 251 and RLGN 251.

ETHS 251A. Oral Performances and Ethnic Identities. 3 Units.
This course is an in-depth study of performances that have helped to shape and anchor the identities of different non-Western ethnic groups. The course will explore the multi-generic composition of the oral epic, which combines forms as diverse as narrative, song, praise poetry, theater, music and historical oratory. ETHS 251A will provide a comprehensive overview of oral performances while focusing on a particular area or areas of Africa, Asia, the United States, or Latin America. In the African continent, for example, the focus will be on the Madinka Sundjata corpus, dealing with the empire of Mali; the life of Shaka, the Zulu in South Africa; while in the United States, the narrative life of Frederick Douglass, blues and negro-spiritual will be considered as the sites of ethnic discourse. Using a comparative approach, the course will examine aesthetic issues of oral performance, the written word, interactions between music and voice, and interaction between poetic and prose narrative forms. The performance texts will be augmented by field recordings and in-class demonstrations by griots and other storytellers from Africa and the United States.

ETHS 252A. Introduction to African-American Studies. 3 Units.
This course is designed to introduce students to the study of Black History, cultures, economics, and politics. Students will learn about the development of the field by exploring theoretical questions, methodological approaches, and major themes that have shaped the study of black people, primarily in the U.S. context. This is a seminar-style, discussion-based course that emphasizes critical analysis and expository writing. Offered as ETHS 252A and HSTY 252A.

ETHS 252B. Introduction to Latina/o Studies. 3 Units.
Interdisciplinary introduction to the basis for a Latina/o ethnicity through an exploration of commonalities and differences in the peoples of Latin American and Caribbean origin within the continental United States. Topics include methodological and theoretical formulations central to the field (e.g., racial, gender, and sexual formations, modes and relations of production and class, nation and transnation), history and contemporary issues of identity, family, community, immigration, and the potential for a pan-ethnic identity. Discussions will focus on major demographic, social, economic and political trends: historical roots of Latinas/os in the U.S.; the evolution of Latina/o ethnicity and identity; immigration and the formation of Latina/o communities; schooling and language usage; tendencies and determinants of socioeconomic and labor force status; discrimination, segregation and bias in contemporary America; racial and gender relations; and political behavior among Latinas/os. Offered as: ETHS 252B and HSTY 259.

ETHS 253A. Introduction to Modern African History. 3 Units.
A general introduction to major themes in modern African history, with an emphasis on the nineteenth and twentieth centuries. Topics include oral tradition and narrative, economic structure and dynamics, religious movements, colonialism, nationalism, and the dilemmas of independent African states. Offered as ETHS 253A and HSTY 135.

ETHS 253B. Introduction to Latin American History. 3 Units.
This course provides an introduction to the historical and cultural development of Latin America, in an attempt to identify the forces, both internal and external, which shape the social, economic and political realities in present day Latin America. Beginning with its pre-Columbian civilizations, the course moves through the conquest and colonial period of the Americas, the wars of independence and the emergence of nation-states in the nineteenth century, and the issues confronting the region throughout the turbulent twentieth century, such as migration and urbanization, popular protest and revolution, environmental degradation, great power intervention, the drug trade and corruption, and the integration of the region into the global economy. Offered as ETHS 253B and HSTY 136.

ETHS 254. The Holocaust. 3 Units.
This class seeks to answer fundamental questions about the Holocaust: the German-led organized mass murder of nearly six million Jews and millions of other ethnic and religious minorities. It will investigate the origins and development of racism in modern European society, the manifestations of that racism, and responses to persecution. An additional focus of the course will be comparisons between different groups, different countries, and different phases during the Nazi era. Offered as HSTY 254, RLGN 254, ETHS 254, and JDST 254.

ETHS 260. U.S. Slavery and Emancipation. 3 Units.
Begins with the African encounter with Europeans during the emergence of the modern slave trade. Students are introduced to the documents and secondary literature on the creation and maintenance of slavery, first in colonial America, and then in the United States. The course concludes with the destruction of slavery. Offered as ETHS 260 and HSTY 260.
ETHS 261. African-American History 1865-1945. 3 Units.
Explores the fashioning of a modern African-American culture between emancipation and the end of World War II. Emergence of a northern-based leadership, the challenge of segregation, emergence of bourgeois culture, the fashioning of racial consciousness and black nationalism, the shift from a primarily southern and rural population to one increasingly northern and urban, the creation and contours of a modern African-American culture, the construction of racial/gender and racial/class consciousness. Offered as ETHS 261 and HSTY 261.

ETHS 262. African-American History Since 1945. 3 Units.
Completes the three-term sequence of the African-American history survey (although the first two courses are not prerequisites for this course). Explores some of the key events and developments shaping African-American social, political, and cultural history since 1945. Offered as HSTY 262 and ETHS 262.

ETHS 280. History of Modern Mexico. 3 Units.
This course explores the major issues that have influenced the formation of modern Mexico. This class is organized around three major themes. First, we will examine Mexican identity formation and its political implications. Second, we will assess Mexican life in relation to the development of the Mexican economy. Finally, we will survey how elite and popular forms of violence have affected Mexican society. Throughout the course, we will discuss the significance of the colonial heritage, regional distinctions, racial and gender stratification, and the creation and reconfiguration of various types of borders. Offered as HSTY 280 and ETHS 280.

ETHS 287. State, War, Drugs, and Coffee in Colombia: History of Modern Colombia. 3 Units.
This course will analyze the major forces that have shaped Colombian history from the 19th century to the present. Colombia is one of the largest and most fascinating countries in Latin America. It has been intricately linked to the U.S. market as a major coffee producer and, more recently, as a major supplier of illicit drugs. Colombia has always been one of the wealthier Latin American countries, and it has a high degree of electoral democracy. Paradoxically, however, Colombia has also experienced rather high levels of regionalism and political violence. This course seeks to explore the history of these paradoxes. It will situate Colombia’s contemporary conflicts within a larger historical perspective. Offered as ETHS 287 and HSTY 287.

ETHS 295. The Francophone World. 3 Units.
The course offers an introduction to the Francophone World from a historical, cultural, and literary perspective. The Francophone World includes countries and regions around the globe with a substantial French-speaking population (where French is sometimes, but not always, an official language): North America (Louisiana, Quebec, and Acadia); North Africa (Tunisia, Morocco, Algeria, and Egypt); the Middle-East (Lebanon, Syria); the Caribbean (Martinique, Guadeloupe, Haiti); Southeast Asia (Vietnam); and Europe (France, Belgium, Switzerland, and Luxembourg). FRCH 295 provides a comprehensive overview of the Francophone World, while focusing on a particular area or areas in any given semester. Offered as ETHS 295, FRCH 295, and WLIT 295.

ETHS 301. Women, Creativity and the Arts. 3 Units.
WGST 301/ETHS 301 is one of two core courses for the program in Women’s and Gender Studies and an elective course for the ETHS minor. All WGST majors are to take one course concentrating on the subject of women and the arts specifically. This course also fulfills the cultural diversity requirement. In this course, students will focus on two areas of study: a) women and creativity and b) women and activism through the arts. A history of women in the arts will be covered, but the general focus of the course is on women in the arts since the 1960s in particular, and on artwork that reflects or provokes social change.

"Arts" are defined in the broadest of sense. That is, students will study women’s production in painting, photography, graphic design, sculpture, dance, film, music, and theater. A variety of learning techniques will be applied. Students will look at feminist theories on art, be introduced to the notion of cyberfeminism, study actual artwork and its reproductions, understand the role of art in feminist activism and how women “create” differently from men, and work closely with several feminist artists/activists through various programs on campus and the community in order to facilitate the planning and carrying out of artistic production. Subsequently, students will interact with children in Cleveland schools in conjunction with these artists giving master classes, and be exposed to art exhibits abroad through videoconferencing with the Algerian Cultural Center in Paris and locally through University Circle Institutions. Offered as WGST 301 and ETHS 301.

ETHS 306. The Cuban Experience: an immersion in its culture and society. 3 Units.
This is a three-week study-abroad intensive course that takes place at Editorial Vigia, in Matanzas, Cuba. The course combines the unique advantages of a total immersion environment in Spanish with a classroom curriculum that includes conversation practice and study of relevant cultural, literary and historical issues. Students complete three hours of classroom instruction and an hour and a half of publishing workshop four days per week. In this workshop, they work in the edition of a bilingual book. In addition, they participate in organized visits to historic sites and museums connected to the culture curriculum. The focus of the culture curriculum is the study of Cuban history and culture through its literature, visual arts, films, and music. After applying and being accepted in the program, students meet for personal advising with the program director and attend four different one hour orientation-information meetings in the spring semester. After successful completion of the study-abroad program, students receive 3 upper-level credits in Spanish. The course is interdisciplinary in approach and provides students with the tools they need to analyze and understand the complexities of modern Cuba. Students will have formal classes taught by their professor and talks and meetings with specialists on Cuban literature, art, architecture, history and other aspects of culture and society. In addition, they will attend lectures, participate in discussions, and take field trips that will expose them to many aspects of Cuban culture, such as art, architecture, music, dance, film, literature, artisan work, folklore, history and urban growth. Offered as SPAN 306, SPAN 406, and ETHS 306. Prereq: SPAN 202.
ETHS 311. Representations of Black Religion in Film. 3 Units.
In this course we will explore cinematic representations of black religion in the Americas and the Caribbean. Each week we will view a film representing diverse religious traditions such as Christianity, Candomble, Santeria, Vodou, and Islam. Films will include Cabin in the Sky, The Color Purple, Black Orpheus, The Serpent and the Rainbow, Malcolm X, Eve's Bayou, and The Princess and the Frog. Throughout the course we will analyze the ways in which notions of gender, the history of colonialism, modern notions of race, and geographical landscapes have informed representations of black religion in film. In addition, we will discuss how these representations, in turn, have influenced cultural ideas of black religion in the Americas. Offered as RLGN 311, ETHS 311, and RLGN 411. Prereq: RLGN 222 or ETHS 251 or ENGL 367 or by permission of Instructor.

ETHS 314. Cultures of the United States. 3 Units.
This course considers the rich ethnic diversity of the U.S. from the perspective of social/cultural anthropology. Conquest, immigration, problems of conflicts and accommodation, and the character of the diverse regional and ethnic cultures are considered as are forms of racism, discrimination, and their consequences. Groups of interest include various Latina/o and Native peoples, African-American groups, and specific ethnic groups of Pacific, Mediterranean, European, Asian, and Caribbean origin. Offered as ANTH 314, ETHS 314, and ANTH 414.

ETHS 316. African Political Thought. 3 Units.
Introduction to select themes in the work of contemporary African philosophers, with special emphasis on political thought. In this course, students will learn something about factors affecting the creation and flow of knowledge and ideas about Africa and discuss the relative importance of the "nation-state" as an idea in Europe, pre-colonial Africa, and postcolonial Africa. Offered as PHIL 316/416 and ETHS 316/416.

ETHS 318. History of Black Women in the U.S.. 3 Units.
Chronologically arranged around specific issues in black women's history organizations, participation in community and political movements, labor experiences, and expressive culture. The course will use a variety of materials, including autobiography, literature, music, and film. Offered as ETHS 318, HSTY 318, and WGST 318.

ETHS 335. Women in Developing Countries. 3 Units.
This course will feature case studies, theory, and literature of current issues concerning women in developing countries primarily of the French-speaking world. Discussion and research topics include matriarchal traditions and FGM in Africa, the Tunisian feminist movement, women, Islam, and tradition in the Middle East, women-centered power structures in India (Kerala, Pondichery), and poverty and women in Vietnam, Laos, and Cambodia. Guest speakers and special projects are important elements of the course. Seminar-style format, taught in English, with significant disciplinary writing in English for WGST, ETHS, and some WLIT students, and writing in French for FRCH and WLIT students. Writing assignments include two shorter essays and a substantial research paper. Offered as ETHS 335, FRCH 335, WLIT 335, WGST 335, FRCH 435 and WLIT 435.

ETHS 338. The Cameroon Experience. 3 Units.
Three-week immersion learning experience living and studying in Cameroon. The focus of the course is the culture, literature, and language of Francophone Cameroon, with some emphasis on Anglophone Cameroon. Students spend a minimum of fifteen hours per week visiting cultural sites and attending arranged courses at the University of Buea. Students will prepare a research paper. Coursework is in French. To do coursework in English, students should enroll in WLIT 338/438 or ETHS 338/438. Offered as ETHS 338, FRCH 338, WLIT 338, ETHS 438, FRCH 438, and WLIT 438.

ETHS 339. Black Women and Religion. 3 Units.
This course is an exploration of the multidimensional religious experiences of black women in the United States. These experiences will be examined within particular historical periods and across diverse social and cultural contexts. Course topics and themes include black women and slave religion, spirituality and folk beliefs, religion and feminist/womanist discourse, perspectives on institutional roles, religion and activism, and spirituality and the arts. Offered as: ETHS 339 and RLGN 338 and WGST 339.

ETHS 340. A History of Workers in the United States. 3 Units.
This course examines the experience of working people in the United States with an emphasis on twentieth-century social movements. It explores the lives of the women and men, skilled and unskilled, and rural and urban laborers that produce the goods and provide the services that society consumes. At crucial moments, working people have created or helped sustain national social movements in an effort to improve some aspect of their lives. We therefore will assess laborers in relation to several known and less known American social movements, such as the eight-hour day movement during the late nineteenth century, the peace movement during WWI, and the Civil Rights movement in the wake of WWII. Throughout the course we will also discuss the politics of time-managed work; the influence of public policy and government institutions; the role of unions within a competitive market economy; the relationship between industrial economies and functional blue-collar communities; and the correlation between immigration and globalization. Offered as HSTY 340, HSTY 430, and ETHS 340.
ETHS 342. Latin American Feminist Voices. 3 Units.
Examination of the awakening of feminine and feminist consciousness in
the literary production of Latin American women writers, particularly from
the 1920s to the present. Close attention paid to the dominant themes of
love and dependency; imagination as evasion; alienation and rebellion;
sexuality and power; the search for identity and the self-preservation of
subjectivity. Readings include prose, poetry, and dramatic texts of female
Latin American writers contributing to the emerging of feminist ideologies
and the mapping of feminist identities. Offered as SPAN 342, SPAN 442,
ETHS 342, WGST 342, WLIT 342, and WLIT 442.

ETHS 352. African Feminisms. 3 Units.
This course traces the history of African feminism from its origins
within traditions through to a more contemporary theoretical analysis of
gender, marriage, and motherhood seen from an Afrocentric perspective.
Approaches studied are those that pertain to anthropology, history,
literature, sociology, and culture. African feminist theory of scholars such
as Filomina Steady, Cheikh Anta Diop, Buchi Emecheta, Ili Amadiume,
Obioma Nnameka, Oyeronko Oyewumi, and Calixthe Beyala will be
studied and there will be some comparative analysis of Western theories
to show how African feminisms are clearly distinct. Theories on these
feminisms will be presented, and in the process, students will look at
cases of women in Cameroon, Nigeria, Ghana, Kenya, and Senegal. It
is commonly believed that African women were defined for a long time
according to constructs of Western anthropology. This course will thus
look at social institutions such as woman-to-woman marriage, matriarchy,
and various women's rituals in order to identify African constructs of
gender, family, kinship, marriage, and motherhood. Offered as ETHS 352
and WGST 352.

ETHS 359. Palestine & Israel: Whose Promised Land? Issues of
Religion, Politics & Media Coverage. 3 Units.
The major focus of this seminar will range from the ongoing questions of
peace and justice in Israel and occupied Palestine to the land and border
questions; Green line, crossing points, the wall; to interpretations from
biblical to contemporary texts, reflecting a multiplicity of agendas. Our
primary focus will be the analysis of recent research and scholarship on
issues of mass violence, contested space and land, gender, race and
ethnicity, religious sectarianism, colonialism/imperialism. Through our
readings we will identify the bias and concerns of various interpretive
communities involved in the ongoing struggles in this very small area.
With two peoples claiming the same land for different reasons, can this
conflict ever be resolved? Recommended preparation: One course about
the Middle East. Offered as ETHS 359 and RGLN 320.

ETHS 362. Politics of Central Asia. 3 Units.
Once an unfamiliar region to many people of the world, Central Asia
took center stage in the fall of 2001 as a result of the U.S. campaign
against terrorism. This course will introduce students to the politics of
Central Asia, focusing on the region today composed of Uzbekistan,
Turkmenistan, Tajikistan, Kyrgyzstan, and Kazakhstan. We will review
the nationalism, foreign relations, religion, ethnicity, and economics of the
region. Offered as ETHS 362, POSC 362, and POSC 462.

ETHS 363H. African-American Literature. 3 Units.
A historical approach to African-American literature. Such writers as
Wheatley, Equiano, Douglass, Jacobs, DuBois, Hurston, Hughes, Wright,
Baldwin, Ellison, Morrison. Topics covered may include slave narratives,
African-American autobiography, the Harlem Renaissance, the Black
Aesthetic, literature of protest and assimilation. Maximum 6 credits.
Offered as ENGL 363H, ETHS 363H, WLIT 363H, ENGL 463H, and
WLIT 463H. Prereq: ENGL 150 or passing letter grade in a 100 level first
year seminar in USFS, FSCC, FSNA, FSSO, FSSY, FSTS, FSCS.

ETHS 364. Dictatorship and Democracy in Modern Latin America. 3
Units.
Examination of political leadership in 20th-century Latin America,
exploring the nature, causes, and consequences of dictatorship and
democracy in the region, moving from the collapse of oligarchic rule
and the emergence of populism in the 1930s and 1940s, to the end
of democracy and establishment of military regimes in the 1960s and 1970s,
and ultimately to the contemporary processes of democratization and
economic liberalization. Offered as ETHS 364, POSC 364, and POSC
464.

ETHS 365N. Topics in African-American Literature. 3 Units.
Selected topics and writers from nineteenth, twentieth, and twenty-first
century African-American literature. May focus on a genre, a single
author or a group of authors, a theme or themes. Maximum 6 credits.
Offered as ENGL 365N, ETHS 365N, WLIT 365N, ENGL 465N, and
WLIT 465N. Prereq: ENGL 150 or passing letter grade in a 100 level first
year seminar in USFS, FSCC, FSNA, FSSO, FSSY, FSTS, FSCS.

ETHS 365Q. Post-Colonial Literature. 3 Units.
Readings in national and regional literatures from former European
colonies such as Australia and African countries. Maximum 6 credits.
Offered as ENGL 365Q, ETHS 365Q, WLIT 365Q, ENGL 465Q, and
WLIT 465Q. Prereq: ENGL 150 or passing letter grade in a 100 level first
year seminar in USFS, FSCC, FSNA, FSSO, FSSY, FSTS, FSCS.

ETHS 366. Government and Politics of Africa. 3 Units.
Comparative analysis of the political forces and organizations currently
functioning in Africa, as well as a survey of the formal government
institutions. Special emphasis on single-party rule, military rule, and
the political ramifications of African socialism, tribalism and the problems
of national integration. Offered as ETHS 366, POSC 366, and POSC
466.

ETHS 369. Current Controversies in Latin American Politics and
Society. 3 Units.
In addition to questions about race, religion, abortion, the drug industry,
immigration, democracy, private property, and free trade, the course will
tackle Latin America's apparent shift to the political and ideological left,
Chavez's "Imperialism," and Cuba's humanitarian aid. Offered as ETHS
369, POSC 369 and POSC 469.

ETHS 370K. Nationalism, Ethnicity, and Religion in World Politics. 3
Units.
Examination of the post-Cold War surge in conflicts among nationalisms,
ethnic groups, and religions with particular attention to the former
Yugoslavia, Ireland, India, Africa, and the Middle East. Offered as ETHS
370K, POSC 370K, and POSC 470K.

ETHS 374. Politics of Development in the Global South. 3 Units.
Exploration of the post-World War II emergence of the Global South
nations of Africa, Asia, the Middle East, Latin America, and the Eastern
Europe arena. Offered as ETHS 374, POSC 374, and POSC 474.
ETHS 385. Hispanic Literature in Translation. 3 Units.
Critical analysis and appreciation of representative literary masterpieces from Spain and Latin America, and by Hispanics living in the U.S. Texts cover a variety of genres and a range of literary periods, from works by Cervantes to those of Gabriel García Márquez. The course will examine the relationship between literature and other forms of artistic production, as well as the development of the Hispanic literary text within the context of historical events and cultural production of the period. Counts toward Spanish major only as related course. No knowledge of Spanish required. Offered as ETHS 385, ETHS 485, SPAN 385, SPAN 485, WLIT 385, and WLIT 485.

ETHS 391. Advanced Readings in Black History. 3 Units.
This is an advanced readings course that may change from semester to semester. This course will provide students with an opportunity to more deeply explore special themes and theoretical issues in the field of black history that are often quickly and briefly covered in broad survey courses. Readings may be organized around specific topics such as resistance and social protest, black intellectual history, black nationalism and identity, black film and historical literacy black cultural forms and politics, black urban history, or some such other combination. Students may take this course more than once and receive credit as long as the course topic differs. Students should contact the History Department for more details on course content during any given semester. Offered as ETHS 391, HSTY 399 and HSTY 499.

ETHS 393. Advanced Readings in the History of Race. 3 Units.
This course examines the concept of race as a social construction that carries political and economic implications. We begin by examining the histories of the early racial taxonomists (e.g., Bernier, Linnaeus, and Blumenbach among others) and the contexts that informed their writings. We then assess how the concept of race changed from the nineteenth to the twentieth century in the United States. We conclude by evaluating how the ideology of race has influenced U.S. domestic life and foreign policy at specific historical moments. Offered as HSTY 393, HSTY 493, and ETHS 393.

ETHS 394. The Subaltern and The Poetics of War in Africa. 3 Units.
This course is a seminar on major war writers and filmmakers in Africa such as Chinua Achebe, Ngugi wa Thiongo, Emmanuel Dongola, Iweala Uzodinma, Ismael Beah, Semebene Ousmane, Ingrid Sinclair etc. Students will be asked to use postcolonial theory to critically read and view films and texts on war in Africa. They will engage in discussion with guest scholars in the field of African studies. In addition to a final research paper, students are also required to write short papers on selected books and films read and/or viewed during the semester.

ETHS 399. Independent Study. 0 - 3 Units.
This course focuses on topics in ethnicity. In consultation with the program director and instructors, students pick topics in their concentrations and make a list of books and films for personal and intensive reading. Some of these projects might be Arts and Identity in post-independent Africa [African Concentration], films, literatures and human rights in Latin America [Latin America and Caribbean Concentration], civil rights through music and songs [African-American Concentration] etc. Travel may be a component of this course depending on the nature of the students’ interests. Weekly reports are required for the instructors to measure the students’ progress.

ETHS 416. African Political Thought. 3 Units.
Introduction to select themes in the work of contemporary African philosophers, with special emphasis on political thought. In this course, students will learn something about factors affecting the creation and flow of knowledge and ideas about Africa and discuss the relative importance of the “nation-state” as an idea in Europe, pre-colonial Africa, and postcolonial Africa. Offered as PHIL 316/416 and ETHS 316/416.

ETHS 438. The Cameroon Experience. 3 Units.
Three-week immersion learning experience living and studying in Cameroon. The focus of the course is the culture, literature, and language of Francophone Cameroon, with some emphasis on Anglophone Cameroon. Students spend a minimum of fifteen hours per week visiting cultural sites and attending arranged courses at the University of Buea. Students will prepare a research paper. Coursework is in French. To do coursework in English, students should enroll in WLIT 338/438 or ETHS 338/438. Offered as ETHS 338, FRCH 338, WLIT 338, ETHS 438, FRCH 438, and WLIT 438.

ETHS 485. Hispanic Literature in Translation. 3 Units.
Critical analysis and appreciation of representative literary masterpieces from Spain and Latin America, and by Hispanics living in the U.S. Texts cover a variety of genres and a range of literary periods, from works by Cervantes to those of Gabriel García Márquez. The course will examine the relationship between literature and other forms of artistic production, as well as the development of the Hispanic literary text within the context of historical events and cultural production of the period. Counts toward Spanish major only as related course. No knowledge of Spanish required. Offered as ETHS 385, ETHS 485, SPAN 385, SPAN 485, WLIT 385, and WLIT 485.
Evolutionary Biology Program

The Evolutionary Biology Program is designed to provide students with knowledge of macro- and micro-evolutionary processes underlying the evolution and diversification of life on Earth and an understanding of the meta-scientific issues involved in this unique field of study.

The program includes grounding in the history and philosophy of evolutionary thought and alternative conceptualizations of the mechanisms, patterns, and processes of evolution. It emphasizes evolutionary theory, foundations of ecology and genetics, focused study of particular organisms or groups of organisms, and the dynamics of evolutionary principles in scientific inquiry.

Undergraduate Programs

Major

Evolutionary biology is a second major, to be pursued in conjunction with a conventional disciplinary major. Up to 12 credits in required and elective courses taken by students for their first major may be applied to their evolutionary biology major.

The 30-credit interdisciplinary major in evolutionary biology consists of:

1. Three foundation courses
2. One course in ecology
3. One course in the philosophy/history of science
4. Four approved electives

The approved electives may include additional philosophy/history of science courses from the list below. In consultation with a major advisor, students will tailor intensive study to suit particular interests within the major.

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<td>EEPS 210</td>
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<td>PHIL/ANTH/BIOL/ EEPS/HSTY 225</td>
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<th>Additional required courses (one from each area)</th>
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<tr>
<td>EEPS/BIOL 307</td>
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<tr>
<td>PHIL 204</td>
</tr>
<tr>
<td>PHIL 303</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Approved electives 12</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANTH 103</td>
</tr>
<tr>
<td>ANTH 302</td>
</tr>
<tr>
<td>ANTH 370</td>
</tr>
<tr>
<td>ANTH 375</td>
</tr>
<tr>
<td>ANTH 377</td>
</tr>
<tr>
<td>ANTH 378</td>
</tr>
<tr>
<td>ANTH 393</td>
</tr>
<tr>
<td>BIOL 214L</td>
</tr>
<tr>
<td>BIOL 218L</td>
</tr>
<tr>
<td>BIOL 223</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Minor</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL 251 or BIOL 214</td>
</tr>
<tr>
<td>BIOL/ANTH/EEPS/ HSTY/PHIL 225</td>
</tr>
<tr>
<td>EEPS/HSTY 210</td>
</tr>
<tr>
<td>Two approved electives selected in consultation with advisor 6</td>
</tr>
</tbody>
</table>

Total Units 27

Program Faculty

Patricia Princehouse, PhD
Senior Research Associate, Department of History; Director, Evolutionary Biology Program

Radhika Atit, PhD
Associate Professor, Department of Biology

Cynthia M. Beall, PhD
Distinguished University Professor and Sarah Idell Pyle Professor, Department of Anthropology

Michael Benard, PhD
George B. Mayer Chair in Urban and Environmental Studies; Assistant Professor, Department of Biology

Darin Croft, PhD
Associate Professor, Department of Anatomy, School of Medicine

Yohannes Haile-Selassie Ambaye, PhD
Adjunct Professor, Department of Anthropology; Curator and Head of Physical Anthropology, Cleveland Museum of Natural History
Emmitt Jolly, PhD  
*Assistant Professor, Department of Biology*

Bruce Latimer, PhD  
*Adjunct Professor of Anthropology; Adjunct Associate Professor, Department of Anatomy, School of Medicine*

Peter McCall, JD, PhD  
*Professor, Department of Earth, Environmental, and Planetary Sciences*

Scott Simpson, PhD  
*Associate Professor, Department of Anatomy, School of Medicine*

Mark Willis, PhD  
*Associate Professor, Department of Biology*

Peter A. Zimmerman, PhD  
*Professor, Center for Global Health and Diseases, School of Medicine*
French and Francophone Studies Program

Designed to develop cross-cultural awareness and to foster international understanding, the French and Francophone Studies (FFS) Program adds an exciting dimension to the traditional liberal arts curriculum. The French and Francophone Studies major differs from the traditional French major in two respects: its interdisciplinary nature and its greater flexibility in accommodating students’ areas of interest. The FFS major answers the needs of students with a strong interest in cultural issues in general and in French and Francophone history and society in particular. By allowing students to take course work in English, the FFS major allows them to profit from the many courses in various departments that focus on France and the Francophone world.

The FFS Program is an interdisciplinary, integrated program that understands the term “French” in its broadest sense. It thus reflects the diversity of the field of French studies, which explores varied cultures of Francophone expression: Canada, the Caribbean, North and West Africa, the Middle East, and Southeast Asia. Reaching beyond disciplinary and national boundaries, the program encourages students to choose from a large selection of courses in the humanities, the arts, and the social sciences. In this way, it provides both a meaningful course of study and a large selection of courses in the humanities, the arts, and the social sciences. In this way, it provides both a meaningful course of study and an outstanding preparation for graduate or professional schools and for careers in international business and finance, law, journalism, diplomatic service, nonprofit and other international organizations, health, teaching, or the arts.

Major | Study Abroad I Minor

Undergraduate Programs

Major

Each student prepares a program of study in close consultation with a faculty advisor drawn from the advisory committee. Students should also discuss their choice of a minor or a second major with their advisor.

French and Francophone Studies (FFS) majors should demonstrate French language ability by completing French 201-202 or the equivalent. They will also take at least one 300-level FRCH course (see Foundations in Culture courses below).

The major in French and Francophone Studies requires a minimum of 33 credit hours in the following areas:

1. Foundations in Language (8 hours)

For students entering at the 200-level of French language:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>FRCH 201</td>
<td>Intermediate French I</td>
<td>4</td>
</tr>
<tr>
<td>FRCH 202</td>
<td>Intermediate French II</td>
<td>4</td>
</tr>
</tbody>
</table>

Students entering at the 300-level of language study complete 21 credits in Electives section below:

Total Units 8

2. Foundations in Culture: Introduction to French and Francophone cultures (9 hours)

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>FRCH/WLIT 295</td>
<td>The Francophone World</td>
<td>3</td>
</tr>
<tr>
<td>Two of the following:</td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>FRCH 316</td>
<td>Contemporary France</td>
<td></td>
</tr>
<tr>
<td>FRCH 318</td>
<td>The Origins of France</td>
<td></td>
</tr>
<tr>
<td>FRCH 319</td>
<td>Modern France</td>
<td></td>
</tr>
<tr>
<td>HSTY 310</td>
<td>The French Revolutionary Era</td>
<td></td>
</tr>
</tbody>
</table>

Total Units 9

3. Electives: Related Courses in French and Other Disciplines (15-21 hours)

Students select from courses that focus on French and Francophone cultures in FRCH and other disciplines (art history, political science, history, etc.). These are chosen from the approved list (see below) and in conjunction with a program advisor. No more than 9 of these credits may be chosen from FRCH courses.

Anthropology

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANTH 337</td>
<td>Comparative Medical Systems</td>
<td>3</td>
</tr>
<tr>
<td>ANTH 399</td>
<td>Independent Study</td>
<td>1</td>
</tr>
</tbody>
</table>

Art History

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARTH 240</td>
<td>Architecture: Ancient to 1850</td>
<td>3</td>
</tr>
<tr>
<td>ARTH 260</td>
<td>Art in Early Modern Europe</td>
<td>3</td>
</tr>
<tr>
<td>ARTH 280</td>
<td>Modern Art and Modern Science</td>
<td>3</td>
</tr>
<tr>
<td>ARTH 284</td>
<td>History of Photography</td>
<td>3</td>
</tr>
<tr>
<td>ARTH 340</td>
<td>Issues in the Art of China</td>
<td>3</td>
</tr>
<tr>
<td>ARTH 367</td>
<td>17th and 18th Century Art in France</td>
<td>3</td>
</tr>
<tr>
<td>ARTH 374</td>
<td>Impressionism to Symbolism</td>
<td>3</td>
</tr>
<tr>
<td>ARTH 379</td>
<td>Issues in 19th Century Art</td>
<td>3</td>
</tr>
<tr>
<td>ARTH 392</td>
<td>Issues in 20th/21st Century Art</td>
<td>3</td>
</tr>
<tr>
<td>ARTH 398</td>
<td>Independent Study in Art History</td>
<td>1</td>
</tr>
</tbody>
</table>

Economics

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECON 372</td>
<td>International Finance</td>
<td>3</td>
</tr>
<tr>
<td>ECON 373</td>
<td>International Trade</td>
<td>3</td>
</tr>
<tr>
<td>ECON 375</td>
<td>Economics of Developing Countries</td>
<td>3</td>
</tr>
</tbody>
</table>

English

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENGL/WLIT 290</td>
<td>Masterpieces of Continental Fiction</td>
<td>3</td>
</tr>
<tr>
<td>ENGL 301</td>
<td>Linguistic Analysis</td>
<td>3</td>
</tr>
<tr>
<td>ENGL/WLIT 368C</td>
<td>Topics in Film</td>
<td>3</td>
</tr>
<tr>
<td>ENGL 379</td>
<td>Topics in Language Studies</td>
<td>3</td>
</tr>
<tr>
<td>ENGL/WLIT 387</td>
<td>Literary and Critical Theory</td>
<td>3</td>
</tr>
</tbody>
</table>

History

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>HSTY 151</td>
<td>Technology in European Civilization</td>
<td>3</td>
</tr>
<tr>
<td>HSTY 201</td>
<td>Science in Western Thought I</td>
<td>3</td>
</tr>
<tr>
<td>&amp; HSTY 202</td>
<td>Science in Western Thought II</td>
<td>6</td>
</tr>
<tr>
<td>HSTY 212</td>
<td>Modern European History</td>
<td>3</td>
</tr>
<tr>
<td>HSTY 215</td>
<td>Europe in the 20th Century</td>
<td>3</td>
</tr>
<tr>
<td>HSTY 234</td>
<td>France and Islam</td>
<td>3</td>
</tr>
<tr>
<td>HSTY 250</td>
<td>Issues and Methods in History</td>
<td>3</td>
</tr>
<tr>
<td>HSTY 308/RLGN 374</td>
<td>Reformation Europe, 1500-1650</td>
<td>3</td>
</tr>
<tr>
<td>HSTY 310</td>
<td>The French Revolutionary Era</td>
<td>3</td>
</tr>
<tr>
<td>HSTY/RLGN 315</td>
<td>Heresy and Dissidence in the Middle Ages</td>
<td>3</td>
</tr>
<tr>
<td>HSTY 332</td>
<td>European Diplomacy in the Age of Nationalism: 1789-1945</td>
<td>3</td>
</tr>
<tr>
<td>HSTY/POSC 348</td>
<td>History of Modern Political and Social Thought</td>
<td>3</td>
</tr>
<tr>
<td>HSTY 397</td>
<td>Undergraduate Tutorial</td>
<td>1</td>
</tr>
</tbody>
</table>

International Studies

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>INTL 296</td>
<td>International Independent Study</td>
<td>1</td>
</tr>
</tbody>
</table>

Music

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>MUHI 301</td>
<td>History of Western Music I</td>
<td>3</td>
</tr>
<tr>
<td>MUHI 302</td>
<td>History of Western Music II</td>
<td>3</td>
</tr>
<tr>
<td>MUHI 303</td>
<td>History of Western Music III</td>
<td>3</td>
</tr>
</tbody>
</table>
### Philosophy

- PHIL 302 Modern Philosophy 3
- PHIL 315 Selected Topics in Philosophy 3
- PHIL 325 Philosophy of Feminism 3
- PHIL 399 Directed Study 3

### Political Science

- POSC 326 Constitutions in Practical Politics 3
- POSC/HSTY 348 History of Modern Political and Social Thought 3
- POSC 351 Modern Political Thought 3
- POSC 366 Government and Politics of Africa 3
- POSC 367 Western European Political Systems 3
- POSC 370A Political Economy 3
- POSC 373 Politics of the European Union 3
- POSC 374 Politics of Development in the Global South 3
- POSC 395 Special Projects 1 - 6

### Religious Studies

- RLGN/HSTY 315 Heresy and Dissidence in the Middle Ages 3
- RLGN 374/HSTY 309 Reformation Europe, 1500-1650 3
- RLGN 392 Independent Study 1 - 3

### Theater

- THTR/WLIT 229 Development of Theater: Renaissance to Romanticism 3
- THTR 329 Dramatic Literature 3
- THTR 399 Independent Study in Theater Arts 1 - 3

### World Literature

- WLIT 211 World Literature I 3
- WLIT 212 World Literature II 3
- WLIT/THTR 229 Development of Theater: Renaissance to Romanticism 3
- WLIT/ENGL 290 Masterpieces of Continental Fiction 3
- WLIT 300 The City in Literature 3
- WLIT/ENGL 368C Topics in Film 3
- WLIT 390 Topics in World Literature 3
- WLIT 399 Independent Study 1 - 3

Courses offered in a given semester with a French and Francophone Studies component are posted in Guilford House at registration time and on the French and Francophone Studies (http://www.case.edu/artscl/fr_studies) website.

### Study Abroad

Study abroad in France, Belgium, Switzerland, French Canada, the Francophone Caribbean, or a Francophone African or Middle Eastern country is strongly encouraged but not required for FFS majors. The Department of Modern Languages and Literatures offers a summer study abroad program in Paris (FRCH 308 The Paris Experience / WLIT 308 The Paris Experience) in even-numbered years. A summer study abroad program in Cameroon (FRCH 308 The Paris Experience / WLIT 308 The Paris Experience / ETHS 338 The Cameroon Experience) is offered in odd-numbered years. FRCH 208 The Montreal Experience is a spring break service-learning excursion to Montreal.

### Minor

The minor requires 15-17 credits. Students entering at the 200 level of language competence take:

- FRCH 201 Intermediate French I 4
- FRCH 202 Intermediate French II 4
- Three courses in FRCH from the approved list 9
- Total Units 17

At least 6 credits should be taken in disciplines other than FRCH.

Students entering at the 300 level of language competence take five courses at the 200 and 300 levels in FRCH and from the approved list. At least 3 credits should be in courses from FRCH taught in the French language, and at least 6 credits should be taken in disciplines other than FRCH.

### Program Advisory Committee

- Gilbert Doho, PhD
  Associate Professor, Department of Modern Languages and Literatures
- Laura E. Hengehold, PhD
  Associate Professor and Chair, Department of Philosophy
- Marie Lathers, PhD
  Elizabeth M. and William C. Treuhaft Professor of Humanities, Department of Modern Languages and Literatures
- Miriam R. Levin, PhD
  Professor, Department of History
- Cheryl Toman, PhD
  Associate Professor, Department of Modern Languages and Literatures
German Studies Program

In its reconstituted form, Germany has again become a major player in European and global affairs. Germany has always been considered important to European development—at various times it has been called the crossroads of the entire continent—but the economic might of modern Germany and the integration of the European Union have now made American understanding of German culture and civilization more important to—and worthy of study by—American students than at any time since 1945.

German Studies, an integrated program of study leading to the BA degree, offers students the freedom to develop an interdisciplinary sequence of courses to meet their particular needs and interests. It builds the foundation for graduate work in many academic fields that call for a thorough knowledge of German language, culture, and history. It also prepares students for careers in international business or for future study in professional programs such as law and business administration.

German Studies administers a summer immersion program, The Munich Experience, which allows students to spend four weeks in Munich and experience the city’s vibrant culture and breathtaking surroundings. After graduation, many German and German Studies majors (most of whom have a second major in another field) return to Germany to study or work. Our majors have returned to Germany on Fulbright scholarships, through internships administered by the Carl-Duisberg-Gesellschaft, or as interns for the German parliament.

Undergraduate Programs

Major

The major in German Studies, which includes a German language requirement, concentrates on the study of the German cultural tradition in history, philosophy, the fine arts, music, film studies, politics, and culture. The major is particularly suited to students wishing to combine interests in German language and culture with a major in another discipline.

The major requires 30 hours, to be distributed as follows:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>GRMN 303</td>
<td>German Culture &amp; Civilization</td>
<td>3</td>
</tr>
<tr>
<td>GRMN 311</td>
<td>Advanced Conversation</td>
<td>3</td>
</tr>
<tr>
<td>GRMN 396</td>
<td>Senior Capstone - German (or equivalent)</td>
<td>3</td>
</tr>
<tr>
<td>Twenty-one additional hours approved by one of the co-directors, with no more than 9 hours from any one department</td>
<td>21</td>
<td></td>
</tr>
</tbody>
</table>

Total Units 30

Possible concentrations for the German Studies major include history and philosophy; German literature and theater history; political science and history; art history; music history; and religious studies. Within the program requirements, students are free to shape the major as they wish, based on their own intellectual interests.

Minor

The course requirements for the minor (15 hours) are as follows:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>One of the following:</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>GRMN 303</td>
<td>German Culture &amp; Civilization</td>
<td></td>
</tr>
<tr>
<td>GRMN 311</td>
<td>Advanced Conversation</td>
<td></td>
</tr>
</tbody>
</table>

Four additional 300-level courses approved by one of the co-directors 12

Total Units 15

Program Faculty

Kenneth Ledford, PhD
Gerontological Studies Program

The Gerontological Studies Program is a multidisciplinary program designed to integrate research and theory from multiple disciplines about aging, old age, and the life course. Prompted in part by broad social and technological changes that include the “graying” of the world’s population, humanists, scientists, social scientists, and professionals have become interested in understanding the position of the aged in society, the aging process in various contexts, and the meaning of aging to individuals. The program draws on the most recent thinking and research in a variety of disciplines to provide students with a background that will be helpful after graduation, both in work and in graduate or professional school.

In keeping with the interdisciplinary nature of the program, the core courses are drawn from five departments: Anthropology, Psychological Sciences (Communication Sciences Program), History, Psychology, and Sociology. Students may choose from a variety of courses according to their own interests. Most of the electives are not specifically gerontology courses but cover topics that contribute to the understanding of aging and the aged. The perspectives gained in the core courses will provide the student with the background needed to relate the material in the more general courses to gerontological issues. The program is firmly grounded in the liberal arts and thus provides the student with the challenge to think and communicate effectively and to integrate diverse information, theories, and practice.

Gerontological Studies is an appropriate major or minor for students with a wide variety of career goals. The aging of the population has made available entry-level positions for persons with baccalaureate degrees in organizations that provide services to and formulate policy for the elderly. Many graduate programs now include an emphasis on aging for which a degree in Gerontological Studies would serve as a useful background. Students planning to pursue professional degrees will find that an increasing number of their clients or patients will be older adults and that problems with which they must deal will be related to the aged. The perspective provided by participating in the Gerontological Studies program provides students with excellent background in working with older populations.

Faculty members associated with the program are engaged in a variety of funded research projects. These include studies of Alzheimer’s disease; cancer survivorship; patterns of care for the urban elderly in China; visual perception changes that accompany aging; the impact of high levels of physical activity on the biological aging process; grandparent-grandchild relationships; and stress, coping, and adaptation among urban community and institutionalized elderly.

Undergraduate Programs

Major

The Gerontological Studies Program offers a major that leads to the Bachelor of Arts degree. However, it may be selected only as a second major, the first major being in a traditional academic department. The major consists of a minimum of 30 credits; 15 are in required core courses and 15 are in approved elective courses.

Required core courses:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANTH 304</td>
<td>Introduction to the Anthropology of Aging</td>
<td>3</td>
</tr>
<tr>
<td>COSI 345</td>
<td>Communication and Aging</td>
<td>3</td>
</tr>
<tr>
<td>PSCL 369</td>
<td>Adult Development and Aging</td>
<td>3</td>
</tr>
<tr>
<td>SOCI 369</td>
<td>Aging in American Society</td>
<td>3</td>
</tr>
<tr>
<td>SOCI 496</td>
<td>Public Policy and Aging</td>
<td>3</td>
</tr>
</tbody>
</table>

Any five of the following approved electives: 15

### Approved Electives

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANTH 215</td>
<td>Health, Culture, and Disease: An Introduction to Medical Anthropology</td>
<td></td>
</tr>
<tr>
<td>ANTH 318</td>
<td>Death and Dying</td>
<td></td>
</tr>
<tr>
<td>SOCI 269</td>
<td>Young and Old Face the 21st Century</td>
<td></td>
</tr>
<tr>
<td>SOCI 311</td>
<td>Health, Illness, and Social Behavior</td>
<td></td>
</tr>
<tr>
<td>SOCI 313</td>
<td>Sociology of Stress and Coping</td>
<td></td>
</tr>
<tr>
<td>SOCI 319</td>
<td>Sociology of Institutional Care</td>
<td></td>
</tr>
<tr>
<td>SOCI 370</td>
<td>Sociology of the Family</td>
<td></td>
</tr>
</tbody>
</table>

Total Units 30

Minor

At least two of the following 15

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANTH 304</td>
<td>Introduction to the Anthropology of Aging</td>
</tr>
<tr>
<td>COSI 345</td>
<td>Communication and Aging</td>
</tr>
<tr>
<td>PSCL 369</td>
<td>Adult Development and Aging</td>
</tr>
<tr>
<td>SOCI 369</td>
<td>Aging in American Society</td>
</tr>
</tbody>
</table>

Total Units 15

* Additional hours may be met by either (1) any three of the approved electives above, or (2) the remaining core courses above.

Graduate Certificate Program in Gerontology

University Center on Aging and Health
1420 Frances Payne Bolton School of Nursing
Phone: 368-2692; Fax: 216-368-6389
Diana L. Morris, PhD, RN, FAAN, FGSA, Executive Director
E-mail: diana.morris@case.edu

The University Center on Aging and Health (http://fpb.case.edu/Centers/UCAH/program.shtm) is dedicated to the premise that aging is a developmental process spanning the entire life cycle, and brings together social and behavioral sciences, health sciences, and the humanities to encourage teaching and research activities in every unit of the University. The Center sponsors a certificate program in gerontology for graduate and professional students and for those who already hold graduate degrees.

A student interested in a graduate certificate in gerontology must be enrolled in a master’s or doctoral program, or be a special non-degree student with at least a master’s degree (or equivalent). To receive a certificate in gerontology, a student must submit a formal application, be approved by the University Center on Aging and Health, and take 12 credit hours of course work.

The student must complete the following courses:

1. Two three-credit courses in gerontology within the student’s discipline, one of which can be an independent study.
2. One three-credit course in gerontology or independent study outside the student’s discipline.
3. A three-credit seminar in gerontology offered by the center.

Any departures from the requirements must be approved by the center director. For further information, contact the University Center on Aging and Health.

Program Faculty

Dale Dannefer, PhD
Selah Chamberlain Professor and Chair, Department of Sociology; Co-Director, Gerontological Studies Program

Gary T. Deimling, PhD  
Professor of Sociology; Co-Director, Gerontological Studies Program

T. J. McCallum, PhD  
Associate Professor, Department of Psychology

Courses

GERO 496. Public Policy and Aging. 3 Units.
Overview of aging and the aged. Concepts in the study of public policy. Policies on aging and conditions that they address. The politics of policies on aging. Emergent trends and issues. Offered as ANTH 498, BETH 496, EPBI 408, GERO 496, HSTY 480, MPHP 408, NURS 479, NURS 579, POSC 480, and SOCI 496.

GERO 498. Seminar in Gerontological Studies. 3 Units.
Major themes in gerontology. Seminar members choose a problem area, explore the relevant literature from a multi-disciplinary perspective, and develop a research project using knowledge gained through community observation and library exploration.

GERO 601. Independent Study. 1 - 3 Unit.
For students enrolled in the graduate certificate program in gerontology.
History and Philosophy of Science Program

The Department of Philosophy and the Department of History together offer an undergraduate major in the history and philosophy of science. The purpose of the major is to develop a humanistic understanding of the nature and development of science through the combined use of philosophical and historical methods. The major provides a foundation for graduate study in a range of academic disciplines and for careers in such areas as business, medicine, law, public policy, and science journalism. It also may be profitably combined with a program in one of the sciences. Within the major, a student may seek an emphasis on the philosophy of science, the history of the physical sciences, or the history of the biological and medically related sciences.

Undergraduate Programs

Major

The history and philosophy of science major requires 30 credit hours from courses in philosophy and in history of science and technology:

Any four of the following seven classes: 12

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHIL 101</td>
<td>Introduction to Philosophy</td>
</tr>
<tr>
<td>HSTY 151</td>
<td>Technology in European Civilization</td>
</tr>
<tr>
<td>HSTY 201</td>
<td>Science in Western Thought I</td>
</tr>
<tr>
<td>HSTY 202</td>
<td>Science in Western Thought II</td>
</tr>
<tr>
<td>HSTY/PHIL 203</td>
<td>Natural Philosophy I</td>
</tr>
<tr>
<td>PHIL 204/HSTY 207</td>
<td>Natural Philosophy II</td>
</tr>
<tr>
<td>PHIL 302</td>
<td>Modern Philosophy</td>
</tr>
</tbody>
</table>
| HSTY/PHIL 390 | Senior Research Seminars in History and Philosophy of Science | 3

Five electives approved by the major advisor 15

Total Units 30

Students who major in the history and philosophy of science are not permitted to take a second major in philosophy or to minor in philosophy.

Minor

Students who minor in history and philosophy of science are required to complete 15 credit hours, as follows:

Any three of the following five classes: 9

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHIL 101</td>
<td>Introduction to Philosophy</td>
</tr>
<tr>
<td>HSTY 202</td>
<td>Science in Western Thought II</td>
</tr>
<tr>
<td>HSTY/PHIL 203</td>
<td>Natural Philosophy I</td>
</tr>
<tr>
<td>HSTY 207/PHIL 204</td>
<td>Natural Philosophy II</td>
</tr>
<tr>
<td>PHIL 302</td>
<td>Modern Philosophy</td>
</tr>
</tbody>
</table>

Two electives approved by the minor advisor 6

Total Units 15

Department Faculty

Alan J. Rocke, PhD
*Henry Eldridge Bourne Professor of History; Director, History and Philosophy of Science Program*

James M. Edmonson, PhD
*Adjunct Associate Professor, Department of History; Director, Dittrick Medical History Center*

Chris Haufe, PhD
*Assistant Professor, Department of Philosophy*

Miriam R. Levin, PhD

Professor, Department of History
Colin McLarty, PhD
*Truman P. Handy Professor of Intellectual Philosophy*

Jonathan Sadowsky, PhD
*Theodore J. Castele Professor; Associate Professor, Department of History*
International Studies Program

The International Studies Program is a multidisciplinary program leading to the BA degree. Study in the program provides students with the ability to read beyond the headlines—to understand how world situations and events came about, how they fit into broader issues and systems, and how they might shape the future. To attain this goal, students are introduced to methods of conceptualizing international and global issues, and to the study of a society other than their own. They learn to think critically about contending and complementary methods and theories, developing an appreciation of both traditional disciplinary approaches and newer, cross-disciplinary approaches. Students also acquire skills in a language other than English (or other than their native language).

It is strongly recommended that all international studies students participate in at least one of several off-campus programs that facilitate the international perspective: study abroad, summer internships overseas or in Washington, D.C., or professional, practicum-type work experiences in Cleveland that involve an international context.

In addition to forming the basis for an evolving understanding of and lifelong engagement with the modern world, a background in international studies provides excellent, practical preparation for careers that deal with the world’s emerging needs. International studies majors go on to careers in international marketing and management, diplomatic service, health, law, social services, and journalism, as well as careers within the academic disciplines. The professional schools of business, medicine, nursing, law, and applied social sciences at Case Western Reserve all have significant international foci, and our students can explore careers in these areas during their undergraduate years. The skills, analytic abilities, and critical approaches of international studies should equip students as well for new employment patterns which may not fit into existing career descriptions.

Undergraduate Program

Major

The major in international studies requires a minimum of 33 credit hours, chosen from approved topical and area studies courses, plus satisfaction of a language competency requirement. Each student will prepare a program of study that includes course selections meeting the six area requirements below. Normally, no more than two courses taken for international studies credit may count simultaneously toward a minor or another major. Courses taken to satisfy the language competency requirement are exempted from this rule, and several international studies courses contribute to the completion of the Arts and Sciences General Education Requirements.

Requirements for the Major

1. Multidisciplinary Foundations (required courses; 12 hours). These courses provide an introduction to understandings of society and culture, principles of economics, change over time, and interactions among nations, while exposing students to a variety of world societies and issues. International studies majors will be expected to have completed the multidisciplinary foundations courses before embarking on a study abroad program. These courses are:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANTH 102</td>
<td>Being Human: An Introduction to Social and Cultural Anthropology</td>
<td>3</td>
</tr>
<tr>
<td>ECON 102</td>
<td>Principles of Microeconomics</td>
<td>3</td>
</tr>
<tr>
<td>HSTY 113</td>
<td>Introduction to Modern World History</td>
<td>3</td>
</tr>
<tr>
<td>PQSC 272</td>
<td>Introduction to International Relations</td>
<td>3</td>
</tr>
</tbody>
</table>

2. Area Focus (6 hours): Two courses that concentrate on a single geographic or cultural area. Examples include Africa, Asia, Europe, Latin America, and the Middle East.

3. Topical Focus (6 hours): A related pair of courses that provide a discrete perspective on global issues and foster an appreciation of complexity through the study of particular issues and the methods appropriate to them. Examples include pairs of courses dealing with ethnicity, international health, international economics, global and environmental analysis, or international relations. Cross-disciplinary approaches are encouraged.

4. Elective Area or Topical Courses (6 hours): Two additional courses within the topical and area studies course listings that provide students with an opportunity to experiment or to tailor their program toward particular interests in international or global issues, methodology, or other cultures.

5. Senior Colloquium (required course, 3 hours): In the fall semester of the senior year, students integrate prior topical and area foci in a colloquium (INTL 398 International Senior Colloquium) that involves the writing of a substantial research paper. Students select a topic and complete the research and writing under a faculty director's supervision. They obtain peer evaluation through regular sessions, supervised by the colloquium coordinator, at which they present their initial concepts, outlines, research, and drafts. Students will be expected to identify their faculty directors and topics by the end of their junior year. Exceptional papers (grade of A) may be considered for honors if the student has maintained a 3.3 overall GPA and a 3.7 GPA in international studies courses (area focus, topic focus, and electives).

6. Language Competency (0 to 16 credit hours): In addition to the 33 credit hours of international studies course work, students must demonstrate competency in a language other than their native language. This may be done by:

1. completing a language course at the 300 level or above
2. demonstrating to the Department of Modern Languages and Literatures a non-native language competency equivalent to that attained by completing a 300-level or above course
3. completing four semesters in a single language

The International Studies Program currently recognizes more than 150 courses from which students may choose to satisfy the area and topical foci requirements. Additional courses may be selected on the basis of individual student interest, in consultation with the director. Courses may also be selected from within existing area studies programs: Asian Studies, French and Francophone Studies, German Studies, and Japanese Studies.

There is no minor in international studies.

Faculty

Kelly McMann, PhD
(University of Michigan)
Associate Professor, Department of Political Science; Director, International Studies Program
Courses

INTL 396. International Independent Study. 1 - 3 Unit.
Study of a topic within the scope of international studies. The student must complete a prospectus form, approved and signed by the supervising faculty member, no later than the second week of classes. The prospectus must outline the goals of the project and the research methodology to be used and is part of the basis for grading. Open to juniors and seniors majoring in international studies.

INTL 398. International Senior Colloquium. 3 Units.
Individual work with a faculty tutor leading to the writing of a major research paper. Regular class sessions are supervised by the colloquium coordinator in which students present their initial concepts, outlines, research, and drafts. Open only to seniors majoring in international studies.
Japanese Studies Program

Today’s students find themselves in a world of increasingly multi-ethnic, multi-religious, multicultural contexts. Through a long history of receiving, reworking, and incorporating influences from nearby cultural centers on the Asian mainland and surrounding Pacific islands and from the world beyond, including Europe and the Americas, Japan has developed a tradition of multiculturalism—a tradition that is best understood through interdisciplinary study. Following this thread, the Japanese Studies Program seeks to foster the student’s global and interdisciplinary perspectives, while at the same time maintaining a flexibility that allows individuals to pursue their own areas of interest. To further foster the students’ linguistic and cultural development, the Japanese Studies Program strongly encourages study abroad in Japan for a year, a semester, or a summer.

Students may pursue a major or a minor in Japanese studies. The program offers a variety of courses to fulfill the requirements, ranging from five levels of the Japanese language to courses about Japanese cinema, literature, and pop culture. Besides these core courses, we encourage the student to take related courses in such interdisciplinary areas as Asian art, cinema, comparative literature of Japan and the West, Japanese religion and history, and international business. Taking advantage of the varied resources of the University and University Circle institutions, the Japanese Studies Program makes the study of Japanese culture an integral part of the student’s undergraduate education. Furthermore, the Japanese Studies Program provides an excellent foundation for graduate or professional school or for careers in international business and finance, careers involving technological or medical exchange, and careers in law, journalism, foreign service, or the arts.

Undergraduate Program

Major

The BA major in Japanese studies requires a minimum of 35 credit hours. For students beginning the major at the 200 level, the course requirements are as follows:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>JAPN 201</td>
<td>Intermediate Japanese I</td>
<td>4</td>
</tr>
<tr>
<td>JAPN 202</td>
<td>Intermediate Japanese II</td>
<td>4</td>
</tr>
<tr>
<td>JAPN 301</td>
<td>Advanced Japanese I</td>
<td>4</td>
</tr>
<tr>
<td>JAPN 302</td>
<td>Advanced Japanese II</td>
<td>4</td>
</tr>
<tr>
<td>JAPN 350</td>
<td>Contemporary Japanese Texts I</td>
<td>3</td>
</tr>
<tr>
<td>or JAPN 450</td>
<td>Japanese in Cultural Context I</td>
<td></td>
</tr>
<tr>
<td>JAPN 351</td>
<td>Contemporary Japanese Texts II</td>
<td>3</td>
</tr>
<tr>
<td>or JAPN 451</td>
<td>Japanese in Cultural Context II</td>
<td></td>
</tr>
<tr>
<td>JAPN 397</td>
<td>Senior Thesis I **</td>
<td>3</td>
</tr>
<tr>
<td>JAPN 398</td>
<td>Senior Thesis II **</td>
<td>3</td>
</tr>
<tr>
<td>Four Asian studies, world literature, or other related courses. ***</td>
<td>12</td>
<td></td>
</tr>
</tbody>
</table>

Total Units 40

* JAPN 450/451, if not taken as replacement(s) for JAPN 350/351, can be counted toward the four Asian studies, world literature, or other related courses.

** This course requires a substantial research paper in Japanese or English. Students are required to identify their faculty advisors and the topic of their paper by the end of the junior year. Exceptional papers may be considered for honors.

*** “Other related courses” may include courses in Japanese literature, film, theater, art history, anthropology, philosophy, religion, sociology, political science, or history.

Students beginning the major at the 300 level do not take JAPN 201 Intermediate Japanese I and JAPN 202 Intermediate Japanese II, but do take one “directed reading” in Japanese in an area related to their major research. All other requirements for the BA are the same.

Courses in other disciplines also form an important component of the Japanese Studies Program. They provide an international, as well as interdisciplinary, perspective on Japanese culture. A faculty advisor supervises each student’s selection of these courses.

In addition to the courses required for the major, the following courses are offered in the Japanese Studies Program:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>JAPN/WLIT 225</td>
<td>Japanese Popular Culture</td>
<td>3</td>
</tr>
<tr>
<td>JAPN/WLIT 255</td>
<td>Modern Japanese Literature in Translation</td>
<td>3</td>
</tr>
<tr>
<td>JAPN/WLIT 245</td>
<td>Classical Japanese Literature in Translation</td>
<td>3</td>
</tr>
<tr>
<td>JAPN/WLIT 345</td>
<td>Japanese Women Writers</td>
<td>3</td>
</tr>
<tr>
<td>JAPN/WLIT 355</td>
<td>Modern Japanese Novels and the West</td>
<td>3</td>
</tr>
<tr>
<td>JAPN 399</td>
<td>Independent Study</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-3</td>
</tr>
</tbody>
</table>

Program Honors

Exceptional papers written for the senior thesis may qualify for program honors. In addition, to qualify for the BA with honors in Japanese, students must achieve a minimum GPA of 3.5 in courses taken for the Japanese major.

Study Abroad

A year of study in Japan is highly recommended, as is additional study in another language. All efforts are made to grant appropriate credit for courses taken at a Japanese university during the year abroad.

Minor

For students beginning Japanese at the introductory level, the course requirements for the minor are as follows:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>JAPN 101</td>
<td>Elementary Japanese I</td>
<td>4</td>
</tr>
<tr>
<td>JAPN 102</td>
<td>Elementary Japanese II</td>
<td>4</td>
</tr>
<tr>
<td>JAPN 201</td>
<td>Intermediate Japanese I</td>
<td>4</td>
</tr>
<tr>
<td>JAPN 202</td>
<td>Intermediate Japanese II</td>
<td>4</td>
</tr>
<tr>
<td>One 300-level course</td>
<td></td>
<td>3</td>
</tr>
</tbody>
</table>

Total Units 19

For students beginning Japanese at the 200 level, the requirements for the minor are five courses at the 200 and 300 level, approved by a program director.

Program Faculty

Linda C. Ehrlich, PhD
Associate Professor, Department of Modern Languages and Literatures; Co-Director, Japanese Studies Program

Takao Hagiwara, PhD
Associate Professor, Department of Modern Languages and Literatures; Co-Director, Japanese Studies Program

Margaret M. Fitzgerald, MA
Lecturer, Department of Modern Languages and Literatures

Yoshiko Kishi, MA
Lecturer, Department of Modern Languages and Literatures
Aiko Ishii, MA  
Lecturer, Department of Modern Languages and Literatures

Program Advisory Committee

William E. Deal, PhD  
Severance Professor in the History of Religion, Department of Religious Studies

Courses

JAPN 101. Elementary Japanese I. 4 Units.  
Introduction to understanding, speaking, reading, and writing Japanese. Students learn to read and write hiragana and katakana syllabaries and approximately 100 kanji characters. Students are expected to achieve control of the aural comprehension and speaking.

JAPN 102. Elementary Japanese II. 4 Units.  

JAPN 201. Intermediate Japanese I. 4 Units.  
Further study of fundamental structures of Japanese. Students improve aural comprehension, speaking, reading, and writing abilities and learn approximately 100 new characters. Recommended preparation: JAPN 102 or equivalent.

JAPN 202. Intermediate Japanese II. 4 Units.  
Continuation of JAPN 201. Students learn an additional 100 kanji characters. With the completion of JAPN 201 - 202, students should have control of the fundamentals of modern Japanese and a firm foundation in the writing system. Recommended preparation: JAPN 201 or equivalent.

JAPN 225. Japanese Popular Culture. 3 Units.  
This course highlights salient aspects of modern Japanese popular culture as expressed in animation, comics and literature. The works examined include films by Hayao Miyazaki, writings by Kenji Miyazawa, Haruki Murakami and Banana Yoshimoto, among others. The course introduces students to essential aspects of modern Japanese popular culture and sensibility. Offered as JAPN 225 and WLIT 225.

JAPN 245. Classical Japanese Literature in Translation. 3 Units.  
Readings in English translation of classical Japanese poetry, essays, narratives, and drama to illustrate essential aspects of Japanese culture and sensibility before the Meiji Restoration (1868). Lectures explore the sociohistorical contexts and the character of major literary genres; discussions focus on interpreting the central images of human value within each period. Japanese sensibilities compared to and contrasted with those of Western and other cultures. Offered as JAPN 245 and WLIT 245.

JAPN 255. Modern Japanese Literature in Translation. 3 Units.  
Focus on the major genres of modern Japanese literature, including poetry, short story, and novel (shosetsu). No knowledge of Japanese language or history is assumed. Lectures, readings, and discussions are in English. Films and slides complement course readings. Offered as JAPN 255 and WLIT 255.

JAPN 301. Advanced Japanese I. 4 Units.  
Emphasizes conversational proficiency and reading. Students must use the course material offered by the Online Language Learning Center in addition to class meetings. Recommended preparation: JAPN 202 or equivalent.

JAPN 302. Advanced Japanese II. 4 Units.  
Continuation of JAPN 301; emphasizes conversational proficiency and reading. Japanese life and culture introduced through supplemental materials and activities. Students must use the course material offered by the Online Language Learning Center in addition to class meetings. Recommended preparation: JAPN 301 or equivalent.

JAPN 345. Japanese Women Writers. 3 Units.  
Contributions of women writers to the literature of pre-modern and modern Japan; investigations of how their works exemplify and diverge from "mainstream" literary practices. Emphasis on the social and cultural contexts of the texts. Offered as JAPN 345 and WLIT 345.

JAPN 350. Contemporary Japanese Texts I. 3 Units.  
The primary aim of this course is to develop communication skills in Japanese based on those that the students have acquired in JAPN 302 or equivalent. The students will read and discuss various texts such as daily conversations, essays, and news scripts with the assistance of vocabulary and kanji (Chinese character) lists and formal grammar explanations. Attention also will be given to enhancing the students' writing and aural/oral proficiencies through regularly assigned homework, presentations, tape listening, video viewing, and classroom discussion. Recommended preparation: JAPN 302 or equivalent.

JAPN 351. Contemporary Japanese Texts II. 3 Units.  
This course is a continuation of JAPN 350 and its primary aim overlaps with that of JAPN 350: to develop more sophisticated communication skills in Japanese. Students will read and discuss various texts such as daily conversations, essays, and news scripts largely with the assistance of vocabulary and kanji (Chinese character) lists. Attention will be given to enhancing the students' writing and aural/oral proficiencies through regularly assigned homework, presentations, tape listening, video viewing, and classrooms discussion. Prereq: JAPN 350 or consent of instructor.

JAPN 355. Modern Japanese Novels and the West. 3 Units.  
This course will compare modern Japanese and Western novels, drama, and novels. Comparisons will focus on the themes of family, gender and alienation, which subsume a number of interrelated sub-themes such as marriage, home, human sexuality, amae (dependence), innocence, experience, death, God/gods, and nature (the ecosystem). Offered as JAPN 355, WLIT 355.

JAPN 396. Senior Capstone - Japanese. 3 Units.  
The Senior Capstone in Japanese is an independent study project chosen in consultation with a capstone advisor. The capstone project should reflect both the student's interest within Japanese and the courses he or she has taken to fulfill the major. The project requires independent research using an approved bibliography and plan of action. In addition to written research, the student will also present the capstone project in a public forum that is agreed upon by the project advisor and the student. Prereq: Senior status required. Major in Japanese required.
JAPN 397. Senior Thesis I. 3 Units.
Intensive study of a literary, linguistic, or cultural topic with a faculty member, leading to the writing of a research paper in English or Japanese. Limited to senior majors. Permit required.

JAPN 398. Senior Thesis II. 3 Units.
Continuation of JAPN 397. Limited to senior majors. Prereq: JAPN 397.

JAPN 399. Independent Study. 1 - 3 Unit.
Directed study for students who have progressed beyond available course offerings.

JAPN 450. Japanese in Cultural Context I. 3 Units.
The primary aim of this graduate course is to develop sophisticated communication skills (listening, speaking, reading, and writing) in Japanese. The students will read and discuss various texts in the original, such as essays, news scripts, and literary works. Classroom instruction and discussion will be conducted in Japanese. The students also will be required to write a research paper of 4000-6000 letters/characters (10-15 genkoyoshi pages) in Japanese on a topic related to Japan and the student's specialty. Recommended preparation: JAPN 351 or equivalent.

JAPN 451. Japanese in Cultural Context II. 3 Units.
This course is a continuation of JAPN 450 and it aims at a further development of sophisticated communication skills (listening, speaking, reading, and writing) in Japanese. The students will read and discuss various texts in the original, such as essays, news scripts, and literary works both classical and modern. Classroom instruction and discussion will be conducted in Japanese. The students also will be required to write a research paper of 6000-8000 letters/characters (15-20 genkoyoshi pages) in Japanese on a topic related to Japan and the student's specialty. Recommended preparation: JAPN 450 or equivalent.
Judaic Studies Program

The Judaic Studies Program offers an interdisciplinary approach to the study of the history, religion, social experience, and culture of the Jewish people. By bringing a variety of fields and disciplines to bear on its subject, the program intends to convey to students the complex interaction of forces that create and express Jewish ethnic and religious identity. Students completing the program will have a broad knowledge of the field along with the tools necessary for continued study of Jewish civilization in all its manifestations.

Undergraduate Program

Minor

The minor consists of a minimum of five or six courses, according to the following scheme, to be chosen in consultation with the program director.

Required Courses:

A. Introduction to Judaic Studies
   JDST 201  Introduction to Judaic Studies  3

B. Nine additional credit hours of courses that have a JDST cross-listing. Alternatively, students may take six credit hours of JDST courses plus three credit hours from one course on the following list:
   ENGL 365E  The Immigrant Experience  9
   HBRW 201  Intermediate Modern Hebrew I  9
   HBRW 202  Intermediate Modern Hebrew II  9
   HBRW 301  Advanced Modern Hebrew I  9
   HBRW 302  Advanced Modern Hebrew II  9
   HBRW 399  Independent Studies  9
   HSTY 257  Immigrants in America  9
   POSC 370K  Nationalism, Ethnicity, and Religion in World Politics  9
   POSC 379  Introduction to Middle East Politics  9

C. Two semesters of Hebrew (HBRW 101 and HBRW 102).  8

Students who place out of the 100-level HBRW courses must take an additional course from B as specified above.

Total Units  20

Program Steering Committee

Peter J. Haas, PhD
Abba Hillel Silver Professor of Jewish Studies; Department of Religious Studies; Director, Judaic Studies Program

Yoram Daon, MBA
Lecturer, Department of Modern Languages and Literatures

Gilbert Doho, PhD
Associate Professor, Department of Modern Languages and Literatures

Jay Geller, PhD
Samuel Rosenthal Professor of Judaic Studies; Associate Professor, Department of History

Miriam Levin, PhD
Professor, Department of History

Sean Martin, PhD
Associate Curator, Jewish Archives, Western Reserve Historical Society; Lecturer, SAGES Program

Judith Neulander, PhD
Lecturer, Department of Religious Studies

Laura Tartakoff, JD
Instructor, Department of Political Science

Gillian Weiss, PhD
Associate Professor, Department of History

Joseph White, PhD
Luxenberg Family Professor of Public Policy, Professor of Epidemiology and Biostatistics, and Director of the Center for Policy Studies.

Program Faculty

Peter J. Haas, PhD
Abba Hillel Silver Professor of Jewish Studies, Department of Religious Studies; Director, Judaic Studies Program

Judith Neulander, PhD
Lecturer, Department of Religious Studies

Jay Geller, PhD
Samuel Rosenthal Professor of Judaic Studies; Associate Professor, Department of History

Yoram Daon, MBA
Lecturer, Department of Modern Languages and Literatures

Courses

JDST 201. Introduction to Judaic Studies. 3 Units.
An introduction to the academic study of Judaic religion and culture, this course does not presuppose any previous study of, or experience with, Judaism. The course takes an interdisciplinary approach, drawing on a variety of methods to examine the diverse issues that make up the current field of Judaic Studies. The course will examine the Jewish experience across time and space, and may include some "field" experience, such as a visit to a synagogue or to the Maltz Museum of Jewish Heritage. Required for the minor in Judaic Studies.

JDST 208. Introduction to Western Religions. 3 Units.
Basic introduction to the three great monotheistic religions of the Western World: Christianity, Judaism, and Islam. All three of these religious traditions trace their roots to the faith of biblical Israel as revealed by a series of prophets including Noah, Abraham, and Moses. Each absorbed the philosophy and science of the Greco-Roman world and went on both to influence and struggle with each other. Many of the religious problems of the contemporary world, from Afghanistan to the Middle East to Yugoslavia, can be traced to tension within and between these religious groups. Offered as RLGN 208 and JDST 208.

JDST 211. Great Books of Western Religion. 3 Units.
Students will engage with the major writings that have shaped Western religious traditions (Christianity, Judaism, Islam) from their earliest expressions until the present day. Readings include the foundational Scriptures (Hebrew Bible, New Testament, Quran) of each tradition, religious poetry and other writings from the Middle Ages, and modern writers on spiritually and religiousness within each of these traditions. The course will be conducted as a seminar, in which students will read the selected original texts and will discuss their religious and spiritual meaning and significance in class. Each student will also prepare a final project based on the assigned authors or readings. Offered as RLGN 211 and JDST 211.
JDST 218. Jews in Early Modern Europe. 3 Units.
This course surveys the history of Jews in Europe and the wider world from the Spanish expulsion through the French Revolution. Tracking peregrinations out of the Iberian Peninsula to the British Isles, France, Holland, Italy, Germany, Poland-Lithuania, the Ottoman Empire, and the American colonies, it examines the diverse ways Jews organized their communities, interacted with their non-Jewish neighbors, and negotiated their social, economic, and legal status within different states and empires. What role did Jews play and what symbolic place did they occupy during a period of European expansion, technological innovation, artistic experimentation, and religious and political turmoil? What internal and external dynamics affected Jewish experiences in the sixteenth, seventeenth, and eighteenth centuries? Through a selection of inquisitorial transcripts, government records, memoirs, and historical literature, we will explore topics such as persecution, conversion, messianism, toleration, emancipation, and assimilation. Offered as HSTY 218, JDST 218, and ETHS 218.

JDST 220. Jewish Traditional Art and Architecture. 3 Units.
Tradition and transformation in Jewish artistic expression over time and across space. Course will begin with biblical period and continue down to the present day in Israel and America. Examination of how concepts such as "Jewish" and "art" undergo change within the Jewish community over this period. Offered as ARTH 220 and JDST 220.

JDST 228. The Jewish Image in Popular Film. 3 Units.
Explores film as social practice for its makers and its audience from the silent era through Hollywood’s Golden Age, to the technological dazzle of the present day. Notes views of the Jews as stereotypical "Racial Other," not only capable of Jewish self-representation, but also capable of representing any group widely believed to be non-white, non-Christian or otherwise "alien." By studying select films in historical context, the course will trace changes in this stereotype. By the end of the semester, students will understand how film is shaped by, and how it actively shapes, our construction of American Selves vs. Ethnic Others.

JDST 231. Jews in the Modern World. 3 Units.
Investigation of the impact of modernity on the Jewish community. In particular, the course will examine the influence of the Emancipation and Enlightenment on the social situation of the Jews in Europe and America and the corresponding changes in Judaic religion, philosophy, social structure, and culture. Attention will be paid to the creation of a modern Jewish identity in the secular culture of the post-Modern world. Offered as HSTY 238, JDST 231, and RLGN 231.

JDST 233. Introduction to Jewish Folklore. 3 Units.
Exploration of a variety of genres, research methods and interpretations of Jewish folklore, from antiquity to the present. Emphasis on how Jewish folk traditions and culture give us access to the spirit and mentality of the many different generations of the Jewish ethnic group, illuminating its past and informing the direction of its future development. Offered as ANTH 233, RLGN 233, and JDST 233.

JDST 254. The Holocaust. 3 Units.
This class seeks to answer fundamental questions about the Holocaust: the German-led organized mass murder of nearly six million Jews and millions of other ethnic and religious minorities. It will investigate the origins and development of racism in modern European society, the manifestations of that racism, and responses to persecution. An additional focus of the course will be comparisons between different groups, different countries, and different phases during the Nazi era. Offered as HSTY 254, RLGN 254, ETHS 254, and JDST 254.

JDST 268. Women in the Bible: Ethnographic Approaches to Rite and Ritual, Story, Song, and Art. 3 Units.
Examination of women in Jewish and Christian Biblical texts, along with their Jewish, Christian (and occasionally Muslim) interpretations. Discussion of how these traditions have shaped images of, and attitudes toward, women in western civilization. Offered as RLGN 268, WGST 268, and JDST 268.

JDST 280. Religion and Politics in the Middle East. 3 Units.
An in-depth look at the relationship between politics and religion in the Middle East. Students will spend the first week on the CWRU campus and the last three weeks in Israel, where time will be divided between classroom teaching, guest lectures, and "field trips" to important sites. Students will have the opportunity to interact directly with members of the region's diverse religious groups within the political, social, and cultural contexts in which they live. A final research paper will be required. Knowledge of Hebrew is not necessary. Offered as JDST 280 and RLGN 280.

JDST 330. Classical Jewish Religious Thought. 3 Units.
The thought of some major biblical and Rabbinic writings and of the classic age of medieval Jewish philosophy. Offered as JDST 330, PHIL 332, and RLGN 330.

JDST 341. Jewish Urban History. 3 Units.
This course examines the relationship between Jews and the modern urban environment. It seeks to answer questions such as: How did the modernization of cities affect Jews and Jewish communities? In what ways did Jews contribute to modern urban cultural and social forms? What is Jewish urban space, is it unique, and how is it remembered later on? Are there differences between the patterns in Europe, the Middle East, and the Americas? Offered as HSTY 341 and JDST 341.

JDST 350. Jewish Ethics. 3 Units.
An exploration of Jewish moral and ethical discourse. The first half of the course will be devoted to studying the structure and content of classical Jewish ethics on issues including marriage, abortion, euthanasia, and social justice. Students will read and react to primary Jewish religious texts. The second half of the course will focus on various modern forms of Judaism and the diversity of moral rhetoric in the Jewish community today. Readings will include such modern thinkers as Martin Buber and Abraham Joshua Heschel. Offered as JDST 350, RLGN 350, and RLGN 450.

JDST 371. Jews under Islam and Christianity. 3 Units.
This course examines the social and political status of Jews under Muslim and Christian rule since the Middle Ages. Themes include interfaith relations, Islamic and Christian beliefs regarding the Jews, Muslim and Christian regulation of Jewry, and the Jewish response. Offered as HSTY 371, JDST 371 and RLGN 371.

JDST 389. History of Zionism. 3 Units.
This course seeks to elucidate the major strands of Zionism, their origins, how they have interacted, and their impact on contemporary Israeli society. These may include political Zionism, cultural Zionism, socialist (labor) Zionism, Revisionist Zionism, and religious Zionism. This course will also examine the differences in the appeal of Zionism to Jews in different places, such as Western Europe, Eastern Europe and the United States. Offered as HSTY 389 and JDST 389.
JDST 392. Independent Study. 1 - 3 Unit.
Up to three semester hours of independent study may be taken in a single semester.
Natural Sciences Program

The natural sciences major is an interdepartmental science program that leads to the Bachelor of Arts (BA) degree. It is intended to serve students whose interests and objectives call for a major in the humanities or social sciences (e.g., the major in history and philosophy of science) that is best accompanied by a broad background in the natural sciences.

Undergraduate Programs

Major

Natural sciences is available as a second major for the BA; the first major must be in a department or program within the arts, humanities, or social sciences, excluding the programs in American Studies, Environmental Studies, Gerontological Studies, and Pre-Architecture. For a student who completes a BS degree in management or accounting, natural sciences may serve as the sole major for the BA degree.

The program requires a minimum of 50 semester hours of work in natural sciences and mathematics. The departments included in the major are astronomy; biology; chemistry; earth, environmental, and planetary sciences; and physics. The student must complete a minimum of 20 hours in one of these departments, a minimum of 8 hours each in two of the other departments, and 3 hours each in the remaining two departments. In addition, all natural sciences majors must complete:

<table>
<thead>
<tr>
<th>One of the following sequences:</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 125 &amp; MATH 126</td>
<td>Math and Calculus Applications for Life, Managerial, and Social Sci I and Math and Calculus Applications for Life, Managerial, and Social Sci II</td>
</tr>
<tr>
<td>MATH 121 &amp; MATH 122</td>
<td>Calculus for Science and Engineering I and Calculus for Science and Engineering II</td>
</tr>
</tbody>
</table>

Total Units: 6

The courses used to satisfy the natural sciences major should be courses that would satisfy requirements of an existing science major. However, any 200-level or higher astronomy course is acceptable for the natural sciences major.

Minor

A minor is achieved through completion of the requirements listed below in any four of the six participating departments.

Astronomy

One of the following sequences:

| ASTR 201 | The Sun and its Planets (& Any other 200-level ASTR course) |
| ASTR 221 & ASTR 222 | Stars and Planets and Galaxies and Cosmology |

Total Units: 6

Biology

Two of the following sequences:

| BIOL 214 & 214L | Genes, Evolution and Ecology and Genes, Evolution and Ecology Lab |
| BIOL 215 & 215L | Cells and Proteins and Cells and Proteins Laboratory |
| BIOL 216 & 216L | Development and Physiology and Development and Physiology Lab |

Total Units: 8

Chemistry

One of the following sequences: 8-10

| CHEM 105 | Principles of Chemistry I |
| & CHEM 106 | and Principles of Chemistry II |
| & CHEM 113 | and Principles of Chemistry Laboratory |
| CHEM 111 | Principles of Chemistry for Engineers |
| & CHEM 113 | and Principles of Chemistry Laboratory |
| & ENGR 145 | and Chemistry of Materials |

Total Units: 8-10

Earth, Environmental, and Planetary Sciences

One of the following:

| EEPS 101 | The Earth and Planets |
| EEPS 110 | Physical Geology |
| EEPS 115 | Introduction to Oceanography |
| EEPS 117 | Weather and Climate |
| EEPS 119 | Geology Laboratory |

One additional EEPS course: 3

Total Units: 19

Mathematics

One of the following sequences: 8

| MATH 125 & MATH 126 | Math and Calculus Applications for Life, Managerial, and Social Sci I and Math and Calculus Applications for Life, Managerial, and Social Sci II |
| MATH 121 & MATH 122 | Calculus for Science and Engineering I and Calculus for Science and Engineering II |

Total Units: 8

Physics

One of the following sequences: 8-11

| PHYS 115 | Introductory Physics I |
| & PHYS 116 | and Introductory Physics II |
| PHYS 121 | General Physics I - Mechanics |
| & PHYS 122 | and General Physics II - Electricity and Magnetism |
| & PHYS 221 | and Introduction to Modern Physics |

Total Units: 8-11
Nutrition

The College of Arts and Sciences awards the Bachelor of Arts and Bachelor of Science degrees in nutrition and nutritional biochemistry and metabolism. The required courses for the majors and minor are offered by the Department of Nutrition in the School of Medicine. For details about the department’s undergraduate programs, please consult the Department of Nutrition (p. 751) section of this bulletin.
Public Policy Program

A minor in public policy is available to undergraduates in the College of Arts and Sciences and in the economics and management programs in the Weatherhead School of Management. The course requirements are in four categories: the public policy process; economic analysis; policy or political institutions or history; and a specific policy field. Courses are listed in the "Undergraduate" section (see link above). Substitutions can be made under exceptional circumstances, at the discretion of the program director.

Undergraduate or graduate courses with public policy content are offered through the Departments of Anthropology, Earth, Environmental and Planetary Sciences, History, Political Science, and Sociology in the College of Arts and Sciences; through the Department of Economics and other departments in the Weatherhead School of Management; through the School of Law, the School of Medicine, and the Frances Payne Bolton School of Nursing; and through the Mandel School of Applied Social Sciences. Students can engage with policy issues both through courses and through the extracurricular programming of the Center for Policy Studies and other university bodies.

Undergraduate Programs

Minor

<table>
<thead>
<tr>
<th>One of the following:</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>POSC 386</td>
<td>Making Public Policy</td>
</tr>
<tr>
<td>POSC 383</td>
<td>Health Policy and Politics in the United States</td>
</tr>
<tr>
<td>POSC 306</td>
<td>Interest Groups in the Policy Process</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>The following:</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECON 102</td>
<td>Principles of Microeconomics</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>One of the following:</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>HSTY 256</td>
<td>American Political History</td>
</tr>
<tr>
<td>HSTY 400</td>
<td>Graduate Topical Seminar</td>
</tr>
<tr>
<td>POSC 308</td>
<td>The American Presidency</td>
</tr>
<tr>
<td>POSC 310</td>
<td>The Legislative Process</td>
</tr>
<tr>
<td>POSC 323</td>
<td>Judicial Politics</td>
</tr>
<tr>
<td>POSC 384</td>
<td>Ethics and Public Policy</td>
</tr>
<tr>
<td>POSC 385</td>
<td>U.S. Bureaucratic Politics</td>
</tr>
</tbody>
</table>

Two courses on a particular field of public policy * 6

Total Units 15

* Selected with the approval of the program director. A list of courses that have been approved in the past is available on the Public Policy Program’s Web site (http://www.case.edu/artsci/public_policy/specialization.html).

Program Advisory Committee

Joseph White, PhD
Luxenberg Family Professor of Public Policy and Chair, Department of Political Science; Director, Center for Policy Studies; Director, Public Policy Program

Brian Gran, PhD, JD
Associate Professor, Department of Sociology

David C. Hammack, PhD
Hiram C. Haydn Professor of History

Susan Helper, PhD
AT&T Professor of Regional Economic Development, Department of Economics, Weatherhead School of Management
Teacher Licensure Program

Teacher Licensure programs are offered in Art Education and Music Education at the undergraduate (Bachelor of Science) and graduate (Master of Arts) levels. A unique feature of these programs is that each is offered in cooperation with a University Circle Institution—the Cleveland Institute of Art and the Cleveland Institute of Music.

In addition, several departments within the College of Arts and Sciences (Biology, Chemistry, Classics, English, History, Mathematics, and Physics) participate in the Case Western Reserve University/John Carroll University Collaborative Program to prepare students for state licensure. Bachelor of Arts degrees in these departments are awarded by Case Western Reserve University, and licensure is recommended by John Carroll University.

Teacher Licensure programs at Case Western Reserve University are accredited by the Teacher Education Accreditation Council (TEAC) and the Ohio Department of Education, and lead to teaching licenses recognized by more than 40 states. In addition, the National Association of Schools of Music (NASM) accredits the music education program.

Undergraduate Programs

Ohio Teacher Education Programs

Teacher Education may be chosen as a second major by students whose primary major is in a field in which Case Western Reserve has teacher licensure agreements with John Carroll University and programs approved by the Ohio Department of Education. The teacher education major requires 36 credit hours in professional education, 12-18 hours taken at Case Western Reserve and 18-24 hours taken at John Carroll University.

Adolescence/Young Adult teacher licensure is available in integrated language arts, integrated social studies, mathematics, integrated life sciences, chemistry, and physics. In addition, the program offers dual-field licensure in physical science, which includes both chemistry and physics, to students pursuing the BA in either discipline. For information concerning specific subject area requirements, go to the departmental descriptions for Biology (p. 184), Chemistry (p. 209), English (p. 239), History (p. 256), Mathematics (p. 275), and Physics (p. 330).

The education course requirements are as follows:

1. Courses at Case Western Reserve University (18 hours):

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSCL 101</td>
<td>General Psychology I (prereq for EDUC 304)</td>
<td>3</td>
</tr>
<tr>
<td>EDUC 255</td>
<td>Literacy Across the Content Areas</td>
<td>3</td>
</tr>
<tr>
<td>EDUC 301</td>
<td>Introduction to Education</td>
<td>3</td>
</tr>
<tr>
<td>EDUC 304</td>
<td>Educational Psychology</td>
<td>3</td>
</tr>
<tr>
<td>EDUC 338</td>
<td>Seminar and Practicum in Adolescents</td>
<td>3</td>
</tr>
<tr>
<td>EDUC 386</td>
<td>Introduction to Instructional Technology</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total Units</strong></td>
<td></td>
<td><strong>18</strong></td>
</tr>
</tbody>
</table>

2. Courses at John Carroll University (18 hours)

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDJC 337</td>
<td>Adolescent Education Special Methods</td>
<td>3</td>
</tr>
<tr>
<td>EDJC 427</td>
<td>Adolescent Education Special Topics</td>
<td>3</td>
</tr>
<tr>
<td>EDJC 405C</td>
<td>Adolescent Education Seminar</td>
<td>3</td>
</tr>
<tr>
<td>EDJC 444C</td>
<td>Adolescent Student Teaching</td>
<td>9</td>
</tr>
<tr>
<td><strong>Total Units</strong></td>
<td></td>
<td><strong>18</strong></td>
</tr>
</tbody>
</table>

Students must maintain a 3.0 GPA in all professional education courses, a 2.7 GPA in the specific content area, and a cumulative overall GPA of 2.5 to be recommended for Ohio teacher licensure.

As noted above, Case Western Reserve University also offers teacher licensure programs in Art Education and Music Education at the undergraduate (Bachelor of Science) and graduate (Master of Arts) levels. For further information on Art Education, see the Department of Art History and Art description in this bulletin (p. 160); for Music Education, see the Department of Music description (p. 307).

Program Faculty

Denise K. Davis, Ed.D
Lecturer, Department of Music; Director of Teacher Education
William I. Bauer, PhD
Associate Professor, Department of Music
David Bellini, MA
Lecturer, Department of Music
Educational Psychology
Jared Bendis, MA
Adjunct Lecturer, Department of Art History and Art
Gary Ciepluch, PhD
Associate Professor, Department of Music
Judy Flamik, BA
Lecturer, Department of Art History and Art; University Supervisor
Art Education
Matthew Garrett, PhD
Assistant Professor, Department of Music
Kathleen Horvath, PhD
Associate Professor, Department of Music
Lisa L. Koops, PhD
Assistant Professor, Department of Music
Sandra Noble, MA
Lecturer, Department of Art History and Art; University Supervisor
Art Education
Tim Shuckerow, MA
Director of Art Education and Art Studio

EDJC Courses

EDJC 255. Literacy Across the Curriculum. 3 Units.
Literacy development examined through psychological, socio-cultural and historical perspectives. Examines reading as an interactive, problem-solving process. Strategies that foster critical thinking, active engagement and social interaction in the teaching of reading and writing across the curriculum. Includes field experience. Field assignments related to licensure and content area. Recommended preparation: EDUC 301, EDUC 304, and EDUC 338.

EDJC 308. Modern Languages; Teaching Languages. 3 Units.
In this course, students will acquire a basic understanding of how languages are constructed, learn about the theoretical underpinnings of teaching foreign languages, practice and evaluate the application of these theories, and reflect on their own development as a language learner and future educator. Prereq: EDUC 301, and EDUC 304, and EDUC 386.
EDJC 337. Adolescent Education Special Methods. 3 Units.
For Adolescent and Multi-Age licensure program students. General methods and specific content area methods for planning, implementing and integrating curriculum, evaluating pupil achievement, and teaching to individual differences. Aligned with Ohio Department of Education’s Competency-Based Models, Praxis 2, INTASC, and learned Society Guidelines. Emphasis given to strategies related to effective teaching and learning in each licensure content area. Additional emphasis placed on nurturing a risk-taking classroom community responsive both to high standards of performance and to students with diverse backgrounds, abilities, and learning styles. Prereq: EDJC 186 and EDUC 301 and EDUC 304 and EDUC 338.

EDJC 395. Independent Study in Education. 1 - 3 Unit.
Independent Study in Education is offered for students with special interests and/or commitments that are not fully addressed in other education courses and who wish to work independently.

EDJC 405C. Adolescent Education Seminar. 3 Units.

EDJC 405D. Multi-Age Education Seminar. 3 Units.
Continued study of all grades’ development, learner achievement, and assessment. Integrates program learning with student teaching experience. Development of the professional portfolio and preparation for job interviewing. Coreq: EDJC 444D and admission to the professional semester.

EDJC 427. Adolescent Education Special Topics. 3 Units.
Practical application of issues to pre-student teaching field setting. Taken by adolescent licensure program students the semester preceding student teaching. Issues of conflict negotiation, social justice, curriculum development and school reform as they relate to the secondary school setting. Prereq: Acceptance into pre-student teaching.

EDJC 444C. Adolescent Student Teaching. 9 Units.
A full-day, full-semester teaching in an accredited secondary school under the direction of a classroom teacher qualified in the content area and a university supervisor. Supervision includes personnel with advanced training in the relevant content area. Lab fee required. Coreq: EDJC 405C and admission to the professional semester.

EDJC 444D. Multi-Age Student Teaching. 9 Units.
A full-day, full-semester experience of teaching in an accredited secondary school under the direction of a classroom teacher qualified in the content area and a university supervisor. Supervision includes personnel with advanced training in the relevant content areas. Lab fee required. Coreq: EDJC 405D and admission to the professional semester.

EDUC Courses

EDUC 255. Literacy Across the Content Areas. 3 Units.
Literacy Across the Content Areas is a three semester hour course on the teaching of reading and writing in the content areas that include instruction in organizing instruction (creating effective units and lessons), use of protocols for oral language development (including strategies for English as Second Language learners), and strategies for word skill development, reading comprehension and assessment for instructional purposes. Students will also explore new literacies that include the ability to learn, comprehend, and interact with technology in a meaningful way. Integral to the course is an eight hour field experience in a local high school. Federal legislation pertaining to the education of children with disabilities as well as Ohio Graduation Tests in content areas requirements are included.

EDUC 301. Introduction to Education. 3 Units.
The historical, sociological, and philosophical role of education in a diverse society. Contemporary practices and issues are introduced, researched, and debated. Issues of professional development. Application of research to instructional methodologies. Clinical/Field experiences required. Research project required for graduate students. Offered as EDUC 301 and EDUC 401.

EDUC 304. Educational Psychology. 3 Units.

EDUC 325. Seminar in Teaching I. 2 Units.
EDUC 325--Seminar in Teaching I is one of two courses designed to be an introduction to the profession of teaching in the high school setting, especially math and science teachers. The course will consist of weekly guided observations in a local high school classroom under the mentorship of a master teacher, and monthly discussions with the course instructor, the master teacher, a CWRU content-area faculty member, and other "reflective triads" enrolled in the course. Students must enroll in both EDUC 325 and EDUC 326, but may take them in either order. Prereq: EDUC 301.

EDUC 326. Seminar in Teaching II. 2 Units.
EDUC 326--Seminar in Teaching II is one of two courses designed to be an introduction to the profession of teaching in the high school setting, especially math and science teachers. The course will consist of weekly guided observations in a local high school classroom under the mentorship of a master teacher, and monthly discussions with the course instructor, the master teacher, a CWRU content-area faculty member, and other "reflective triads" enrolled in the course. Students must enroll in both EDUC 325 and EDUC 326, but may take them in either order. Prereq: EDUC 301.
EDUC 338. Seminar and Practicum in Adolescents. 3 Units.
Supervised field placement and attendance in early childhood, child, and adolescent settings including preschools, schools, hospitals, and neighborhood centers. This class is used to fulfill requirements by the Ohio Department of Education teacher licensure program. Recommended preparation: PSCL 101, EDUC 301, EDUC 304, and permission of program director. Offered as EDUC 338, PSCL 338, and SOCI 338.

EDUC 386. Introduction to Instructional Technology. 3 Units.
This course is designed to address the basic technology skills, which are required of all teachers. The course uses both concept and project based learning activities. Each of the projects is centered on a set of activities designed to allow students to demonstrate a particular subset of competencies. The course will not always provide step by step directions for completing projects; instead it will promote the use of existing information and help resources to allow students to develop the ability to learn new technology independently. Each of the projects will also contain the opportunity for the student to reflect on how technology impacts their teaching. Course projects are designed to assess both a basic comfort level with learning and using technology tools and the student’s ability to apply technology to improve teaching and learning. The nature of the course is a mix of technology and should engage teachers in thinking about ways to improve their teaching. Offered as EDUC 386 and EDUC 486.

EDUC 395. Independent Study in Education. 1 - 3 Unit.
Independent Study in Education is offered for students with special interests and/or commitments that are not fully addressed in other education courses and who wish to work independently. Offered as EDUC 395 and EDUC 495.

EDUC 401. Introduction to Education. 3 Units.
The historical, sociological, and philosophical role of education in a diverse society. Contemporary practices and issues are introduced, researched, and debated. Issues of professional development. Application of research to instructional methodologies. Clinical/Field experiences required. Research project required for graduate students. Offered as EDUC 301 and EDUC 401.

EDUC 404. Educational Psychology. 3 Units.

EDUC 486. Introduction to Instructional Technology. 3 Units.
This course is designed to address the basic technology skills, which are required of all teachers. The course uses both concept and project based learning activities. Each of the projects is centered on a set of activities designed to allow students to demonstrate a particular subset of competencies. The course will not always provide step by step directions for completing projects; instead it will promote the use of existing information and help resources to allow students to develop the ability to learn new technology independently. Each of the projects will also contain the opportunity for the student to reflect on how technology impacts their teaching. Course projects are designed to assess both a basic comfort level with learning and using technology tools and the student’s ability to apply technology to improve teaching and learning. The nature of the course is a mix of technology and should engage teachers in thinking about ways to improve their teaching. Offered as EDUC 386 and EDUC 486.

EDUC 495. Independent Study in Education. 1 - 3 Unit.
Independent Study in Education is offered for students with special interests and/or commitments that are not fully addressed in other education courses and who wish to work independently. Offered as EDUC 395 and EDUC 495.
Washington Study Program

The Washington Study Program provides students with the opportunity to complete a full-time, research-intensive internship in Washington, D.C. By participating in a semester-length program during the fall or spring (WASH 2A Washington Center Internship), students earn 9 credit hours; for a summer internship (WASH 2D Washington Center Summer Internship), they earn 3 credit hours. In addition, students earn 3 credit hours by developing a portfolio based on their internship experiences (WASH 2C Washington Center - Portfolio). The credits earned can be counted as general electives or applied to a student’s major or minor, with the prior consent of the individual department(s). Finally, as part of the Washington Study Program, students participate in a seminar and attend a weekly lecture/discussion group (WASH 2B Washington Center - Politics and Public Policy Course).

To be eligible for the program, a student is expected to be a junior or senior and have at least a 3.0 GPA. The program director, the student’s major advisor, and the appropriate dean must approve each application. Students must ensure that their participation will not prevent them from meeting on-campus residency or other university requirements.
Women's and Gender Studies Program

The goal of the Women's and Gender Studies Program is to educate students in interdisciplinary approaches to feminist theories of women, gender, culture, and society. Students are exposed to a variety of forms of critical thinking in relation to:

1. the social construction of knowledge and philosophy
2. approaches to science and medicine informed by "feminist empiricism" and "feminist standpoint" theories
3. historicized and cross-cultural accounts of gender and gender inequality
4. literary criticism
5. contemporary theories of art, performance, language, jurisprudence, social science, and religion in the context of women's experience
6. studies of the body as a focal point for theorizing relations among the arts and sciences

Women's and Gender Studies is an interdisciplinary program that prepares students to think critically and creatively within a framework employing gender as a central category of analysis. The program is set up to test and challenge the technologies and limitations of gender roles in a multitude of cultural and historical settings. It is designed to familiarize students with the analytical and hermeneutic tools of research and interpretation, and to create awareness of the ethical, political, and aesthetic dimensions of gender in history and culture.

Undergraduate Program

Major

The Women’s and Gender Studies Program offers a major leading to the Bachelor of Arts degree. The program offers a sound course of study with a disciplinary concentration grounding the program’s interdisciplinary objectives. Up to six credit hours in required or elective courses for another major may also be applied to the Women’s and Gender Studies major. In the two required courses, students become fluent in current tools of research and interpretation employed in women’s and gender studies. These two "core" courses are 201 and one from the list below:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>WGST 201</td>
<td>Introduction to Gender Studies</td>
<td>3</td>
</tr>
<tr>
<td>WGST 301</td>
<td>Women, Creativity and the Arts</td>
<td>3</td>
</tr>
<tr>
<td>WGST 318</td>
<td>History of Black Women in the U.S.</td>
<td>3</td>
</tr>
<tr>
<td>WGST 326</td>
<td>Gender, Inequality, and Globalization</td>
<td>3</td>
</tr>
<tr>
<td>WGST 353</td>
<td>Women in American History I</td>
<td>3</td>
</tr>
<tr>
<td>WGST 365</td>
<td>Gender and Sex Differences: Cross-cultural Perspective</td>
<td>3</td>
</tr>
<tr>
<td>ENGL/PHIL/RLGN 270</td>
<td></td>
<td>3</td>
</tr>
</tbody>
</table>

Elective courses: WGST majors must distribute their courses among the Arts, Humanities, and Social Sciences. They must take at least one course in each of these three areas. In two of the areas, they must take two courses. Consult one of the program’s academic representatives with questions about the curriculum. Majors and minors in WGST may also conduct an Independent Study (WGST 399) and/or a SAGES Capstone (WGST 396) with program faculty.

Total Units: 27

Minor

Fulfillment of the minor requires completion of 18 credit hours according to the following course distribution:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>WGST 201</td>
<td>Introduction to Gender Studies</td>
<td>3</td>
</tr>
<tr>
<td>Five approved electives</td>
<td></td>
<td>15</td>
</tr>
</tbody>
</table>

Total Units: 18

To help ensure a comprehensive course of study in a particular area of interest, each student’s combination of courses and the structure of an independent study must be approved by one of the program’s academic representatives.

Program Faculty

Athena Vrettos, PhD
Associate Professor, Department of English; Academic Representative, Women's and Gender Studies Program

Cheryl Toman, PhD
Associate Professor, Department of Modern Languages and Literatures; Academic Representative, Women's and Gender Studies Program

Eileen Anderson-Fye, EdD
Assistant Professor, Department of Anthropology

Karen Beckwith, PhD
Flora Stone Mather Professor, Department of Political Science

Diana Bilimoria, PhD
Professor, Department of Organizational Behavior, Weatherhead School of Management

Joy Bostic, PhD
Assistant Professor, Department of Religious Studies

Susan S. Case, PhD
Associate Professor, Department of Organizational Behavior, Weatherhead School of Management

M. Gabriela Copertari, PhD
Associate Professor, Department of Modern Languages and Literatures

Elina Gertsman, PhD
Assistant Professor, Department of Art History and Art

Mary Grimm, MA
Associate Professor, Department of English

Susan W. Hinze, PhD
Associate Professor, Department of Sociology

Margaretmary Daley, PhD
Associate Professor, Department of Modern Languages and Literatures

Gilbert Doho, PhD
Associate Professor, Department of Modern Languages and Literatures

Kimberly K. Emmons, PhD
Associate Professor, Department of English

Christopher Flint, PhD
Associate Professor, Department of English

T. Kenny Fountain, PhD
Assistant Professor, Department of English

Atwood D. Gaines, PhD
Professor, Department of Anthropology

Anne Helmreich, PhD
Associate Professor, Department of Art History and Art

Laura E. Hengehold, PhD
Associate Professor, Department of Philosophy
Jill Korbin, PhD  
Professor, Department of Anthropology

Ellen G. Landau, PhD  
Andrew W. Mellon Professor of the Humanities, Department of Art History and Art

Marie Lathers, PhD  
Elizabeth M. and William C. Treuhaft Professor of Humanities, Department of Modern Languages and Literatures

Miriam Levin, PhD  
Professor, Department of History

Michelle McGowan, PhD  
Assistant Professor, Department of Bioethics, School of Medicine

Colin McLarty, PhD  
Truman P. Handy Professor of Philosophy; Department of Philosophy

Jacqueline C. Nanfito, PhD  
Associate Professor, Department of Modern Languages and Literatures

Jonathan Sadowsky, PhD  
Theodore J. Castele Professor; Associate Professor, Department of History

Renee M. Sentilles, PhD  
Associate Professor, Department of History

Thrity Umrigar, PhD  
Professor, Department of English

Rhonda Y. Williams, PhD  
Associate Professor, Department of History

Martha Woodmansee, PhD  
Professor, Department of English

Courses

WGST 201. Introduction to Gender Studies. 3 Units.  
This course introduces women and men students to the methods and concepts of gender studies, women’s studies, and feminist theory. An interdisciplinary course, it covers approaches used in literary criticism, history, philosophy, political science, sociology, anthropology, psychology, film studies, cultural studies, art history, and religion. It is the required introductory course for students taking the women’s and gender studies major. Offered as ENGL 270, HSTY 270, PHIL 270, RLGN 270, SOCI 201, and WGST 201. Prereq: ENGL 150 or passing letter grade in a 100 level first year seminar in USFS, FSCC, FSNA, FSSO, FSSY, FSTS, FSCS.

WGST 207. Women and Religion. 3 Units.  
Examination of feminist perspectives on religion, such as the status of women in Western and non-Western religions, the nature and purpose of religious beliefs and practices from the standpoints of religious and non-religious feminists, the current status of feminist philosophies of religion, and the efforts of feminists to transform traditional religions and to create new religions. Offered as RLGN 207 and WGST 207.

WGST 222. Gender in U.S. Society. 3 Units.  
The focus of this course is on unique and convergent experiences of men and women in U.S. society. Different social expectations and opportunities encountered by men and women in the context of marriage and the family, work settings, and in informal organizations will be addressed. Legislation and social policy dealing with gender issues will be considered. Offered as SOCI 222 and WGST 222.

WGST 228. Sociology of Sexuality. 3 Units.  
This course analyzes the issues of sex and sexuality from a sociological point of view. It is centered on the notion that what we consider to be ‘normal’ or ‘natural’ about sex and sexuality is, in reality, socially constructed. One’s viewpoint on the issues surrounding sexuality are influenced by the social context in which they live, as opposed to the purely biological viewpoint that presupposes some sense of normalcy or naturalness regarding sexual relations. A range of topics will be covered, including readings that discuss the variations of sexuality and the notions of sexual “deviance” in order to explore the cultural and societal variation that exists along the lines of gender, race, ethnicity, sexual orientation, age and disability. Offered as SOCI 228 and WGST 228.

WGST 268. Women in the Bible: Ethnographic Approaches to Rite and Ritual, Story, Song, and Art. 3 Units.  
Examination of women in Jewish and Christian Biblical texts, along with their Jewish, Christian (and occasionally Muslim) interpretations. Discussion of how these traditions have shaped images of, and attitudes toward, women in western civilization. Offered as RLGN 268, WGST 268, and JDST 268.

WGST 301. Women, Creativity and the Arts. 3 Units.  
WGST 301/ETHS 301 is one of two core courses for the program in Women’s and Gender Studies and an elective course for the ETHS minor. All WGST majors are to take one course concentrating on the subject of women and the arts specifically. This course also fulfills the cultural diversity requirement. In this course, students will focus on two areas of study: a) women and creativity and b) women and activism through the arts. A history of women in the arts will be covered, but the general focus of the course is on women in the arts since the 1960s in particular, and on art that reflects or provokes social change. “Arts” are defined in the broadest of sense. That is, students will study women’s production in painting, photography, graphic design, sculpture, dance, film, music, and theater. A variety of learning techniques will be applied: Students will look at feminist theories on art, be introduced to the notion of cyberfeminism, study actual artwork and its reproductions, understand the role of are in feminist activism and how women "create” differently from men, and work closely with several feminist artists/ activists through various programs on campus and the community in order to facilitate the planning and carrying out of artistic production. Subsequently, students will interact with children in Cleveland schools in conjunction with these artists giving master classes, and be exposed to art exhibits abroad through videoconferencing with the Algerian Cultural Center in Paris and locally through University Circle Institutions. Offered as WGST 301 and ETHS 301.
WGST 312. Women in the Ancient World. 3 Units.
The course offers a chronological survey of women's lives in Greece, Hellenistic Egypt, and Rome. It focuses on primary sources as well as scholarly interpretations of the ancient record with a view to defining the construction of gender and sexuality according to the Greco-Roman model. Additionally, the course aims to demonstrate how various methodological approaches have yielded significant insights into our own perception of sex and gender. Specific topics include matriarchy and patriarchy; the antagonism between male and female in myth; the legal, social, economic, and political status of women; the ancient family; women's role in religion and cult; ancient theories of medicine regarding women; pederasty and homosexuality. Offered as CLSC 312 and WGST 312.

WGST 315A. International Bioethics Policy and Practice: Women's Health in the Netherlands. 3 Units.
This 3-credit course allows students to familiarize themselves with social policies and practices related to women's health in the United States and the Netherlands. Issues covered in the course include birth control and family planning, abortion, prenatal testing, childbirth, health care disparities, cosmetic surgery, prostitution and trafficking in women. This course also addresses the US and Dutch national policies regarding the public provision of health care for women. The course places an emphasis on the ways in which social norms shape policies over time, which political actors are involved in shaping women's health policy, and the balance between women's health as a matter of the public good or individual responsibility. This course substantively explores gender-specific cultural values and practices in relation to women's health in the United States and the Netherlands and will help students develop the analytical skills necessary for evaluating social policy and ethical issues related to women’s health. Offered as BETH 315A and BETH 415A.

WGST 318. History of Black Women in the U.S.. 3 Units.
Chronologically arranged around specific issues in black women's history organizations, participation in community and political movements, labor experiences, and expressive culture. The course will use a variety of materials, including autobiography, literature, music, and film. Offered as ETHS 318, HSTY 318, and WGST 318.

WGST 325. Philosophy of Feminism. 3 Units.
Dimensions of gender difference. Definition of feminism. Critical examination of feminist critiques of culture, including especially politics, ideology, epistemology, ethics, and psychology. Readings from traditional and contemporary sources. Offered as PHIL 325 and PHIL 425 and WGST 325.

WGST 326. Gender, Inequality, and Globalization. 3 Units.
Using a sociological perspective, this course examines how major societal institutions, including the economy, polity, medicine, religion, education and family, are structured to reproduce gendered inequalities across the globe. Attention is given to the intersections of race/ethnicity, social class, gender and sexuality in social systems of power and privilege. Of critical importance is how gender figures in the relationship between Economic North and Economic South countries. We will elucidate how gender norms vary by culture and exert profound influence on the daily, lived experiences of women and men. The course will be informed by recent scholarship on feminism, women’s movements, and globalization. Offered as SOCI 326 and WGST 326. Prereq: SOCI 101 or permission of program director.

WGST 335. Women in Developing Countries. 3 Units.
This course will feature case studies, theory, and literature of current issues concerning women in developing countries primarily of the French-speaking world. Discussion and research topics include matriarchal traditions and FGM in Africa, the Tunisian feminist movement, women, Islam, and tradition in the Middle East, women-centered power structures in India (Kerala, Pondicherry), and poverty and women in Vietnam, Laos, and Cambodia. Guest speakers and special projects are important elements of the course. Seminar-style format, taught in English, with significant disciplinary writing in English for WGST, ETHS, and some WLIT students, and writing in French for FRCH and WLIT students. Writing assignments include two shorter essays and a substantial research paper. Offered as ETHS 335, FRCH 335, WLIT 335, WGST 335, FRCH 435 and WLIT 435.

WGST 339. Black Women and Religion. 3 Units.
This course is an exploration of the multidimensional religious experiences of black women in the United States. These experiences will be examined within particular historical periods and across diverse social and cultural contexts. Course topics and themes include black women and slave religion; spirituality and folk beliefs, religion and feminist/womanist discourse, perspectives on institutional roles, religion and activism, and spirituality and the arts. Offered as: ETHS 339 and RLGN 338 and WGST 339.

WGST 342. Latin American Feminist Voices. 3 Units.
Examination of the awakening of feminine and feminist consciousness in the literary production of Latin American women writers, particularly from the 1920s to the present. Close attention paid to the dominant themes of love and dependency; imagination as evasion; alienation and rebellion; sexuality and power; the search for identity and the self-preservation of subjectivity. Readings include prose, poetry, and dramatic texts of female Latin American writers contributing to the emerging of feminist ideologies and the mapping of feminist identities. Offered as SPAN 342, SPAN 442, ETHS 342, WGST 342, WLIT 342, and WLIT 442.

WGST 343. Language and Gender. 3 Units.
This course introduces students to the study of language and gender by exploring historical and theoretical trends, methods, and research findings on the ways gender, sexuality, language, and discourse interact with and even shape each other. Topics may include "grammatical" versus "biological" gender, feminine écriture, the women and language debate, speech acts and queer performativity, nonsexist language policy, discourses of gender and sexuality, feminist stylistics, and LGBT sociolinguistics. Offered as: ENGL 343, ENGL 443, and WGST 343. Prereq: ENGL 150 or passing letter grade in a 100 level first year seminar in USFS, FSCC, FSNA, FSSO, FSSY, FSTS, FSCS.
WGST 346. Women and Politics. 3 Units.
Women and Politics involves a critical examination of the impact of gender on the forms and distributions of power and politics, with primary reference to the experience of women in the United States. Major concerns of the course include what we mean by "sex," "gender," and "politics"; the relationship between women and the state; how women organize collectively to influence state policies; and how the state facilitates and constrains women's access to and exercise of political power. The course is organized around four foci central to the study of women and politics. The first section of the course focuses on what we mean by "women," "gender," and "politics." In this section, we will consider how these concepts intersect and the ways in which each may be used to deepen our understanding of the workings of governments and political systems, and of women's relative political powerlessness. The second section of the course employs these concepts to understand the (re)emergence of the US feminist movement, its meanings, practices, and goals, and its transformation across US political history. In the third section, we turn to conventional electoral politics, focusing on women's candidacies, their campaigns, and women's voting behavior. In the final section of the course, we consider those general factors that might provide for increased gender equality and improved life status for women, in global, comparative perspective. Offered as POSC 346 and POSC 446 and WGST 346.

WGST 352. African Feminisms. 3 Units.
This course traces the history of African feminism from its origins within traditions through to a more contemporary theoretical analysis of gender, marriage, and motherhood seen from a Afrocentric perspective. Approaches studied are those that pertain to anthropology, history, literature, sociology, and culture. African feminist theory of scholars such as Filomina Steady, Cheikh Anta Diop, Buchi Emecheta, Iyi Amadiume, Oyeronko Oyewumi, and Calixthe Beyala will be studied and there will be some comparative analysis of Western theories to show how African feminisms are clearly distinct. Theories on these feminisms will be presented, and in the process, students will look at cases of women in Cameroon, Nigeria, Ghana, Kenya, and Senegal. It is commonly believed that African women were defined for a long time according to constructs of Western anthropology. This course will thus look at social institutions such as woman-to-woman marriage, matriarchy, and various women's rituals in order to identify African constructs of gender, family, kinship, marriage, and motherhood. Offered as ETHS 352 and WGST 352.

WGST 353. Women in American History I. 3 Units.
The images and realities of women's social, political, and economic lives in early America. Uses primary documents and biographers to observe individuals and groups of women in relation to legal, religious, and social restrictions. Offered as HSTY 353, WGST 353, and HSTY 453.

WGST 354. Women in American History II. 3 Units.
With HSTY 353, forms a two-semester introduction to women's studies. The politics of suffrage and the modern woman's efforts to balance marriage, motherhood, and career. (HSTY 353 not a prerequisite.) Offered as HSTY 354, WGST 354, and HSTY 454.

WGST 363. Gender in America. 3 Units.
Gender is the term used to describe the social characteristics attributed to the different sexes by the larger contextual society. This social and cultural history seminar allows students to explore various constructions of masculine and feminine identity in America between the late 18th century and the end of the 20th century. This is a multicultural course using a mixture of historical texts, gender theory, and personal biography to explore changing notions of gender (and with it sexuality, race, and religion) over time in the United States. Offered as HSTY 363, HSTY 463 and WGST 363.

WGST 365. Gender and Sex Differences: Cross-cultural Perspective. 3 Units.
Gender roles and sex differences throughout the life cycle considered from a cross-cultural perspective. Major approaches to explaining sex roles discussed in light of information from both Western and non-Western cultures. Offered as ANTH 365 and ANTH 465 and WGST 365.

WGST 370. Women in Organizations. 3 Units.
The purpose of this course is to explore the unique challenges of life for women in their twenties as they increase understanding of the issues surrounding women, ambition, and success in a variety of organizations and professions. At this stage of life there are many choices women can make regarding careers and relationships. This course will broaden understanding of the context of work in women's lives and help women and men understand the leadership and managerial issues that will surround them in organizations. Offering more complex understandings of issues women face in the workplace related to race and gender, the course will help increase self knowledge about personal identity and direction, values, and abilities including the enhancement of leadership capabilities. It will also facilitate career development, improving the ability of individual women to be choiceful about the quality of integration of both a personal and professional life. Offered as ORBH 370 and WGST 370.

WGST 372. Work and Family: U.S. and Abroad. 3 Units.
Covers the impact on human lives of the interface between work and family; the different ways gender structures the experience of work and family depending upon racial and ethnic background, social class, age, and partner preference; the impact of historical context on work-family experiences; work-family policies in the United States and other countries. Offered as SOCI 372, WGST 372, and SOCI 472.

WGST 373. Advanced Topics in American Women's History. 3 Units.
This advanced seminar is designed to allow students to investigate aspects of American women's history that are not deeply explored in other courses. The two central purposes of the course are to move students forward in their study of American women's history and to provide advanced study for graduate students and other students interested in women-focused topics. The topic is subject to change, but may be any of the following or something similar: women and medicine, images of women in popular culture, growing up female, women and political movements, women and war, etc. Recommended preparation: HSTY 353/453 or HSTY 354/454. Offered as HSTY 373, WGST 373, and HSTY 473.

WGST 383. Gender Issues in Feminist Art: The 20th/21st Century. 3 Units.
An in-depth thematic approach to issues affecting works of art by and about women. Focus on the late 20th century. Emphasis on a specifically modern use of feminine myths, subjects and modes of production, and feminist criticism. Offered as ARTH 383, WGST 383 and ARTH 483.
WGST 396. SAGES Capstone. 3 Units.
Capstone experience in the fields of Women’s and Gender Studies for an in-depth, independent project of particular interest to the student. Students are strongly encouraged to work with a WGST program faculty member, but some projects may be supervised by faculty in other areas or by other qualified professionals. All capstones require a WGST faculty advisor’s approval of the proposal prior to registration. Open to juniors and seniors majoring in Women’s and Gender Studies. Prereq: WGST 201; Junior or Senior standing with major/minor in WGST.

WGST 399. Independent Study. 1 - 3 Unit.
Independent research project in the fields of Women’s and Gender Studies. Project proposals must be approved by a WGST faculty advisor. Students are strongly encouraged to work with a WGST program faculty member, but some projects may be supervised by faculty in other areas for by other qualified professionals with a WGST faculty advisor’s approval. Credit varies with the scope and depth of the project. Prereq: WGST 201.
World Literature Program

World literature is a discipline that draws together literatures and cultures of a wide variety of countries and regions, including Western and non-Western ones. It emphasizes literatures and cultures of the past (ancient Greece and Rome, for example) as well as the present. It understands "minority" or "third world" literatures as being just as worthy of study as European literatures, and it recognizes the importance of the "classics" of both the West and the East.

The World Literature Program offers comparative courses as well as courses on individual authors, periods, and literatures. The major in world literature requires study in a language other than English, thus emphasizing that literature and language are intimately related. Students learn to examine literature from a truly multi-cultural and multi-lingual standpoint, and they become conversant in the major schools of literary criticism and theory.

In addition, students in the program take courses that investigate visual arts, film, and music. These courses reflect a belief that literature and the arts must be in permanent dialogue, and they provide students with an interdisciplinary perspective in which cultural history and aesthetic history necessarily coexist.

The World Literature Program is associated with several departments in the College of Arts and Sciences, including classics, cognitive science, modern languages and literatures, philosophy, history, and religious studies.

Apart from the major and minor undergraduate specializations, the World Literature Program recently created an interdisciplinary master’s program. See the “Graduate” page for details.

Undergraduate Programs

Major

The World Literature Program offers a major leading to the Bachelor of Arts degree. Requirements for the major are as follows:

Required Courses:

- WLIT 211 World Literature I 3
- WLIT 212 World Literature II 3
- One of the following: 3
  - ENGL/WLIT 290 Masterpieces of Continental Fiction
  - ENGL/WLIT 291 Masterpieces of Modern Fiction
- One of the following: 3
  - WLIT/CLSC 203 Gods and Heroes in Greek Literature
  - WLIT/CLSC 204 Heroes and Hustlers in Latin Literature
  - ENGL/WLIT 387 Literary and Critical Theory
- Two courses in literature at the 300 level in a language other than English 6
- WLIT 390 Topics in World Literature 3
- Twelve hours of electives 12

Total Units 33

All literature courses at the 200 and 300 levels offered by the Departments of Modern Languages and Literatures, Classics, and English are approved as world literature courses.

Undergraduate Honors

The honors program in world literature is for especially talented and dedicated majors. Requirements for honors are: 1) a GPA of at least 3.5 in the major, and 2) an honors thesis completed over the course of two semesters in the senior year, devoted to the investigation of a literary or cultural topic. Honors students enroll in WLIT 397 Honors Thesis I and WLIT 398 Honors Thesis II and write their thesis under the supervision of a WLIT faculty advisor. The thesis must be approved by a second faculty member and receive a grade of B or better. Students who qualify receive their degrees "with Honors in World Literature." A registration/proposal form for students electing honors must be completed by the end of the second week of classes in each of the two semesters.

Minor

The minor in world literature requires:

Required Courses:

- WLIT 211 World Literature I 3
- WLIT 212 World Literature II 3
- Nine credits of electives chosen in consultation with a program advisor 9

Total Units 15

BA in Classics: Classical Tradition Concentration

Students interested in world literature may also be interested in the new Classical Tradition Concentration, one of three tracks for a BA in Classics. For course information, please visit the Department of Classics page (p. 216).

Graduate Program

The interdisciplinary MA program in world literature offers tuition waivers and teaching assistant stipends to qualified students. Created in 2009, the program has ties with many other departments in the College of Arts and Sciences, including classics, modern languages and literatures, cognitive science, history, and philosophy. Interested students are invited to consult the program director.

Program Director

Florin Berindeanu, PhD
Instructor, Department of Classics; Director, World Literature Program

Steering Committee

Antonio Candau, PhD
Associate Professor, Department of Modern Languages and Literatures
Sarah Gridley, MFA
Assistant Professor, Department of English
Takao Hagiwara, PhD
Associate Professor, Department of Modern Languages and Literatures
William Siebenschuh, PhD
Professor, Department of English
Timothy Wutrich, PhD
Visiting Assistant Professor, Department of Classics

Courses

WLIT 203. Gods and Heroes in Greek Literature. 3 Units.
This course examines major works of Greek literature and sets them in their historical and cultural context. Constant themes are war, wandering, tyranny, freedom, community, family, and the role of men and women within the household and the ancient city-state. Parallels with modern life and politics will be explored. Lectures and discussions. Offered as CLSC 203 and WLIT 203.
WLIT 204. Heroes and Hustlers in Latin Literature. 3 Units.
This course constitutes the second half of a sequence on Classical literature. Its main themes are heroism vs. self-promotion, love vs. lust, and the struggle between democracy and tyranny. These topics are traced in a variety of literary genres from the period of the Roman republic well into the empire. Parallels with modern life and politics will be drawn. Offered as CLSC 204 and WLIT 204.

WLIT 211. World Literature I. 3 Units.
Survey of literature from antiquity to 1600. May include Western and non-Western texts by Homer, Vergil, Ovid, St. Augustine, Dante, Boccaccio, Rabelais, Cervantes, Sei Shonagon, Basho, and the Baghavad Gita.

WLIT 212. World Literature II. 3 Units.
Survey of literature from 1600 to present. May include Western and non-Western texts by Swift, Voltaire, Rousseau, Tolstoi, Baudelaire, Austen, Mann, Kafka, Lispector, Marmon Silko, Soyinka.

WLIT 220. Art & Literature in the Classical Tradition, Pt 1: Renaissance and Baroque (14th to 17th centuries). 3 Units.
Through lectures, varied assignments, and visits to the Cleveland Museum of Art this course will introduce students to the major issues in the study of early modern art and literatures. The emphasis will inevitably be on Italy, as the place where the physical remains of ancient Rome confronted and inspired such remarkable masters as Michelangelo (as poet and artist), Palladio, Gian Lorenzo Bernini, Nicholas Poussin (Bernini and Poussin are represented in the CMAI), though some artists -- notably Leonardo -- resisted the lure of the classical past. From Italy new ideas spread to the rest of Europe and beyond. We will not have much time to study Shakespeare in the course, but we will not be able to ignore the greatest author of the Renaissance period. Like Shakespeare, we will move between the court and the city, between scenes of often-endangered order and scenes of sometimes-productive disorder, in which classical models provided a key cultural and even psychological resource in challenging times. Recommended preparation: CLSC 112. Offered as CLSC 220 and WLIT 220.

WLIT 222. Classical Tradition 2: Birth of Archaeology. 3 Units.
The course will focus on the history of diverse methods for studying societies remote in time and space; i.e., on the formation of the distinct disciplines of archaeology and anthropology, and the interest in the origins of human society and cultural practices. The birth of archaeology occurred in the context of the profound transformation of European cultural life in the eighteenth century, the era of the Enlightenment. On the basis of a range of cultural productions (literary and historical texts, objects of luxury and use, etc.), we will study visual and literary works and consider the relationship between different modes of artistic production and expression, as well as the marketing and display of prestigious objects, whether ancient or modern. We will consider the eighteenth-century model of experiential education, the "Grand Tour," and the formation of private and public collections, as well as the emergence of the museum as institution. Finally, we will also consider important recent work on the relationship between the production of luxury commodities (sugar, coffee, tea, etc.) through the plantation economy in the Americas and beyond and the development of attitudes and ideas in Europe. Offered as CLSC 222 and WLIT 222.

WLIT 224. Sword and Sandal: The Classics in Film. 3 Units.
Gladiator. Alexander. The 300. Contemporary society's continuing fascination with putting the ancient world on the big screen is undeniable; and yet the causes underlying this phenomenon are not quite so readily apparent. In this course we will watch and discuss a number of movies about the ancient world, running the gamut from Hollywood classics such as Ben-Hur and Spartacus to more recent treatments (the aforementioned 300 and Gladiator, for starters), and from the mainstream and conventional (Clash of the Titans, Disney's Hercules) to the far-out and avant-garde (Fellini's Satyricon, anyone?). As we do so we'll learn quite a bit about the art and economics of film, on one hand, and the ancient world, on the other. And yet what we'll keep coming back to are the big questions: what does our fascination with the ancient Mediterranean tell us about ourselves as a society? Why do such movies get made, and what kinds of agendas do they serve? To what extent can we recapture the past accurately? And if we can't, are we doomed to just endlessly projecting our own concerns and desires onto a screen, and dressing them in togas? No knowledge of ancient languages is required for this course. Offered as CLSC 224 and WLIT 224.

WLIT 225. Japanese Popular Culture. 3 Units.
This course highlights salient aspects of modern Japanese popular culture as expressed in animation, comics and literature. The works examined include films by Hayao Miyazaki, writings by Kenji Miyaazawa, Haruki Murakami and Banana Yoshimoto, among others. The course introduces students to essential aspects of modern Japanese popular culture and sensibility. Offered as JAPN 225 and WLIT 225.

WLIT 228. Development of Theater: Beginnings to English Renaissance. 3 Units.
THTR 228/World Literature 228 explores the foundations of theater in Western civilization, beginning with Greece and then charting and analyzing the developments in playwriting, design, acting, and theater architecture. Students read a wide variety of plays in order to obtain a comprehensive understanding of the history of the art form, but also learn how theater has played an integral societal function as a medium of political, economic, and cultural commentary. Development of Theater I explores developments from Aeschylus to the English Renaissance. Offered as THTR 228 and WLIT 228. Prereq: Sophomore standing.

WLIT 229. Development of Theater: Renaissance to Romanticism. 3 Units.
THTR 229 explores the many developments in playwriting, design, acting, and theater architecture across the world. Students read a wide variety of plays in order to obtain a comprehensive understanding of the history of the art form, but also learn how theater has played an integral societal function as a medium of political, economic, and cultural commentary. Development of Theater II not only explores the development of theatrical conventions in Spain, England, Italy, France and other European countries that lead to the creation of modern drama, but the course also offers an in-depth look at the history and conventions of theater in India, Korea, China, and Japan. Offered as THTR 229 and WLIT 229. Prereq: Sophomore standing.

WLIT 235. Asian Cinema and Drama. 3 Units.
Introduction to major Asian film directors and major traditional theatrical schools of India, Java/Bali, China, and Japan. Focus on the influence of traditional dramatic forms on contemporary film directors. Development of skills in cross-cultural analysis and comparative aesthetics. Offered as ASIA 235 and WLIT 235.
WLIT 245. Classical Japanese Literature in Translation. 3 Units.
Readings, in English translation, of classical Japanese poetry, essays, narratives, and drama to illustrate essential aspects of Japanese culture and sensibility before the Meiji Restoration (1868). Lectures explore the sociohistorical contexts and the character of major literary genres; discussions focus on interpreting the central images of human value within each period. Japanese sensibilities compared to and contrasted with those of Western and other cultures. Offered as JAPN 245 and WLIT 245.

WLIT 255. Modern Japanese Literature in Translation. 3 Units.
Focus on the major genres of modern Japanese literature, including poetry, short story, and novel (shōsetsu). No knowledge of Japanese language or history is assumed. Lectures, readings, and discussions are in English. Films and slides complement course readings. Offered as JAPN 255 and WLIT 255.

WLIT 285. The Francophone World. 3 Units.
A survey of the imaginative literatures in a variety of genres from the Spanish-speaking world, including texts authored by Hispanics living in the United States. The selections will help students gain a greater understanding and appreciation of the impact and adaptation of Spanish language and culture among widely diverse populations of the world over the past centuries. Counts towards Spanish major as related course. No knowledge of Spanish required. Offered as SPAN 285 and WLIT 285.

WLIT 290. Masterpieces of Continental Fiction. 3 Units.
Major works of fiction from the 19th century and earlier. Offered as ENGL 290 and WLIT 290.

WLIT 291. Masterpieces of Modern Fiction. 3 Units.
Major works of fiction of the 20th century. Offered as ENGL 291 and WLIT 291.

WLIT 295. The Francophone World. 3 Units.
The course offers an introduction to the Francophone World from a historical, cultural, and literary perspective. The Francophone World includes countries and regions around the globe with a substantial French-speaking population (and where French is sometimes, but not always, an official language): North America (Louisiana, Quebec, and Acadia); North Africa (Tunisia, Morocco, Algeria, and Egypt); the Middle-East (Lebanon, Syria); the Caribbean (Martinique, Guadeloupe, Haiti); Southeast Asia (Vietnam); and Europe (France, Belgium, Switzerland, and Luxembourg). FRCH 295 provides a comprehensive overview of the Francophone World, while focusing on a particular area or areas in any given semester. Offered as ETHS 295, FRCH 295, and WLIT 295.

WLIT 300. The City in Literature. 3 Units.
Focus on major cities of the world as catalysts and reflections of cultural and historical change. Interdisciplinary approach utilizing the arts, literature, social sciences. Examples include Berlin at the turn of the century; Paris in literature and film; Tokyo in history and literature. Offered as WLIT 300 and WLIT 400.

WLIT 305. The Paris Experience. 3 Units.
Three-week immersion learning experience living and studying in Paris. The focus of the course is the literature and culture of the African, Arab, and Asian communities of Paris. Students spend a minimum of fifteen hours per week visiting cultural centers and museums and interviewing authors and students about the immigrant experience. Assigned readings complement course activities. Students enrolled in FRCH 308/408 have the option of completing coursework in English. Graduate students have additional course requirements. Offered as FRCH 308, WLIT 308, FRCH 408, and WLIT 408.

WLIT 314. Love Poetry from Sappho to Shakespeare. 3 Units.
Introduction to the love poetry of ancient Greece and Rome and its impact on the later European tradition in such poets as Petrarch, Chaucer, and Shakespeare. Readings will focus especially on questions of generic convention, audience expectation, and the social setting of love poetry in the different ages under consideration. No knowledge of the original languages required. Offered as CLSC 314 and WLIT 314.

WLIT 315. Mysticism and Literature. 3 Units.
This co-taught seminar will explore and compare mystical elements in selected literary and theoretical works from the West and the East. Comparisons will focus on a number of interrelated sub-themes such as mind, language, alienation, innocence, experience, life, death, cosmogony, cosmology, good, evil, God/gods, and nature (the ecosystem). Offered as WLIT 315, WLIT 315, MLIT 415 and WLIT 415.

WLIT 316. Greek Tragedy. 3 Units.
This course provides students the opportunity to read a significant number of ancient Greek tragedies in modern English translations. We shall read, study, and discuss selected works by Aeschylus, Sophocles, and Euripides, and attempt to understand the plays as literature composed for performance. We shall study literary elements within the plays and theatrical possibilities inherent in the texts. As we read the plays, we shall pay close attention to the historical context and look for what each play can tell us about myth, religion, and society in ancient Athens. Finally, we shall give occasional attention to the way these tragic dramas and the theater in which they were performed have continued to inspire literature and theater for thousands of years. Lectures will provide historical background on the playwrights, the plays, the mythic and historical background, and possible interpretation of the texts as literature and as performance pieces. Students will discuss in class the plays that they read. The course has three examinations and a final project that includes a short essay and a group presentation. Offered as CLSC 316, WLIT 316, WLIT 416.
WLIT 317. Erotic Literature Ancient to Modern. 3 Units.
The erotic drive is a fundamental impulse in human beings, indeed in the animal world in general. Primordially, the erotic find expression in sexual desire and in associated behaviors, which in antiquity -- as in other myth-oriented cultures -- accounts to a production of poetry to aid in seduction, to praise an object of desire, or simply reflect the nature of love and/or sexual desire in general. Highly sexualized language appears in both ancient and modern texts that take into account a variety of foundational texts in Western culture. From Plato, who wrote a whole dialogue (Symposium) describing different kinds of love, to Christian interpreters of sacred texts, eroticism was a term that defined both pagan and religious experiences. This course will explore fictional as well as theoretical inquiries into the nature and purpose of erotic desire and its evaluation as aesthetic phenomenon. It will focus on texts such as Longus’s Daphnis and Chloe, Abelard’s Letters, Aucassin and Nicolette, mystical voices, Freudian theory and modern contribution such as Roland Barthes and Georges Bataille. Modern theoreticians as those mentioned here illustrate how the libidinal (whether understood as subjective drive or in Freudian terms) is inseparable from the aesthetic. Offered as: CLSC 315 and WLIT 317.

WLIT 319. Inspiration: The Topic of Creativity in Art and Literature--Ancient to Medieval. 3 Units.
Inspiration is an inextricably essential part of the aesthetic genesis, and it has instantly become one of the most frequented themes of artistic creation. Where does inspiration come from? Are artists “chosen ones” that implicitly stand out from the “non-inspired” rest? Trying to answer these questions and others related to the phenomenon of creativity, one direction that this course should take and focus on is the theme of “divine” or “transcendent” as a source of inspiration in art and literature. The course will start with the mystical teaching and theories of Pythagoras that influenced Plato and the Neo-Platonists that will be carried on further in the general tradition of Christian literature. In this respect, the course will examine creativity in readings that include both Ancient and Medieval writers whose writings place the subject of inspiration at the center of their own aesthetic invention. Among the authors included in the course will be Pseudo-Dionysius, Gregory Palamas, Jacopone da Todi, Caterina da Siena, Dante, Petrarch, and Meister Eckhart. Offered as: CLSC 317 and WLIT 319.

WLIT 320. Epic: The Sublime and Terrible in Literature. 3 Units.
The course focuses on the epic genre that dominates the dawn of Western literature as well as the literary traditions of much of the rest of the world. From the Homeric epic to the Middle Ages and deep into the Renaissance, there was a collective urge to record both in verse and in prose extraordinary adventures with exceptional heroes as central figures. Thus, the epic genre typically encouraged variations in the aesthetic treatment of the hero that eventually came to define distinct categories within the genre. “Sublime” and “terrible” are common notions in the aesthetics of classicism, from antiquity to the early modern period. Authors studied in the course include such key figures in the creation and development of epic as Homer, Virgil, Ovid, Gottfried von Strassburg, Dante, and Cervantes. The works of these authors exemplify, on the one hand, the aesthetic directions mentioned above and, on the other hand, provide opportunities for using the close engagement with particular texts to illuminate wider cultural fields, in which various aesthetic perceptions of social, political, and religious reality coexist and therefore stimulate remarkable innovations in the standard epic narrative. Offered as CLSC 319, CLSC 419, WLIT 320 and WLIT 420.

WLIT 335. Women in Developing Countries. 3 Units.
This course will feature case studies, theory, and literature of current issues concerning women in developing countries primarily of the French-speaking world. Discussion and research topics include matriarchal traditions and FGM in Africa, the Tunisian feminist movement, women, Islam, and tradition in the Middle East, women-centered power structures in India (Kerala, Pondicherry), and poverty and women in Vietnam, Laos, and Cambodia. Guest speakers and special projects are important elements of the course. Seminar-style format, taught in English, with significant disciplinary writing in English for WGST, ETHS, and some WLIT students, and writing in French for FRCH and WLIT students. Writing assignments include two shorter essays and a substantial research paper. Offered as ETHS 335, FRCH 335, WLIT 335, WGST 335, FRCH 435 and WLIT 435.

WLIT 338. The Cameroon Experience. 3 Units.
Three-week immersion learning experience living and studying in Cameroon. The focus of the course is the culture, literature, and language of Francophone Cameroon, with some emphasis on Anglophone Cameroon. Students spend a minimum of fifteen hours per week visiting cultural sites and attending arranged courses at the University of Buea. Students will prepare a research paper. Coursework is in French. To do coursework in English, students should enroll in WLIT 338/438 or ETHS 338/438. Offered as ETHS 338, FRCH 338, WLIT 338, ETHS 438, FRCH 438, and WLIT 438.

WLIT 340. Seminar in Enlightenment Art and Literature: Piranesi and Vico. 3 Units.
This course explores aspects of the European eighteenth century as a transformative epoch in the history of western culture. Though the Enlightenment is usually associated especially with France, in this course we will focus on Italy, as the irresistible goal of travelers taking part in the “Grand Tour,” and as a landscape of powerful ancient and modern architecture and artworks universally recognized as exemplary. In particular we will study one of the strangest and most fascinating visual artists of the period, the self-proclaimed architect Giovanni Battista Piranesi (1720-1778) famous no less now than in his own time for his fantastic prison engravings as well as his views of Rome, involving a radical rethinking of the city as a particular kind of inhabited as well as imagined space. Piranesi’s polemical response to the advocates of the Greek revival, then coming into fashion, will lead into discussion of the key philosophical debates and aesthetic shifts of the time, notably the emergence of the notion of the sublime as a category eventually subversive of western ideals of rationality and still present -- and potent -- in our own culture. Finally we will place Piranesi within a current of discussion of the origins and nature of language and of human society in general, not least as manifested in architecture and other symbolic practices. The leading figure here is the Neo-Platonic G.B. Vico, whose New Science of 1725 remains one of the most stimulating texts in the western intellectual tradition. Offered as CLSC 340, COGS 340, WLIT 340, CLSC 440, and WLIT 440.
WLIT 342. Latin American Feminist Voices. 3 Units.
Examination of the awakening of feminine and feminist consciousness in the literary production of Latin American women writers, particularly from the 1920s to the present. Close attention paid to the dominant themes of love and dependency; imagination as evasion; alienation and rebellion; sexuality and power; the search for identity and the self-preservation of subjectivity. Readings include prose, poetry, and dramatic texts of female Latin American writers contributing to the emerging of feminist ideologies and the mapping of feminist identities. Offered as SPAN 342, SPAN 442, ETHS 342, WGST 342, WLIT 342, and WLIT 442.

WLIT 345. Japanese Women Writers. 3 Units.
Contributions of women writers to the literature of pre-modern and modern Japan; investigations of how their works exemplify and diverge from "mainstream" literary practices. Emphasis on the social and cultural contexts of the texts. Offered as JAPN 345 and WLIT 345.

WLIT 355. Modern Japanese Novels and the West. 3 Units.
This course will compare modern Japanese and Western novellas, drama, and novels. Comparisons will focus on the themes of family, gender and alienation, which subsume a number of interrelated sub-themes such as marriage, home, human sexuality, amae (dependence), innocence, experience, death, God/gods, and nature (the ecosystem). Offered as JAPN 355, WLIT 355.

WLIT 363H. African-American Literature. 3 Units.
A historical approach to African-American literature. Such writers as Wheatley, Equiano, Douglass, Jacobs, DuBois, Hurston, Hughes, Wright, Baldwin, Ellison, Morrison. Topics covered may include slave narratives, African-American autobiography, the Harlem Renaissance, the Black Aesthetic, literature of protest and assimilation. Maximum 6 credits. Offered as ENGL 363H, ETHS 363H, WLIT 363H, ENGL 463H, and WLIT 463H. Prereq: ENGL 150 or passing letter grade in a 100 level first year seminar in USFS, FSCC, FSNA, FSSO, FSSY, FSTS, FSCS.

WLIT 365. German Literature in Translation. 3 Units.
Goethe defined "World Literature" (Weltliteratur) as "Intellectual Trade Relations" (geistiger Handelsverkehr). This course gives students the opportunity to study German literary works in translation and thus to familiarize themselves with literature in general. The texts are historically or thematically organized. Maximum 6 credits. Offered as GRMN 365 and WLIT 365.

WLIT 365E. The Immigrant Experience. 3 Units.
Study of fictional and/or autobiographical narrative by authors whose families have experienced immigration to the U.S. Among the ethnic groups represented are Asian-American, Jewish-American, Hispanic-American. May include several ethnic groups or focus on a single one. Attention is paid to historical and social aspects of immigration and ethnicity. Maximum 6 credits. Offered as ENGL 365E, WLIT 365E, ENGL 465E, and WLIT 465E. Prereq: ENGL 150 or passing letter grade in a 100 level first year seminar in USFS, FSCC, FSNA, FSSO, FSSY, FSTS, FSCS.

WLIT 365N. Topics in African-American Literature. 3 Units.
Selected topics and writers from nineteenth, twentieth, and twenty-first century African-American literature. May focus on a genre, a single author or a group of authors, a theme or themes. Maximum 6 credits. Offered as ENGL 365N, ETHS 365N, WLIT 365N, ENGL 465N, and WLIT 465N. Prereq: ENGL 150 or passing letter grade in a 100 level first year seminar in USFS, FSCC, FSNA, FSSO, FSSY, FSTS, FSCS.

WLIT 365Q. Post-Colonial Literature. 3 Units.
Readings in national and regional literatures from former European colonies such as Australia and African countries. Maximum 6 credits. Offered as ENGL 365Q, ETHS 365Q, WLIT 365Q, ENGL 465Q, and WLIT 465Q. Prereq: ENGL 150 or passing letter grade in a 100 level first year seminar in USFS, FSCC, FSNA, FSSO, FSSY, FSTS, FSCS.

WLIT 368C. Topics in Film. 3 Units.
Individual topics in film, such as a particular national cinema, horror films, films of Alfred Hitchcock, images of women in film, film comedy, introduction to film genres, Asian-cinema and drama, dance on screen, science fiction films, storytelling and cinema, and literature and film. Maximum 12 credits. Offered as ENGL 368C, WLIT 368C, ENGL 468C, and WLIT 468C.

WLIT 375. Russian Literature in Translation. 3 Units.
Critical analysis and appreciation of representative literary masterpieces from Spain and Latin America, and by Hispanics living in the U.S. Texts cover a variety of genres and a range of literary periods, from works by Cervantes to those of Gabriel Garcia Marquez. The course will examine the relationship between literature and other forms of artistic production, as well as the development of the Hispanic literary text within the context of historical events and cultural production of the period. Counts toward Spanish major only as related course. No knowledge of Spanish required. Offered as ETHS 385, ETHS 485, SPAN 385, SPAN 485, WLIT 385, and WLIT 485.

WLIT 387. Literary and Critical Theory. 3 Units.
A survey of major schools and texts of literary and critical theory. May be historically or thematically organized. Maximum 6 credits. Offered as ENGL 387, WLIT 387, ENGL 487, and WLIT 487. Prereq: ENGL 150 or passing letter grade in a 100 level first year seminar in USFS, FSCC, FSNA, FSSO, FSSY, FSTS, FSCS.

WLIT 389. Topics in World Literature. 3 Units.
In-depth examination of specific critical and literary theories and of their relevance for literature and culture studies. Authors, works and instructor may vary. Offered as WLIT 390 and WLIT 490.

WLIT 391. Introduction to Text Semiotics. 3 Units.
Introduction to Text Semiotics addresses both students of Literature and students in Cognitive Science. Most of the authors included in the reading list extend their linguistic approach towards fields that intersect literature, psychology, philosophy, aesthetics, and anthropology. The scholarly traditions of text analysis and structural theory of meaning, including authors from classical formalism, structuralism, structural semiotics, and new criticism will be connected to cognitive theories of meaning construction in text, discourse, and cultural expressions in general. The focus of this course, taught as a seminar, is on empirical studies, specific text analyses, discourse analyses, speech act analyses, and other studies of speech, writing, and uses of language in cultural contexts. This course thus introduces to a study of literature and cultural expressions based on cognitive science and modern semiotics—the new view that has be coined Cognitive Semiotics. Offered as COGS 391 and WLIT 391.
WLIT 395. French Literature in Translation. 3 Units.
Topics vary according to student and faculty interest. May include Francophone literature, literature and cinema, women writers, contemporary literature. Counts toward French major only as related course. No knowledge of French required. Offered as FRCH 395, WLIT 395, FRCH 495, and WLIT 495.

WLIT 397. Honors Thesis I. 3 Units.
Intensive study of a literary, linguistic, or cultural topic with a faculty member, leading to the writing of a research paper. Prereq: Senior status.

WLIT 398. Honors Thesis II. 3 Units.
Continuation of WLIT 397. Prereq: WLIT 397 and senior status.

WLIT 399. Independent Study. 1 - 3 Unit.
For majors and advanced students under special circumstances.

WLIT 400. The City in Literature. 3 Units.
Focus on major cities of the world as catalysts and reflections of cultural and historical change. Interdisciplinary approach utilizing the arts, literature, social sciences. Examples include Berlin at the turn of the century; Paris in literature and film; Tokyo in history and literature. Offered as WLIT 300 and WLIT 400. Prereq: Graduate standing.

WLIT 408. The Paris Experience. 3 Units.
Three-week immersion learning experience living and studying in Paris. The focus of the course is the literature and culture of the African, Arab, and Asian communities of Paris. Students spend a minimum of fifteen hours per week visiting cultural centers and museums and interviewing authors and students about the immigrant experience. Assigned readings complement course activities. Students enrolled in FRCH 308/408 do coursework in French. WLIT 308/408 students have the option of completing coursework in English. Graduate students have additional course requirements. Offered as FRCH 308, WLIT 308, FRCH 408, and WLIT 408. Prereq: Graduate standing.

WLIT 415. Mysticism and Literature. 3 Units.
This co-taught seminar will explore and compare mystical elements in selected literary and theoretical works from the West and the East. Comparisons will focus on a number of interrelated sub-themes such as mind, language, alienation, innocence, experience, life, death, cosmogony, cosmology, good, evil, God/gods, and nature (the ecosystem). Offered as MLIT 315, WLIT 315, MLIT 415 and WLIT 415.

WLIT 416. Greek Tragedy. 3 Units.
This course provides students the opportunity to read a significant number of ancient Greek tragedies in modern English translations. We shall read, study, and discuss selected works by Aeschylus, Sophocles, and Euripides, and attempt to understand the plays as literature composed for performance. We shall study literary elements within the plays and theatrical possibilities inherent in the texts. As we read the plays, we shall pay close attention to the historical context and look for what each play can tell us about myth, religion, and society in ancient Athens. Finally, we shall give occasional attention to the way these tragic dramas and the theater in which they were performed have continued to inspire literature and theater for thousands of years. Lectures will provide historical background on the playwrights, the plays, the mythic and historical background, and possible interpretation of the texts as literature and as performance pieces. Students will discuss in class the plays that they read. The course has three examinations and a final project that includes a short essay and a group presentation. Offered as CLSC 316, WLIT 316, WLIT 416.

WLIT 420. Epic: The Sublime and Terrible in Literature. 3 Units.
The course focuses on the epic genre that dominates the dawn of Western literature as well as the literary traditions of much of the rest of the world. From the Homeric epic to the Middle Ages and deep into the Renaissance, there was a collective urge to record both in verse and in prose extraordinary adventures with exceptional heroes as central figures. Thus, the epic genre typically encouraged variations in the aesthetic treatment of the hero that eventually came to define distinct categories within the genre. “Sublime” and “terrible” are common notions in the aesthetics of classicism, from antiquity to the early modern period. Authors studied in the course include such key figures in the creation and development of epic as Homer, Virgil, Ovid, Gottfried von Strassburg, Dante, and Cervantes. The works of these authors exemplify, on the one hand, the aesthetic directions mentioned above and, on the other hand, provide opportunities for using the close engagement with particular texts to illuminate wider cultural fields, in which various aesthetic perceptions of social, political, and religious reality coexist and therefore stimulate remarkable innovations in the standard epic narrative. Offered as CLSC 319, CLSC 419, WLIT 320 and WLIT 420.

WLIT 435. Women in Developing Countries. 3 Units.
This course will feature case studies, theory, and literature of current issues concerning women in developing countries primarily of the French-speaking world. Discussion and research topics include matriarchal traditions and FGM in Africa, the Tunisian feminist movement, women, Islam, and tradition in the Middle East, women-centered power structures in India (Kerala, Pondicherry), and poverty and women in Vietnam, Laos, and Cambodia. Guest speakers and special projects are important elements of the course. Seminar-style format, taught in English, with significant disciplinary writing in English for WGST, ETHS, and some WLIT students, and writing in French for FRCH and WLIT students. Writing assignments include two shorter essays and a substantial research paper. Offered as ETHS 335, FRCH 335, WLIT 335, WGST 335, FRCH 435 and WLIT 435.

WLIT 438. The Cameroon Experience. 3 Units.
Three-week immersion learning experience living and studying in Cameroon. The focus of the course is the culture, literature, and language of Francophone Cameroon, with some emphasis on Anglophone Cameroon. Students spend a minimum of fifteen hours per week visiting cultural sites and attending arranged courses at the University of Buea. Students will prepare a research paper. Coursework is in French. To do coursework in English, students should enroll in WLIT 338/438 or ETHS 338/438. Offered as ETHS 338, FRCH 338, WLIT 338, ETHS 438, FRCH 438, and WLIT 438.
WLIT 440. Seminar in Enlightenment Art and Literature: Piranesi and Vico. 3 Units.
This course explores aspects of the European eighteenth century as a transformative epoch in the history of western culture. Though the Enlightenment is usually associated especially with France, in this course we will focus on Italy, as the irresistible goal of travelers taking part in the "Grand Tour," and as a landscape of powerful ancient and modern architecture and artworks universally recognized as exemplary. In particular we will study one of the strangest and most fascinating visual artists of the period, the self-proclaimed architect Giovanni Battista Piranesi (1720-1778) famous no less now than in his own time for his fantastic prison engravings as well as his views of Rome, involving a radical rethinking of the city as a particular kind of inhabited as well as imagined space. Piranesi's polemical response to the advocates of the Greek revival, then coming into fashion, will lead into discussion of the key philosophical debates and aesthetic shifts of the time, notably the emergence of the notion of the sublime as a category eventually subversive of western ideals of rationality and still present -- and potent -- in our own culture. Finally we will place Piranesi within a current of discussion of the origins and nature of language and of human society in general, not least as manifested in architecture and other symbolic practices. The leading figure here is the Neapolitan G.B. Vico, whose New Science of 1725 remains one of the most stimulating texts in the western intellectual tradition. Offered as CLSC 340, COGS 340, WLIT 340, CLSC 440, and WLIT 440.

WLIT 442. Latin American Feminist Voices. 3 Units.
Examination of the awakening of feminine and feminist consciousness in the literary production of Latin American women writers, particularly from the 1920s to the present. Close attention paid to the dominant themes of love and dependency; imagination as evasion; alienation and rebellion; sexuality and power; the search for identity and the self-preservation of subjectivity. Readings include prose, poetry, and dramatic texts of female Latin American writers contributing to the emerging of feminist ideologies and the mapping of feminist identities. Offered as SPAN 342, SPAN 442, ETHS 342, WGST 342, WLIT 342, and WLIT 442.

WLIT 463H. African-American Literature. 3 Units.
A historical approach to African-American literature. Such writers as Wheatley, Equiano, Douglass, Jacobs, DuBois, Hurston, Hughes, Wright, Baldwin, Ellison, Morrison. Topics covered may include slave narratives, African-American autobiography, the Harlem Renaissance, the Black Aesthetic, literature of protest and assimilation. Maximum 6 credits. Offered as ENGL 363H, ETHS 363H, WLIT 363H, ENGL 463H, and WLIT 463H. Prereq: Graduate standing.

WLIT 465E. The Immigrant Experience. 3 Units.
Study of fictional and/or autobiographical narrative by authors whose families have experienced immigration to the U.S. Among the ethnic groups represented are Asian-American, Jewish-American, Hispanic-American. May include several ethnic groups or focus on a single one. Attention is paid to historical and social aspects of immigration and ethnicity. Maximum 6 credits. Offered as ENGL 365E, WLIT 365E, ENGL 465E, and WLIT 465E. Prereq: Graduate standing.

WLIT 465N. Topics in African-American Literature. 3 Units.
Selected topics and writers from nineteenth, twentieth, and twenty-first century African-American literature. May focus on a genre, a single author or a group of authors, a theme or themes. Maximum 6 credits. Offered as ENGL 365N, ETHS 365N, WLIT 365N, ENGL 465N, and WLIT 465N. Prereq: Graduate standing.

WLIT 465Q. Post-Colonial Literature. 3 Units.
Readings in national and regional literatures from former European colonies such as Australia and African countries. Maximum 6 credits. Offered as ENGL 365Q, ETHS 365Q, WLIT 365Q, ENGL 465Q, and WLIT 465Q. Prereq: Graduate standing.

WLIT 468C. Topics in Film. 3 Units.
Individual topics in film, such as a particular national cinema, horror films, films of Alfred Hitchcock, images of women in film, film comedy, introduction to film genres, Asian-cinema and drama, dance on screen, science fiction films, storytelling and cinema, and literature and film. Maximum 12 credits. Offered as ENGL 368C, WLIT 368C, ENGL 468C, and WLIT 468C. Prereq: Graduate standing.

WLIT 485. Hispanic Literature in Translation. 3 Units.
Critical analysis and appreciation of representative literary masterpieces from Spain and Latin America, and by Hispanics living in the U.S. Texts cover a variety of genres and a range of literary periods, from works by Cervantes to those of Gabriel Garcia Marquez. The course will examine the relationship between literature and other forms of artistic production, as well as the development of the Hispanic literary text within the context of historical events and cultural production of the period. Counts toward Spanish major only as related course. No knowledge of Spanish required. Offered as ENGL 385, ETHS 385, SPAN 385, SPAN 485, WLIT 385, and WLIT 485. Prereq: Graduate standing.

WLIT 487. Literary and Critical Theory. 3 Units.
A survey of major schools and texts of literary and critical theory. May be historically or thematically organized. Maximum 6 credits. Offered as ENGL 387, WLIT 387, ENGL 487, and WLIT 487. Prereq: Graduate standing.

WLIT 490. Topics in World Literature. 3 Units.
In-depth examination of specific critical and literary theories and of their relevance for literature and culture studies. Authors, works and instructor may vary. Offered as WLIT 390 and WLIT 490. Prereq: Graduate standing.

WLIT 495. French Literature in Translation. 3 Units.
Topics vary according to student and faculty interest. May include Francophone literature, literature and cinema, women writers, contemporary literature. Counts toward French major only as related course. No knowledge of French required. Offered as FRCH 395, WLIT 395, FRCH 495, and WLIT 495. Prereq: Graduate standing.

WLIT 590. Seminar in World Literature. 3 Units.
Topics vary depending on student and instructor interests; may include Postcolonial literature; Latin American literature and film; African Anglophone and Francophone literature. Prereq: Graduate standing.

WLIT 595. Independent Research. 1 - 3 Unit.
For graduate students under special circumstances. Prereq: Graduate standing.

WLIT 601. Independent Study. 1 - 18 Unit.
For graduate students under special circumstances. Prereq: Graduate standing.

WLIT 651. Thesis MA. 1 - 18 Unit.
Frances Payne Bolton School of Nursing

History
The Frances Payne Bolton School of Nursing (http://bulletin.case.edu/schoolofnursing) (FPB) has a proud heritage beginning with the Lakeside Hospital Training School for Nurses established in 1898. With a generous endowment from Frances Payne Bolton (http://fpb.case.edu/Visitors/bolton.shtm), who was the first congresswoman from Ohio, FPB was established in 1923 as a school within Western Reserve University. In 1969, Western Reserve University and Case Institute of Technology merged forming the current university, Case Western Reserve University. Consistently, FPB is ranked among the leading schools in U.S. News and World Report and in funding from the National Institutes of Health. Graduate-level specialty majors have been in the top 10.

FPB is noted for its innovation, leadership and excellence in education, research and practice. To support this mission, the school has fifteen endowed chairs, among the largest number in the world for a school of nursing. FPB also houses one of only 10 World Health Organization Collaborating Centers (http://fpb.case.edu/Centers/WHOCC) for nursing in the country. The Sarah Cole Hirsh Center for Best Nursing Practices Based on Evidence (http://fpb.case.edu/Centers/Hirsh) was established in 1998 was the first national center of its kind.

Strategic Vision
Mission
Within the mission of Case Western Reserve University, the Frances Payne Bolton School of Nursing builds on a tradition of innovation and a commitment to the highest standards of excellence to provide the very best nursing education, research, clinical scholarship, and professional service locally, nationally, and internationally.

Priorities
The Frances Payne Bolton School of Nursing is committed to global leadership in nursing. The discovery, transmission, and use of knowledge are at the core of our work. Knowledge of health and illness in individuals, families, groups, and communities, both locally and internationally, provides the context for our work. The ultimate test of the validity of our vision is the results, over time, of the contributions of our faculty and graduates.

Purpose
The purpose of the Frances Payne Bolton School of Nursing is to provide an environment that permits individuals to develop their personal and professional capabilities, including the sense of responsibility for continued learning; to learn as efficiently and effectively as possible; to find enjoyment, excitement, and challenge in the pursuit of knowledge and its application; and to develop behaviors that enable them to function in a changing, complex society. As an integral component of Case Western Reserve University, the school assumes responsibility for the preparation of individuals committed to excellence and leadership in professional nursing. The faculty of the school accepts the responsibility for teaching and scholarly inquiry as integral parts of the educational process.

Philosophy
FPB has set forth the following philosophy to accomplish the stated mission.

Nursing is an academic discipline and profession. Nursing as an academic discipline is a distinctive branch of human knowledge fundamental to nursing practice, nursing education, and nursing administration, and to the continuous development of the profession. The distinctive perspective of nursing includes a focus on the metaparadigm concepts of persons, environment and nursing. The specific conceptual focus within FPB is the health-seeking mechanisms and behaviors of human beings. Some of those mechanisms and behaviors are innate; others are learned or developed and may be subject to the influence of nurses’ knowledgeable ministrations. The body of nursing knowledge is continuously advanced, structured, and restructured as a consequence of a range of methods including scientific inquiry, philosophic inquiry, historical inquiry, and clinical evaluation.

Scientific inquiry within nursing is designed to discover, advance, and clarify knowledge about determinants and correlates of optimal biological, psychological, and social functioning; physical, emotional and spiritual comfort; and individual and group attainment of health goals in multiple environments and under a variety of circumstances (including illness and injury) attendant to birth, living, development, decline and death. Philosophic inquiry is undertaken to clarify the values that underlie consumers’ and nurses’ responsibilities for human health promotion, the ethics of nursing practice, and the nature of the body of knowledge known as nursing. Historical inquiry is undertaken to document significant influences (by events and individuals) on the development of nursing over time as a body of knowledge and as a profession. Clinical evaluation is designed to test and verify the relative efficacy of strategies used in nursing administration, consultation, education, and practice, and the means employed to advance nursing knowledge.

Professional nurses have mastery over a body of scientific and humanistic knowledge that is fundamental to their particular kinds of practice. They selectively use this knowledge in the execution of their professional responsibilities and in the attainment of professional goals. Those involved in differentiated nursing practices employ nursing technologies (skills and approaches that represent the application of scientific knowledge), using artistry in the execution of their professional responsibilities. Professional nurses’ several, particular practices are guided by a code of professional ethics and also by knowledge about the individuals and groups whom they serve. The nurse’s professional goal is to appraise accurately and to enhance effectively the health status, health assets, and health potentials of individuals, groups, families, and communities and to promote the initiative and independence of those they serve in the attainment of reasonable health goals, mutually agreed upon by consumers and by nurses as their health care providers. Nursing practice includes assisting persons in the maintenance of health, detecting deviations from health, assisting persons in the restoration of health, and supporting persons during life. These responsibilities are accomplished through a systematic and deliberative process. Nursing practice includes independent and interdependent functions and nurses are an integral part of the health care system.

Other beliefs essential to nursing that are shared by the faculty are stated below:

Individuals and Groups

• Individuals have commonalities, but each person is unique and has worth.
• Individuals are in constant interaction with the environment.
• Individuals have a capacity to grow and develop.
• Human behavior is purposeful and involves choices that are directed toward meeting the individual’s needs.
• Individuals and groups have rights and responsibilities in relation to the promotion of optimal health.
• Individuals have the responsibility for making decisions about their health and have the potential to act on these decisions.
• Most individuals possess the capability for making appropriate decisions, although there are times when these abilities are diminished or absent.

Learning
• Individuals are capable of changing their behavior through the process of learning.
• The need and ability to learn continues throughout life.
• Learning is affected by interaction between the individual and the environment.
• Learning is enhanced when consideration is given to individual differences in cognitive styles.
• The responsibility for learning resides in the individual learner.
• The learning process is an individual endeavor; stimulation of the process is a joint responsibility of teacher and learner working toward common goals.

Cultural Diversity
• Learning is affected by interaction between the Individual and the environment.
• Learning is enhanced when consideration is given to individual differences in cognitive styles as well as cultural background and influences.

Health
• Health is a dynamic, ever-changing state.
• Health is influenced by an individual’s heredity, environment, and lifestyle.
• Individuals may manifest simultaneously states of health and illness.
• Individuals differ in the ways they value and define health.
• Individuals have the potential to grow as a result of an experience with illness.

Health Care
• Health care encompasses all activities necessary to promote optimal physiological, psychological, and social functioning.
• Health care is rendered by the individual alone or in collaboration with health care providers, including nurses, and extends throughout the life span of the individual.
• Health care is complex and depends on the skills, resources, and cooperative efforts of consumers and health care providers.
• A recognized need exists in society to organize effectively the delivery of health care services.
• A variety of providers, each offering a unique and specific service, may be present in an organized health care system.
• The primary contribution of nursing to the health care system is to assist individuals and groups to attain, maintain, and regain optimal health.
• Health care professionals (including nurses) and consumers collaborate to define health; to identify factors inimical to health; to limit, reduce, or eliminate threats to health; to determine human and material resources necessary to provide health care services; and to evaluate and improve health services.
• Collaboration among health professionals and consumers can lead to the achievement of health care delivery systems that provide care that is available, accessible, feasible, acceptable, of optimal quality, sustained, and cost effective.
• Relevant concepts are further defined by faculty as follows:

Optimal Level of Health
The highest achievable level of function and security. This includes physiological function and environmental (physical security, psychosocial function, and security), and personal growth.

Health-Seeking Behaviors
The range of mental and physical activities consciously performed to maintain, attain, or regain optimal health.

Environment of Care
The “place” and phenomenal field where a nurse encounters clients who need assistance in maintaining, attaining, or regaining competence in striving for health, and where the nurse performs acts for clients to facilitate health-seeking behaviors (when they cannot do for themselves).

Professional Encounter
A person’s competence in matters related to health is dynamic and is influenced by genetic endowment and life experiences. At times a person requires assistance in improving competence. At these times, the nurse may enter into a relationship with the person (client) to facilitate the client’s health-seeking behaviors as he/she strives toward an achievable level of health. The client and nurse may view this relationship differently. The professional encounter requires a reciprocal relationship in which the nurse, as a professional expert with the client’s assent, influences the behavior of the client. The client in turn evokes responses from the nurse. The professional encounter is the initiation of a relationship between a nurse and a person requiring nursing care. The relationship is reciprocal in nature and may be initiated by either the client or nurse. Through the relationship mutual goal setting regarding health attainment is sought. When a nurse and client interact within the professional relationship, each performs functions deriving from their positions within a particular social context. The context (human-physical environment) in which the encounter occurs will have varying influence on both the client and nurse based on the cognitive, perceptual and emotional capacities of both. Although the environment in its physical representation is essentially the same for both, the perceptions of the client and nurse are different. The attributes that they bring to the relationship are shaped by intervening variables.

Nursing Strategies
Nursing strategies can be categorized according to the function they serve in facilitating clients’ health-seeking behaviors. A tentative classification scheme according to the function strategies is set forth below. Within each category there are multiple behaviors from which the nurse can select depending on the nature of the clients’ assets and deficits. Also, each category is open to the discovery of more activities than are presently known. Each category focuses on facilitating health-seeking behaviors.
Compensating: Performing selected activities or measures (including monitoring) for clients when they are unable to do these activities.

Teaching: Performing actions intended to induce learning.

Counseling: Assisting clients to examine alternative course of action.

Supporting: Promoting clients’ ability to cope, adapt and change.

Stimulating: Promoting clients’ desire to perform health-seeking behaviors.

Advocating: Intervening on behalf of the client to overcome obstacles that are interfering with health-seeking behaviors.

Comforting: Providing an environment that promotes ease and well being.

The choice of nursing strategies for enhancing client’s health-seeking behaviors is based on assessment of these behaviors and the intervening variables to determine the assets and deficits and potential for engaging in behaviors that are directed toward attaining, maintaining or regaining an optimal level of health.

Accreditation

The Bachelor of Science in Nursing (BSN) and Master of Science in Nursing (MSN) programs are accredited by the National League for Nursing Accrediting Commission (NLNAC). The initial accreditation was in 1951. The last accreditation was in 2008. The next accreditation is due in 2016.

National League for Nursing Accrediting Commission, Inc.
61 Broadway-33rd Floor
New York, NY 10006
212-363-5555 Ext. 153
http://www.nlnac.org/

The Bachelor of Science in Nursing (BSN) and Master of Nursing (MN) programs are accredited by the Ohio Board of Nursing. The last visit for the BSN program was in 2010 and the next visit is due in fall 2015. The last visit for the MN program was in 2007 and the next visit is due in November 2012.

Ohio Board of Nursing
17 High Street
Suite 400
Columbus, OH 43215-3413
614-466-3947
www.state.oh.us/nur (http://www.state.oh.us/nur)

The neonatal nurse practitioner program (http://fpb.case.edu/MSN/NNP.shtm) is certified through the MSN Programs, by NLNCE. The National Certification Corporation also holds a repository of our annual program director reports and a profile of the program.

National Certification Corporation
PO Box 11082
Chicago, IL 60611-0082
www.ncncnet.org (http://www.ncncnet.org)

The nurse anesthesia program (http://fpb.case.edu/MSN/anesthesia.shtm) is accredited by the Council on Accreditation of Nurse Anesthesia Education Programs (COA). The last accreditation was in 2012.

American Association of Nurse Anesthetists
222 South Prospect Avenue
Park Ridge, Illinois 60068-4001
(847) 692-7050

Facilities

Instructional Facilities

With a highly qualified faculty engaged in teaching, research, and community service, FPB offers high quality academic programs. Instruction includes lectures, seminars, individual conferences and small group discussions, and clinical experiences under the guidance of a preceptor. Modern research and educational facilities include computer and skills laboratories.

Clinical Facilities

Instructional facilities are abundant and varied. The University Hospitals of Cleveland is a 947-bed academic medical center and is an aggregate of specialized hospitals that includes Alfred and Norma Lerner Tower, Samuel Mather Pavilion and Lakeside Hospital for adult medical/surgical care; Rainbow Babies and Children’s Hospital; University MacDonald Women’s Hospital; University Ireland Cancer Center; and skilled nursing and rehabilitation services. University Hospitals is part of the University Hospitals Health System with services provided at 100 locations in 40 northern communities. The Cleveland Clinic Health System has 2,957 beds and is comprised of the Cleveland Clinic Foundation and Fairview Hospital, Health Hill Hospital for Children, Lakewood Hospital, Lutheran Hospital, Marymount Hospital, Euclid Hospital, Hillcrest Hospital, Huron
Hospital, and South Pointe Hospital. MetroHealth Medical Center is a regional referral center with 690-beds for medical/surgical care to adults and children. It is a trauma I center with a burn center and 143-bed rehabilitation facility specializing in spinal cord injuries, only one of 19 in the nation. MetroHealth also has the Clement Center for Family Care, a neighborhood outpatient center, and a 291 bed skilled nursing care center. These hospitals are major clinical resources.

Additional opportunities are available in a variety of health, social, and educational agencies. These include, for example, American Red Cross, Benjamin Rose Institute, Hospice of the Western Reserve, Cleveland Psychiatric Institute, Kenneth W. Clement Center for Family Health Care, Judson Park Retirement Community, Hospice of the Western Reserve, Visiting Nurses Association, Cleveland Public Health Department, the Ohio Permanente Medical Group and many others.

Libraries
The Kelvin Smith Library, a 144,000 square foot building completed in 1996, houses most of the collections of Case Western Reserve University. This includes over 1,290,000 monographs, 7,363 serial titles, U.S. Government publications, company annual reports, newspapers, CDs, technical reports, over 12,000 DVDs and videos, and more. The library enables users to integrate both traditional resources and state-of-the-art technology into teaching, research, and learning. A variety of seating styles accommodates 900 people and provide electrical ports for connecting personal laptop computers. Case Western Reserve’s wireless network enables personal laptops to have internet access throughout the library. Two multimedia rooms include scanners and sound and video digitizers. Available are individual study spaces, meeting rooms, conference areas, and social gathering places. Thirty miles of compact moveable shelving allows the library to keep much of its collection onsite for immediate access to print materials. The user-friendly interface to the online catalog, databases, and other resources allows library staff to focus their attention on working in-depth with faculty and students.

In addition to the Kelvin Smith Library, students and faculty have access to the following libraries located on campus: the Cleveland Health Sciences Libraries, supporting programs in dentistry, medicine and nursing; the School of Law Library; the Lillian and Milford Harris Library in the Mandel School of Applied Social Sciences; the Kulas Music Library; and the Astronomy Library. Altogether, collections at the Case Western Reserve libraries encompass more than 1.8 million volumes, nearly 14,000 serials and periodicals, and a wide range of electronic information resources, including a CD-ROM reference database that is accessible through the Case Western Reserve network. These include OhioLINK, a state-funded network that links the libraries of 17 public universities, 23 community/technical colleges, 44 private colleges, and the State Library of Ohio and also offers access to research databases and other information resources.

The Health Sciences Libraries, which consist of the Health Center Library and the Allen Memorial Library, serve as the major libraries for holdings related to nursing, medicine, dentistry, nutrition, and biology. The Health Center Library adjacent to the School of Nursing houses nearly 350,000 volumes, 2,780 current periodicals, and audiovisual materials. Approximately 8,800 volumes are specifically nursing texts, and more than 100 journals are nursing publications. The library also houses a historical collection of nursing materials. The most current and heavily used books are placed on reserve to insure their availability to students. Faculty also place materials on reserve for use in the library. There are 18 public workstations to access the internet, and the library also provides wireless access for those with properly-equipped laptop computers.

FPB School of Nursing Information Technology Services
The Frances Payne Bolton School of Nursing has its own Information Technology Services department (http://fpbrc.case.edu/CurrentStudents/technology.shtml). This department manages and oversees all computer related operations within the school. Furthermore, the team assists faculty, staff and students with any computer problems, issues, needs, or equipment purchase. FPB has its own Help Desk and provides troubleshooting of problems and repairs to all school-owned equipment. There are two computer laboratories and a Cyber-Café where students have access to computers and network-access connection for hooking up their laptops along with wireless network access. The main computer lab is located on the second floor and the Cyber-Café is located on the ground floor. These two areas are available during the weekdays, evenings, and weekend on a 24 hours basis. The second lab (Center for Bioinformatics) is located within the Learning Resource Center (LRC) on the ground floor and is only available when not used for classroom activities during weekdays from 9:00 a.m. to 5:00 p.m.

Learning Resource Center (LRC)
The Learning Resource Center (LRC) (http://fpbrc.cwru.edu) is a state of the art facility comprised of four academic support units, the Cyber Café, the Center for Bioinformatics and Health Promotion, the Multi-media Simulation Center and the Clinical Teaching Center. FPB students have the opportunity to advance their nursing skills by active participation in hands-on training sessions that demonstrate the real-life aspects of nursing. Our experienced learning support staff strives for competence, confidence and excellence. The staff is available by appointment to meet with students individually in order to review a particular skill, practice with SimMan, CathSim, SimBaby, SimChild, or utilize the Bioinformatics lab to work with various nursing software packages. SimMan, SimBaby, and SimChild are high-tech human patient simulators that breathe, have a pulse, and maintain heart-rhythm and blood pressure. They simulate almost any patient emergency situation and are programmable to provide the most life-like responses with immediate feedback for student learning. CathSim is an intravenous trainer, which uses virtual reality-based patients to teach intravenous (IV) catheterization. They give students the ability to choose the patient they will start an IV on, depending on their particular clinical setting. The program offers immediate feedback and opportunities for review to enhance the nursing skills needed in real life environments.

FPB is equipped with four technology-enhanced classrooms, which allow our faculty to use powerful tools in teaching to engage the students with learning. The classrooms are equipped with a Dell computer, VHS DVD combo player, a ceiling mounted video projection system, a document camera, wall-mounted speakers, and a touch panel-controlled LCD monitor.

Administration
Mary E. Kerr, PhD, RN, FAAN
(Case Western Reserve University)
May L. Wykle Endowed Professor of Nursing; Dean of Nursing
Shirley Moore, PhD, RN, FAAN
(Case Western Reserve University)
Edward J. and Louise Mellen Professor of Nursing; Associate Dean for Research
Jacline A. Zauszniewski, PhD, RN-BC, FAAN
(Case Western Reserve University)
Kate Hanna Harvey Professor in Community Health Nursing; Associate Dean for Doctoral Education; Director, PhD Program
Marilyn B. Lotas, PhD, RN
(University of Michigan)
Associate Dean for Undergraduate Programs
Elizabeth A. Madigan, PhD, RN, FAAN
(Case Western Reserve University)
Professor of Nursing; Head, WHO Collaboration Center
Katherine R. Jones, PhD, RN, FAAN
(Stanford University)
Sarah Cole Hirsh Professor of Nursing; Associate Dean for Evidence Based Practice
Donna A. Dowling, PhD, RN
(University of Illinois)
Associate Professor of Nursing; Program Director, DNP Program
Carol Savrin, DNP, CPNP, FNP, BC, FAANP
(Case Western Reserve University)
Associate Professor of Nursing, Director of MSN Program
Diana L. Morris, PhD, RN, FAAN, FGSA
(Case Western Reserve University)
Executive Director, University Center on Aging and Health
Evelyn G. Duffy, DNP, ANP/GNP-BC, FAANP
(Case Western Reserve University)
Associate Director, University Center on Aging and Health
Barbara Daly, PhD, RN, FAAN
(Bowling Green State University)
Gertrude Perkins Oliva Professor in Oncology Nursing; Director, BEST Center
Gayle Petty, MSN, RN
(Case Western Reserve University)
Assistant Director, BSN Program
Patricia W. Underwood, PhD, RN, FAAN
(University of Michigan)
Associate Professor of Nursing
Teona C. Griggs, M.Ed., MA
(Cleveland State University)
Director of Student Services; Director of Diversity & Inclusion
Nada Di Franco, MNO
(Case Western Reserve University)
Director of Alumni Relations
Amy Raufman, MNO
Director of Development
Samira Hussney, MPH
(Case Western Reserve University)
Director, International Programs & WHO Collaborating Center
Susan Frey, MAFIS
(Cleveland State University)
Assistant Dean for Finance and Administration
Caron Baldwin, MCSE
(Ohio Wesleyan University)
Information Services Manager
Kathleen O’Linn, BS
(Ursuline College)
Manager, Human Resources and Facilities
Helen Jones-Toms, MNO
(Case Western Reserve University)
Director of Marketing
Jason Barone, MA
(Case Western Reserve University)
Asst. Director, Marketing & Communications
Tiffany Cooper, MBA
(Ursuline College)
Executive Aide
Kathleen O’Linn, BS
(Ursuline College)
Bachelor of Science in Nursing (BSN)

Bachelor of Science in Nursing

The BSN program emphasizes intensive and early clinical experience, a strong foundation in acute and critical care nursing and a commitment to service to our community. Our students begin their clinical experience in the first term of the freshman year and complete their program with a 300-hour clinical preceptorship in the senior year. Students graduate with over 1600 hours of clinical experience, far exceeding that of other schools of nursing. In addition, students provide healthcare services to children and families—collectively amassing approximately 20,000 hours of service to local schools alone each year.

The student-learning environment includes traditional classrooms, world-class clinical facilities, community settings and the Learning Resource Center (LRC). The LRC consists of four activity centers: the Clinical Teaching Center; the Center for Bio-informatics and Health Promotion; the Multimedia Simulation Center; and the Cyber Café. Clinical experiences occur in Cleveland’s nationally and internationally renowned health care facilities including the University Hospitals of Cleveland, the Cleveland Clinic and the MetroHealth System. Students also have extensive experience in community health departments, community centers and the Cleveland Municipal School District.

The opportunities available to students are limitless. Students are encouraged to participate in interdisciplinary research projects with senior faculty. They have the opportunity to explore health issues in the global arena, to study in international sites as part of their standard curriculum. International activities are supported by FPB’s World Health Organization (WHO) Collaborating Center.

Graduates have a foundation in the discipline of nursing, demonstrate leadership in clinical practice, use clinical inquiry to advance practice, become involved in research, and assume responsibility for their own professional development.

Characteristics of the Graduate

- Teaches and counsels individuals, families and other groups about health, illness and health seeking behaviors
- Critiques and applies research findings to clinical practice
- Provides direct patient care and assumes leadership role in directing nursing care to individuals, groups and families
- Participates and assumes beginning leadership roles
- Uses principles of ethics and the professional code as a framework for decision making
- Works effectively as a member of an interdisciplinary health care team
- Uses effective communication techniques with diverse clients, colleagues, and information systems
- Describes process of health care policy development

Degree Requirements (http://fpb.case.edu/BSN/degree.shtm)

Candidates for the Bachelor of Science in Nursing degree must complete the following:

1. Minimum of 128 credit hours as specified by the requirements with a 2.0 GPA
2. A minimum of C for all courses taken in nursing and science courses counting toward the major
3. A minimum of 50 credit hours in 300 and 400 level courses
4. The SAGES General Education Requirements for the School of Nursing

Progression in the BSN Program

Progression in the Bachelor of Science in Nursing program is contingent upon satisfactory academic achievement in all required courses. To maintain satisfactory academic standing, students must attain a GPA of 2.0 or above by the end of their junior year and must obtain a C or above in all nursing and science courses counting toward the major.

Students who receive two unsatisfactory grades (D or F) in nursing and/or natural and behavioral science courses may be subject to separation from the school of nursing. See the Undergraduate Student Handbook (http://fpb.case.edu/CurrentStudents/handbook.shtm) for a description of the criteria for academic standing.

Students who receive a grade of Incomplete (I), given at the discretion of the instructor for the course, must complete course requirements by the eleventh week of the following semester. It is the student’s responsibility to notify the instructor of the circumstances preventing completion of all assigned work. In the absence of notification or adequate justification, the instructor may give the student a final grade that assumes a failing grade for the missing work. If a student fails to submit the work required for removing the Incomplete by the date established or by the eleventh week of the following semester, the instructor will give a failing grade (F). The grade will convert from I to F when the deadline for making up incomplete grades from a previous semester has passed.

Students who receive a grade below C for a nursing course must register for that course the next semester that it is offered. If the student fails to meet the University’s requirement for good academic standing, the student is placed on academic probation. If the GPA does not improve the next semester, the Academic Standing Board of the Faculty Senate Committee on Undergraduate Education will review the student’s record to determine whether extenuating circumstances warrant an additional semester of probation or separation from the university.

Curriculum (http://fpb.case.edu/BSN/curriculum.shtm)

This four-year generic program for high school graduates leads to a BSN degree. Upon successful completion of the program, graduates will be eligible to sit for the NCLEX examination (http://www.ncsbn.org) for licensure as a Registered Nurse (RN). A sample study plan (http://fpb.case.edu/BSN/sampleplan.shtm) also demonstrates how a BSN student might schedule the required courses.

The FPB School of Nursing has the right to determine a student’s readiness to sit for the NCLEX-RN examination and the right to restrict testing until the student demonstrates a readiness to pass this examination. This examination is given by State Boards of Nursing, and satisfactory completion of this examination enables the graduate to practice as an RN in the state for which the examination was written.

The BSN program includes nursing, science and liberal arts courses. A minimum of 128 credit hours, with at least 50 credits from upper division courses, are required for award of the BSN degree. Students must meet the University requirements for graduation. The ratio of clinical hours to credit hours is 4 to 1, and for laboratory hours, it is 2 to 1. The program plan for entry-level students to the BSN program is as follows:

<table>
<thead>
<tr>
<th>Freshman</th>
<th>Units</th>
<th>Fall</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foundations of the Discipline (NURS 110)</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Foundations of Practice (NURS 111)</td>
<td>3</td>
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### Sophomore

<table>
<thead>
<tr>
<th>Units</th>
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<tbody>
<tr>
<td>Nursing Care of the Adult I (NURS 230)</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Introduction to Pharmacology (NURS 211)</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Aging in Health and Illness (NURS 250)</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Community Engagement Seminar II (NURS 210)</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Concepts for a Molecular View of Biology II (BIOL 121)</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>SAGES University Seminar</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Medical Microbiology, Immunity, and Infectious Disease (NURS 342)</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Psychiatric-Mental Health Nursing (NURS 317)</td>
<td>4</td>
<td></td>
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<tr>
<td>Nursing Care of the Adult II (NURS 240)</td>
<td>5</td>
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<tr>
<td>Community Engagement Seminar III (NURS 260)</td>
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<tr>
<td>Human Development: Medical and Social (SOCI 203)</td>
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<tr>
<td>Year Total:</td>
<td>16</td>
<td>17</td>
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### Junior

<table>
<thead>
<tr>
<th>Units</th>
<th>Fall</th>
<th>Spring</th>
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</thead>
<tbody>
<tr>
<td>Parents and Neonates in Health and Illness (NURS 315) or Infants, Children, and Adolescents in Health and Illness (NURS 316)</td>
<td>4.5</td>
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<tr>
<td>Basic Statistics for Social and Life Sciences (STAT 201)</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Care of the Adult and Older Adult with Complex Health Alterations (NURS 338) or Care of the Perioperative Patient (NURS 339)</td>
<td>3.5-4.5</td>
<td></td>
</tr>
<tr>
<td>Community Engagement Seminar IV (NURS 310)</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>GER General Education Requirement</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Infants, Children, and Adolescents in Health and Illness (NURS 316) or Parents and Neonates in Health and Illness (NURS 315)</td>
<td>4.5</td>
<td></td>
</tr>
<tr>
<td>Theoretical and Evidence Bases for Best Practice in Nursing (NURS 320)</td>
<td>3</td>
<td></td>
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<tr>
<td>Care of the Perioperative Patient (NURS 339) or Care of the Adult and Older Adult with Complex Health Alterations (NURS 338)</td>
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<tr>
<td>Nursing Informatics III: Clinical NIS (NURS 345)</td>
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<tr>
<td>Community Engagement Seminar V (NURS 360)</td>
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<tr>
<td>GER General Education Requirement</td>
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<td></td>
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<tr>
<td>Year Total:</td>
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### Senior

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<tr>
<th>Units</th>
<th>Fall</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information Technologies in Health (NURS 370)</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Public Health Nursing (NURS 371)</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Health in the Global Community (NURS 372)</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Global Health Practicum (NURS 373)</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Issues and Ethics in Health Care (NURS 343)</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Concepts of Management (NURS 341)</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Senior Preceptorship: NURS 350, NURS 352, NURS 354, NURS 356</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>Year Total:</td>
<td>12</td>
<td>14</td>
</tr>
</tbody>
</table>

Total Units in Sequence: 125-127
Doctor of Nursing Practice

The Doctor of Nursing Practice Program (DNP) is an innovative academic program designed to prepare advanced practice nurses who are leaders in their fields. The Post-Master’s DNP program is flexible in meeting the needs of distance education students, with an innovative executive format and cohort program that has partnerships with several academic institutions and hospitals around the country. The DNP program admits students at three different stages in order to accommodate students with diverse educational backgrounds.

- Graduate Entry Program (Pre-Licensure stage; MN degree awarded): The Graduate Entry program is a pre-licensure stage designed for individuals with baccalaureate (or above) degrees from an accredited college or university in a discipline other than nursing. Students admitted to the Graduate Entry program prepare for licensure as a registered nurse. A generalist Master of Nursing (MN) degree is awarded at successful completion of the program, and students can then apply to a Board of Nursing for licensure as a Registered Nurse and practice as a beginning staff nurse. They are also encouraged to proceed to the next phase of the DNP program to attain their MSN degree.

- Post-Licensure (Advanced Nursing Practice stage; MSN degree awarded): This phase of the DNP program is designed for registered nurses who have received the Master of Nursing (MN) degree. It awards a Master of Science in Nursing (MSN) degree and allows students to apply to a professional organization for certification in the advanced nursing specialty and to a Board of Nursing for credentials to practice in the advanced nursing specialty.

- Post-Master’s DNP (Practice Doctorate stage; DNP degree awarded): This stage of the DNP program prepares nurses with MSN degrees to be clinical leaders at the absolute pinnacle of their field. Students acquire in-depth knowledge in nursing theory, research, policy, and education or management. Most DNP students at the post-master’s level are already practicing in roles as advanced practice nurses, administrators, or educators. Once they are admitted to this phase of the program, they choose one of two elective sequences: education leadership or practice leadership.

Characteristics of the Graduate

- Teaching/Learning: Develops, implements and evaluates educational offerings, individually and in collaboration with others.
- Research/Inquiry: Promotes evidence based practice by initiating, synthesizing and generating knowledge for and through clinical research.
- Nature of Practice: Assumes functions of advanced nursing practice roles and identifies health issues amenable to clinical research and evidence based practice.
- Leadership: Assumes leadership positions of increasing complexity at the local, state, national and international levels
- Ethics: Identifies and analyzes ethical issues and standards and incorporates them into practice.
- Collaboration: Develops and promotes trans-disciplinary initiatives in the practice community.
- Communication: Disseminates knowledge and evidence to improve health. Evaluates communication systems and generates new models to enhance system efficacy.
- Policy Development: Participates in the initiation, evaluation and modification of health policy locally to globally.

Degree Requirements

- Post-master’s entry students must complete the DNP program within four years. Students who do not complete the DNP program within the above timeframe should send a letter to the Director of the Doctor of Nursing Practice Program with a request for an extension and a proposed plan for completing of remaining requirements.
- Records of students who do not complete the program within the specified timeframe will be re-evaluated in terms of the curriculum in effect at the time of review. The student may be required to take additional course work to graduate.

Academic Performance

Progression in the Doctor of Nursing Practice degree program is contingent upon satisfactory academic achievement in all required courses.

Doctor of Nursing Practice students must achieve a cumulative grade point average of 3.0 or above in all courses taken for credit as a DNP student at the Frances Payne Bolton School of Nursing to be awarded the DNP degree. All DNP students must successfully defend their scholarly project.

The grade of incomplete (I) will be given at the discretion of the instructor for work not completed in the semester. A grade of I must be removed by the end of the semester following the one in which the course was taken or before the student enrolls in a course for which the initial course is a prerequisite. No credit is given for an I grade. The I will remain a permanent part of the transcript if the student fails to complete course requirements within the next semester.

Scholarly Project

The DNP program culminates in successful completion of a scholarly project. The scholarly project is designed by the student in collaboration with a 3-member committee approved by the Program Director. The scholarly project must focus on an issue related to improving patient outcomes. The scholarly project can take the form of a thesis or a manuscript suitable for publication. The procedures and written product must conform to the regulations of the FPB School of Nursing.

Students must successfully defend their completed scholarly project in an “oral examination” with their committee members who are responsible for certifying that it meets acceptable scholarly standards. The defense is open to faculty and students; the chair determines whether the defense is open to those outside of the University. The committee determines the adequacy of the oral examination and written product. A student will pass if two or more of the committee members agree that the student successfully responded to questions during the defense and the written product met scholarly standards.

Post-Master’s DNP Curriculum

Most classes are held in an intensive format (http://fpb.case.edu/Programs/intensives.shtm), meeting for a specified number of days with additional meetings held online. A 3-credit course will meet for 5-6 days. Two courses are held online across the semester. Intensive sessions are given three times a year (January, May, and August) for at least two weeks. Papers and projects are due in the semester following the intensive session.

Required Courses

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>NUND 450</td>
<td>Applied Statistics</td>
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<tr>
<td>NUND 504</td>
<td>Theories for Nursing Practice and Scholarship</td>
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</tr>
<tr>
<td>NUND 506</td>
<td>Leadership in Organizations and Systems</td>
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<tr>
<td>NUND 508</td>
<td>Health Care Policy and Planning</td>
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<tr>
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<tr>
<td>NUND 530</td>
<td>Research Principles and Methods</td>
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<tr>
<td>NUND 531</td>
<td>Approaches to Practice Focused Research</td>
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<td>NUND 610</td>
<td>Translating Evidence into Nursing Practice</td>
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<td>NUND 611</td>
<td>Practicum</td>
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<td>NUND 612</td>
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<td>NUND 619</td>
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<td>NUND 620</td>
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### Educational Leadership Electives

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<tr>
<td>NUND 509</td>
<td>Curriculum and Instruction</td>
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<tr>
<td>NUND 609</td>
<td>Theoretical Foundations of Educational Testing and Evaluation</td>
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### Practice Leadership Electives

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<tbody>
<tr>
<td>NUND 507</td>
<td>Management in Advanced Nursing Practice</td>
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</tr>
<tr>
<td>NUND 607</td>
<td>Advanced Leadership and Management in Healthcare</td>
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Graduate Entry Nursing Program

The Graduate Entry Nursing Program is designed for individuals who hold at least a BA/BS in a non-nursing major and whose career and educational goals include nursing practice at the advanced specialty level. All applicants are admitted to three stages of the program (http://fpb.case.edu/GradEntry/pathways.shtm): pre-licensure stage (leading to the Master of Nursing, or MN), advanced nursing practice stage (leading to the MSN), and practice doctorate stage (leading to the DNP). Students are encouraged to complete all phases of the program. However, they may choose to exit (temporarily or permanently) after each phase. Certain MSN majors have separate experience requirements and/or admission process.

During the pre-licensure stage, students earn about 15 credits applicable to most MSN majors. Graduate Entry students may apply for the PhD program following the pre-licensure (MN) program. The Graduate Entry Nursing program has an innovative quality and safety component (http://fpb.case.edu/QualSafe) woven throughout the curriculum, emphasizing the importance of the patient experience.

Characteristics of the Graduate

The MN (Master of Nursing) is a generalist nursing degree awarded to those who satisfactorily complete the pre-licensure stage of the Graduate Entry program. MN graduates possess the following characteristics:

- Teaching/Learning: Provides opportunities for individuals, other professionals, populations and communities to enhance their knowledge about health, illness, and health seeking behaviors through consultation and education conceived in partnership with the learner
- Research/Inquiry: Integrates best current evidence to continuously improve the delivery of care and identify areas where further evidence is needed
- Nature of Practice: Provides and directs nursing care for individuals, groups, families and populations, that focuses on safety, quality, and the recipients' needs, preferences and values
- Leadership: Assumes beginning nursing leadership roles that are directed toward outcomes evaluation and implementation of care improvement initiatives
- Ethics: Applies ethical principles in complex nursing situations
- Collaboration: Promotes nursing and inter-professional collaboration to achieve safe, quality healthcare
- Communication: Integrates technology and interpersonal techniques in communication, knowledge management, error mitigation, and decision-making with diverse clients and colleagues
- Policy Development: Actively participates in policy development at local, unit, and state levels to promote safe, quality healthcare

Degree Requirements

Time Frame for Completion of Degree

- Completion of MN degree. Graduate Entry Nursing Program students (non-nurses) must complete the MN program within 4 years of initial enrollment.
- Completion of the MSN, DNP, or PhD; refer to policies for those programs.
- Records of students who do not complete their program within the specified timeframe will be re-evaluated in terms of the curriculum in effect at the time of review. The student may be required to take additional course work to graduate.

Progression in the Program

Satisfactory Academic Standing

Progression in the Graduate Entry Nursing Program is contingent upon satisfactory achievement in all required courses. To maintain satisfactory academic standing, students enrolled for the pre-licensure (Master of Nursing-MN) component of the Graduate Entry Nursing Program must attain and maintain a GPA of 3.0 or above. C, the lowest passing grade, is viewed as borderline performance. An overall GPA of 3.0 is required to progress to the post-licensure component of the Graduate Entry Nursing Program. If a student’s semester GPA is less than 3.0 or the overall GPA is less than 3.0, the student will be placed on probation and an individualized plan will be developed and documented. The student will be removed from probation when the overall GPA is 3.0 or higher. If the student is on probation for two semesters, the student’s record will be reviewed by the Executive Committee to determine whether extenuating circumstances warrant an additional semester of probation or whether the student should be separated from the program.

When a student receives a grade of F for a required course, the student must register for that course the next semester in which the course is available. Refer to the Frances Payne Bolton Student Handbook (http://fpb.case.edu/programs/handbook.shtm) for more information on a repeating course with an F grade and the GPA. Graduate Entry students who receive two failing grades indicating unsatisfactory performance (F, NP, or U) in required courses will be excluded from Frances Payne Bolton; contact the Graduate Entry Program Director (http://bulletin.case.edu/schoolofnursing/mn/mailto:dxl41@case.edu). Progression from one semester to the next in the pre-licensure (MN) component of the Graduate Entry Nursing Program is contingent upon passing grades in all courses taken in the preceding semester. The grade of Incomplete (I) will be given at the discretion of the instructor for work not completed in the semester. A grade of I must be removed by the end of the semester following the one in which the course was taken or before the student enrolls in a course for which the initial course is a prerequisite. No credit is given for an I grade. The I will remain a permanent part of the transcript if the student fails to complete course requirements within the next semester.

Graduate Entry students in the post-licensure component must meet all progression requirements of the degree program in which they are enrolled (MSN (p. 464), DNP (p. 460), or PhD (p. 472)). Refer to those sections of the Bulletin for further information.

Approval of RN Licensure Applications

In order to have the “Program Completion” section of the application for RN licensure approved by the Program Director, students must meet the following criteria:

1. Have been awarded the Master of Nursing (MN) degree.
2. Demonstrate readiness to take the NCLEX-RN examination by achieving at least a minimum score on a NCLEX-RN predictor exam. (refer to separate procedure on “Demonstrating Readiness to the NCLEX-RN Exam” for details).

Curriculum

Applicants admitted to the Graduate Entry Nursing Program are admitted for the MN, MSN and DNP degrees (certain MSN majors have separate experience requirements and/or admission process). On completion of the MSN, or MSN degrees, students may apply for the PhD and/or DNP programs. Upon successful completion of the M.N. curriculum, graduates are eligible to sit for the NCLEX examination for licensure as a Registered
Nurse. NOTE: Successful completion of all pre-licensure courses is necessary to sit for the Professional Nursing Licensing Examination (NCLEX-RN). FPB has the right to determine a student’s readiness to sit for this exam and also reserves the right to restrict testing until the student demonstrates a readiness to pass the examination.

The MN curriculum (below) includes 72 credit hours of required courses. Students must meet the University requirements for graduation. The ratio of credit hours to clock hours is: didactic and seminar, 1:1; lab, 1:2; and clinical, 1:4.

<table>
<thead>
<tr>
<th>First Year</th>
<th>Units</th>
<th>Fall</th>
<th>Spring</th>
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<tbody>
<tr>
<td>Introduction to the Discipline and Practice of Nursing (NUND 401)</td>
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<td>Introduction to Pharmacology (NUND 402)</td>
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<tr>
<td>Introduction to Nursing Informatics (NUND 403A)</td>
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<tr>
<td>Inquiry A for the Graduate Entry DNP (NUND 404A)</td>
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<tr>
<td>Aging in Health and Illness (NUND 406)</td>
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<td>Health Assessment (NUND 410)</td>
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<td>Altered Human Functioning (NUND 405)</td>
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<td>Acute Care Nursing of the Adult (NUND 407)</td>
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<td>Introduction to Concepts of Genetics in Nursing (NUND 408)</td>
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<td>Professional Role Development: Leadership (NUND 409A)</td>
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<td>Public Health Nursing A (NUND 411A)</td>
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<tr>
<td>Issues and Ethics in Health Care (NUND 413)</td>
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<th>Spring</th>
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<tr>
<td>Inquiry B for the Graduate Entry DNP (NUND 404B)</td>
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<td>Professional Role Development: Health Policy, Advocacy and Delegation (NUND 409B)</td>
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<tr>
<td>Parents and Neonates in Health and Illness (NUND 415)</td>
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<tr>
<td>or Children and Families in Health and Illness (NUND 416)</td>
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<td>Psychiatric Mental Health Nursing (NUND 417)</td>
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<td>Health Promotion Across the Life Span (NUNP 410)</td>
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<td>Concepts in Nursing Management (NUND 414)</td>
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<td>or Parents and Neonates in Health and Illness (NUND 415)</td>
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<td>Integrated Nursing Practice (NUND 418)</td>
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<td>18</td>
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</table>

Total Units in Sequence: 72

Credits Toward the MSN Earned in the Master of Nursing Curriculum

Students who successfully complete the Master of Nursing curriculum and are awarded the MN degree have earned the following credits applicable toward most MSN majors for the MSN degree.

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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<tbody>
<tr>
<td>NURS 405</td>
<td>Inquiry I - Theoretical Foundations (Basis: waiver)</td>
</tr>
<tr>
<td>NURS 425</td>
<td>Inquiry II - Research Process (Basis: waiver)</td>
</tr>
<tr>
<td>NURS 502</td>
<td>Inquiry III - Evidence-Based Nursing Practice (Basis: course completed)</td>
</tr>
<tr>
<td>NUNP 410</td>
<td>Health Promotion Across the Life Span (Basis: course completed)</td>
</tr>
<tr>
<td>NURS 444A</td>
<td>Ethical Issues in Advanced Practice (Basis: waiver)</td>
</tr>
<tr>
<td>NURS 443C</td>
<td>Teaching and Learning in Advanced Practice (Basis: waiver)</td>
</tr>
</tbody>
</table>
Master of Science in Nursing (MSN)

The Master of Science in Nursing program prepares registered nurses for advanced practice specialization either as a nurse practitioner, clinical nurse specialist, advanced public health nurse, nurse midwife, or nurse anesthetist. Dual degree programs are offered in bioethics (MSN/MA), anthropology (MSN/MA), business administration (MSN/MBA), and public health (MSN/MPH). Post-master’s certificates can be provided for all programs and are crafted according to individual needs and background education.

Characteristics of the Graduate

- Teaching/Learning: Develops and teaches educational offerings and provides consultation with other professionals/populations and communities about health, illness and health-seeking behavior
- Research/Inquiry: Identifies clinical research problems, initiates utilization of research and participates in scientific inquiry
- Nature of Practice: Assumes functions and role of the Advanced Practice Nurse
- Leadership: Assumes leadership positions in employment or community organizations at the local/state/national level
- Ethics: Applies ethical principals in Advanced Practice Nursing
- Collaboration: Initiates interdisciplinary teams to enhance practice
- Communication: Establishes effective communication systems among clients and colleagues
- Policy Development: Contributes, implements and influences health policy development through work and professional organizations

Degree Requirements

The MSN program itself requires a minimum of 36 credit hours to graduate, but the majors require an average of 40 credit hours of graduate credit for the student who enters with a BSN degree. Other degree requirements must be fulfilled for those entering with the portfolio option. A maximum of nine (9) semester hours of credit in approved graduate courses, where the student obtained a grade of B or above, may be transferred to meet program requirements, and three (3) credits may be waived for a total of 12 credits. To be awarded an MSN degree, the student must have a cumulative GPA of 3.0 and received satisfactory grades in all nursing courses taken for credit as a MSN student. Degree requirements must be completed within 5 years of initial enrollment.

Path to the MSN

Students in the MSN program choose from several different majors, but virtually all students must take at least ten core courses (http://fpb.case.edu/MSN/program.shtm). Student must complete a required number of credit hours as well as clinical hours. The majors require an average of 40 credit hours, usually completed in three or four semesters (including summer). Most MSN majors also require at least 500 clinical hours; the anesthesia, midwifery, cardiovascular, and flight nursing programs require more.

Courses are usually scheduled to meet once a week for several hours. This frees up other days for clinical hours or work. Students can choose either a part-time or full-time program, with full-time consisting of 9 or more credits per semester and part-time being anything less.

Course Grades

Progression in the MSN program is contingent on a cumulative GPA of 3.0 and passing grades in all courses (A, B, C, P, or S). If the cumulative GPA falls below 3.0 during any semester, the student will be placed on academic probation. To be removed from probation, the student must have a cumulative GPA of 3.0 or higher in the next academic semester he/she is registered. If the student fails to be removed from academic probation at this time, he/she may be separated from the FPB School of Nursing.

The grade of Incomplete (I) will be given at the discretion of the instructor for work not completed in the semester. The “Arrangement to Resolve a Grade of Incomplete” form must be completed prior to the end of the semester, or the instructor may assign a grade of U or F. A grade of I must be removed by the end of the semester following the one in which the course was taken or before the student enrolls in a course for which the initial course is a prerequisite. No credit is given for an I grade. The I will remain a permanent part of the transcript if the student fails to complete course requirements within the next semester, unless alternative arrangements are approved in writing.

A student who receives a grade of F or U for a required course must register for the course the next semester it is offered to continue in the MSN program. If the grade of U or F is in a course that is not required for the MSN program, the student may register for the same course, or a substitute course and achieve a passing grade to continue in the MSN program. If the student receives a grade of F or unsatisfactory performance (F, U, and NP) in two courses, he/she will be excluded from FPB.

Majors and Sample Full-Time Curriculum

Virtually all MSN students must take at least ten core courses in Professional Development, Scientific Inquiry, and Nursing Practice (for nurse practitioner majors). Although the MSN program itself requires a minimum of 36 credit hours to graduate, the majors require an average of 40 credit hours, usually completed between 18 and 24 months, though the nurse anesthesia program requires 28 months of study. Students also need to put in at least 500 clinical hours for most MSN majors; the anesthesia, midwifery, cardiovascular, and flight nursing programs require even more. Post-master’s certificates can be provided for all programs and are crafted according to individual needs and background education.

Nurse Practitioner Majors

Acute Care Nurse Practitioner (http://fpb.case.edu/MSN/ACNP.shtm) (ACNP)

- Subspecialty: Flight Nursing (http://fpb.case.edu/MSN/ACNPFlight.shtm)
- Subspecialty: Cardiovascular Nursing (http://fpb.case.edu/MSN/ACNPCardio.shtm)

Acute care nurse practitioners (ACNPs) often serve as first responders in a variety of healthcare settings that include community and academic hospitals, intensive care units, outpatient clinics, and specialty practices like medical cardiology, subacute care, or trauma.

As part of FPB’s MSN program, the ACNP major requires at least 39 credit hours of coursework and 600 hours of clinical experience. A recent year of adult intensive care (ICU) nursing experience is required prior to beginning this program.

<table>
<thead>
<tr>
<th>First Year</th>
<th>Units</th>
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<th>Spring</th>
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<tbody>
<tr>
<td>Inquiry I - Theoretical Foundations (NURS 405)</td>
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<tr>
<td>Foundations for Adult-Gerontology Acute Care Nursing (NUNP 438)</td>
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</table>
Advanced Pathophysiology (NURS 453) 4
Integrated Assessment for Advanced Nursing Practice (NURS 459) 3
Pharmacology and Therapeutics (NURS 430) 3
Acute Health Problems of Adults and Older Adults (NUNP 443) 4 - 6
Inquiry II - Research Process (NURS 425) 3
Collaboration, Consultation, & Credentialing in Advanced Practice Nurs (NURS 443A) 1
Role Development in Advanced Practice (NURS 443B) 1
Teaching and Learning in Advanced Practice (NURS 443C) 1
Year Total: 14.5 13-15

Second Year

Units

Fall Spring
Inquiry III - Evidence-Based Nursing Practice (NURS 502) 2
Inquiry Practicum (NURS 503) 1 - 2
Advanced Management of Acutely Ill Adults and Older Adults (NUNP 444) 3 - 4
Ethical Issues in Advanced Practice (NURS 444A) 1
Health Care Delivery and Finance in Advanced Practice (NURS 444B) 1
Health Policy Legislation and Legal Issues in Advanced Practice (NURS 444C) 1
Year Total: 9-11

Total Units in Sequence: 36.5-40.5

Adult-Gerontology Nurse Practitioner (http://fpb.case.edu/MSN/adultgero.shtm)
- Subspecialty: Cardiovascular Nursing (http://fpb.case.edu/MSN/adultgerocardio.shtm)
- Subspecialty: Gerontology

Adult-gerontology NPs provide comprehensive care, including wellness and acute and chronic illness care, to patients from late-adolescence through adulthood to the elderly. They specifically emphasize health promotion, disease prevention, and comprehensive gerontological assessment. They practice in a wide variety of locations that include hospitals, urgent and primary care settings, community clinics, long-term care facilities, and private practice.

As part of FPB’s MSN program, the adult-gero NP major requires 41 hours of coursework, plus about 600 hours of clinicals. The coursework is usually completed within 18 months (four semesters) for full-time students, and courses are offered in a distance-friendly format that requires about eight trips to Cleveland.

First Year

Units

Fall Spring Summer
Inquiry I - Theoretical Foundations (NURS 405) 3
Advanced Pathophysiology (NURS 453) 4
Integrated Assessment for Advanced Nursing Practice (NURS 459) 3
Health Promotion Across the Life Span (NUNP 410) 2
Inquiry II - Research Process (NURS 425) 3
Pharmacology and Therapeutics (NURS 430) 3
Common & Acute Health Problems of the Adult and Older Adult (NUNP 432) 5
Collaboration, Consultation, & Credentialing in Advanced Practice Nurs (NURS 443A) 1
Primary Care of Older Adults (NUNP 449) 4
Inquiry III - Evidence-Based Nursing Practice (NURS 502) 2
Role Development in Advanced Practice (NURS 443B) 1

Teaching and Learning in Advanced Practice (NURS 443C) 1

Year Total: 12 12 8

Second Year

Units

Fall Spring Summer
Advanced Management in Adult Primary Care (NUNP 434) 5
Inquiry Practicum (NURS 503) 1 - 2
Ethical Issues in Advanced Practice (NURS 444A) 1
Health Care Delivery and Finance in Advanced Practice (NURS 444B) 1
Health Policy Legislation and Legal Issues in Advanced Practice (NURS 444C) 1

Year Total: 9-10

Total Units in Sequence: 41-42

Pediatric Nurse Practitioner (http://fpb.case.edu/MSN/PNP.shtm) (PNP)
- Subspecialty: Cardiovascular Nursing (http://fpb.case.edu/MSN/PNPcardio.shtm)

Pediatric nurse practitioners (PNPs) are advanced degree nurses who provide primary health care for children from infancy to 21 years of age, including physical, psychosocial, and family dimensions of health. They diagnose and treat childhood illnesses, provide immunizations, perform developmental screenings and physical assessments, and much more in their objective to protect and enhance the health of children. Along with pediatricians and other providers, PNPs practice in settings such as private practice, primary care clinics, community health centers, and hospitals.

As part of FPB’s MSN program, the PNP major requires 40 credit hours of coursework, plus about 600 hours of clinicals. The coursework is usually completed within 18 months (four semesters) for full-time students, and courses are offered in a distance-friendly format that requires about eight trips to Cleveland.

First Year

Units

Fall Spring Summer
Inquiry I - Theoretical Foundations (NURS 405) 3
Advanced Pathophysiology (NURS 453) 4
Integrated Assessment for Advanced Nursing Practice (NURS 459) 3
Health Promotion Across the Life Span (NUNP 410) 2
Health Promotion in Children and Adolescents (NUNP 401) 3
Inquiry II - Research Process (NURS 425) 3
Pharmacology and Therapeutics (NURS 430) 3
Common and Acute Health Problems of Children (NUNP 402) 6
Inquiry III - Evidence-Based Nursing Practice (NURS 502) 2
Collaboration, Consultation, & Credentialing in Advanced Practice Nurs (NURS 443A) 1
Role Development in Advanced Practice (NURS 443B) 1
Teaching and Learning in Advanced Practice (NURS 443C) 1

Year Total: 15 12 5

Second Year

Units

Fall Spring Summer
Inquiry Practicum (NURS 503) 1 - 2
Advanced Management in Pediatric Primary Care (NUNP 403)  5
Ethical Issues in Advanced Practice (NURS 444A)  1
Health Care Delivery and Finance in Advanced Practice (NURS 444B)  1
Health Policy Legislation and Legal Issues in Advanced Practice (NURS 444C)  1
Year Total:  9-10

Total Units in Sequence:  41-42

**Neonatal Nurse Practitioner** ([http://fpb.case.edu/MSN/NNP.shtm](http://fpb.case.edu/MSN/NNP.shtm)) (NNP)

Neonatal nurse practitioners (NNPs) are advanced practice nurses who focus on the management and care of fragile, critically ill, and premature infants and their parents. Their role encompasses activities that promote optimal health, detect illness, and facilitate restoration and maintenance of the health of neonates. NNPs practice in neonatal intensive care units (NICUs), which are found in children’s and large general hospitals.

Two years of NICU nursing are needed prior to beginning the NNP major. As part of FPB’s MSN program, the major requires 40 credit hours of coursework, plus about 600 hours of clinicals in NICUs. Full-time coursework is completed within 24 months (4 semesters).

### First Year

<table>
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<tr>
<th>Units</th>
<th>Fall</th>
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<th>Summer</th>
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<tbody>
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<td>Inquiry I - Theoretical Foundations (NURS 405)</td>
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<tr>
<td>Integrated Assessment of the Neonate (NUNP 416)</td>
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<td>Advanced Pathophysiology (NURS 453)</td>
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Total Units in Sequence:  39.5-40.5

**Family Nurse Practitioner** ([http://fpb.case.edu/MSN/FNP.shtm](http://fpb.case.edu/MSN/FNP.shtm)) (FNP)

- Subspecialty: Cardiovascular Nursing ([http://fpb.case.edu/MSN/FNPcardio.shtm](http://fpb.case.edu/MSN/FNPcardio.shtm))
- Subspecialty: Gerontology

Family nurse practitioners (FNPs) are advanced nurses who offer care, promote health, and treat disease in patients ranging from children to elders. They provide comprehensive wellness care as well as management of acute and chronic illnesses. FNPs practice in hospitals, urgent care and primary care settings, federally-qualified health centers, and private practice offices.

As part of the MSN program, the FNP major requires 40 credit hours of coursework, plus about 600 hours of clinicals. The coursework is usually completed within 18 months (four semesters) for full-time students, and courses are offered in a distance-friendly format that requires only eight trips to Cleveland.

### First Year

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Total Units in Sequence:  40-41

**Women’s Health Nurse Practitioner** ([http://fpb.case.edu/MSN/WHNP.shtm](http://fpb.case.edu/MSN/WHNP.shtm)) (WHNP)

Women’s health nurse practitioners (WHNPs) are experts in woman-focused health promotion and disease prevention. As specialists, WHNPs deliver comprehensive health care to women, with emphasis on reproductive and gynecologic health needs. They provide well-woman care, care during and after pregnancy, and care before and after menopause. They also care for women experiencing episodic acute or chronic illnesses. WHNPs see a broad range of patients in practice settings that include primary care centers, adolescent health centers, and private practice.

The WHNP major, as part of FPB’s MSN program, requires 38 credit hours of coursework, plus about 600 hours of clinicals. With full-time enrollment, coursework is usually completed within 12 months (four semesters).
semesters). Core MSN courses are offered in an intensive format (http://fpb.case.edu/Courses/intensive.shtm) that requires limited trips to Cleveland.

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Total Units in Sequence: 35-36

Blended Role (NP/CNS) Majors

Advanced Practice Adult Oncology/Palliative Care (http://fpb.case.edu/MSN/OncologyPalliativeCare.shtm)

Advanced practice adult oncology/palliative care nurses provide expert care to patients undergoing cancer treatment and those focusing on the management of complex symptoms. These advanced practice nurses care for both inpatients and outpatients, within hospitals and clinics as well as via hospice and palliative care programs.

At FPB, this innovative, versatile major prepares graduates to practice in a variety of oncology or hospice and palliative care settings. Students may select either nurse practitioner or clinical nurse specialist tracks. Graduates of the program will be eligible for the adult nurse practitioner certification and/or oncology nurse practitioner certification, oncology clinical nurse specialist certification, or certification in palliative care, assuming other examination and practice requirements are met. The program can be done on either a full-time or part-time basis. One year of oncology or medical-surgical nursing experience is required. The major requires 40-41 credit hours of coursework, plus about 500 hours of clinicals. The coursework is usually completed within 24 months (four semesters) for full-time students.

Opportunities to obtain post-Master’s certification in oncology or palliative care are also available. Palliative care courses (Symptom Management I and II) may be taken as electives as part of any other APN major, or by non-degree students seeking additional preparation for their practice.

Family Systems Psychiatric Mental Health Nursing (http://fpb.case.edu/MSN/familysystems-psych.shtm)

In addition to the shortage of advanced practice psychiatric nurses, healthcare systems are challenged to address the needs of an increasing elderly population; stressed military families; families impacted by the economy, loss of employment, home foreclosure, and other stressors; and a population facing an increase in reported rates of domestic and youth violence.

The work of an advanced practice psychiatric nurse practitioner or clinical nurse specialist is dynamic in scope, ranging from prevention and health promotion to early detection and assessment to integration and culturally appropriate, client-centered intervention. Similarly, they can practice in a multitude of environments, including community mental health clinics; hospitals systems; private physician offices; prison systems; military bases and Veteran’s Affairs Hospitals; treatment facilities; and psychiatric mental health community centers, among others.

The Family Systems Psychiatric Mental Health Nursing major, as part of the MSN program, requires 45 credit hours of coursework and 720 hours of clinicals. The coursework is usually completed within four semesters.

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Total Units in Sequence: 41-42
General Systems Theory: Foundations for Practice (NURS 476) 2
Advanced Practice Seminar: Blended Role of Psychiatric-Mental Health APRN (NURS 476) 1
Integrated Assessment for Advanced Nursing Practice (NURS 459) 3
Pharmacology and Therapeutics (NURS 430) 3
Psychopharmacology (NURS 465) 2
Advanced Psychopathology Across the Lifespan Part II (Adult and Older Adult) (NURS 474) 2
Family Systems Theoretical Foundations (NURS 481) 2
Family Systems Integration and Application (NURS 482) 1
Inquiry II - Research Process (NURS 425) 3
Individual and Group Modalities for Family Systems Practice Across the Lifespan (NURS 484) 3
Practicum and Supervision: Family Systems Practice Across the Lifespan (NURS 485) 2
Year Total: 12 13 8

Second Year Units
Inquiry III - Evidence-Based Nursing Practice (NURS 502) 2
Inquiry Practicum (NURS 503) 1 - 2
Modalities for Family Systems Practice: Vulnerable Family Populations (NURS 486) 3
Theoretical Basis of Practice and Supervision in Consultation, Collaboration (NURS 488) 2 - 3
Practicum and Supervision in Role of Family Systems Psych-Mental Health Advanced Practice Nurse (NURS 489) 3
Management in Advanced Nursing Practice (NUND 507) (elective) 3
Year Total: 14-16

Total Units in Sequence: 47-49

Other Majors
Nurse Anesthesia (http://fpb.case.edu/MSN/anesthesia.shtm)
Nurse anesthetists are advanced practice nurses who administer all types of anesthetic for every kind of surgery or procedure. As expert clinicians primarily responsible for direct patient care, they focus on preoperative evaluation, intraoperative management, and postoperative anesthesia care.

Clinical courses for MSN nurse anesthesia students at FPB provide them with the opportunity to give direct patient care, participate in staff education programs, and identify clinical topics for research. Students work one-on-one with a clinical preceptor with expertise in nurse anesthesia. They will also take part in administering general and regional anesthesia in persons of all ages. The management of emergency operations, obstetrics, pediatrics, and neurosurgery are an integral part of the clinical experience. Graduates will be eligible to take the certification examination administered by the Council on Certification of Nurse Anesthetists.

All applicants must have at least two years of recent experience in one of the following acute care settings: recovery room, emergency room, or medical, surgical, neonatal, or pediatric intensive care or one year's experience with certification in their respective nursing specialty (CCRN, CEN, CPAN).

First Year Units
Collaboration, Consultation, & Credentialing in Advanced Practice Nurs (NURS 443A) 1
Role Development in Advanced Practice (NURS 443B) 1
Teaching and Learning in Advanced Practice (NURS 443C) 1
Chemical and Physical Properties of Anesthesia (NUAN 449) 1
Anesthesia Nursing I (NUAN 455) 1
Pharmacological Strategies in Anesthesia Practice (NUAN 450) 1
Inquiry I - Theoretical Foundations (NURS 405) 3
Physiological Variables and Responses I: Respiratory System (NUAN 451) 1
Physiological Variables and Responses II: Cardiovascular (NUAN 452) 1
Anesthesia Nursing II (NUAN 456) 1
Anesthesia Nursing III (NUAN 457) 1
Physiological Variables and Responses III: Peds, OB, Endo & Geriatrics (NUAN 453) 1 - 5
Ethical Issues in Advanced Practice (NURS 444A) 1
Health Care Delivery and Finance in Advanced Practice (NURS 444B) 1
Health Policy Legislation and Legal Issues in Advanced Practice (NURS 444C) 1
Year Total: 6 6 5-9

Second Year Units
Inquiry II - Research Process (NURS 425) 3
Physiological Variables and Responses IV: Renal and Neurologic Systems (NUAN 454) 3
Nurse Anesthesia: Advanced Practice I (NUAN 551A) 2
Nurse Anesthesia: Advanced Practice I (NUAN 551B) 2
Inquiry III - Evidence-Based Nursing Practice (NURS 502) 2
Inquiry Practicum (NURS 503) 1 - 2
Nurse Anesthesia: Advanced Practice I (NUAN 551C) 1 - 5
Year Total: 8 5-6 1-5

Third Year Units
Nurse Anesthesia: Advanced Practice II (NUAN 552) 1 - 5
Year Total: 1-5

Total Units in Sequence: 32-45

Nurse Midwifery (http://fpb.case.edu/MSN/midwifery.shtm)
Certified nurse-midwives (CNMs) are educated in the two disciplines of nursing and midwifery and are certified according to the requirements of the American Midwifery Certification Board. CNMs manage women's health care, focusing on common primary care issues, family planning and gynecologic needs, pregnancy, childbirth, the postpartum period, and care of the newborn. They practice within a healthcare system that provides for consultation, collaboration, or referral as indicated by the...
health status of the client, in accordance with the Standards for the Practice of Midwifery, as defined by the American College of Nurse-Midwives (ACNM).

Nurse midwife students must complete 48 credit hours of coursework as well as work individually with a clinical preceptor in a variety of out-patient, in-patient, and out-of-hospital settings to provide optimal care to women in the antepartum, intrapartum, and postpartum periods. Graduates will be eligible to take the certification examination administered by the American Midwifery Certification Board. With the addition of 3 clinical hours in NURS 559 Advanced Practice in Nursing Care of Women, students are eligible for dual certification in Women’s Health.

First Year

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<td>Health Care Delivery and Finance in Advanced Practice (NURS 444B)</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Advanced Midwifery (NURS 557)</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inquiry Practicum (NURS 503)</td>
<td>1 - 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Year Total:</td>
<td>12</td>
<td>7 - 8</td>
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</tbody>
</table>

Total Units in Sequence: 48-49

Joint Degrees

Master of Science in Nursing/Master of Arts in Anthropology (MSN/MA Anthropology) (http://fpb.case.edu/MSN/MSNMABIO.shtm)

The Master of Science in Nursing/Master of Arts in Anthropology joint degree provides students with the unique combination of cross-cultural expertise in medical anthropology and clinical expertise in nursing. Students must complete a minimum of 19 credits in nursing core courses, 12 to 22 credits in clinical major courses, and a minimum of 18 credits in anthropology courses, distributed as indicated below. The actual number of credits depends upon the major selected. This curriculum plan reflects clinical nursing majors other than nurse anesthesia and community health. Choice of electives should guarantee that minimum credit requirements are met. All students must pass the Masters Qualifying Examination in Anthropology.

Required Nursing Courses

<table>
<thead>
<tr>
<th>Units</th>
<th>Fall</th>
<th>Spring</th>
<th>Summer</th>
</tr>
</thead>
<tbody>
<tr>
<td>NURS 43A</td>
<td>Collaboration, Consultation, &amp; Credentialing in Advanced Practice Nurs</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>NURS 443B</td>
<td>Role Development in Advanced Practice</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>NURS 443C</td>
<td>Teaching and Learning in Advanced Practice</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>NURS 444A</td>
<td>Ethical Issues in Advanced Practice</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>NURS 444B</td>
<td>Health Care Delivery and Finance in Advanced Practice</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>NURS 444C</td>
<td>Health Policy Legislation and Legal Issues in Advanced Practice</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>NURS 453</td>
<td>Advanced Pathophysiology</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>NURS 459</td>
<td>Integrated Assessment for Advanced Nursing Practice</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>NURS 430</td>
<td>Pharmacology and Therapeutics</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>NURS 405</td>
<td>Inquiry I - Theoretical Foundations</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Clinical major selected</td>
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</table>

Required Anthropology Courses

<table>
<thead>
<tr>
<th>Units</th>
<th>Fall</th>
<th>Spring</th>
<th>Summer</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANTH 480</td>
<td>Medical Anthropology and Global Health I</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>ANTH 481</td>
<td>Medical Anthropology and Global Health II</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>ANTH 462</td>
<td>Contemporary Theory in Anthropology</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Anthropology electives (health-related)</td>
<td></td>
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Required Research Courses

<table>
<thead>
<tr>
<th>Units</th>
<th>Fall</th>
<th>Spring</th>
<th>Summer</th>
</tr>
</thead>
<tbody>
<tr>
<td>NURS 425</td>
<td>Inquiry II - Research Process</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>NURS 502</td>
<td>Inquiry III - Evidence-Based Nursing Practice</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>NURS 503</td>
<td>Inquiry Practicum</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>or ANTH 504</td>
<td>Anthropological Research Design</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>500-level medical anthropology course</td>
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</table>

Required Elective

Approved Elective course in Anthropology OR Nursing | 3 |

Master of Science in Nursing/Master of Arts in Bioethics (MSN/MA Bioethics) (http://fpb.case.edu/MSN/MSNMABIO.shtm)

The Master of Science in Nursing/Master of Arts in Bioethics joint degree program is designed to provide nurses with the concepts essential to ethics and ethical decision-making. This program is relevant for nurses who are family advocates within health care systems. The total MSN/MA degree requirements are 53-63 credits.

Required Nursing Courses

<table>
<thead>
<tr>
<th>Units</th>
<th>Fall</th>
<th>Spring</th>
<th>Summer</th>
</tr>
</thead>
<tbody>
<tr>
<td>NURS 453</td>
<td>Advanced Pathophysiology</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>NURS 459</td>
<td>Integrated Assessment for Advanced Nursing Practice</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>NURS 430</td>
<td>Pharmacology and Therapeutics</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>NURS 405</td>
<td>Inquiry I - Theoretical Foundations</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>NURS 425</td>
<td>Inquiry II - Research Process</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>NURS 502</td>
<td>Inquiry III - Evidence-Based Nursing Practice</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>NURS 443A</td>
<td>Collaboration, Consultation, &amp; Credentialing in Advanced Practice Nurs</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>NURS 443B</td>
<td>Role Development in Advanced Practice</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>NURS 443C</td>
<td>Teaching and Learning in Advanced Practice</td>
<td>1</td>
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</tr>
</tbody>
</table>

Required Bioethics Courses

<table>
<thead>
<tr>
<th>Units</th>
<th>Fall</th>
<th>Spring</th>
<th>Summer</th>
</tr>
</thead>
<tbody>
<tr>
<td>BETH 401</td>
<td>Foundations in Bioethics I</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>BETH 402</td>
<td>Foundations in Bioethics II</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>BETH 405</td>
<td>Clinical Ethics Rotation</td>
<td>1.5</td>
<td></td>
</tr>
<tr>
<td>or ANTH 504</td>
<td>Anthropological Research Design</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>
Nursing Centers of Excellence

The Centers of Excellence at the Frances Payne Bolton School of Nursing expose students first-hand to nursing research, global health care systems, evidence-based practice, initiatives in aging care, self-management, end-of-life science, and inclusion of persons with disabilities into research.

Sarah Cole Hirsh Institute for Best Nursing Practices Based on Evidence (http://fpb.case.edu/Centers/Hirsh)

Established in 1998, the Sarah Cole Hirsh Institute for Best Nursing Practices Based on Evidence develops and promotes evidence-based practice in nursing. Historically, nursing and medical practices have been based, in part, on expert opinion and tradition, creating variations in practice and often subjectivity in judgment. Through the integration of research and practice, the Hirsh Institute stimulates the use of best nursing practices based on evidence as a basis for delivering superior health care, and shaping the next phase of nursing research.

Center for Research and Scholarship (http://fpb.case.edu/Research)

The Center for Research and Scholarship provides a variety of services to support the research and scholarship efforts of faculty, students, and postdoctoral fellows, including management of the internal and external funding process. The center provides faculty and students with current funding opportunities that are available, assists in the development of research proposals, and disseminates research results regionally, nationally, and internationally. The center staff assists in the submission of Human Subjects Research reviews to the affiliated institutional review boards. The center provides support for all stages of faculty members’ manuscript submission including submission and tracking. Four full-time employees staff the center. A conference room and a workroom are available within the center for both faculty and student investigators.

WHO Collaborating Center for Research and Clinical Training in Home Care Nursing (WHOCC) (http://fpb.case.edu/Centers/WHOCC)

The WHOCC is affiliated with the World Health Organization, which was established in 1948 by the United Nations as its specialized agency for health. The WHO’s objective, as set out in its Constitution, is the attainment by all peoples of the highest possible level of health. WHO Collaborating Centers are national institutions around the world designated by the WHO to collect and disseminate information on world health issues, provide education and training, and participate in collaborative research. The WHO Collaborating Center at FPB is charged with research and clinical training in home care nursing and is one of only 10 designated centers for nursing in the United States.

The University Center on Aging and Health (UCAH) (http://fpb.case.edu/Centers/UCAH)

By the year 2020, a staggering number (approximately 17%) of the US population will be considered elderly. In addition, almost 40% of a physician’s time will be spent treating the elderly by that year. UCAH at Case Western Reserve University serves international, national, and local communities by providing an interdisciplinary platform for gerontological education, research, and services. A key objective of UCAH is to increase the number of students in the role of gerontology and utilize its partnerships to promote interdisciplinary collaboration.

Center of Excellence for Self-Management Advancement through Research and Translation (SMART) (http://fpb.case.edu/SMARTCenter)

The SMART Center is an NIH-funded research center designed to address the science of self-management at the levels of individual, family, organization, and community. Its goals are to expand knowledge related to self-management through interdisciplinary investigations of self-management, serve as a national leader in research and dissemination of research findings to the scientific community, and diffuse knowledge into clinical practice and policy to enhance the use of self-management strategies to improve the health, function, and quality of life of individuals.

Building End-of-life Science through Positive Human Strengths and Traits (BEST) Center (http://fpb.case.edu/Centers/BEST)

The BEST Center is funded by the National Institute of Nursing Research/National Institute of Health. It focuses on quality of life research for seriously ill people, including those who are at the end of life. The Center’s mission is to radically shift the direction of quality of life research.

Full Inclusion of Persons with Disabilities in Self-Management Research (FIND) Lab (http://fpb.case.edu/FINDLab)

The FIND Lab’s mission is to promote the full inclusion of persons with disabilities in mainstream health care research through use of Universal Design of Research and to encourage research on the general health care needs of persons with disabilities. It is funded by the National Institutes of Nursing Research/National Institute of Health.
Other Student Categories

Non-Degree Students
An applicant with basic preparation in nursing may apply to register as a non-degree student for up to 9 credits. Those who have not yet been formally accepted into the FPB School of Nursing must complete the non-degree application (http://fpb.case.edu/StudentServices/forms.shtm) and return it to the Registrar’s office (http://fpb.case.edu/StudentServices/registrar.shtm) by fax or e-mail. After your application is received and approved, you will receive further instructions via e-mail on how to register via the Student Information System (SIS). They must also request that any former colleges or universities forward their transcripts to FPB.

For those wishing to take PhD courses, the applicant must obtain written permission from the faculty teaching the course and the Associate Dean for Doctoral Education in FPB for those taking PhD courses. Contact the Graduate Studies Office (http://www.cwru.edu/provost/gradstudies) at 216-368-4390.

Clinical courses may not be taken as a non-degree student. Continuation of this status is at the discretion of FPB’s administrative officer. Status as a non-degree student does not imply acceptance into FPB. If the non-degree student applies for admission to FPB, course work completed as a non-degree student will be evaluated on an individual basis for its applicability to degree requirements within the time frame for the degree.

Special Students
Special students are those who take a specified course of study designed to meet an individual’s needs. They must meet the admission requirements for the program where the majority of class work will be done. Their status and satisfactory performance will be reviewed after one year. Students completing MSN courses to obtain a certificate in any advanced practice nursing major will be admitted as special students.

If a special student decides to pursue a graduate degree, the approval of the Associate Dean of Academic Programs must be obtained. Entrance into the degree program will be considered the date when the student enrolled in the first course work as a special student. These courses must have been taken within the last five years. If more than five years have elapsed since the course work as special student was done, the student must meet the current academic requirements for the major selected.

International Students
International students may enroll in the masters, nursing doctorate and PhD programs. They must meet the admission requirements for the program that they select. In addition, application should be submitted approximately one year before the desired date of enrollment. English translations of transcripts are required.

Each applicant must document the ability to speak, read, and write English as evidenced by satisfactory performance on the Test of English as a Foreign Language (TOEFL). The International English Language Testing System (IELTS) is also accepted.

Test information can be obtained at: www.toefl.org (http://bulletin.case.edu/schoolofnursing/otherstudentcategories/http://www.toefl.org) and www.ielts.org (http://bulletin.case.edu/schoolofnursing/otherstudentcategories/http://www.ielts.org)

Students whose native language is English are exempt. For those whose native language is not English, the minimum acceptable scores are:

• Paper-based TOEFL: 577
• IELTS: 7.0

Additional requirements for international students:

• International students must present evidence of adequate financial resources to meet the expenses of full-time study and travel expenses to and from Cleveland. Financial assistance is not available from FPB. The student must arrange for a sponsor who will provide full financial support. The sponsor must document their ability to financially support the student, including costs of tuition and fees, room and meals, books, incidentals, and travel expenses.
• Students applying to clinical programs must be eligible for licensure as a registered nurse (RN) before any clinical courses are taken. To obtain RN licensure, the student can either 1) obtain licensure in a state other than Ohio and apply for reciprocity in Ohio, or; 2) sit for the licensure examination (NCLEX-RN) in Ohio. For information on how to become licensed in any state, you must obtain information from the specific state where you wish to become licensed. For the individual addresses of each State Board of Nursing, go to the National Council of State Boards of Nursing website (http://www.ncsbn.org) and then go to “Click here to access the Boards of Nursing contact information and Web sites.”

Students may also write to:
National Council of State Boards of Nursing
676 N. St. Clair Street
Suite 550
Chicago, IL 60611-2921
Telephone: 312.787.6555

Once admitted to FPB, an application form for a student visa will be sent to the student. Upon enrollment at the university, the student must subscribe to the Student Medical Insurance Plan or proved proof of other medical insurance coverage.

• Internet-based TOEFL: 90
PhD in Nursing

The PhD program is a post baccalaureate degree program designed to prepare scientists who initiate and conduct research relevant to nursing. Expertise in clinical nursing and competence in research are required to prepare scholars to disseminate knowledge into clinical practice and nursing education. To achieve excellence in the academic program, students engage in activities consistent with the areas of research excellence of the faculty. Moreover, the faculty is committed to the intellectual growth of the student, which is achieved through mentorship and collaboration in scholarship.

The PhD student concentrates on the organization and development of knowledge requisite to nursing practice for service to a population. The population may include: age group (children, adults), focus of service (individual, family, or community) and position on the continuum of health (health and wellness, acute and chronic disruptions in health). PhD students are culturally diverse, and many develop and apply knowledge relevant to global health needs.

Characteristics of the Graduate

- Develops, implements and evaluates educational offerings, individually and in collaboration with others, related to research and nursing theory.
- Synthesizes and generates knowledge for the discipline of nursing.
- Identifies health issues amenable to research; disseminates knowledge and evidence to improve health.
- Assumes leadership positions of increasing complexity at the local/state/national and international levels.
- Identifies and analyzes ethical issues and standards related to science and knowledge development.
- Develops systems to establish and promote interdisciplinary teams in the scientific community.
- Uses and promotes the development of effective communication strategies that support scholarship and the dissemination of research findings.
- Generates and disseminates knowledge relevant to health care policy.

Degree Requirements

Our PhD in Nursing program prepares students for careers as researchers, scientists, or university-level faculty members. They have the opportunity to participate in the research that has a profound effect on the science of nursing and changing nursing practices. PhD students concentrate on the organization and development of knowledge requisite to nursing practice for service to a particular population. PhD students are culturally diverse, and many develop and apply knowledge relevant to global health needs.

The PhD requires a minimum of 57 semester hours of course work, which includes the foundation for the student’s dissertation as well as dissertation completion. The program is individualized, taking into account student interests, aspirations, and work experience. Students entering the program with a BSN who do not wish to obtain an MSN degree will be required to take NURS 507 Clinical Knowledge and NURS 508 Context of Care. A dual degree MSN/PhD program is available for those who also want an MSN degree.

The general program requirements are listed below. Additional coursework may also be necessary, as determined by the faculty advisor.

Knowledge Development/Theory Core (6 credit hours)

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>NURS 506</td>
<td>Nursing Epistemology</td>
<td>3</td>
</tr>
<tr>
<td>NURS 511</td>
<td>Strategies for Theory Development</td>
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Research Methods Core (9 credit hours)

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<th>Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>NURS 518</td>
<td>Qualitative Nursing Research</td>
<td>3</td>
</tr>
<tr>
<td>NURS 530</td>
<td>Advanced Nursing Research Methods I</td>
<td>3</td>
</tr>
<tr>
<td>NURS 531</td>
<td>Advanced Nursing Research II</td>
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</table>

Statistics Core (9 credit hours)

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>NURS 532</td>
<td>Basic Statistics: Fundamentals for Analysis</td>
<td>3</td>
</tr>
<tr>
<td>NURS 630</td>
<td>Advanced Statistics: Linear Models</td>
<td>3</td>
</tr>
<tr>
<td>NURS 631</td>
<td>Advanced Statistics: Multivariate Analysis</td>
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Support Courses (12 credit hours)

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
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<tbody>
<tr>
<td>NURS 609</td>
<td>Health Care Policy and Planning</td>
<td>3</td>
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<tr>
<td>NURS 615</td>
<td>Topical Seminar in Health Science Research</td>
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</tr>
<tr>
<td>Electives</td>
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Preparation for Research (minimum 3 credit hours)

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<th>Title</th>
<th>Credits</th>
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<td>NURS 671</td>
<td>Proposal Development</td>
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<td>Candidacy Exam</td>
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<tr>
<td>Proposal Defense</td>
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</table>

Dissertation Research (minimum 18 credit hours)

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<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>NURS 701</td>
<td>Dissertation Ph.D.</td>
<td>1 - 18</td>
</tr>
</tbody>
</table>

Dissertation Fellowship (upon recommendation to the School of Graduate Studies) for a maximum of 4 consecutive semesters after completion of NURS 701

Optional PhD Education Courses

To insure that graduates from our PhD in Nursing program are prepared to assume the full faculty role upon graduation, including preparation for teaching and mentoring others, students are encouraged to take optional courses that specifically address the development of their teaching skills.

While two of these courses are taught in an intensive format, between semesters, the third course consists of a 60-hour teaching practicum.

Preparation for Nursing Education Coursework

- Curriculum and Instruction
- Theoretical Foundations of Teaching and Evaluation
- Teaching Practicum

It is recommended that courses within this education track be integrated within the student’s planned program of study within the first two years of the program.

The courses and teaching practicum must be completed before the student will be advanced to candidate status.

Opportunities for undergraduate and graduate clinical and didactic teaching during paid teaching assistantships are available.

Sample Curriculum Plans

See the website for details. (http://fpb.case.edu/PhD/sampleplans.shtm)
Traditional Format Sample Plan

Students who already have earned the MSN degree can enter the PhD program directly and complete the PhD core coursework during fall and spring semesters.

- A minimum of 3 credits of proposal development is required; however, students may need more time to complete their candidacy exam and proposal development and may therefore need to take more credits of proposal development.
- Concurrent enrollment in proposal development credits and dissertation credits is not permitted.
- Full time status is defined as 9 credits per semester ONLY while students are enrolled in their coursework prior to proposal development. However, enrollment in even a single credit of NURS 671 Proposal Development or NURS 701 Dissertation Ph.D. constitutes full time study.
- Total required credit hours for the nursing PhD (post MSN) = 57 credits

Fast-Track Sample Plan

Students with a BSN or equivalent can pursue the PhD degree without earning an MSN. In addition to PhD core requirements, they must complete transition courses to gain clinical knowledge and be able to develop a research focus pertinent to nursing in the context of care.

- A minimum of 3 credits of proposal development is required; however, students may need more time to complete their candidacy exam and proposal development and may therefore need to take more credits of proposal development.
- Concurrent enrollment in proposal development credits and dissertation credits is not permitted.
- Full time status is defined as 9 credits per semester ONLY while students are enrolled in their coursework prior to proposal development. However, enrollment in even a single credit of NURS 671 Proposal Development or NURS 701 Dissertation Ph.D. constitutes full time study.
- Total required credit hours for the nursing PhD (post BSN or equivalent) = 63 credits

Dual Degree Programs

MSN/PhD Dual Degree Program

Students are accepted into both programs. They select an MSN major or clinical specialty and may take MSN and PhD courses concurrently. Up to 8 credits of course overlap are allowed, depending on the clinical major.

DNP/PhD Dual Degree Program

Students are accepted into both programs and meet course requirements for both doctorates with an overlap of 11 credits. Students develop proposals for the DNP thesis project and PhD dissertation concurrently in order to facilitate timely completion of both degrees.

Advanced Standing for DNP Graduates

Students who have earned a DNP degree within the past five years may be granted advanced standing in the PhD nursing program and qualify for a waiver of up to 9 credits.

Other Programs

Summers-Only Plan

Depending on the number of registrants, PhD courses may be offered during the summer months to enable students to earn the degree in six summers.
School of Nursing Courses

NUAN Courses

NUAN 449. Chemical and Physical Properties of Anesthesia. 1 Unit.
Introduction and elaboration of basic chemical and physical principles as they relate to clinical nurse anesthesia practice. An in-depth study of organic and biochemical principles, structure/relation, relationships and their significance in pharmacology. Emphasis will be on the integration and practical application of these principles to clinical nurse anesthesia practice.

NUAN 450. Pharmacological Strategies in Anesthesia Practice. 1 Unit.
Application of pharmaco-kinetic and pharmaco-dynamic principles as they relate to specific anesthetic and adjunct drugs used in anesthesia practice. Integration of this information into clinical area regarding anesthetic uses, dosages, and side effects of these classes of drugs is emphasized. Coreq: NUAN 449.

NUAN 451. Physiological Variables and Responses I: Respiratory System. 1 Unit.
A detailed study of the anatomic structures and the related physiochemical mechanisms governing respiratory function in health and disease. Assess the functional integrity of this system utilizing all pertinent objective and subjective data. Consider the impact of anesthetic agents and techniques on this system and how one can plan anesthetic to facilitate health-seeking behaviors as a patient attempts to attain, maintain or regain optimal health. Implications for all types of surgery due to the effect of anesthesia on respiratory system, however, special attention on surgery involving this specific system. Prereq: NUAN 449.

NUAN 452. Physiological Variables and Responses II: Cardiovascular. 1 Unit.
A detailed study of the anatomic structures and the related physiochemical mechanisms governing cardiovascular function in health and disease. Assess the functional integrity of this system utilizing all pertinent objective and subjective data. Consider the impact of anesthetic agents and techniques on this system and how one can plan anesthetic to facilitate health-seeking behaviors as a patient attempts to attain, maintain, or regain optimal health. Implications for all types of surgery due to the effect of anesthesia on cardiovascular system, however, special attention on surgery involving this specific system. Coreq: NUAN 451.

NUAN 453. Physiological Variables and Responses III: Peds, OB, Endo & Geriatrics. 1 - 5 Unit.
Study of health-seeking behaviors and intervening variables with special consideration of the anatomy, physiology, and pathophysiology of the pediatric and obstetric, endocrine and geriatric patient. Focus will be on the integration of this information into the nurse anesthesia care to support the health-seeking behaviors of these patients. Prereq: NUAN 451 and NUAN 452.

NUAN 454. Physiological Variables and Responses IV: Renal and Neurologic Systems. 3 Units.
Systematic investigation of the physiologic factors related to health-seeking behaviors with special emphasis on pathophysiology of the renal and neurologic systems. Focus will be on the integration of this knowledge into the planning, implementation, and evaluation of patients requiring nurse anesthesia intervention. Prereq: NUAN 453.

NUAN 455. Anesthesia Nursing I. 1 Unit.
An introduction to the art and science of nurse anesthesia including basic anesthetic principles and beginning clinical practicum to introduce the student to anesthetic equipment and operating room environment. This course is designed to give the student practical information regarding administration of safe anesthesia.

NUAN 456. Anesthesia Nursing II. 1 Unit.
Progressive, guided instruction on clinical and ethical management of clients undergoing all forms of anesthesia. This unit includes the history of nurse anesthesia relevant to contemporary anesthetic practice, legal and ethical aspects of anesthesia delivery, and patient/client interaction strategies. The course is designed to give the nurse exposure to career expectations in nurse anesthesia; as well as prepare him/her in administration of safe, routine anesthetic with moderate amount of instructor intervention. Prereq: NUAN 455.

NUAN 457. Anesthesia Nursing III. 1 Unit.
Graduated, guided instruction in clinical management of clients receiving various types of anesthesia. Emphasis is on the preparation and planning for anesthesia utilizing Schlotfeldt paradigm. Includes actual administration of anesthesia for clients exhibiting more complicated pathophysiology. More advanced technical instruction and experience. Correlation of didactic and clinical materials, as well as continuous evaluation of student progress are integral to this course. Prereq: NUAN 456.

NUAN 551A. Nurse Anesthesia: Advanced Practice I. 2 Units.
Individual, in-depth study of advanced clinical nurse anesthesia in such specialty areas as neurosurgical, cardiovascular, obstetric and pediatric anesthesia. The nurse learns to handle more difficult, specialized patients who are at a higher risk. Emphasis is on more complex management with advanced monitoring techniques, use of pharmacological agents and handling higher stress situations. Students develop and utilize practical clinical applications of nurse anesthesia theory. Prereq: NUAN 457.

NUAN 551B. Nurse Anesthesia: Advanced Practice II. 2 Units.
(See NUAN 551A.) Prereq: NUAN 551A.

NUAN 551C. Nurse Anesthesia: Advanced Practice I. 1 - 5 Unit.
(See NUAN 551A.) Prereq: NUAN 551B.

NUAN 552. Nurse Anesthesia: Advanced Practice II. 1 - 5 Unit.
The continuation of advanced, independent clinical nurse anesthesia administration. Emphasis is on management of higher risk patients for more difficult procedures, performing total anesthetic care with minimum of anesthesiologist supervision, and readiness for transition from student to graduate status. Prereq: NUAN 551A and NUAN 551B and NUAN 551C.

NUND Courses

NUND 400. Guided Study. 1 - 6 Unit.
Selected topics in basic nursing. May include clinical experiences.
NUND 401. Introduction to the Discipline and Practice of Nursing. 7.5 Units.
This course is an introduction to the discipline and practice of nursing. Factors influencing health and illness will be explored. Selected nursing strategies and interventions designed to support the maximum health potential of the adult client will be incorporated into labs sessions and practiced in a variety of settings. Small group seminars will be used to examine historical, societal, and legal influences on nursing and the role of functions of the professional nurse. Coreq: NUND 402 and NUND 410.

NUND 402. Introduction to Pharmacology. 3 Units.
This course introduces basic principles of pharmacology and pharmacotherapeutics. A survey of characteristics and uses of major drug groups with an emphasis on nursing implications is presented. Coreq: NUND 401 and NUND 410.

NUND 403A. Introduction to Nursing Informatics. 1 Unit.
This course will introduce students to the concept of health informatics and the role nurses play in the management of information in supporting all areas of nursing including clinical practice, education, research, and administration. Using case studies, lecture and class discussion. Students will develop an awareness of the importance of nursing involvement in the design, implementation, and use of information systems and other technologies. Coreq: NUND 401.

NUND 403B. Nursing and Health Informatics. 1 Unit.
This is the second of a two part course sequence in Nursing Informatics. The focus of this course is the transdisciplinary nature of informatics in health care and the use of advanced information technologies (IT) to support decision-making, promote safety, and ensure quality in patient care. Current issues in health care policy and legislation relating to health information technology will be discussed. Prereq: NUND 403A.

NUND 404A. Inquiry A for the Graduate Entry DNP. 2 Units.
This course provides an introduction to conceptual and theoretical thinking. Students will examine knowledge development in nursing, conceptual structures, and the use of theory in nursing practice and research. Coreq: NUND 401.

NUND 404B. Inquiry B for the Graduate Entry DNP. 2 Units.
This course is a continuation of NUND 404A GE Inquiry A. It completes the introduction to conceptual and theoretical thinking and begins examination of the research process in nursing. The student will examine scientific inquiry and scientific investigation, including the research process. Prereq: NUND 404A.

NUND 404C. Inquiry C for the Graduate Entry DNP. 2 Units.
This course is a continuation of NUND 404B GE DNP Inquiry B. It expands the examination of scientific investigation in nursing and includes data management, analysis, and interpretation; critique of existing research; and implications for nursing practice. Coreq: NUND 404B.

NUND 405. Altered Human Functioning. 3 Units.
Introduction to basic pathophysiologic outcomes of selected intervening variables that alter human physiologic and cognitive functioning. This course builds on the student’s foundation of normal anatomy and physiology. Recommended preparation: completion of first semester of D.N.P. program.

NUND 406. Aging in Health and Illness. 2 Units.
This course will explore the concept of aging in health and illness with an emphasis on the older adult as an individual with the capacity to grow and develop. Prereq or Coreq: NUND 401 and NUND 410.

NUND 407. Acute Care Nursing of the Adult. 8.5 Units.
The focus of this course is the integration of the nursing process in clinical practice. Human responses to significant health events and alterations are analyzed. Application of relevant physiology, psychosocial dimensions, and pharmacology are included. Particular emphasis is placed on nursing strategies, interventions, and the evaluation of their effectiveness in the care of the acutely ill adult. Prereq: NUND 401, NUND 402, NUND 343, NUND 403A, NUND 404A, and NUND 410.

NUND 408. Introduction to Concepts of Genetics in Nursing. 1 Unit.
Introduction to the theories and concepts relevant to human genetics and genomics and their applications in health care.

NUND 409A. Professional Role Development: Leadership. 1 Unit.
This seminar is the second in a series designed to address professional role development. The seminar focuses specifically on leadership development in nursing. Prereq: NUND 401.

NUND 409B. Professional Role Development: Health Policy, Advocacy and Delegation. 1.5 Unit.
This seminar is the third in a series designed to address professional role development. The seminar content focuses specifically on health policy, delegation and advocacy. Prereq: NUND 409A.

NUND 410. Health Assessment. 2.5 Units.
Comprehensive introduction to the assessment skills required for a successful nursing practice. Basic skills, such as vital signs, are taught along with a system by system approach to physical examination. Taking a health and psychosocial history is integrated into the course. The course is taught concurrently with anatomy and physiology, concepts of nursing practice, and strategies and interventions for alterations in functioning. Coreq: NUND 401 and NUND 402.

NUND 411A. Public Health Nursing A. 2.5 Units.
This is the first of a two course sequence in public health nursing - health promotion disease prevention for groups, populations, and communities. This course will focus on enhancing the health and health-seeking behaviors of groups and populations. Adult teaching-learning theories and processes will be explored. Coreq: NUND 405, NUND 406, NUND 407, NUND 408, NUND 409A.

NUND 411B. Public Health Nursing B. 2 Units.
This is the second of a two course sequence in public health nursing - health promotion-disease prevention for groups, populations, and communities. This course will focus on enhancing the health and health-seeking behaviors of a selected community. Coreq: NUND 411A.

NUND 413. Issues and Ethics in Health Care. 2 Units.
This course introduces students to the principles underlying ethical issues and methods of rational decision making. Fundamental theories will be reviewed and applied through case analyses to address ethical dilemmas common to modern health care. Coreq: NUND 401.
NUND 414. Concepts in Nursing Management. 2 Units.
This course focuses on the study of basic concepts related to management and working with groups in the provision of nursing care. Concepts of nursing management including: planning, organizing, staffing, directing, and controlling within healthcare settings will be discussed. Coreq: NUND 417 or permission of course faculty.

NUND 415. Parents and Neonates in Health and Illness. 4.5 Units.
This course introduces biological, psychosocial, and developmental concepts applicable to the nursing care of women, newborns, and families during the childbearing cycle. Emphasis is placed on assessment and identification of health needs as parents and neonates respond to the changes inherent in the childbearing cycle. Strategies related to nursing care of parents and neonates are discussed. The clinical experience focuses on the direct application of these concepts and strategies in the care of patients in various perinatal settings. Prereq: NUND 405, NUND 407, NUND 408, NUND 409A, NUND 411A.

NUND 416. Children and Families in Health and Illness. 4.5 Units.
This course is the study of children from infancy through adolescence and their health status from a developmental perspective. Emphasis is on healthy children as well as those with common acute and chronic illness within the context of their family environment. Nursing strategies focus on interventions to promote, restore, and maintain health and foster growth and development. These strategies are based on understanding advanced concepts of children’s and families’ responses in health and illness. Prereq: NUND 405, NUND 407, NUND 408, NUND 409A, NUND 411A.

NUND 417. Psychiatric Mental Health Nursing. 4 Units.
This course is designed to address psychiatric and mental health nursing concepts. The focus is on clients with acute and chronic psychiatric disorders and their mental health. Nursing strategies that are appropriate for assessment and intervention with individuals, families, and groups to facilitate optimal mental health will be discussed and practiced. Prereq: NUND 407 and NUND 408.

NUND 418. Integrated Nursing Practice. 5.5 Units.
The focus of this course is implementation of the nursing process in the care of clients with increasingly complex issues of health and illness. Emphasis is placed on integrating principles of safe and quality nursing care. The didactic component includes contemporary topics of relevance to all specialties and settings of nursing practice. The clinical component will allow the student to collaborate with faculty to shape the experience based on the student’s identified learning needs. Prereq: NUND 405, NUND 407, NUND 409A, NUND 411A.

NUND 450. Applied Statistics. 3 Units.
This course provides an advanced overview of the assumptions and applications necessary to analyze and interpret questions and research related to clinical practice. Emphasis will be on statistical interpretation of research. During the course, data management, statistical analysis, and data interpretation, as well as univariate, bivariate, and multivariate statistics such as ANOVA and ANCOVA will be examined. The data analysis process will be examined and deconstructed throughout the course. Prereq: STAT 201 or equivalent within past 5 years.

NUND 480. Action Research and Program Evaluation. 1 Unit.
This course introduces the student to the concept of purposeful evaluation. The applicability of action research and evaluation to the change process and to continuous improvement within various venues will be explored. The iterative, participative, and emergent nature of generation of new knowledge and practice innovations will be discussed. Offered as NUND 480 and NURS 620. Prereq or Coreq: NUND 479.

NUND 500. D.N.P. Thesis. 1 - 6 Unit.
Systematic investigation of a clinically based research problem selected by the student for independent study. This includes proposal refinement and acceptance, data analysis and thesis completion under thesis committee supervision. Prereq: NURS 521.

NUND 504. Theories for Nursing Practice and Scholarship. 3 Units.
This initial course in the Doctor of Nursing Practice program examines the nature of theory, theory development in nursing, and significant conceptualizations of nursing. Application of mid-range theory to practice, practice change, and scholarship is explored. Recommended preparation: Post Masters graduate standing or permission of faculty.

NUND 505. D.N.P. Project. 1 - 6 Unit.
Systematic completion of a project based on existing educational or clinical research. The project could include: (1) program needs assessment, (2) development and testing of an assessment instrument/protocol for clients, (3) implementation and evaluation of a new program; or evaluation of a major existing program. The evaluation may include financial, clinical, or educational components as appropriate to the project. The project will be developed under the supervision of the student’s N.D. project committee. Prereq: NURS 521.

NUND 506. Leadership in Organizations and Systems. 4 Units.
Leadership theory, organization theory and philosophy, culture, structure, processes, information management, and other factors are analyzed for their relevance to health care enterprises. Nursing is examined within the larger context of the health care system.

NUND 507. Management in Advanced Nursing Practice. 3 Units.
This course is focused on management entrepreneurial concepts and issues related to advanced nursing practice. Seminars will focus on integrating legal, fiscal, quality improvement, and other intervening variables that affect environments of care. Prereq: NUND 506.

NUND 508. Health Care Policy and Planning. 3 Units.
The primary focus of this course is to explore the leadership role of nurses in health policy development and implementation as well as the role of research in health care policy formation and planning. Special emphasis is placed on selected national and international health policy issues that form the socio-political and economic context of nursing care and practice. Ethical dimensions of public policy formulations and implementation are highlighted. Offered as NUND 508 and NURS 609.
NUND 509. Curriculum and Instruction. 3 Units.
The purpose of this course is to explore the theoretical underpinnings of education and to examine innovative approaches to critical thinking. Students are provided the opportunity to analyze philosophies and principles of education along with teaching and learning styles. The focus of this course is on curriculum planning and development congruent with the philosophy and objectives of a nursing program. Curriculum development includes determination of program and course objectives, along with selection and organization of appropriate learning experiences to meet these objectives. Effective techniques for instruction in the classroom, laboratory, and clinical settings are explored.

NUND 530. Research Principles and Methods. 3 Units.
This course provides an overview of the components of the research process. Application of these principles to traditional as well as non-traditional research problems will be explored. Prereq: NUND 504. Prereq or Coreq: NUND 450

NUND 531. Approaches to Practice Focused Research. 3 Units.
This course considers a variety of methods used for practice improvement and research. The applicability of these methods, such as action research, program evaluation and quality improvement, to the change process and to continuous improvement within various venues will be explored. The iterative, participative, and emergent nature of knowledge and practice innovations will be discussed. Prereq: NUND 530.

NUND 607. Advanced Leadership and Management in Healthcare. 2 Units.
Leadership strategies and competencies for adapting to strategic advances in knowledge, technology, and organizational processes are explored. Emphasis is placed on developing strategic capacity within the dynamics of the competitive healthcare environment. Prereq: NUND 507.

NUND 609. Theoretical Foundations of Educational Testing and Evaluation. 2 Units.
In this course an overview of theories on educational measurement and evaluation is provided. Methods of evaluating teaching effectiveness, student learning, and student performance are explored with particular emphasis being placed on test construction and analysis. Prereq or Coreq: NUND 509.

NUND 610. Translating Evidence into Nursing Practice. 3 Units.
This course focuses on methods for developing best practice protocols, and translating them into practice. Prereq or Coreq NUND 531

NUND 611. Practicum. 1 - 2 Unit.
Under the guidance of the faculty advisor and designated mentor(s), the student will develop, implement and evaluate a specific clinical practice experience that strengthens and expands current expertise. This practicum will synthesize previous coursework. Prereq or Coreq: NUND 610.

NUND 615. Teaching Practicum. 1 - 6 Unit.
In this preceptored teaching practicum, the student may engage in classroom, laboratory, and clinical teaching assignments in nursing. The student will be expected to use current educational theory and nursing knowledge in completing the practicum experience (minimum 60 hours). Offered as NUND 615 and NURS 621. Prereq: NUND 509 and NUND 609.

NUND 619. Proposal Development. 1 - 2 Unit.
Under guidance of the student's chair, the student will develop a proposal addressing a practice-based research problem for acceptance by the proposal committee and IRB. Prereq: NUND 610.

NUND 620. Scholarly Project. 1 - 3 Unit.
Under the guidance of their advisor and committee, the student will complete a systematic investigation of a previously identified problem. The experience will culminate with a written report of the findings. Prereq: NUND 619.

NUNI Courses
NUNI 421. Theoretical Foundations of Nursing Informatics. 4 Units.
This course focuses on the practice of Nursing Informatics through the examination of concepts, theories, models, and phenomena relevant to the discipline. Conceptual and functional components of information management will be discussed along with their application within the health care setting. Nursing language concepts will be discussed including the Nursing Minimum Data Set, NIC, NOC, NANDA, as well as various specialized data sets used in health care.

NUNI 431. Advanced Nursing Informatics. 4 Units.
This course emphasizes the information needs of clinical users and the flow of information within the health care environment. General systems theory concepts and their applicability to health care information systems will be discussed. Diagnosis of information management problems, formulation of user-friendly solutions, implementation of those solutions, and their subsequent evaluation will be emphasized. Evolving/emerging information technologies will be discussed as well as the role of human-technology interactions in health care. Prereq: NUNI 421, MIDS 409, and NURS 471.

NUNI 432. Health Care Information Systems. 3 Units.
This course covers concepts, techniques and technologies for providing information systems to enhance the effectiveness and efficiency of health care organizations. Offered as HSMC 432, MIDS 432, MPHP 532 and NUNI 432.

NUNI 499. Internship in Nursing Informatics. 1 - 5 Unit.
This capstone experience consists of four components: the precepted internship in an external health care setting, an outline discussion experience, a leadership seminar, and a comprehensive program examination. This internship is designed to provide the Nursing Informatics student with the opportunity to apply the knowledge and skills acquired through the program to the management of health care information activities. Recommended preparation: Completion of first year of M.S.N.

NUNP Courses
NUNP 401. Health Promotion in Children and Adolescents. 3 Units.
This course introduces the concepts of pediatric primary health care from a developmental perspective. Concepts and theories from nursing and other related disciplines associated with the assessment and care of well children and their families are explored. Clinical application of theories and nursing strategies to optimize the health of children and their families are emphasized in the professional role development of students. Coreq: NUNP 410.
NUNP 402. Common and Acute Health Problems of Children. 6 Units.
This course introduces the common and acute health problems occurring in infancy through adolescence using a bio/psycho/social/cultural approach. Pathophysiology, assessment and diagnostic strategies specific to acute and common problems in children will be emphasized. Nursing strategies used to enhance, maintain and restore health will be discussed. Prereq: NURS 453, NURS 459 and NUNP 410. Prereq or Coreq: NURS 430.

NUNP 403. Advanced Management in Pediatric Primary Care. 5 Units.
This course focuses on the primary rehabilitative health care concepts specific to the management of complex, multidimensional health problems experienced by infants, children and adolescents within the context of their family and community environments. Pathophysiology, assessment and diagnostic strategies specific to complex health problems in children are emphasized. The selection of clinical interventions, clinical decision making and evaluation of strategies used to enhance the health outcomes of children and their families will be stressed. Emphasis will be placed on the consultation and referral processes within interdisciplinary and multidisciplinary teams. Prereq: NUNP 402.

NUNP 405. Neonatal Nurse Practitioner I. 3 Units.
This course introduces the role of the Neonatal Nurse Practitioner and concepts relevant to the management of the well or ill neonate. Analysis of nursing strategies to optimize health-seeking behaviors in families with well or ill neonates is highlighted. Prereq or Coreq: NUNP 416.

NUNP 410. Health Promotion Across the Life Span. 2 Units.
This course introduces health promotion fundamental to advanced practice nursing. Epidemiological principles and international, national and local health promotion goals are examined with emphasis on cultural and environmental principles, individual assessment and evidence based practice. Diagnostic reasoning and intervention strategies to optimize health-seeking behaviors in clients and to foster therapeutic relationships are examined.

NUNP 412. Neonatal Nurse Practitioner II. 4 Units.
This course focuses on the health problems of the high-risk neonate in the context of family, culture, and community. Nursing strategies that enhance, maintain, and restore health in ill neonates and their families. Principles identified for advanced diagnostic and therapeutic approaches specific to the neonate, including pharmacology, are emphasized. Prereq: NUNP 405.

NUNP 413. Neonatal Nurse Practitioner III. 3 Units.
Pathophysiology, assessment, and diagnostic approaches specific to neonates with acute problems will be examined. Concepts related to discharge planning collaboration and long-term follow-up will be introduced. Prereq: NUNP 412.

NUNP 414. Neonatal Nurse Practitioner IV. 5 Units.
This course focuses on the acute and on-going habilitative care specific to the management of neonates with complex health problems. Pathophysiology, assessment, and diagnostic approaches specific to complex health problems of preterm infants, infants with chromosomal aberrations, and infants with multidimensional health problems will be emphasized within the context of their family and community environments. Community-based service learning will be stressed along with follow-up of the infant and family during the first year of life. Emphasis will be placed on consultation and referral processes within multidisciplinary teams. Prereq: NUNP 405, NUNP 412 and NUNP 413.

NUNP 416. Integrated Assessment of the Neonate. 2.5 Units.
This course introduces principles fundamental to the integrated assessment of the neonate. It stresses perinatal history taking, gestational age assessment, physical assessment skills, and assessment of genetic risks. The course provides the basis for problem identification, decision making, advanced therapeutics, and case management. Coreq: NUNP 405.

NUNP 419. Family Health Nursing: Health of Adults and Older Adults. 5 Units.
This course introduces the student to the practice of primary health care of adults and older adults. The course includes the principles of growth and development, health promotion, disease prevention, and management of common acute and chronic health problems. Emphasis is placed on the biological, psychological, social and cultural aspects of care. Pathophysiology, assessment and diagnostic techniques specific to the acute and common problems are stressed. Nursing strategies related to health problems used to enhance, maintain, and restore health are emphasized; health-seeking behaviors and the impact on family are stressed. Prereq: NURS 453, NURS 459 and NUNP 410. Prereq or Coreq: NURS 430.

NUNP 421. Symptom Management I. 1 Unit.
The emphasis of this course is on holistic care for persons and families, addressing symptoms that interfere with quality of life at all phases: during active-cure-oriented treatment of reversible illness, during life limiting illnesses, and at the end of life.

NUNP 422. Symptom Management II. 1 Unit.
The emphasis of this course includes the holistic care of persons and families, addressing symptoms that interfere with quality of life at all phases: during active cure-oriented treatment of reversible illness, during life limiting illnesses, and at the end of life. Contextual factors influencing care delivery will also be addressed. These include interdisciplinary collaborative practice models, financial, ethical, cultural, and legal considerations. The role of advanced practice nurse in promoting quality and safety in the provision of palliative care will be emphasized. Prereq: NUNP 421.

NUNP 429. Family Health Nursing: Health of the Family During Childbearing Years. 4 Units.
This course introduces the influence of family dynamics on the care of women and their families before pregnancy, during pregnancy and within the interconceptional period. Assessment of physical and psychosocial health and deviations is central to the course. Content also includes principles of education for childbearing, parenting and conception control. Nursing strategies to optimize health-seeking behaviors of the family during the childbearing years are emphasized. Prereq: NUNP 410 and NUNP 419.
NUNP 431. Advanced Oncology Nursing. 4 Units.
The emphasis of this course is on the genetic basis and pathophysiology of cancer, and common treatment modalities. Advanced practice nursing responsibilities in all phases of cancer care (prevention, detection, diagnosis, treatment, survivorship, and end of life) will be discussed. Traditional, experimental, and complementary treatment modalities will be explored in relation to mechanisms of action, efficacy, and short and long-term side effects. Strategies for addressing health promotion and problem management in patients with cancer will be critically evaluated and implemented. Prereq: NUNP 419.

NUNP 432. Common & Acute Health Problems of the Adult and Older Adult. 5 Units.
This course introduces the common and acute health problems occurring across the adult life span. A problem-oriented approach is used with emphasis on the biological, psychological, social, and cultural aspects of care. Pathophysiology, pharmacology, assessment, and diagnostic strategies specific to the acute and common problems of adults and older adults will be included. Nursing strategies used to enhance, maintain, and restore health will be emphasized. Prereq: NURS 453, NURS 459 and NUNP 410. Prereq or Coreq: NURS 453.

NUNP 433. Common and Acute Health Problems of the Adult II. 3 Units.
This course is a continuation of NUNP 432. Emphasis is on the pathophysiology, assessment and diagnostic approaches specific to the adolescent and adult client. Health-seeking behaviors will be stressed within the context of the family and community.

NUNP 434. Advanced Management in Adult Primary Care. 5 Units.
This course focuses on the health care concepts specific to the management of complex, multidimensional health problems experienced by adolescents and adults within the context of their family and community environments. Pathophysiology, assessment and diagnostic strategies specific to complex health problems in adults are emphasized. The selection of clinical interventions, clinical decision making, and evaluation of strategies used to enhance the health outcomes of adults will be stressed. Prereq: NUNP 449.

NUNP 438. Foundations for Adult-Gerontology Acute Care Nursing. 4.5 Units.
This course focuses on establishing elements of advanced practice nursing (APN) assessment and diagnostic reasoning across the continuum of healthcare services to meet the specialized physiologic and psychosocial needs of adults and older adults with complex acute and/or chronic health conditions. Prereq or Coreq: NURS 453 and NURS 459 or students with an MSN and NP certification, permission of faculty.

NUNP 439. Family Health Nursing: Health of Children and Adolescents. 4 Units.
This course introduces the influence of family dynamics and the information necessary for the practice of primary health care of children and adolescents. The course includes application of the principles of growth and development, disease prevention, and management of common acute and chronic health problems. The impact of the family on child and adolescent development and health is explored. Clinical application of nursing strategies to optimize health-seeking behaviors is emphasized. Prereq: NUNP 429.

NUNP 441. Comprehensive Care of the Chronically Ill Adult and Older Adult. 4 Units.
The focus of this course is on implementation of advanced practice for patients with cancer and other life limiting conditions. Health promotion, health protection, disease prevention, and treatment of patients with cancer and other life-limiting conditions and their families will be included. An interdisciplinary approach to the care of patients and families across the cancer disease trajectory will be addressed. Cultural considerations for diverse populations will be incorporated in the implementation of advanced practice strategies.

NUNP 443. Acute Health Problems of Adults and Older Adults. 4 - 6 Units.
Emphasis is on the pathophysiology, assessment, and diagnostic approaches to adults and older adults with complex acute and chronic health disorders that manifest with physiologic instability. The clinical practicum focuses on further development of diagnostic reasoning, clinical judgement, caring practices, and collaboration in health care systems that deliver acute and critical advanced practice nursing. Students with a MSN and NP experience can request permission for enrollment. Prereq: NURS 453 and NURS 459 and NUNP 438.

NUNP 444. Advanced Management of Acutely Ill Adults and Older Adults. 3 - 4 Units.
This course focuses on concepts specific to complex, multidimensional health problems of acute and critically ill adults and older adults. Clinical practice focuses on management of patients with complex health problems and life-threatening conditions across the entire adult spectrum. Students with a MSN and NP experience can request permission for enrollment. Prereq: NUNP 443.

NUNP 449. Primary Care of Older Adults. 4 Units.
This course will focus on the assessment of the older adults. These factors are analyzed in various environments. Epidemiological and health behavior models are used to assess health risks, assist with problem identification, primary, secondary, and tertiary prevention strategies. Cultural, ethnic, and developmental issues are addressed. Concepts, assessment strategies, interventions and evaluation approaches specific for older adults are identified. Prereq: NUNP 432.

NUNP 454. Advanced Management of Complex Problems in the Older Adult. 4 Units.
This course focuses on the management of complex multidimensional health problems experienced by older adults and their families in multiple environments of care. Pathophysiology, assessment, and diagnostic strategies specific to complex health problems in older adults are emphasized. Evidence-based management strategies used to enhance the outcomes in older adults to promote health and prevent disability will be stressed. The role of the GNP on care giving teams will be included. Prereq: NUNP 449. Coreq: NURS 442.

NURS Courses
NURS 110. Foundations of the Discipline. 1 Unit.
The course is designed to introduce the student to the practice, profession and discipline of nursing. A futuristic perspective will provide a framework for discussion of the foundation of contemporary nursing practice within a variety of health care settings. Critical historical influences that affected the development of contemporary nursing will be discussed. Selected trends and issues that will guide future nursing practice will conclude this course.
NURS 111. Foundations of Practice. 3 Units.
This course is designed as a foundation for clinical nursing practice with a focus on communication, safety, and comfort. The relationship among evidence, theory, and nursing care will be explored. The basic components of the nursing process are presented as a framework for beginning clinical practice.

NURS 120. Nursing Informatics I: Introduction. 2 Units.
This course focuses on the application of mathematics for nursing, including algebra and biostatistics. Microcomputer, word processing and information concepts for nursing practice will be introduced.

NURS 122. Foundations of Practice II. 3 Units.
This course builds on the concepts essential to the foundations of nursing practice presented in previous nursing courses. It is designed to focus on strategies, skills, and techniques to obtain a comprehensive individual health history, family health history, and physical examination. Therapeutic interventions based on assessment and scientific knowledge will be performed. Prereq: C or higher in BIOL 116.

NURS 160. Community Engagement Seminar I. 1 Unit.
This course is a one credit seminar focused on the delivery of culturally appropriate community based health care and on selected issues contributing to the growing disparities in health care outcomes. Students will engage in a 12 hour field experience in a Cleveland community health facility or school system. The seminar will include two sessions devoted to the reflection and evaluation of the field experience. In addition, each semester will include required attendance at the Rozella Schlotfeldt Public Lectures related to issues contributing to disparities in health care. Prereq: NURS 111 or permission of instructor.

NURS 201. Applied Nutrition in Health and Disease. 2 Units.
This course builds upon the student’s knowledge of human physiology and metabolism. Nutrient requirements are highlighted as well as changes related to different stages in the lifespan. Contemporary nutritional issues will be addressed. Prereq: BIOL 114 and BIOL 116 or permission of instructor. Coreq: BIOL 117 and BIOL 119.

NURS 210. Community Engagement Seminar II. 1 Unit.
This course is a one credit seminar focused on the delivery of culturally appropriate community based health care and on the issues of aging and poverty as they contribute to the growing disparities in health care outcomes. Students will engage in a 12 hour field experience in a Cleveland community health facility or school system. The seminar will include two sessions devoted to the reflection and evaluation of the field experience. In addition, each semester will include required attendance at the Rozella Schlotfeldt Public Lectures related to issues contributing to disparities in health care. Prereq: NURS 160 or permission of instructor.

NURS 211. Introduction to Pharmacology. 2 Units.
Introduction to basic principles of pharmacology and pharmacotherapeutics. Review of characteristics and use of major drug groups with emphasis on nursing implications. Prereq: NURS 122 and BIOL 116.

NURS 230. Nursing Care of the Adult I. 5 Units.
This is the first of two courses focusing on the application of the nursing process to adults and older adults experiencing common acute and chronic health alterations. Special emphasis is placed on patient assessment, diagnostic testing, beginning medication teaching and administration, and other nursing interventions as they relate to caring for adults and older adults with alterations in fluid/electrolyte and acid/base balance, and respiratory, cardiac, genitourinary, and endocrine (diabetes) functioning. Care of the patient in the perioperative setting and care of the patient with cancer are also emphasized. Prereq: NURS 122, BIOL 114, and BIOL 117. Coreq: BIOL 121.

NURS 240. Nursing Care of the Adult II. 5 Units.
This course builds upon the knowledge and skills mastered in NURS 230. Course content and learning opportunities provide students with the information necessary to collaborate with other members of the health care team in providing comprehensive care to adults and older adults. Students are expected to collaborate with members of the health care team to plan and implement interventions and to evaluate patient responses to selected interventions. Special emphasis is placed on patients experiencing co-morbid conditions which include alterations in immunologic, hematologic, gastrointestinal, musculoskeletal, and neurologic functioning. Prereq: NURS 211, NURS 230, NURS 250, and BIOL 121.

NURS 250. Aging in Health and Illness. 2 Units.
This course will explore the concept of aging as a healthy developmental process with a particular focus on the elderly as active, independent, and contributing members of the community. Content will include the physiology of aging, health problems common to the elderly, the psychological, emotional, and sociological aspects of the aging process and policy issues. Prereq: NURS 122, BIOL 114, BIOL 117, and BIOL 119.

NURS 260. Community Engagement Seminar III. 1 Unit.
This course is a one credit seminar focused on the delivery of culturally appropriate community based health care and on the issues of culture, ethnicity and socio-economic background as they contribute to the growing disparities in health care outcomes. Students will engage in a 12 hour field experience in a Cleveland health care facility or school system where they will provide health screening and health education services to children and families. The seminar will include two sessions devoted to reflection and evaluation of the field experience. In addition, each semester will include required attendance at the Rozella Schlotfeldt Public Lectures related to issues contributing to disparities in health care. Prereq: NURS 110.

NURS 277. BCLS and First Aid for Health Care Providers. 0 Units.
Designed for healthcare professional students, this course follows the American Heart Association Basic Life Support (BLS) for Healthcare Providers Course objectives. It provides a variety of healthcare professional students the ability to recognize several life-threatening emergencies, provide CPR, use an AED, and relieve choking in a safe, timely and effective manner. Basic first aid skills are also included in this course.
NURS 310. Community Engagement Seminar IV. 1 Unit.

This course is a one credit seminar focused on the delivery of culturally appropriate community based health care and on the issues of culture, ethnicity and socio-economic background as they contribute to the growing disparities in health care outcomes. Students will engage in a 12 hour field experience in a Cleveland health care facility or school system where they will provide health screening and health education services to children and families. The seminar will include two sessions devoted to reflection and evaluation of the field experience. In addition, each semester will include required attendance at the Rozella Schlotfeldt Public Lectures related to issues contributing to disparities in health care. Prereq: NURS 260.

NURS 315. Parents and Neonates in Health and Illness. 4.5 Units.

This course focuses on the study of child bearing families and their health-seeking behaviors from a developmental perspective. Content includes nursing knowledge and skills related to assessment of health status of parents and neonates. Nursing strategies focusing on interventions to promote, restore, and maintain health are discussed. Prereq: NURS 240, NURS 317, and NURS 342.

NURS 316. Infants, Children, and Adolescents in Health and Illness. 4.5 Units.

The study of infants, children, and adolescents, and the health-seeking behaviors from a developmental perspective. Emphasis is on healthy infants, children, and adolescents as well as infants, children, and adolescents with common, acute, and chronic illness within the context of their family environment. Nursing strategies focus on interventions to promote, restore, and maintain health and foster growth and development. Prereq: NURS 240, NURS 317, and NURS 342.

NURS 317. Psychiatric-Mental Health Nursing. 4 Units.

The course is designed to address health-seeking behavior patterns within the context of psychiatric and mental health nursing concepts. The focus is on clients with psychiatric disorders and their mental health. Nursing strategies that are appropriate for assessment and intervention with individuals, families, and groups to facilitate optimal mental health will be discussed and practiced. Prereq: NURS 230 and NURS 211, or permission of instructor.

NURS 318. Nursing in the Community. 4 Units.

The study of the promotion of health and the primary, secondary, and tertiary prevention of health problems of a population. Focuses on the community as client with nursing care of individuals, families, and groups. The clinical component focuses upon developing and evaluating health promotion programs, family assessment, community assessment, and community-based home care within the context of the community. Recommended preparation: RN license.

NURS 320. Theoretical and Evidence Bases for Best Practice in Nursing. 3 Units.

This course explores the theoretical and evidence bases for best practices in nursing. The course begins with an overview of the theoretical and philosophical underpinnings of nursing practice and nursing science. The course includes an intensive focus on the concept of evidence based practice and the process of evaluation supporting practice. Additionally, the course introduces evaluation models used to determine the effectiveness and quality of existing practice and to recommend improvements. Prereq: STAT 201 and completion of five semesters of B.S.N. program.

NURS 338. Care of the Adult and Older Adult with Complex Health Alterations. 4.5 Units.

The purpose of this course is to provide the student with the knowledge and skills to care for one or more complex, acutely ill adult patients, who presents with co-morbid conditions and may be dependent on technologies. This complexity encompasses the physical, psychological, social, spiritual and ethical domains of care and includes both patient and the family. Prereq: NURS 211 and NURS 240 and NURS 342.

NURS 339. Care of the Perioperative Patient. 3.5 Units.

The purpose of this course is to provide the student with a dynamic learning experience in a perioperative environment to enhance the knowledge, cognitive and psychomotor skills to care for one or more patients undergoing operative or invasive procedures. The Perioperative Patient-Focused Model (AORN, 2008) will provide the framework for this course. This Model addresses patient centered care, patient safety, physiologic responses, and behavioral responses of the patient and family. In addition, content will cover issues of quality and safety, informatics, and identification of evidence based practice within the perioperative context. The clinical setting is interdisciplinary and multidisciplinary with other members of the perioperative team. As a member of this team, the student will develop strategies to inspire team work and collaboration with emphasis on communication, patient advocacy and leadership skills. Prereq: NURS 211 and NURS 240 and NURS 342.

NURS 341. Concepts of Management. 3 Units.

This course focuses on the study of basic concepts related to leadership, management and working with groups in the provision of nursing care. Concepts include: decision making, power, authority, roles, teaching-learning, evaluation, leader behaviors, work groups, change, legal aspects and quality. Students will apply the key concepts from marketing, law, finance, quality management, and other intervening variables that affect environments of care.

NURS 342. Medical Microbiology, Immunity, and Infectious Disease. 4 Units.


NURS 343. Issues and Ethics in Health Care. 2 Units.

This course is designed to introduce the student to the principles underlying ethical issues and methods of rational decision making. Fundamental theories will be reviewed and opportunity provided, using case analysis, to apply the theories in addressing ethical dilemmas common to modern health care.

NURS 345. Nursing Informatics III: Clinical NIS. 2 Units.

The focus of this course is directed toward the understanding and use of information technologies and systems that support decision making in nursing practice, administration, research and education. Tools such as list servers, the World Wide Web, e-mail and databases may be used to augment the knowledge base in the course. Recommended preparation: RN license. Prereq: NURS 240 or RN license.
NURS 346. Nursing Informatics IV: Applications. 2 Units.
The focus of this course is directed toward the advanced informatics concepts and the implementation of selected applications within the healthcare setting. Systems analyzed and implemented may range from those used for patient care within the inpatient environment to those used in community or outpatient environments. Affected users of the systems may be clients, families, nursing or other health care professionals. Prereq: NURS 345 or permission.

NURS 350. Concepts and Management in Geriatric Nursing. 9 Units.
This course will introduce concepts of rehabilitation, family nursing, geriatric nursing, and geriatric mental health and assist students in applying these concepts in a long-term care setting. Content will focus on assessment and intervention strategies for health problems common in the older adult. This will include a focus on developmental issues in the elderly, the assessment and management of depression. The course will also include content on assessment and intervention to improve the physical and functional capacities of the elderly, exercise interventions to improve cardiovascular and muscular capacity required for daily activities. Prereq: NURS 351 and NURS 353.

NURS 352. Acute Care III. 9 Units.
This course focuses on the knowledge and skills necessary to provide nursing care for patients with complex problems. Emphasis is on nursing strategies designed to provide comprehensive care to patients and their families affected by acute illness. Clinical practice is directed toward the care of acutely ill adults. Prereq: NURS 370, NURS 371, NURS 372, NURS 373.

NURS 354. Nursing Care of Critically Ill Adults. 9 Units.
This course focuses on the integration of knowledge and skills to provide effective and efficient nursing care to critically ill adults. Emphasis is on nursing strategies directed toward the care of the critically ill patient with a focus on use of biomedical technology, planning and managing patient care, and beginning care of patients with complex care needs. Prereq: NURS 370, NURS 371, NURS 372, NURS 373.

NURS 356. Nursing Care of Critically Ill Neonates, Infants, and Children. 9 Units.
This course focuses on the knowledge and skills necessary for beginning practice in the nursing care of critically ill neonates, infants and children. Emphasis is on nursing strategies directed toward the application of basic principles of critical care nursing with attention to special needs of critically ill newborns, infants and children and their families. Prereq: NURS 370, NURS 371, NURS 372, NURS 373.

NURS 360. Community Engagement Seminar V. 1 Unit.
This course is a one credit seminar focused on the delivery of culturally appropriate community based health care and on the issues of culture, ethnicity and socio-economic background as they contribute to the growing disparities in health care outcomes. Students will engage in a 12 hour field experience in a Cleveland health care facility or school system where they will provide health screening and health education services to children and families. The seminar will include two sessions devoted to reflection and evaluation of the field experience. In addition, each semester will include required attendance at the Rozella Schlotfeldt Public Lectures related to issues contributing to disparities in health care. Prereq: NURS 310.

NURS 370. Information Technologies in Health. 1 Unit.
The focus of this course is the application of advanced information and communication technologies in the healthcare setting. Students will explore Geographic Information Systems (GIS), data mining techniques, telemedicine technology, and advanced communication technologies in the context of health care. Prereq: NURS 315, NURS 316, NURS 345, NURS 351 and NURS 353. Coreq: NURS 371, NURS 372 and NURS 373.

NURS 371. Public Health Nursing. 3 Units.
In this course, students will utilize a problem-based approach to develop knowledge and specific competencies in applying key concepts of public health, public health nursing and epidemiology. Through guided observation and classroom experiences, students will discover strategies to assess, plan, implement and evaluate population-focused programs for health promotion and disease prevention. Prereq: NURS 315, NURS 316, NURS 345, NURS 351 and NURS 353. Coreq: NURS 370, NURS 372 and NURS 373.

NURS 372. Health in the Global Community. 3 Units.
This course focuses on an analysis of the forces shaping community and global health patterns. Drawing on multidisciplinary sources, this course explores the impact of these global processes as they manifest in the health of our own and other societies. Emphasis is placed on analysis of the broad cultural, environmental, social-economic, and political systems that contribute to health status and outcomes, health policies, and health care delivery around the world. Prereq: NURS 315, NURS 316, NURS 345, NURS 351 and NURS 353. Coreq: NURS 370, NURS 371, and NURS 373.

NURS 373. Global Health Practicum. 5 Units.
The purpose of this practicum is to provide students with the opportunity to analyze the concepts of health and health care, health policy and finance, culture and ethics through a preceptoried, 10-week community-based immersion experience in local, national, or international settings. Students will apply epidemiological techniques, the skills of negotiation, partnership building, community assessment and nursing science in the identification and analysis of a health problem leading to the development of an intervention. Prereq: NURS 315, NURS 316, NURS 345, NURS 351 and NURS 353. Coreq: NURS 370, NURS 371 and NURS 372.

NURS 392. Dynamics of Nursing Practice and Management. 4 Units.
The focus of this course is management and leadership concepts and their application to nursing practice management. Topics such as strategic planning, resource management, organizational structure, legal issues, and delegation will be explored. Recommended preparation: RN license.

NURS 393. New Applications in Nursing Practice Management. 4 Units.
The focus of this course is the application of management and leadership concepts in a seminar format and clinical practicum for registered nurses. Students will apply concepts of strategic planning, resource management, organizational structure, and delegation in a healthcare setting. Recommended preparation: RN license.
NURS 394. Global Health Seminar. 3 Units.
The focus of this course is the issues and trends in global health from both a nursing and a trans-disciplinary perspective. The course covers how international social, political, economic, environmental, and cultural issues affect health and health care. Particular emphasis is placed on nursing’s contribution to global health issues and outcomes. Offered as: NURS 394 and NURS 494. Coreq: INTH 301/401.

NURS 399. Independent Study. 1 - 12 Unit.
Independent guided study for undergraduate students with special needs or interests.

NURS 400. Guided Study in Nursing. 1 - 18 Unit.
Independent study for students with special needs and interests.

NURS 401. Statistics for Health Sciences. 3 Units.
This course examines statistical methods of analyses of variance and multiple linear regression. Content includes ANOVA, repeated measures analysis of variances, correlation analysis, and multiple linear regression. Learning statistical theories is coupled with practice of data analysis using statistical software. This course is for graduate students in nursing and health sciences. It is not for credit toward any undergraduate or graduate degrees in Statistics. Recommended preparation: completion of basic statistics within five years of admission to program. Prereq: STAT 201.

NURS 404. Emergent Care of the Child. 2 Units.
This course incorporates biological, developmental, psychological, emotional, social, and cultural aspects of care. The emphasis is on pathophysiology, assessment, diagnostic approaches, and interventions specific to emergent care of infants, children, and adolescents. Advanced therapeutics are introduced. Recommended preparation: Certification in PALS and neonatal resuscitation or concurrent enrollment in NUNP 444. Prereq or Coreq: NUNP 444.

NURS 405. Inquiry I - Theoretical Foundations. 3 Units.
This course provides an introduction to conceptual and theoretical thinking. Students will examine knowledge development in nursing, conceptual structures, and their uses as a basis for nursing practice and research.

NURS 406. Flight Nursing Seminar I. 1 Unit.
This seminar course provides a forum for preparing students to care for patients requiring air transfer to specialty care facilities. Special emphasis is placed on advanced procedures, flight physiology, and environmental influences on the clinical approach in order to apply acute care competencies to flight nursing practice. Prereq or Coreq: NUNP 443.

NURS 407. Flight Nursing Seminar II. 1 Unit.
This seminar continues to prepare students to care for patients requiring air transfer to specialty care facilities. Special emphasis is placed on clinical approaches to patient management across the lifespan. Recommended preparation: ACLS, PALS, and neonatal resuscitation certification. Recommended preparation or concurrent enrollment in NUNP 444, NURS 406, NURS 404.

NURS 409. Specialty Assessment and Diagnostics in Cardiovascular Nursing. 2 Units.
This course provides the basis for the selection and interpretation of assessment and testing strategies during the process of differential diagnosis of cardiovascular problems. Lecture is supplemented with specific clinical lab experiences.

NURS 410. Cardiovascular Nursing Seminar I. 1 Unit.
This seminar course focuses on cardiac rhythm abnormalities and their management. Prereq or Coreq: NURS 430. Coreq: NURS 409.

NURS 411. Cardiovascular Nursing Seminar II. 1 Unit.
This seminar course focuses on the management of complex cardiovascular disease. Prereq: NURS 410.

NURS 416. Integrated Assessment of the Neonate for Midwives. 1 Unit.
This course introduces principles fundamental to the integrated assessment of the neonate. Gestational age assessment, assessment of genetic risks, and physical assessment skills are developed.

NURS 424. Theoretical Basis of Medical/Surgical Nursing II. 5 Units.
This course provides the opportunity to explore complex health problems of patients requiring a variety of health care services and support systems. Nursing strategies requiring independent, interdependent, and collaborative activities are evaluated for their efficacy in supporting and assisting the patient’s progress toward health. Clinical experiences are individualized to promote implementation of the Clinical Nurse Specialist role and build upon the student’s expertise.

NURS 425. Inquiry II - Research Process. 3 Units.
This course emphasizes scholarly inquiry, scientific integrity and scientific investigation. It includes study of the research process, particularly design, sampling, data collection and analysis, and interpretation and reporting of findings. Recommended preparation: NUND 201 or STAT 201. Prereq: NURS 405.

NURS 430. Pharmacology and Therapeutics. 3 Units.
Examination of the major categories of pharmacologic agents and application of pharmacologic concepts in the clinical setting. Emphasis is placed on understanding the physiologic action of the drugs, expected patient responses, and major side effects. Major-specific seminars integrate knowledge of pharmacology into clinical practice. Recommended preparation: NURS 453, RN license or consent of instructor.

NURS 431. Introduction to Complementary and Alternative Healthcare in APN. 1 Unit.
The focus of this course is the use of complementary and alternative therapies in the delivery of healthcare by advanced practice registered nurses. The learner is exposed to an historical overview of therapies that are used as an adjunct to conventional healthcare. Emphasis is placed on the variety of evidence supporting these practices.

NURS 440. The Challenge of Suffering: Meaning, Responses, and Potential for Growth. 3 Units.
The interdisciplinary course will address the multiple facets of suffering, including the meaning of suffering, potential for growth and transformation, policies and practices that influence suffering, and those factors that affect quality of life and quality of death. Concepts and theories will be drawn from the social sciences and humanities, as well as from the health disciplines. The influence of socio-political, cultural, and economic forces of suffering will be addressed. Graduate standing or permission of instructor is required. Offered as: ANTH 442 and MEDS 9440 and NURS 440.
NURS 441. Mental Health of Older Adults. 1 Unit.
This course focuses on discussion of the consultative, investigative, and planning skills to meet the special mental health needs of the elderly. Concepts of mental health promotion, mental illness prevention, knowledge development, implementation, and evaluation of psychotherapeutic nursing strategies are examined. The examination of diverse mental health disorders in the aged mental health service delivery are included.

NURS 442. Mental Health Interventions with Older Adults. 1 Unit.
This course focuses on the theoretical basis of psychosocial assessment and intervention with older adults and their families, with an emphasis on individual, group, and family interventions. Concepts from individual, family, and group modalities and the process of consultation and education are examined. Students will also learn the components of individual and family assessment in "well elders" and the identification of mental disorders, including problems with memory and cognition. This knowledge base serves as the foundation for developing and applying interventions in practice to meet the mental health needs of older adults. Prereq or Coreq: NURS 441.

NURS 443A. Collaboration, Consultation, & Credentialing in Advanced Practice Nurs. 1 Unit.
The focus of this course is the process of consultation and collaboration in advanced practice nursing. The organizations that are involved in promoting and assisting advanced practice nurses (APNs) will be addressed. The similarities and differences in the roles of the APN will be explored. The process of credentialing APNs will also be examined.

NURS 443B. Role Development in Advanced Practice. 1 Unit.
The focus of this course is the study of the multiple roles integrated into advanced practice nursing including principles of management and leadership. Strategies to market the value of the advanced practice nurse (APN) role and the individual APN are addressed.

NURS 443C. Teaching and Learning in Advanced Practice. 1 Unit.
The focus of this course is the examination of the process of teaching, learning, and evaluation. A variety of teaching modalities applicable across the lifespan will be explored.

NURS 444A. Ethical Issues in Advanced Practice. 1 Unit.
The focus of this course is ethical decision-making for advanced practice nurses. The interaction between the health care delivery system and ethical decision making is explored.

NURS 444B. Health Care Delivery and Finance in Advanced Practice. 1 Unit.
The focus of this course is the study of the financial and business factors related to the health care delivery system and advanced practice nursing. Students will discuss strategies related to reimbursement, business practices, billing, and coding.

NURS 444C. Health Policy Legislation and Legal Issues in Advanced Practice. 1 Unit.
The focus of this course is the critical analysis of health policy and legal issues. Strategies for influencing the regulatory process will be explored.

NURS 446. Collaboration and Administration in the Health Care Delivery System. 3 Units.
Examination of the influence of the health care delivery environment on the delivery of care and the role of the Advanced Practice Nurse as collaborator within the health care structure. Clinical practice and seminars will focus on the role of the manager in planning, organizing, staffing, directing, and controlling the health care environment for the purpose of improving patient care, facilitating collaborative activities with other health care professionals, and identifying mechanisms to effect change within the health care system. Clinical practice 8 hours per week.

NURS 453. Advanced Pathophysiology. 4 Units.
This course focuses on the alterations produced by injury and disease across the lifespan to distinguish normal physiology from pathophysiologic process. Biologic concepts and relationships that contribute to capacity for health and vulnerability to illness are examined.

NURS 454. Well Woman Health Care. 3 Units.
Study of selected theoretical formulations and models applied by professional nurses in the promotion of growth and wellness in adolescent and adult women. Emphasis on conception, decision making, sexuality and health teaching. Acquisition of knowledge and skill related to physical and psychosocial health assessment of pregnant and nonpregnant clients. Individually planned experiences with nurse faculty who are serving as primary care givers in maternity, family planning and gynecologic care settings. Prereq or Coreq: NURS 453 and NURS 459.

NURS 455. The Childbearing Family. 4 Units.
This course will focus on analysis and applications of the nursing strategies to enhance health-seeking behaviors of the pregnant family during the maternity cycle and on the education of parents about the childbearing year. The normal aspects of the pregnant woman and the identification of any deviations from the normal are central to the content. The course will also emphasize the enhancement of the pregnant family's childbirth experience through utilization of the teaching-learning process. The student will learn to evaluate and apply techniques relative to childbirth education. Clinical experiences will be planned in ante partum, neonatal, childbirth education and home settings. Prereq: NURS 454. Coreq: NURS 430.

NURS 457. Labor and Birth. 5 Units.
The focus of this course is the application of nursing theory, practice and research by advanced practice nurses in the promotion of health and wellness of women, newborns and their families during intrapartum and the immediate postpartum period. Emphasis is placed on the health-seeking behaviors of the mother and her family using a holistic approach emphasizing cultural, ethnic and racial diversity in the provision and evaluation of care. Supervised clinical experience includes anticipating and identifying complications and participating in consultations, referrals and collaborative management. Prereq: NURS 455.

NURS 459. Integrated Assessment for Advanced Nursing Practice. 3 Units.
This course introduces concepts fundamental to the role of the Advanced Practice Nurse. It stresses health assessment, history taking, interviewing, and physical assessment skills, and provides the basis for decision making, advanced therapeutics and case management. Recommended preparation: RN license or consent of instructor.
NURS 460A. Theoretical Basis for Individual Counseling. 1 Unit.
This course emphasizes the ongoing development of the counseling relationship across the life span. The professional encounter between the individual and advanced practice nurse will be formulated based on the Helping Model for problem management. Students will differentiate counseling and therapy. Students will also develop and apply crisis intervention skills, interviewing skills and alternative adjunct therapies.

NURS 460B. Theoretical Basis for Individual Psychotherapy. 1 Unit.
This course will build therapeutic skills for the advanced practice nurse specializing in mental health. Students will master Helping Skills in their interventions with individuals with psychopathology. Prereq: NURS 460A, Prereq or Coreq: SSBT 548 or PSCL 524.

NURS 461. Practicum and Supervision of Individual Therapy. 1 - 2 Unit.
Direct care experience. Focus on therapeutic process with persons experiencing psychosocial disturbances. Use of nursing strategies to enhance health-seeking behaviors. Examination of genesis of psychopathology; emphasis on methods of assessment, goal setting, intervention, and evaluation. Group and individual supervision. Prereq: NURS 460A.

NURS 462. Practicum and Supervision of Group and Family Therapy. 2 - 3 Units.
Direct care experience, formal group and family experience focusing on process, content and leader behavior. The nurse-therapist employs nursing strategies to enhance health-seeking behaviors of family and group. Use of concepts from psychiatry and behavioral and social sciences related to the promotion of mental health and treatment of psychosocial distress in groups and families. Group and individual supervision of clinical experience. Focus of supervision is on judgment, family and group intervention skills, and application of theory from analysis and interpretation of data. Prereq or Coreq: NURS 467.

NURS 465. Psychopharmacology. 2 Units.
Course content will focus on drugs commonly used to treat psychiatric disorders and clinical implications for patient and family.

NURS 466. Theory of Family and Group Modalities. 2 - 3 Units.
The professional encounter between nurse therapist and the group or group members and the family or family members occurs within the context of an environment of care. The nurse therapist enhances health-seeking behaviors of individuals, families and groups. The nurse therapist employs nursing strategies cognizant of interviewing variables, to facilitate health-seeking behaviors of family and group members. Concepts from family and group theory, family and group literature, and research in family and small group dynamics are selected to provide an eclectic approach to treatment.

NURS 468. The Continual Improvement of Healthcare: An Interdisciplinary Course. 3 Units.
This course prepares students to be members of interprofessional teams to engage in the continual improvement in health care. The focus is on working together for the benefit of patients and communities to enhance quality and safety. Offered as EPBI 468, MPHP 468, NURS 468.

NURS 473. Advanced Psychopathology Across the Lifespan: Part I (Infant through Young Adult). 2 Units.
The course focuses on the assessment and diagnosis of psychopathology in children of all ages, infants through young adults. Behavioral deviations from normal growth and development will be assessed while considering age, social, cultural, and economic differences. The responses of family members to psychopathology in these age groups will be discussed.

NURS 474. Advanced Psychopathology Across the Lifespan Part II (Adult and Older Adult). 2 Units.
This course focuses on the assessment and diagnosis of psychopathology in adults and older adults. Behavioral/cognitive deviations from normal growth and development will be evaluated while considering socio-cultural differences and age-appropriate behavior. Responses of family members in relation to adults or older adults’ psychopathology will be discussed. Prereq: NURS 473.

NURS 475. General Systems Theory: Foundations for Practice. 2 Units.
This foundational seminar introduces General Systems Theory as a framework for understanding complex entities comprised of component parts that are in constant and mutual interaction. The concepts covered will emphasize the openness and flexibility of a system by attending to its entirety as opposed to focusing on separate parts. The focus is on the organizational structure and processes of that system that are circular in nature through cybernetics processes such as feedback loops which allow system adaptation and transformation. These changes enable systems to become more organized and efficient and to develop the capacity to repair themselves. Students will apply General Systems Theory to their disciplines.

NURS 476. Advanced Practice Seminar: Blended Role of Psychiatric-Mental Health APRN. 1 Unit.
Within the context of family and community, students will explore the blended role of the Psychiatric Mental Health Nurse Practitioner and Psychiatric Mental Health Clinical Nurse Specialist. A focus of the course is boundaries and professional development in the blended role. Students will examine ethical, legal, cultural and professional standards as they relate to micro and macro systems.

NURS 479. Public Policy and Aging. 3 Units.
Overview of aging and the aged. Concepts in the study of public policy. Policies on aging and conditions that they address. The politics of policies on aging. Emergent trends and issues. Offered as ANTH 498, BETH 496, EPBI 408, GERO 496, HSTY 480, MPHP 408, NURS 479, NURS 579, POSC 480, and SOCI 496.

NURS 481. Family Systems Theoretical Foundations. 2 Units.
This course focuses on the major contemporary theoretical approaches and therapies for conceptualizing and working with families across the lifespan. Attention is given to families challenged by situations such as stress, trauma, violence, psychiatric disorders, and substance abuse. Prereq: NURS 473 and NURS 475 and NURS 476. Coreq: NURS 474.
NURS 482. Family Systems Integration and Application. 1 Unit.
This practicum experience in the application of family theory addresses the professional encounter between the advanced practice nurse (APN) and the family system with attention to health promotion and psychiatric disorder management. Special consideration is given to policy, legal, cultural, and ethical issues regarding family care and practice. Group supervision of the practicum experience is an expectation. Prereq: NURS 473 and NURS 475 and NURS 476. Coreq: NURS 474 and NURS 481.

NURS 484. Individual and Group Modalities for Family Systems Practice Across the Lifespan. 3 Units.
This seminar addresses therapeutic modalities and their foundation as they are applied to families across the lifespan. Brief, individual, and group modalities will be studied in the context of Family Systems Theory with a focus on differences in family constellations and developmental stages. The selection of modalities for families will consider the implications of cultural and gender differences, vulnerable populations, and the stigma of psychiatric illness. Prereq: NURS 481 and NURS 482.

NURS 485. Practicum and Supervision: Family Systems Practice Across the Lifespan. 2 Units.
This practicum experience involves the professional encounter between the individual, group members, and nurse therapist within the context of family systems theory. The nurse therapist employs nursing strategies and concepts from psychiatry and behavioral and social sciences related to the promotion of mental health and biopsychosocial treatment in individual and group members across the life span. Attention will be given to situations such as stress, loneliness, trauma, violence, and substance abuse. Group supervision of the practicum experience is an expectation. Prereq: NURS 481 and NURS 482. Coreq: NURS 484.

NURS 486. Modalities for Family Systems Practice: Vulnerable Family Populations. 3 Units.
Within the context of family and community in urban and rural settings, students will explore the special needs of families who are currently manifesting mental health and substance abuse disorders. Examples of vulnerable families include those who have been exposed to acute and chronic stress, natural and man-made disasters, and military-related and other forms of trauma. The needs of youth and adults who are incarcerated will be addressed. Students will encounter the diverse nature of family relationships, including blended, migrant, and immigrant families; relationships that are defined by choice; and families residing on reservations and in religious enclaves. A variety of treatment modalities will be discussed. Prereq: NURS 481 and NURS 482.

NURS 487. Theoretical Basis of Practice and Supervision in Consultation, Collaboration. 2 - 3 Units.
This course focuses on the professional encounter between the nurse consultant-educator and families, work groups, and communities within the context of an environment of care. The nurse consultant-educator applies general systems and family systems theory to enhance the capacity of families to learn, adapt, and develop through mutual interaction and cybernetic processes based on systems theory. The roles of the nurse, educator, researcher, administrator, and therapist supervisor are explored. The theories and processes of consultation, collaboration, and adult education are discussed relative to mental health and community education. Prereq: NURS 484 and NURS 485.

NURS 488. Psych-Mental Health Advanced Practice Nurse. 3 Units.
This practicum course emphasizes the professional encounter between the psychiatric mental health nurse practitioner/clinical nurse specialist (NP/CNS), families, organizations, communities, and agency personnel providing mental health services in the context of an environment of care. Systems variables that influence the learning, adaptation, and development of families, organizations and systems are emphasized. The psychiatric nurse clinician functions as a change agent in direct and indirect care through the role of practitioner, educator, consultant, planner, evaluator, and researcher. Prereq: NURS 484 and NURS 485. Coreq: NURS 487.

NURS 491. Public Health Nursing I: Foundations of Advanced Public Health Nursing. 3 Units.
This is the first course in the Public Health Nursing major. It is designed to introduce students to the role and functions of the advanced public health nurse and emphasizes the importance of population/community-based focused practice. Synthesizing knowledge from the discipline of nursing and public health sciences, students will examine the historical, philosophical, legal, and ethical foundations of community health nursing practice. This course requires a 60 hour community engagement experience in an existing population focused program. Coreq: NURS 405.

NURS 494. Global Health Seminar. 3 Units.
The focus of this course is the issues and trends in global health from both a nursing and a trans-disciplinary perspective. The course covers how international social, political, economic, environmental, and cultural issues affect health and health care. Particular emphasis is placed on nursing’s contribution to global health issues and outcomes. Offered as: NURS 394 and NURS 494. Coreq: INTH 301/401.

NURS 495. Public Health Nursing II: Assessment and Planning for the Health of Communities. 2 Units.
This is the second course in the Advanced Public Health Nursing major. Students will be introduced to assessment and program planning models based on theoretical underpinnings. Students will learn to identify appropriate evidence-based interventions based on primary, secondary, and tertiary prevention strategies to attain expected outcomes. Prereq: NURS 491.

NURS 496. Public Health Nursing III: Program Evaluation and Dissemination. 3 Units.
This course completes the Advanced Public Health Nursing major didactic content. A case method approach will be used to develop strategies for program evaluation. This course will explore approaches to encourage program dissemination, sustainability, community empowerment, coalition building, and collaborative activities with stakeholders. Prereq: NURS 495.
NURS 497. Public Health Nursing Clinical. 1.5 - 4.5 Unit.
The clinical hours for the Advanced Public Health Nurse major include population assessment, planning, implementation, and evaluation. The clinical content integrates the didactic content from the NURS 491, 495, and 496 courses. Students, in consultation with faculty and partnership with a community-based organization, identify a population, complete needs assessment, identify health assets and needs, develop and implement a program in consultation with stakeholders, and systematically evaluate the effectiveness of the program. Students can only implement the clinical aspects concurrent with or following the successful completion of the didactic content. For example, students may enroll for clinical hours for assessment while or after they have completed NURS 491 content. Coreq: NURS 491, NURS 495, or NURS 496.

NURS 499. The Nurse Executive-Personal & Professional Challenges in Health Care. 3 Units.
Offered toward end of the M.S.N./M.B.A. program and prepares the graduate for entry into a nurse management role. The focus will be on contemporary role demands in nursing management, ranging from head nurses to vice presidents of nursing to heads of community health and mental health agencies, and taking account of all regions of the U.S. Emphasis will be placed on exploring knowledge and skill requirements of nursing management, current developments (such as nursing values, goals, and tasks), and the strategic and operational configuration of hospitals and other health care agencies.

NURS 500. Master's Thesis. 1 - 4 Unit.
Systematic investigation of a research problem selected by the student for independent study. Prereq: NURS 415.

NURS 502. Inquiry III - Evidence-Based Nursing Practice. 2 Units.
This course focuses on linking research evidence to nursing practice. Processes for implementation and evaluation of evidence-based nursing practice will be included. Prereq: NURS 425 or NUND 404C.

NURS 503. Inquiry Practicum. 1 - 2 Unit.
This course focuses on the development of competencies in scientific inquiry. Such competencies are achieved through participation in a research study or evidence-based project related to nursing science with dissemination of the experience. Prereq or Coreq: NURS 502.

NURS 506. Nursing Epistemology. 3 Units.
This course involves the study of knowledge shared among members of the discipline, the patterns of knowing and knowledge development, criteria for evaluating knowledge claims and philosophy of science. The course is a search and discussion experience aimed at enabling graduate students to become knowledgeable about approaches to the study of disciplines and scientific knowledge development. Forces affecting the development of knowledge, the origins of key terms and concepts, and identification of major themes in nursing will be explored.

NURS 507. Clinical Knowledge. 3 Units.
This course is structured to allow students to develop clinical knowledge about their area of interest and to begin the process of identifying clinical research questions. Supervision for this experience will be twofold. Students will be placed with an expert clinician with a minimum of a master's degree (in nursing) to identify and arrange relevant clinical experiences. The student and the clinician will work with the course faculty to create opportunities for the student to experience the clinical phenomena of interest, which may include actual "hands-on" experience. Students will also meet regularly with the other students in the course and the course faculty for group supervision that focuses on linking clinical practice issues to research questions. Course requirements would include eight hours of practicum experiences per week.

NURS 508. Context of Care. 3 Units.
This course is designed to allow students to explore the social, political, economic, and health care issues that form the context for their clinical phenomena of interest. The intent of this course is for the student to become knowledgeable about the broader forces that affect their clinical problem. Topics might include current research in their field, as well as health policy related to their phenomena, political entities that affect funding, and the regulation of practice in their area of interest. The student will need a content expert to help them plan and coordinate their practicum experiences, which should be multiple and varied, and include exposure to both local and state level entities. Prereq: NURS 507 or equivalent.

NURS 510. Health Disparities. 3 Units.
This course aims to provide theoretical and application tools for students from many disciplinary backgrounds to conduct research and develop interventions to reduce health disparities. The course will be situated contextually within the historical record of the United States, reviewing social, political, economic, cultural, legal, and ethical theories related to disparities in general, with a central focus on health disparities. Several frameworks regarding health disparities will be used for investigating and discussing the empirical evidence on disparities among other subgroups (e.g., the poor, women, uninsured, disabled, and non-English speaking populations) will also be included and discussed. Students will be expected to develop a research proposal (observational, clinical, and/or intervention) rooted in their disciplinary background that will incorporate materials from the various perspectives presented throughout the course, with the objective of developing and reinforcing a more comprehensive approach to current practices within their fields. Offered as CRSP 510, EPBI 510, MPHP 510, NURS 510, and SASS 510.

NURS 511. Strategies for Theory Development. 3 Units.
This course examines the nature of theory and strategies for theory development in nursing. Students will explore a variety of strategies and select an approach for beginning theory development that addresses nursing phenomena in their area of interest.

NURS 518. Qualitative Nursing Research. 3 Units.
This course is a study of qualitative research approaches directed toward the development of nursing knowledge. This course will include methods and issues in data collection, analysis, and critique of research findings. It will focus on the philosophical and epistemological foundations of qualitative research, present an overview of various methodological approaches, examine in depth the criteria for rigor, and analyze ethical issues in qualitative methodologies.
NURS 521. Advanced Nursing Research II. 3 Units.
The discussion of research designs and their rationale for use will be continued. Principles of measurement, study implementation and data analysis will be discussed. The development of a research proposal will be the expected outcome of this two-semester sequence. Prereq: NURS 401 or STAT 401 and NURS 520.

NURS 522. Advanced Internship in Cardiovascular Nursing. 1 - 5 Unit.
This 600-hour internship is designated to provide the master’s prepared ACNP-Cardiovascular Nursing Program graduate with the experience needed to enter practice as an APN caring for patients with complex cardiac disorders. Recommended preparation: completion of appropriate NP program. Prereq: NURS 411.

NURS 523. Advanced Internship in Flight Nursing. 1 - 5 Unit.
This internship is designed to provide the Master’s prepared ACNP-flight nurse concentration graduate with experience needed to qualify for the Certification Examination in Flight Nursing. This experience consists of a 600 hour precepted internship in a flight nursing setting. Recommended preparation: Completion of M.S.N. program focus in Flight Nursing and ACNP certification, certification in ACLS, PALS, and neonatal resuscitation.

NURS 524. Advanced Practicum in Infection Control. 1 - 5 Unit.
This practicum experience consists of up to 600 hours of a precepted experience in an infection control program setting. This practicum is designed to provide the student with experience needed to qualify for the Certification Examination in Infection Control administered by the Certification Board of Infection Control and Epidemiology to receive CIC certification. The student may choose among a public health, acute care, long-term care, or international setting. Prereq: NURS 450.

NURS 530. Advanced Nursing Research Methods I. 3 Units.
This course focuses on conceptualization of a research problem within a nursing perspective, threats to validity, sampling, measurement, and survey, quasi-experimental, and experimental designs. The emphasis is on the application of these strategies while encouraging flexibility in conceptualizing a study using different research methods. Students will develop a research study using methods consistent with theoretical and empirical knowledge and the nursing perspective. Coreq: NURS 532.

NURS 531. Advanced Nursing Research II. 3 Units.
This course is the second in a two-course sequence of research methods. It focuses on power analysis, data management, experimental and epidemiological designs and designs to assess change. Included is a discussion of ethics and concerns regarding human subjects. The emphasis is on the application of research strategies while encouraging flexibility in conceptualizing a study using different methods. The development of a research proposal is the outcome of this two-semester sequence. Prereq: NURS 530 and NURS 532 or consent of instructor.

NURS 532. Basic Statistics: Fundamentals for Analysis. 3 Units.
The purpose of this course is to provide the student with the fundamentals needed for analysis of research problems. It will review theoretical foundations of statistical analysis and inference, probability theory, and hypothesis testing. Use of measures of central tendency, basic parametric and non-parametric tests will be discussed, with specific application to health problems. Use of SPSS will be included. Prereq: Graduate standing or permission of instructor.

NURS 537. Advanced Midwifery. 6 Units.
In consultation with faculty, students select a nurse-midwifery service where they assume the responsibilities of beginning practitioner for a minimum of 10 weeks of intensive, supervised clinical practice. Synthesis of the nurse-midwifery management process while providing continuity of care integrating all core competency areas is emphasized. Students explore the professional aspects of nurse-midwifery practice. Historical development of the profession is used as a framework for understanding current issues related to nurse-midwifery education and practice in the United States. Prereq: NURS 457.

NURS 559. Advanced Practice in Nursing Care of Women. 4 Units.
Integration of concepts, theories, conceptual, and theoretical models, focused on supporting the health-seeking of women and their families as they contend with intervening factors. Emphasis on psychosomatic, acute and long-term illnesses and their interplay with psychosocial problems encountered by women. Clinical practice and seminars will include providing nursing care to women and their families in all stages of life cycle. Prereq: NURS 455.

NURS 557. M.S.N./M.B.A. Management Practicum. 3 Units.
The student will enter the M.S.N./M.B.A. program with a minimum of two years of recent clinical nursing experience, and may or may not have had any management experience. This practicum is designed to provide a guided experience in a management context. NURS 577 will be offered in the spring semester of the second year of the M.S.N.M.B.A. program, after the student has completed nearly all basic courses in both schools. The management practicum will provide onsite experience in management activities. Most practicum sites will be area health care agencies. In some cases, students my alternate opportunities addressing health-related policies in area businesses or corporations. Typical practicum experiences will engage students in management projects, special assignments and/or research. Students are expected to use current management and nursing knowledge and will often use the research process in completing the practicum experience. They will work closely with nurse executives and managers within their organizations. Prereq: NURS 468 and NURS 471.

NURS 578. Curriculum and Instruction. 3 Units.
The purpose of this course is to explore the theoretical underpinnings of education and to examine innovative approaches to critical thinking. Students are provided the opportunity to analyze philosophies and principles of education along with teaching and learning styles. The course will focus on curriculum planning and development congruent with the philosophy and objectives of a nursing program. Curriculum development includes determination of program and course objectives, along with selection and organization of appropriate learning experiences to meet these objectives. Techniques for instruction in the classroom, laboratory, and clinical settings are explored.

NURS 579. Public Policy and Aging. 3 Units.
Overview of aging and the aged. Concepts in the study of public policy. Policies on aging and conditions that they address. The politics of policies on aging. Emergent trends and issues. Offered as ANTH 498, BETH 496, EPBI 408, GERO 496, HSTY 480, MPH 408, NURS 479, NURS 579, POSC 480, and SOCI 496.

NURS 601. Special Problems. 1 - 12 Unit.
This course is offered, with permission, to Ph.D. students in Nursing undertaking reading in a field of special interest.
NURS 609. Health Care Policy and Planning. 3 Units.
The primary focus of this course is to explore the leadership role of nurses in health policy development and implementation as well as the role of research in health care policy formation and planning. Special emphasis is placed on selected national and international health policy issues that form the socio-political and economic context of nursing care and practice. Ethical dimensions of public policy formulations and implementation are highlighted. Offered as NUND 508 and NURS 609.

NURS 615. Topical Seminar in Health Science Research. 3 Units.
This Ph.D. course is designed to provide in-depth knowledge of research in a given area. Opportunities are provided to apply knowledge for further development of the student’s research interests and ideas. An in-depth examination of selected theoretical and methodological approaches to the development of research related to human science will be emphasized. Interrelationships among theory, research, and knowledge from nursing and related disciplines will be explored.

NURS 619. Theoretical Foundations of Educational Testing and Evaluation. 2 Units.
In this course, an overview of educational measurement and evaluation is provided. Methods of evaluating teaching effectiveness, student learning, and student performance are explored, with particular emphasis placed on test construction and analysis. Prereq: NURS 578.

NURS 620. Action Research and Program Evaluation. 1 Unit.
This course introduces the student to the concept of purposeful evaluation. The applicability of action research and evaluation to the change process and to continuous improvement within various venues will be explored. The iterative, participative, and emergent nature of generation of new knowledge and practice innovations will be discussed. Offered as NUND 480 and NURS 620. Prereq: NURS 619.

NURS 621. Teaching Practicum. 1 - 6 Unit.
In this preceptored teaching practicum, the student may engage in classroom, laboratory, and clinical teaching assignments in nursing. The student will be expected to use current educational theory and nursing knowledge in completing the practicum experience (minimum 60 hours). Offered as NUND 615 and NURS 621. Prereq: NURS 578, NURS 619, NURS 620. Coreq: NURS 578, NURS 619.

NURS 630. Advanced Statistics: Linear Models. 3 Units.
This course is focused on advanced procedures for data analysis and statistical inference in health research. The course is devoted to discussion of linear models, including simple and multiple regression, logistic regression and application to study design. The role of assumptions and theory in guiding the analysis plan is emphasized through lecture, readings, and critical evaluation of published research in the student’s area of interest. Prereq: NURS 532.

NURS 631. Advanced Statistics: Multivariate Analysis. 3 Units.
This course focuses on selected advanced multivariate topics and procedures in health research. Topics will be covered through lecture, readings, computer analysis as well as critical analysis of published research in the health sciences fields. Topics to be covered in this course include: survival analysis, factor analysis, path analysis, repeated measures ANOVA and advanced regression techniques (logistic, loglinear, mixed models). Prereq: NURS 530 and NURS 531 and NURS 532 and NURS 630.

NURS 671. Proposal Development. 1 - 6 Unit.
Provides an opportunity for guided development of a candidacy proposal through planned contact with a designated committee of faculty members. The aim is to assist the student in the development of a refined proposal with strong scientific merit. The course should be utilized only by those with a candidacy proposal statement. Minimum 3 hours required for progression in program.

Prereq: Predoctoral research consent or advanced to Ph.D. candidacy milestone.
School of Nursing Faculty

Professors

Claire M. Andrews, PhD, CNM, FAAN
(Wayne State University)
Professor of Nursing

Barbara J. Daly, PhD, RN, FAAN
(Bowling Green University)
Professor of Nursing

Joyce J. Fitzpatrick, PhD, MBA, RN, FAAN
(New York University)
Elizabeth Brooks Ford Professor of Nursing

Faye A. Gary, EdD, RN, FAAN
(University of Florida, Gainesville)
The Medical Mutual of Ohio Kent W. Clapp Chair & Professor of Nursing; Associate Dean for Minority Affairs and Health Disparities

Nahida H. Gordon, PhD
(Case Western Reserve University)
Professor of Nursing

Sarah Hall Gueldner, DSN, RNC, FAAN
(Emory University)
Arline H. and Curtis F. Garvin Professor of Nursing

Katherine R. Jones, PhD, RN, FAAN
(Stanford University)
Sarah Cole Hirsh Professor of Nursing

Mary E. Kerr, PhD, RN
(Case Western Reserve University)
May L. Wykle Professor of Nursing; Dean of Nursing

Susan M. Ludington, PhD, CNM, FAAN
(Texas Woman's University)
Carl W. & Margaret Davis Walter Professor of Pediatric Nursing

Elizabeth A. Madigan, PhD, RN, FAAN
(Case Western Reserve University)
Professor of Nursing

Judith A. Maloni, PhD, RN, FAAN
(University of Pittsburgh)
Professor of Nursing

Shirley M. Moore, PhD, RN, FAAN
(Case Western Reserve University)
Edward J. and Louise Mellen Professor of Nursing; Associate Dean for Research

Carol M. Musil, PhD, RN, FAAN
(Case Western Reserve University)
Professor of Nursing

May L. Wykle, PhD, RN, FAAN, FGSA
(Case Western Reserve University)
Marvin E. and Ruth Durr Denekas Professor

Jaclene A. Zauszniewski, PhD, RN, FAAN
(Case Western Reserve University)
Kate Hanna Harvey Professor in Community Health Nursing; Associate Dean for Doctoral Education

Associate Professors

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Associate Professor of Nursing

Sara L. Douglas, PhD, RN
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Associate Professor of Nursing

Donna A. Dowling, PhD, RN
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Associate Professor of Nursing

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Associate Professor of Nursing

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Marilyn J. Lotas, PhD, RN
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Associate Professor of Nursing

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Florence Cellar Associate Professor of Gerontological Nursing

Mary T. Quinn Griffin, PhD, RN
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Associate Professor

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Chris Winkelman, PhD, RN
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Amy Y. Zhang, PhD
(The Pennsylvania State University)
Associate Professor of Nursing

Assistant Professors

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Assistant Professor of Nursing; Director of the Learning Resource Center

Christopher J. Burant, PhD, MACTM
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Elizabeth R. Click, ND, MS, RN
Mary A. Dolansky, PhD, RN  
Assistant Professor of Nursing  

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Assistant Professor of Nursing  

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Assistant Professor of Nursing  

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Patricia E. McDonald, PhD, RN  
Assistant Professor of Nursing  

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Assistant Professor of Nursing, Director of Nurse Midwifery Program  

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Theresa S. Standing, PhD, RN  
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Assistant Professor of Nursing  

Camille B. Warner, PhD  
Assistant Professor of Nursing  

Theresa A. Backman, MSN, RN  
Instructor of Nursing  

Amelia L. Bieda, MSN, RN  
Instructor of Nursing  

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Margaret A. Contrera, MSN, CRNA  
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Kimberly Dillon, MSN, RN  
Instructor of Nursing  

Gregory Graham, MA  
Instructor  

Mary de Haan, MSN, ACNS-BC  
Instructor of Nursing  

Laura Distelhorst, MSN, RN  
Instructor of Nursing  

Kimberly A. Edwards, DNP, RN  
Instructor of Nursing  

Carolyn W. Harmon, PhD, ARNP-BC  
Instructor of Nursing  

Heather J. Hawkins, MSN, CRNA  
Nurse Anesthesia Instructor  

Marcella T. Hovancsek, MSN, RN  
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Molly J. Jackson, MSN, RN, CPN  
Instructor of Nursing  

Sandra L. Jorgensen, MSN, RN, CNP  
Instructor of Nursing  

Kathleen M. Juniper, MSN, RN  
Instructor of Nursing  

Instructors
Instructor of Nursing

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Kathleen Massoli, MSN, CRNA  
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Kelly K. McConnell, MSN, RN  
(University of Phoenix)  
Instructor of Nursing

Christopher F. Manacci, MSN, RN, CCRN, CFRN  
(Case Western Reserve University)  
Instructor of Nursing, Director of Flight Nursing Program

Angela Milosh, MSN, CRNA  
Nurse Anesthesia Instructor

Sonya D. Moore, MSN, CRNA  
Nurse Anesthesia Instructor

Cindy L. Motley, MSN, RN, FNP-BC  
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Gayle M. Petty, MSN, RN  
Instructor of Nursing; Assistant Director of BSN Program

Melissa D. Pinto-Foltz, PhD, RN  
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Tamara Schurigyn, MSN, CRNA  
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Allison R. Webel, PhD, RN  
Instructor of Nursing

Lecturers

Jennifer Lynne Brewer, MSN, RN  
Lecturer of Nursing

Ebony M. Hardee, MSN, RN  
Lecturer of Nursing

Stephanie L. Steiner, MSN, RN, ACNP  
Lecturer of Nursing

LaTonya Martin Stergis, ND, RN, CNM  
Lecturer of Nursing

Mary Njalian Variath, MSN, RN  
Lecturer of Nursing
Mandel School of Applied Social Sciences

The Mandel School of Applied Social Sciences (http://msass.case.edu) offers curricula leading to the Master of Science in Social Administration (MSSA) degree in social work, and to the Doctor of Philosophy (PhD) degree in social welfare. The school also operates a continuing education program for social work practitioners in the community.

Mission Statement

The mission of the Mandel School is to provide and integrate professional social work education, research, and service to promote social justice and empowerment in communities through social work practices locally, nationally and internationally.

A History of Innovation

Ranked among the nation’s top ten graduate schools of social work by U.S. News and World Report, and ranked number one in Ohio, the Mandel School of Applied Social Sciences has always committed itself to learning from and fostering the best in social work practice and to building social work’s knowledge base. Since its founding in 1915 as the nation’s first university-affiliated professional graduate school of social work, the Mandel School has been an innovator in professional education, where educators, researchers and practitioners work side-by-side to investigate, study and disseminate knowledge to bridge the gap between the classroom and communities in which social workers practice.

The Mandel School provides students with a solid foundation designed to build core competencies with its innovative Ability-Based Learning Environment, which allows graduates a great degree of flexibility and portability. Students choose concentrations in either Community and Social Development or Direct Practice, which offers specializations in Aging; Alcohol and Other Drug Abuse; Children, Youth and Families; Health; and Mental Health. Certificate programs include gerontology, global health, management and leadership, and school social work. Dual-degree programs enable Mandel School students to obtain their social work degree concurrently with a master’s degree in bioethics, law, management and public health.

The Mandel School believes that advanced practitioners are strategists of change, working in partnership with others to enhance the caring capacity of communities. The concentrations structure cross-trains Mandel School students, who build foundations in both areas that bring a breadth of knowledge to their work lives, allowing them the flexibility to pursue their interests even as they change over time. The school prepares advanced practitioners who become lifelong learners with the abilities needed to practice ethically and effectively with diverse populations and with systems of various sizes and types. Students learn to understand the dynamics of problematic social situations and to identify the strengths and resources in individuals, families and communities that offer the best solutions. The school is committed to a vision of social work practice as a force of social justice, empowerment, and the building of healthy communities. That commitment extends beyond our national borders with the Mandel School’s award-winning program of international study options.

The Mandel School counts among its alumni many prominent educators, government officials, accomplished practitioners, researchers, advocates, public-policy-makers, and chief executives of national and regional agencies. Faculty achievements in professional organizations, research, and agency consultation further extend the school’s reputation as an active participant in the advancement of social work practice.

Mandel School education is more than preparation. It is an opportunity to join a national network of scholars and practitioners who are shaping the course of social work in communities throughout the world. The Mandel School is ranked seventh in faculty productivity among social work schools by Academic Analytics.

For nearly one hundred years, the Mandel School of Applied Social Sciences has stood at the forefront of social work education, introducing innovations in teaching, research, and practice at every step of the way, with an approach that integrates theory and practice like no other.

At the heart of the Mandel difference is experience – not just the in-depth experience of our distinguished faculty – but the experience students obtain working in the real world of social work from the time they start their education here. The Mandel School is unique among social work schools for its students’ paid field placements, providing invaluable work experience, and, by making the education more affordable, extending the opportunity to an even broader range of students. Students learn through the Mandel School’s teaching and by their own doing. What they discover in a classroom can be applied to real life at their placements. Graduates leave the Mandel School prepared to handle the demands of social work.

Mandel students take their places alongside long-time professionals in a variety of social work fields in placements at one of the more than 350 agencies with which the Mandel School collaborates, understanding firsthand the challenges of social work and sharing in its rewards. In a broad spectrum of local and regional organizations, students develop skills in direct practice, policy analysis and development, research, management and community development.

Accreditation and Licensure

The Mandel School of Applied Social Sciences is accredited by the Council on Social Work Education and the Ohio Chemical Dependency Professionals Board of Ohio.

The Master of Science in Social Administration (MSSA), the social work master’s degree program (MSW for many other programs), at the Mandel School of Applied Social Sciences is accredited by the Council on Social Work Education, a nationally recognized professional accrediting association for social work graduate and undergraduate programs.

The Mandel School of Applied Social Sciences’ Alcohol and Other Drug Abuse (AODA) curriculum is accredited by the Ohio Chemical Dependency Professionals Board of Ohio. The accreditation indicates that the AODA curriculum meets the formal master’s degree education requirements for the top level of licensed independent chemical dependency counselors in Ohio.

The Mandel School of Applied Social Sciences (MSASS) in collaboration with Baldwin Wallace College meets all of the State of Ohio Department of Education requirements for licensing in School Social Work.

The Master of Science in Social Administration (MSSA) degree fulfills part of the requirements of social work licensure in fifty (50) states in the United States. For further information about various licensing requirements by state, visit the website of the Association of Social Work Boards (ASWB) (http://www.aswb.org).

Administration

Grover Cleveland Gilmore, PhD
Dean and Professor
Sharon E. Milligan, PhD
Aloen Townsend, PhD  
Chair, Doctoral Program

David Biegel, PhD  
Associate Dean, Research and Training; Codirector, Center on Substance Abuse and Mental Illness

Nora Hennessey, MNO  
Associate Dean, Development

Sarah Andrews, MSSA  
Assistant Dean, Academic Affairs, Director, Twelve-Month Advanced Standing Program

Andrea G. Porter, MSSA  
Assistant Dean, Student Services

Karen A. Powers, MBA  
Assistant Dean, Finance and Administration

Pamela Carson, BS  
Director of Development, Alumni and Allied Constituencies

Richard Cole, MA  
Manager/Director, Research and Training

Claudia J. Coulton, PhD  
Co-Director, Center on Urban Poverty and Community Development

Churyl Croone, BA  
Director, Admissions and Financial Aid

Maria Dimengo, BA  
Director, Communications and Marketing

Debra Fields  
Registrar

Robert L. Fischer, PhD  
Co-Director, Center on Urban Poverty and Community Development

Daniel J. Flannery, PhD  
Director, Begun Center for Violence Prevention Research and Education

Carmelo Franchina, BA  
Director, Office of Information Technology

Deborah R. Jacobson, DSW  
Director, International Education Programs

Lenore A. Kola, PhD  
Co-Director, Ohio Substance Abuse and Mental Illness Coordinating Center of Excellence

Gerald Mahoney, PhD  
Director, Center on Interventions for Children and Families

Soad Mansour, MSSA  
Director, International Affairs for Social Welfare and Non-Government Organizations

Michele Murphy, MNO  
Director, Professional Development and Continuing Education

Amber Oxley, MS  
Director, Annual Giving and Special Gifts

Mark I. Singer, PhD  
Co-Director, Center on Substance Abuse and Mental Illness

Samantha C. Skutnik, MLS

Gerald A. Strom, MSW  
Director, Intensive Weekend Program

Scott Wilkes, JD  
Director, Field Education

Zoe Breen Wood, MSW  
Director, Educational Outcome Assessment
Academic Regulations

Non-Degree Study
Foundation courses may be taken on a non-degree basis with the permission of the assistant dean for academic affairs. A maximum of 12 hours earned on a non-degree basis may be counted toward requirements for the master’s degree if the student is subsequently admitted as a degree candidate.

Admission and Application Information
Admission to the master’s degree program at the Mandel School of Applied Social Sciences is granted on a selective basis determined by the quality of the total application. An applicant for admission is expected to meet the following minimum requirements:

1. A bachelor’s degree from an accredited college or university.
2. Evidence of capacity to succeed in graduate level social work education based on undergraduate work and any previous graduate work. Previous work must include courses in social and behavioral sciences strong enough to ensure the applicant’s ability to do creditable work at the graduate level.
3. A minimum undergraduate grade-point average is 2.7. A Miller Analogies Test or Graduate Record Exam is required for applicants with less than a 2.7 grade point average. In exceptional cases, applicants who lack the required academic credentials but whose other qualifications are outstanding may be admitted on a probationary basis. Students who enter on probation may not carry more than 15 credit hours in their first semester. Probationary students must achieve at least a 3.0 grade point average in their first semester of course work (minimum of six credits) to have their probationary status removed and continue in the program.
4. Evidence of a combination of personal qualities and values that are considered essential for the professional practice of social work: strong moral character; strong analytical and verbal skills; a caring and compassionate nature; and a personal commitment to social justice, empowering individuals, and serving vulnerable and under-represented groups.
5. The school may request a personal interview or additional information about an applicant if necessary.

Admission Procedures
Application materials for admission to the Mandel School of Applied Social Sciences can be secured from the Office of Student Services, Mandel School of Applied Social Sciences, Case Western Reserve University, 10900 Euclid Avenue, Cleveland, Ohio 44106-7164; by calling 800.863.6772; or by visiting the school’s website (http://msass.case.edu).

Students applying for full-time study are admitted in the fall semester. Applications are accepted on a rolling admissions basis but the latest application date is May 15 (July 1 for Intensive Weekend), though prospective students are strongly encouraged to apply early (December/January) for admission.

Students pursing the Virtual MSSA in the online format are admitted in fall, spring, and summer semesters. Deadlines for completed applications are as follows: Spring semester: December 1; Summer semester: March 15; and Fall semester: June 15.

Advanced Standing
Advanced standing may be granted to students who have earned a bachelor’s degree in social work within the past seven years from an institution accredited by the Council on Social Work Education. Students must have earned a grade of B or better in each social work foundation course for which advanced standing credit hours are given.

Proficiency Examinations
Students without a bachelor’s degree in social work may waive the foundation courses in policy, socio-behavioral theory, and research by passing a proficiency examination. Successful completion of the exam(s) exempts the student from the requirement to complete the course(s). Elective course(s) may be substituted in order to fulfill graduation requirements. There is no fee or penalty associated with taking the proficiency exams. However, each exam may be taken only once. Exams are offered prior to the start of fall and spring semesters. Students must make reservations to take those exams with the Mandel School Office of Student Services.

Transfer
Students who are transferring to the Mandel School from another accredited graduate school of social work may apply for transfer credit for up to one full year of academic work and field education. Transfer students from social work programs must submit field work evaluations, official transcripts, and course syllabi.

Transfer credit (6 hour limit) may be given for related, but non-social work, coursework completed within the past five years. Credit hours must not have been applied toward a previous graduate degree. Students must have received a grade of B or better in any course for which transfer credit is sought. Course syllabi, request for transfer form and official transcript must be submitted to the Mandel School Office of Student Services.

International Students
Applicants from other countries follow the regular application procedure. International students must have completed available social work training in their own countries, and have had paid experience in the social welfare field prior to entering the professional degree program. International students are required to furnish results of the Test of English as a Foreign Language (TOEFL) administered by the Educational Testing Service (http://www.ets.org/toefl). Results of this test must be forwarded to the Office of Student Services. A student from abroad whose native language is English, who has completed his or her work in a foreign university where English is the language of instruction, or who has studied at or graduated from an American institution, is exempt from this requirement. Federal requirements mandate that all international students on J-1 visas purchase the medical insurance. No exceptions are allowed. All other students are strongly urged to carry health insurance of some kind.

All international applicants must submit to the university’s Office of International Students evidence of funding sources to fully finance the cost of education, housing, and transportation (approximately $13,000) for one year. Living expenses for dependents, if applicable, must also be included, i.e. spouse $6,000 and child $3,000.

All international applicants must submit to the Case Western Reserve Office of International Students evidence of funding sources to fully finance the cost of education, housing, and transportation. Applicants from other countries will be sent an additional form requiring them to provide evidence of financial resources sufficient to cover their anticipated expenses before acceptance can be finalized.

Students holding a BSW from their country of origin may be eligible for advanced standing. Applicants should contact the Council on Social Work Education (http://bulletin.case.edu/mandelschool/appliedsocialsciences/)
academicregulations/www.cswe.org) (CSWE) directly and ask to have their program reviewed.

An international applicant who holds a Master of Social Work (MSW) degree for his or her country may request a credit review for transfer credit. However, the student must complete at least 27 hours of academic credit and three semesters of field credit (9 hours) at the Mandel School.

Please note that material submitted for application cannot be returned to the applicant.

Financial Information

Tuition

In the 2012-2013 academic year, tuition for the Mandel School of Applied Social Sciences in the full-time master’s degree program (12-16 credit hours) is a flat rate of $37,120 or $1237 per credit hour.

A non-refundable tuition deposit of $100 is required of all master’s degree candidates at the time of acceptance. This deposit will be applied toward tuition for the degree program. Complete information about academic policies, procedures, and financial aid is available by contacting the Office of Student Services, Mandel School of Applied Social Sciences by calling 800-863-6772 or by visiting the school's website (http://msass.case.edu).
Doctoral Program

Doctor of Philosophy in Social Welfare

The purpose of the Doctor of Philosophy (PhD) in Social Welfare degree program is the preparation of scholars, teachers, and leaders to generate new knowledge on the policies and programs of social welfare and the practice of social work. Accordingly, we emphasize the creative and evaluative skills necessary for independent inquiry. The program prepares students to be knowledgeable in the following:

- Relevant areas of the social and behavioral sciences
- Research design, statistics, qualitative methods, and the philosophy of science
- Theory-building and theories of social welfare
- Methods for the application and transmission of knowledge in the human services

In addition to this foundation knowledge, students develop specialized expertise in policy analysis and program planning or social work practice theory and in one or more substantive areas of social welfare. Effort is made to provide an educational climate in which critical analysis and creative thinking flourish. The program core emphasizes philosophical and scientific approaches to theory development, the content and boundaries of theoretical social welfare, statistics, and advanced research methodologies, and the social and behavioral science foundations underpinning social welfare programs and social work practice.

The area of specialization enables the student to apply social science theory, analytical approaches, and research tools to a social problem or issue in either social welfare policy or social work practice. Students are encouraged to focus on a substantive policy or practice area during the period of specialization. This facilitates the development of a dissertation proposal. Permeating the content of the entire program is a focus on the development and transmission of knowledge as a part of an educational process.

Students with a specific career interest in teaching, regardless of their area of specialization, are encouraged to take courses in social work education, learning theories, and teaching strategies as an integral part of the educational plan. Teaching mentorships are available.

Students can pursue special interests through individual reading and research projects. In addition, regular course offerings in other departments of the university are available to students. Practical experiences on faculty-conducted research projects are made available to doctoral students.

A total of 36 credit hours of course work is required, plus 18 hours of dissertation credit. A qualifying examination, given after completion of course work, determines each student's eligibility for degree candidacy. The degree is awarded following successful completion of the dissertation.

The school reserves the right to require additional courses, which may not be credited toward the doctoral requirements, if the faculty believes the student has insufficient knowledge in core areas of the curriculum, or to assist students in their intellectual and professional development.

In response to the different needs and interests of potential PhD students, the Mandel School offers two formats for meeting course and degree requirements. Program requirements under both formats include taking 12 courses (36 credit hours), passing a qualifying exam, and completing a dissertation. The Alternative Program Structures are:

Full-Time Program

Under this format, full-time students can complete course requirements and individualized research fellowships over two academic years.

Plan of Study: Full-Time Doctoral Program

<table>
<thead>
<tr>
<th>Units</th>
<th>First Year</th>
<th>Fall</th>
<th>Spring</th>
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<tbody>
<tr>
<td>3</td>
<td>Philosophy of Science and Theory Building (SASS 608)</td>
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<tr>
<td>3</td>
<td>Theories of Human Behavior: Macro and Micro Dimensions (SASS 610)</td>
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<tr>
<td>3</td>
<td>Advanced Research Design (SASS 613)</td>
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<td>3</td>
<td>Theories of Social Welfare and Social Justice (SASS 609)</td>
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<td>3</td>
<td>Models of Qualitative Research (SASS 614)</td>
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<tr>
<td>3</td>
<td>Social Statistics and Data Analysis (SASS 615)</td>
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<td>9</td>
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<tr>
<th>Units</th>
<th>Second Year</th>
<th>Fall</th>
<th>Spring</th>
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<tr>
<td>3</td>
<td>Applied Regression and the Linear Model (SASS 616)</td>
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<tr>
<td>6</td>
<td>Theory and Research Base of Social Work Practice (SASS 620) &amp; Social Welfare Policy (SASS 621)</td>
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<tr>
<td>1-18</td>
<td>Individual Reading (SASS 637) (or course outside of MSASS) or Research Project (SASS 632)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Measurement Issues in Quantitative Research (SASS 618)</td>
<td></td>
<td></td>
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<tr>
<td>3</td>
<td>Seminar on Social Work Education (SASS 630)</td>
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<tr>
<td>3</td>
<td>Choose one of the following:</td>
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<tr>
<td>3</td>
<td>Methodological Issues in Qualitative Research (SASS 635)</td>
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<tr>
<td>3</td>
<td>Specialization Seminar (SASS 617)</td>
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<tr>
<td>3</td>
<td>Individual Reading (SASS 637)</td>
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<tr>
<td>3</td>
<td>Research Project (SASS 632)</td>
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<tr>
<td>10-27</td>
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<tr>
<td>1-18</td>
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<tr>
<td>1-18</td>
<td>Year Total:</td>
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| Total Units in Sequence: | 39-90 |

Fellowship Courses
SASS 701 Dissertation Ph.D. (18 credit hrs required)

Students must register each semester until the dissertation is complete. SASS 701 Dissertation Ph.D. hours are not required during the summer semester, unless the student is defending his/her dissertation.

Part-Time Program

The part-time format accommodates social work professionals who must maintain their employment commitments but wish to pursue PhD study through the completion of a minimum of four courses per year. Partial financial assistance is available to students in this program.

Academic Policies

Faculty Advisors

Each doctoral student is assigned a faculty advisor to assist in the planning of his or her educational experience. At the appropriate time, a dissertation advisor is appointed after consultation with the student.
Qualifying Examination
The qualifying examination for doctoral candidates is taken after completion of coursework. The exam is intended to test the student’s ability to critically analyze and integrate knowledge.

Admission to Candidacy
Students are admitted to candidacy for the PhD degree upon the successful completion of the qualifying examination. To be admitted to candidacy, the candidate also must have maintained a grade point average of 3.0 and received not more than one course grade of C or lower. To remain in the program, students must maintain a minimum of a cumulative 3.0 average and receive no more than one grade of C or lower.

Dissertation Requirements
Each candidate for the PhD degree must submit a written dissertation as evidence of his or her ability to conduct independent research at an advanced level. The dissertation must present a significant contribution to knowledge in the student’s field, and at least a portion of the content must be suitable for publication in a reputable professional journal or as a book or monograph.

The dissertation prospectus must be completed and accepted within two calendar years after the student has been admitted to candidacy, and the dissertation must be completed and accepted within five calendar years after admission to candidacy. It is to the student’s advantage to make steady progress in his or her research and aim for early completion of the dissertation.

Once a student registers for SASS 701 Dissertation Ph.D., he or she must continue to register each succeeding regular semester (fall and spring) until the dissertation is complete unless granted a leave of absence. The minimum requirement for the dissertation is 18 hours.

All requirements for the PhD degree must be completed within a period of five consecutive calendar years after a student is admitted to candidacy, including periods of leaves of absence.

Admission and Financial Aid
Information about admission and financial aid for the PhD in Social Welfare (http://msass.case.edu/doctorate) can be found on the Mandel School of Applied Social Sciences website.
Dual Degree Programs

Dual and Interdisciplinary Degree Programs

Dual and interdisciplinary degree programs are available to full-time students only.

Master of Science in Social Administration and Law (MSSA/JD)

The dual-degree program established by the Mandel School of Applied Social Sciences and the university’s School of Law makes it possible for selected full-time students to pursue an integrated program of studies to receive the Master of Science in Social Administration (MSSA) and Juris Doctor (JD) degrees within four years rather than the normal five years. Applicants for the dual-degree program must apply to and meet the admission requirements of both professional schools and are encouraged to apply for admission to both programs simultaneously. Dual-degree students must receive the MSSA and JD degrees simultaneously to be granted credit for specific courses taken in the other program.

Master of Science in Social Administration and Business (MSSA/MBA)

The Mandel School of Applied Social Sciences and the Weatherhead School of Management offer a dual-degree program leading to the Master of Science in Social Administration (MSSA) with the Master of Science in Business Administration (MBA). The program is designed for candidates who wish to prepare for advanced social work practice in a variety of direct practice and community and social development settings, while developing the skills to assume management responsibility within those settings. Candidates must apply separately to each program.

MSSA/MBA students may begin the dual-degree in either Mandel School of Applied Social Sciences or Weatherhead School of Management. Students will continue to register in the school at which they began the program, regardless of the school they are attending. There are 102 credit hours in the dual MSSA/MBA Program (51 credit hours at MSASS, 51 credit hours at Weatherhead), compared with 124 credit hours if both degrees were completed separately. By integrating the course work, completing some course work over the summer, and reducing the elective requirements in each program, dual-degree students may complete the MSSA/MBA in three years, instead of the four years required if both degrees were to be completed separately. Dual-degree students must receive the MSSA and MBA degrees simultaneously to be granted credit for specific courses taken in the other program.

Master of Science in Social Administration and Bioethics (MSSA/MA)

A dual degree established by the Mandel School of Applied Social Sciences and the Department of Bioethics (http://www.case.edu/med/bioethics) in the university’s School of Medicine makes it possible for selected students to pursue an integrated program of studies to earn the Master of Science in Social Administration (MSSA) and the Master of Arts (MA) in Bioethics. In a full-time format both degrees may be earned in two years plus one summer semester.

As the number and complexity of ethical dilemmas continue to increase, there is a growing need for social workers knowledgeable of the principles and practices fundamental to bioethics. Graduates of this program may help counsel clients and care providers as well pursuing careers related to policy and practice.

Applicants must apply separately and meet the admission requirement of the both professional programs and are encouraged to apply simultaneously to both schools. Dual-degree students must receive the MSSA and MA degrees simultaneously to be granted credit for specific courses taken in the other program.

Master of Science in Social Administration and Public Health (MSSA/MPH)

The “Side by Side” Dual Degree Program leads to both the Masters of Science in Social Administration (MSSA) and the Masters in Public Health (MPH). The MSSA/MPH program will prepare graduates with flexibility for professional leadership in a broad range of health and social services within communities and organizations. Areas of study will include prevention, program planning, development and evaluation.

The impetus for this dual program arises from a growing societal recognition that issues once thought to represent individual-level interventions, such as family violence, substance use, and mental illness, are multi-level problems demanding multi-level interventions for their amelioration. The MSSA/MPH Degree Program will equip students with a broader set of skills and perspectives to address such issues.

This degree option is open to full-time students only due to the sequencing of courses. Applicants must apply separately and meet the admission requirement of the both professional programs and are encouraged to apply simultaneously to both schools. This dual degree can be completed in 36 months. Dual-degree students must receive the MSSA and MPH degrees simultaneously to be granted credit for specific courses taken in the other program.
Mandel School of Applied Social Sciences Courses

SASS Courses

SASS 315. Adoption Practice and Policy. 3 Units.
This course covers the concepts, knowledge, skills, and policies associated with contemporary adoption practice. The practice method reflects a constellation perspective, meaning that adoption is examined from the viewpoints of birth families, adoptees, and adoptive families. Exemplars and case studies are presented for illustration purposes. Consideration of constellation members' needs at different life cycle stages are presented. Ethical issues and dilemmas related to adoption are emphasized throughout the course in each content area. Course content is covered via lectures and classroom discussions, as well as appropriate guest speakers. Students are expected to participate fully through field trips and classroom discussions.

SASS 318. Death, Grief, and Loss. 3 Units.
This course provides students the opportunity to become informed, aware citizens understanding human issues related to end-of-life decision making, dying, and experiencing grief and loss. Topics focus on death and grief across the lifespan; the role of death in American culture; understanding individual and family challenges with decision making at the end of life; and the experience of grieving across life stages, cultures, gender, and spiritual difference. The course provides exposure to the experience of death as it relates to the self of the student; the terminally ill person, and the bereaved. Students will gain insight into their own values and beliefs in this area, as well as understanding the needs of terminally ill people, those who need support in their grief and mourning, and persons dealing with challenging life and death decisions regarding self or loved ones. Creation of a personal learning objective is an additional focus. Course content is implemented via lectures, class discussion, individual and small group work, audio-visuals, and guest speakers.

SASS 325. The Netherlands Social Justice: Health and Violence. 3 Units.
Social justice issues including violence prevention and health care services/policies will be explored via agency visits, lectures, and discussion with Dutch experts. The pervasive use of a harm reduction policy in the Netherlands will be examined. The course will help students develop the analytical skills necessary for evaluating social policy and practice issues related to a range of health care services as well as social justice issues that pertain to health care, prostitution and substance use. Students will familiarize themselves with the United States and Dutch social policies and practices related to issues such as: right to die, euthanasia for terminally ill, those in chronic pain or severely ill newborns; access to healthcare and health disparities; addictions; and prostitution. The manner in which a society treats its citizens least capable of taking care of themselves reveals many of the core values of its cultural system of social justice and approaches to health care.

SASS 350. Seminars in Applied Social Sciences. 3 Units.
Survey of special subject areas. Topics vary in response to faculty and student interests. Small group discussion. Prerequisite depends on content.

SASS 355. Drugs and Youth. 3 Units.
Drug abuse is a more acute problem and more widespread than in any previous era of our country. Just as technology continues to evolve, drug use follows similar paths of evolution. Today, there are thousands of new drugs available that are used for medicinal purposes, recreational purposes, and other uses that affect the health of our citizens. The impact of drug use and/or abuse on the lives of ordinary people will be explored both through academic readings as well as biographies of young people who have dealt with the problem of drug abuse. Material will be presented from a wide range of disciplines and theoretical perspectives highlighting the bio-psycho-social nature of the problem—both the etiology as well as the effects of addiction. The impact of both macro (society) and micro (family and friends) on drug use of both licit (alcohol, over the counter drugs, and prescription) and illicit (marijuana, hallucinogens, and cocaine) on various subcultures such as sports/athletic, college students, women, adolescents, etc. will be explored. Course content will be covered via lectures, classroom discussions as well as appropriate guest speakers.

SASS 367. Poverty, Wealth Building, and Social Entrepreneurship. 3 Units.
With poor communities and individuals across the world aspiring for higher standards of living and quality of life, monolithic development strategies are proving to be insufficient. Microenterprise and social entrepreneurship are among the latest strategies for poverty alleviation. New strategies that are grass-roots, multi-dimensional, entrepreneurial, and engage stakeholders as partners are gaining ground. They seek to fundamentally transform the roles and relationships of the stakeholders in the economy. While social entrepreneurship is revolutionizing the practice of development work, the micro-enterprise sector plays an important role for some of the poorest sectors of society who gain employment, connection to the market, and opportunities for innovation through it. In this course, we will examine social entrepreneurship, the change it brought about in how development is viewed, conceived, and implemented. Some of the examples that will provide core content include economic development strategies that promote asset building among the poor; Mandragon in Spain (and other similar institutions from across the world), Greyston Bakery (and other similar examples from around the United States) and Evergreen Cooperative (and other relevant local examples).
SASS 368. Whatever it Takes: Creating Paths Out of Poverty for Children. 3 Units.
This course will examine current community-based strategies for providing young people living in high poverty, multiple needs, urban areas with the educational, social and economic support they need for a stronger future. The course will begin with a review of the debated root causes of poverty in the United States and an exploration of the short and long term effects of poverty on children. Students will understand how poverty differentially affects different populations and geographic areas across the United States and globally. Special attention will be given to the complexity of urban poverty issues and the corresponding need for holistic interventions. The course will further explore the concepts and strategies underlying innovative community-based initiatives being implemented across the country including the theories, programming content, inclusion criteria and outcomes of these efforts. Students will have to critically think through the cost/benefits of this programming considering economic, political and social justice issues. Special attention will be given to the Harlem Children Zone’s (HCZ) model. The HCZ has achieved successes in boosting college attendance and closing the racial and socioeconomic achievement gap among youth in a high-poverty target area in New York City. The HCZ is the model for the Obama Administration’s Promise Neighborhoods Initiative to support comprehensive neighborhood development programs for children and youth. It includes efforts for social, educational and medical support designed sequentially to keep up with youth’s developmental needs. Students will critically analyze this model and its applicability across other geographic areas and populations. Students will also learn from local best practice Initiatives in education attempting to provide a path out of poverty for Cleveland’s children through site visits at local schools. This will include experiential opportunities for firsthand contact with program staff and youth.

SASS 369. Social Networking and Community Organizing in the 21st Century. 3 Units.
This course will examine the changing nature of place, given increased mobility and diversity in communities within the United States and the emergence of a truly global economy and communication network due to the revolution in information technology. Community itself is being redefined as many members of society consider their most important relationships are primarily virtual in nature. The forms of engaging citizens are also changing as old models of community organizing give way to new approaches that focus on connectivity through social networks. This course will examine various new approaches to engagement, from political or campaign organizing to social networking around mutual interest to mobilizing people for a cause. We will examine the Obama presidential campaign as an example of a new mobilization strategy that emphasizes choice, flexibility, value, and the ability to influence through organic informal networks. The course will also explore case studies, such as network-centric organizing as developed by Bill Traynor and Lawrence (MA) Community Works. Special attention will be given to controversial efforts criticized by the right or the left, such as the ACORN voter registration initiative. Students will also explore the changing nature of community in Northeast Ohio and how this new approach might lead to social change and economic development for greater Cleveland.

SASS 375. International Travel and Study Seminar. 3 Units.
The course provides an intensive experiential learning experience that take students to a Non-Western European country for appropriately 10-12 days to explore social and community development issues, policies and practices. There will be at least 42 hours of contact time with the instructors in Cleveland and the Non-Western European country. The program explores innovative approaches to social development and draws parallels to that of the United States. The purpose of the trip is to familiarize students with social development and social policy issues. Topics appropriate to the targeted country, such as poverty alleviation, non-formal education, prostitution, HIV-AIDS, multicultural aspects of healthcare, international adoption, and possible application of information communication technologies in addressing social problems will be addressed. The trip will include guided tours to neighborhoods, field-action project workers, healthcare professionals, government officials, scholars, and researchers will further enhance students’ understanding. Students are required to attend a minimum of two pre-trip seminars, write and/or present pre-trip assignment(s), attend a post-trip meeting, and complete a final written assignment. The course requires an additional cost for travel.

SASS 385. Social Welfare Capstone Seminar. 3 Units.
This seminar course will revolve around the identification and critical investigation of current social problems. Insights gained from social welfare research will be applied to better understand these problems. Successful completion of the course will require critical analysis of published research, integration of information from social work and different disciplines, an oral presentation and a final written research report including a literature review.

SASS 390. Independent Study for Undergraduates. 1 - 3 Unit.
Individual study in Applied Social Sciences involving specific programs of reading, research, and special projects. Requires prior approval of faculty member directing the project. Recommended preparation: 12 hours of social science courses; approval of MSASS Associate Dean.

SASS 391. Seminar on Community Needs and Services. 3 Units.
The course is directed towards students interested in exploring the relationship between community needs and service delivery. The course will have both a classroom and experiential community component. The goal of the course is to provide students an opportunity to experience first-hand the application of theoretical knowledge to community needs.

SASS 426. Research Methods in Social Work. 3 Units.
This course provides an overview of the basic concepts used in the conduct of scientific inquiry and the tools of research methodology. It introduces students to the issues involved in the design, implementation, analysis and utilization of social research. Students are encouraged to focus on a practice-related research problem in their individual or group research projects, as well as to focus on research issues relevant to their specialization, field of practice, or field of practicum setting. Students are alerted to the risks of cultural bias in research throughout the course through examples and scientific readings.
SASS 440. Human Development I: Child and Adolescent. 3 Units.
This course offers an overview of normal individual development throughout the life cycle. Psychosocial theory, learning theories, and social role theory constitute the theoretical base for this foundation course. Developmentally determined objectives and tasks for every life stage are examined in the context of biological, genetic, psychological, familial, and sociocultural factors. Special emphasis is placed on the impact of gender, health, and minority status, and on community institutions of human development. This course supports the foundation social work methods course by introducing substantive content on human development as a framework for assessment, prevention, and intervention with psychosocial problems. Curricularly related to the advanced sociobehavioral courses on human development and developmental dysfunction, this course provides a basic understanding of normal human development, which can serve as a contextual framework for developmental deviations from the norm.

SASS 441. Human Development II: Adult. 3 Units.
This course builds on SASS 440 Human Development I (child & adolescent) by compassing the general themes of feeling (emotion), thinking (cognition), and acting (behavior) with adult emotional, cognitive, and behavioral development. Students will understand the differences and similarities between earlier (child and adolescent) and later (adult, including older adult) emotional, cognitive, and behavioral development by examining, across the life-span, the idea/concept of; (1) adult development as gains/losses, (2) adult development as plasticity and variation (i.e., development can take many forms and can change), (3) adult development as risks, conflicts, protective factors, and resilience and (4) adult development as context (e.g., family, society, gender culture, ethnicity, social class, discrimination, sexual orientation, and socio-historical (i.e., cohort contexts). Prereq: SASS 440.

SASS 470. Social Policy. 3 Units.
This course provides basic perspectives on social policies related to poverty, health, aging, mental health, substance abuse, and discrimination. An analytical framework is used to systematically identify, define, and analyze social problems and policies. The course also introduces the student to social planning and service delivery.

SASS 477. Direct Practice Foundation Methods Skills. 3 Units.
The goal of this course is to develop culturally competent social work generalist practitioners who are armed with the knowledge and skills necessary to practice ethically with individuals and families in diverse social work practice settings. The course introduces major social work theories (i.e., systems-ecological theory) and intervention approaches (i.e., problem-solving). Understanding and practicing the skills necessary to carry out generalist practice will be a major focus on both lectures and skills lab.

SASS 478. Macro and Policy Practice Skills. 3 Units.
This course focuses on the development and application of practice skills in work with task groups, communities, and social policy institutions. It includes both didactic and experiential teaching and learning. The course is built on first semester foundation learning, particularly in the areas of social policy, diversity, discrimination, and oppression, and the direct practice skills lab. It will also draw on knowledge taught in the second semester course on theories of groups, organizations, and communities. Finally, there will be interaction with the field seminar and the field practicum. Prereq: SASS 477.

SASS 484. Theories of Oppression and Social Justice. 3 Units.
This course provides students with a basis for developing their ability to value a diverse world and to understand how discrimination and oppression operate to limit the life opportunities of members of minority and disenfranchised groups. Students will have the opportunity to develop and enhance their personal and professional awareness of their own cultural identity and to use this as a basis for developing their competence to work with individuals and groups different from themselves. Selected theoretical perspectives will provide a descriptive and explanatory framework for critically analyzing the manifestation of discrimination and oppression and their impact on the affected populations. Social work’s response to discrimination and oppression within the profession and in society at large will also be examined.

SASS 495. Field Education Seminar. 1 Unit.
This seminar prepares students for entry into field education. The course introduces students to a number of topics that are considered basic to beginning the social work field practicum.

SASS 500. Special Topics in Applied Social Sciences. 1 - 6 Unit.

SASS 505. Adoption: Practice and Policy. 3 Units.
This course covers the concepts, knowledge, skills, and policies associated with contemporary adoption practice. The practice method reflects a triad perspective, meaning that adoption is examined from the viewpoints of birth parents, adoptees, and adoptive parents. For each topic area, social work roles, activities, tasks, and skills are explored along with policy issues. Exemplars and case studies are presented for illustration purposes. Consideration of triad needs at different life cycle stages are presented. The issues of ethnically competent adoption practice are emphasized throughout the course in each content area.

SASS 506. Perspectives on Management and Leadership. 0 Units.
This course is designed to explore management and leadership capabilities. The class explores personal and organizational aspects of leadership and management examining theoretical perspectives and models, governance, communication, advocacy, ethics and accountability. In addition, the course examines key tools for effective management and leadership to manage risk, challenges, building consensus and collaboration. The course also guides students through a personal leadership development journey. The classroom will serve as an interactive learning environment. Students will learn management and leadership abilities from readings, lecture, group discussion, reflection, assessment, planning and application. The content of the course integrates research across social work, business, the nonprofit sector, and literature to inform a solid perspective to enhance management and leadership capabilities. This course includes activities and feedback for students to facilitate growth and development, and is appropriate for students who want to become effective managers and leaders, growing related abilities and knowledge.

SASS 509. Integrative Seminar in Social Work and Public Health. 0 Units.
This course is designed to develop critical thinking skills in the evaluation of research in public health and social work, an understanding of how social work and public health strategies can be integrated at multiple levels, and an understanding of how policy in the one of these domains has implications in the other. The noncredit course is required for all students enrolled in the dual MPH-MSSA degree program. Enrollment is limited to students enrolled in the dual MPH-MSSA degree program. Prereq: Enrolled in dual MPH-MSSA degree program.
SASS 510. Health Disparities. 3 Units.
This course aims to provide theoretical and application tools for students from many disciplinary backgrounds to conduct research and develop interventions to reduce health disparities. The course will be situated contextually within the historical record of the United States, reviewing social, political, economic, cultural, legal, and ethical theories related to disparities in general, with a central focus on health disparities. Several frameworks regarding health disparities will be used for investigating and discussing the empirical evidence on disparities among other subgroups (e.g., the poor, women, uninsured, disabled, and non-English speaking populations) will also be included and discussed. Students will be expected to develop a research proposal (observational, clinical, and/or intervention) rooted in their disciplinary background that will incorporate materials from the various perspectives presented throughout the course, with the objective of developing and reinforcing a more comprehensive approach to current practices within their fields. Offered as CRSP 510, EPBI 510, MPHP 510, NURS 510, and SASS 510.

SASS 515. Family Caregiving. 3 Units.
The purpose of this interdisciplinary graduate-level seminar is to explore the theoretical research, policy, and practice issues related to informal caregiving of the elderly. Topics will include the historical and cultural context of family caregiving, theoretical paradigms (i.e., adult development, stress and coping), characteristics of caregivers (i.e., gender, relationship, race, ethnicity, employment status, geographical setting), characteristics of the elderly care-receiver (i.e., type of cognitive and physical impairments), ethics, physical and mental health outcomes, service delivery issues, institutionalization, and bereavement. Through readings, discussions, guest lectures, and paper presentations, students will learn about the complexities of informal caregiving of the elderly from a range of disciplinary perspectives in order to improve assessment and practice skills in a variety of settings. Students are encouraged to focus on issues relevant to their discipline, specialization, or field of practice for their seminar papers.

SASS 517. Family System Interventions. 3 Units.
This course covers the knowledge, concepts, and skills associated with working families. The practice method will reflect a family systems approach, integrating theories and approaches within a systemic perspective. It will build practice skills in assessing, interviewing, and intervening with families and emphasize a strength-based perspective on intervention with families. Considerations of family issues at different developmental stages will be presented. The issue of ethically competent and community-based social work practice with families will be stressed throughout the course for each content area. Prereq: SASS 477 or SASS 400-TR.

SASS 522. Needs Assessment and Program Evaluation. 3 Units.
This course covers research methods and analytic tools that are used in communities and organizations to plan, monitor, and evaluate programs, projects, and initiatives. It builds upon the research methods course in the foundation curriculum and deepens and expands this content at the advanced level. The content prepares students to use quantitative and qualitative research methods to plan and evaluate programs, policies, and practices. The class covers the conceptual and technical aspects of conducting needs assessment in and applying the tools and findings to the community, program, and organizational development process. The course employs a circle perspective with the goal that students will be able to judge the strengths and weaknesses of various tools and approaches and the degree to which ethical standards have been met. Students are introduced to a variety of methods for community and needs assessment, demographic, statistical and geographic analysis, qualitative and quantitative data gathering methods, and program and policy evaluation designs. The importance of conducting research in ways that respect cultural diversity and are valid across diverse populations is emphasized. The practical aspects of using data to drive decision making, quality improvement, outcomes management and the engagement of partners and stakeholders are also covered in the course. This course is structured to have a strong emphasis on skill development in data gathering, analysis and application. Prereq: SASS 426 or SRCH 426 or SASS 400-TR.

SASS 534. Community and Social Development Perspectives. 3 Units.
An overview of the community and social development field. This course covers the history of community and social development in the US and abroad, theoretical and empirical underpinnings of this work, major approaches, institutions and public policy related to community and social development. Focus will be placed on understanding and analyzing community power, and the relationship between community and regional power structures. The history of institutional involvement in community and social development (e.g., World Bank, United Nations, Banking Industry, Intermediaries, etc.) will be traced as well as the policies that affect community and social development.

SASS 537. Medical Aspects of Disabilities. 3 Units.
The focus is on the study of children with disabilities and chronic health conditions. Related issues of development, diagnosis, treatment, and family concerns are included. Continuum of care from hospital to home considered. Involvement of the family as a member of the treatment and care team is emphasized. Context of treatment is considered from a multidisciplinary team approach.

SASS 539. Early Intervention: Theories and Practice. 3 Units.
This course both describes the characteristics of young children with disabilities and examines the intervention models and practices that are used to address the developmental and social-emotional needs of these children. The course describes the legislative and philosophical foundations for contemporary early intervention practice. It discusses the meaning of evidence based practice and examines contemporary early intervention practices from this perspective. The readings and assignments for this course have been designed to reflect the course objectives.
SASS 547. Problem Identification, Screening and Assessment/ Diagnosis. 3 Units.
This course will provide a bio-psycho-social approach to identification, screening, assessment and diagnoses of common psychosocial problems/dysfunctions experienced clients. This course introduces the student to the etiology, recognition and diagnoses of these problems in the context of social work practice. Through use of a competency-based model, students will be introduced to techniques used to screen, assess and diagnose problems such as serious mental illness, suicidality, depression and anxiety, substance abuse, child abuse, elder abuse, and exposure trauma. Students will also become familiar with the use of the DSM IV TR in providing axis I diagnostic formulations. A skills-based approach will be used in presenting students with specific screening, assessment and diagnostic protocols. This course is designed to incorporate a range of issues associated with stages across the lifespan from childhood to late life. Prereq: SASS 477 or SASS 400-TR.

SASS 549. Theory/Practice Approaches in Direct Practice Social Work. 3 Units.
This required, three credit course introduces selected theories and practice approaches commonly used in social work with individuals, families and groups. The course is designed to provide students with knowledge of theoretical explanations and practice frameworks commonly used in direct social work practice. The course also encourages students to apply critical thinking skills to theory and its practical applications. Case presentations, class discussions and assignments will require students to apply various theoretical perspectives to common problems and issues in social work practice. The course will highlight the use of professional social work values and attention to human development issues, diversity and cultural perspectives as they apply in each theory or framework. Prereq: SASS 477 or SASS 400-TR.

SASS 563. Resources for Community And Social Development. 3 Units.
Students will be able to understand and utilize the methods to identify, garner, and effectively use resources that promote community and social development. These methods can be applied to expanding resources for individuals, families, communities, and society, as well as to generate resources for organizations. While primarily focusing on financial resources, the course will also consider the important means of positioning an agency or organization to attract and receive resources and collaborate with others to put those resources to their most effective use. The skills that students practice in the course will include fund raising, grant development, financing, strategic partnerships and business deals, marketing, etc. The course will introduce proven models, such as low income tax credits, micro-enterprise, individual development accounts, and revolving loan programs. Students will also learn how to analyze and understand key domestic and international policies and institutions (e.g., foundations, banks, businesses, governments, associations) that relate to resources for community and social development.

SASS 564. Social Work Practice in Alcohol and Other Drug Abuse. 3 Units.
SASS 564 is an advanced direct practice concentration course focused upon knowledge, skills and values important for social work practice with people who abuse and/or are dependent on alcohol and other drugs. The content of SASS 564 directly builds upon the foundation direct practice course (SASS 477) and the required advanced course in screening and assessment (SASS 576). SASS 564 takes a bio-psycho-social approach to prevention, assessment and treatment of alcohol and other drug abuse and dependency (AODA) problems. This course introduces the student to the etiology and treatment of alcohol and other drug abuse in the context of social work practice. The historical background and the development of the evidence base of alcohol and other drug treatment interventions, self-help groups, and conceptual models of addiction will be presented. Students will explore their own attitudes and values toward AODA problems and how these affect treatment outcome as well as commonly used prevention and treatment approaches in social work with people who abuse and/or are dependent upon alcohol and other drugs. The course will use case materials to illustrate similarities and differences among various populations including minority/ethnic identity groups. Prereq: SASS 477 or SASS 400-TR.

SASS 565. Community-Based Practice with Children and Families. 3 Units.
This course covers knowledge, concepts, and tools associated with contemporary child welfare practice. The practice method reflects a family centered or family based approach, meaning that the welfare of children cannot be considered separately from the families of which they are a part. For each topic area, major social work roles, activities, tasks and skills are explored along with problems and issues in implementation. Program exemplars and case studies are presented for illustration purposes and practical application of the skills and techniques presented. Child welfare services that promote safety, permanency, and child well-being are presented. Consideration of family needs at different developmental stages of the child and family life cycle are also presented. The issue of culturally competent community based social work practice is stressed throughout the course for each content area. While this is primarily a methods course, program delivery and policy issues are discussed as they relate to the socio-political and organizational contexts of practice. Prereq: SASS 477 or SASS 400-TR.

SASS 567. CSD Practice I: Strategies for Assessing, Building and Organizing. 3 Units.
This course covers the frameworks and models in community assessment, community building and community organizing with a focus on the social processes in community development in the United States and internationally. Students will participate in a comparative analysis of models and learn specific skills used in community organizations and development practice, such as strategic planning, participatory action research, consciousness raising, and direct action. Through real world experience and case studies students will develop skills in neighborhood assessment, civic engagement, empowerment, leadership development, group work, relationship building, social capital formation, conflict resolution, democratic process, social policy analysis and change, and other methods. The course will provide specific applications of these models in relation to the dynamics of diversity and social justice.
SASS 569. CSD Practice II: Strategy for Designing and Implementing Community. 3 Units.
Students will learn about the design and implementation of community development in the U.S. and internationally. Content will include neighborhood revitalization, affordable housing, workforce development, business development, cooperatives, micro-enterprise, and other models of development that originated internationally and have been adapted in the United States. Attention will be given to globalization and the cultural and economic context—whether in disadvantaged communities in the U.S. or in the developing world—and to the skills that foster cultural competence. Students will practice the skills necessary for mobilizing human capital, designing community and social change, revitalizing neighborhoods, promoting productive employment, and affecting social policy. Students will learn to apply these change strategies in ways that promote sustainable development and social justice in both this country and around the world. Prereq: SASS 567

SASS 576. Integrative Seminar in Alcohol and Other Drug Abuse Treatment. 3 Units.
This course is an advanced level course in the Alcohol and Other Drug Abuse Specialization that provides opportunities for students to increase their knowledge of topics in the areas of assessment, diagnosis and treatment of alcohol and other drug disorders. The seminar builds upon course material in Foundation Methods (477) and in the advanced methods courses (SASS 549 and SASS 564). The seminar is intended to help students understand the evidence base for the treatment of substance use disorders and to explore selected areas of social work practice in intervention in the context of that evidence. Community applications of theory and techniques are stressed. The integrative Seminar in AODA Treatment uses a seminar format and provides students the opportunity to interact with treatment professionals from various treatment and practice settings. The seminar formal also facilitates individual learning: each student selects his or her own topic to pursue in depth. Each student is responsible for leading a minimum of one seminar presentation. Each student will select the topic for the seminar in consultation with the instructor. Coreq: SASS 477 and SSWM 564 or SASS 564.

SASS 573. Home Based MultiSystemic Interventions. 3 Units.
This course provides students with an in-depth comprehensive framework for home based interventions with youth and families. The course reviews clinical foundations for home based work and teaches skills and competencies necessary for multisystemic assessments and therapeutic interventions, including parent training techniques. Themes running throughout the course include ethical issues in multisystemic interventions; collaboration, teamwork, and supervision in multisystemic intervention; and consideration of diversity and multicultural appropriateness in multisystemic intervention. A variety of teaching methods are used to learn, observe, and practice new skills. This course is intended primarily for students working with children, youth and families in mental health, child welfare, juvenile justice, and substance abuse. Prereq: SASS 477.

SASS 574. Legal Issues in Social Work. 3 Units.
This course explores the legal issues that permeate the social work profession. Starting with a historical examination of our legal systems, the course will illustrate how social work is influenced and shaped by constitutional, statutory, and legal policy constructs. Students will learn about the skills necessary to provide testimony and to conduct forensic interviews, and we will discuss the legal foundation of ethical considerations and social work values. Students will also learn basic skills in how to utilize the law and legal processes to best advocate for clients and address larger social justice issues. By the end of the course, students will understand how social workers can competently navigate the choppy waters of the law in an interdisciplinary professional environment.

SASS 575. Travel and Study Seminar. 3 Units.
This course acquaints the student with the socio-political factors that influence the development of social welfare systems in a selected country and the impact of these systems on the development and functioning of individuals, families, groups, or communities. The role of the emerging social work profession in social change is explored via the social welfare system. Topics focus on the health care, mental health, aging, child, and/or educational systems and are oriented towards direct practice, management, or community development.

SASS 570. Social Work Practice in Mental Health: Children and Adolescents. 3 Units.
This advanced methods course builds on the content from required foundation social work methods, policy and human development courses including Direct Practice Methods and Skills, Mental Health Policy and Service Delivery. This course complements the content of advanced methods courses including Social Work with People Who Have Chronic Mental Illness, Social Work in Child Abuse and Family Violence, and Interventions in Alcohol and Other Drug Abuse. This course develops biopsychosocial knowledge and intervention techniques related to professional settings specializing in child and adolescent mental health: hospitals, child guidance agencies, family service agencies, mental health centers, and residential treatment centers. Students learn to use development and clinical theory to guide interventions while, maximizing individual strengths, social work treatment centers. Students learn to use development and clinical theory to guide interventions while, maximizing individual strengths, social work values and ethics, and empowerment. Social and economic risk factors, such as poverty, discrimination, and oppression, are considered in the intervention process and in the utilization of mental health services. In addition, students learn to think critically about the myriad ways cultural diversity influences parenting, child and adolescent norms and expectations. Students utilize assessment skills, coupled with knowledge of development and clinical theory to explore clinical case studies. Prereq: SASS 440 and SASS 477 or SASS 400-TR.

SASS 581. Social Work Practice with Older Adults. 3 Units.
This course is an advanced methods course that builds on the knowledge gained in Foundation Methods. The content of SASS 581 directly builds upon the foundation direct practice course (SASS 477) and the required advanced course in screening and assessment (SASS 576). It is also a required course in the Aging Specialization for the MSSA. The course will focus on the persistent principles and emerging emphases in direct practice with older adults and their families. Students will be asked to develop a model of practice based on knowledge of this unique population, social work values, and practice concepts. The course includes special issues in assessment, strengths-base case management, and intervention approaches known to be effective with emotional disorders in older adults. Prereq: SASS 477 or SASS 400-TR.
SASS 583. Social Work Practice in Mental Health Adults. 3 Units.
This advanced methods course builds on the content from required foundation social work methods, policy, and advanced sociobehavioral theory courses including Direct Practice Methods and Skills, Mental Health Policy and Service Delivery, Advanced Child and Adolescent Development and Dysfunction, and Adult Psychopathology. This course complements the content of advanced methods courses including Social Work with People Who Have Chronic Mental Illness, Social Work in Child Abuse and Family Violence, and Interventions in Alcohol and Other Drug Abuse. This course develops biopsychosocial knowledge and intervention techniques related to professional settings specializing in child and adolescent mental health: hospitals, child guidance agencies, family service agencies, mental health centers, and residential treatment centers. Students learn to use development and clinical theory to guide interventions while, maximizing individual strengths, social work values and ethics, and empowerment. Social and economic risk factors, such as poverty, discrimination, and oppression, are considered in the intervention process and in the utilization of mental health services. In addition, students learn to think critically about the myriad ways cultural diversity influences parenting, child and adolescent norms and expectations. Students utilize assessment skills, coupled with knowledge of development and clinical theory to explore clinical case studies. Prereq: SASS 477 or SASS 400-TR.

SASS 584. Integrative Seminar in Mental Health: Children and Adolescents. 3 Units.
Integrative Seminar in Mental Health: Children and Adolescents is an advanced level course, a capstone course in the Mental Health Child and Adolescent Specialization, that provides opportunities for students to increase their knowledge of assessment, diagnosis and treatment. This course builds on the course material in SASS 580, SASS 477, SASS 549, and SASS 576. The seminar is intended to help students integrate theory and practice, especially in the context of public mental health and community-based, social service practice. The integrative Seminar in Social Work Practice with Children and Adolescents uses a seminar format facilitates individual learning and promotes a learning-to-practice, reflective approach. The seminar assumes there are numerous evidenced-based models and practices and focuses student learning on the role of the professional use of self in the implementation of theory, technique, model, or intervention.

SASS 587. Integrative Seminar in Mental Health: Adults. 3 Units.
The Integrative Seminar in Social Work Practice with Adults is an advanced level course, a capstone course in the Mental Health Adult Specialization, that provides opportunities for students to increase their knowledge of assessment, diagnosis and treatment. This course builds on course material in SASS 583, SASS 477, and SASS 576. The seminar is intended to help students integrate theory and practice, especially in the context of public mental health and community-based, social service practice. The Integrative Seminar in Social Work Practice with Adults uses a seminar format and provides students the opportunity to interact with professionals, from various treatment and practice settings. The seminar format facilitates individual learning and promotes a learning-to-practice, reflective approach. The seminar assumes there are numerous evidenced-based models and practices and focuses student learning on the role of the professional use of self in the implementation of theory, technique, model, or intervention.

SASS 589. Social Work in Health: Chronic Illness. 3 Units.
This course is an interest-focused seminar, which consists of the instructor’s didactic presentations and students’ individual presentations. The instructor addresses the unique features of practice in healthcare settings within a community-based context perspective. Various social work interventions appropriate for use in healthcare are explored. Additional content focuses on developmentally determined issues for chronically ill children, adolescents, young adults, middle-aged adults, and older adults, including sensitivity to issues of diversity in practice populations. Students select one chronic illness for intensive study. The chronic illness must be an organically-based disease process, not a mental illness or an addiction. Prereq: SASS 477 or SASS 400-TR.

SASS 590. Field Practice. 1 - 12 Unit.

SASS 594. Independent Study Abroad. 1 - 12 Unit.
(Credit as arranged.)

SASS 598. Individual Reading. 1 - 12 Unit.
Special written permission needed. See MSASS registrar.

SASS 601. Field Education I. 2 Units.
The overall goal of this course is to provide graduate level social work students with field related opportunities to develop foundation level competencies in the eight abilities by helping students apply knowledge of social work theory, skills, values and ethics acquired in the classroom in an agency setting. These collective experiences provide students with a forum to develop social work skills, integrate and operationalize the values and ethics inherent in professional practice, and confront social injustice as self-reflective, competent developing practitioners. The field instructor is based at the social service setting and provides the direct instruction of the student. The faculty advisor, who is based at the School, serves as a link between all parties, interprets the requirements and standards of the School, and participates and consults in the design of the student’s learning experience. The field instructor assigns tasks to the student according to the requirements of the School and the educational and experiential level of the student. Student, field instructor, and faculty field advisor all participate in various ways in the evaluation of the student’s work; the faculty advisor is responsible for assigning the grade.

SASS 602. Field Education II. 3 Units.
This course is designed to be taken by entering Advanced Standing students in the first semester of their master’s program and by Foundation level social work students in the second semester of their master’s program. It consists of a field practicum and participation in professional development opportunities. For students entering the program with advanced standing, there is an additional requirement of four logs and an integrative assignment, and periodic meetings with a field faculty advisor in addition to the field conference. The overall goal of this course is to provide graduate level social work students with field related opportunities to continue to develop foundation level competencies in the eight abilities by helping students apply knowledge of social work theory, skills, values, and ethics acquired in the classroom in an agency setting. The periodic meetings with the field faculty advisor are designed to provide students with an opportunity to integrate classroom and field learning. These collective experiences provide students with a forum to develop social work skills, integrate and operationalize the values and ethics inherent in professional practice, and confront social injustice as self-reflective, competent, developing practitioners. Students spend 336 hours in field and professional development in SASS 602. Prereq: SASS 601 or SASS 400-TR.
SASS 603. Field Education III. 3 Units.
The overall goal of this course is to provide graduate level social work students with field related opportunities to continue to develop advanced level competencies in their area of concentration in the eight abilities by helping students apply knowledge of social work theory, skills, values and ethics acquired in the classroom in an agency setting. The periodic meetings with the field faculty advisor are designed to provide students with an opportunity to integrate classroom and field learning. These collective experiences provide students with a forum to develop social work skills, integrate and operationalize the values and ethics inherent in professional practice, and confront social injustice as self-reflective, competent, developing practitioners. Students spend 336 hours in field and professional development in SASS 603. Prereq: SASS 602 or equivalent.

SASS 604. Field Education IV. 3 Units.
This course is designed to be taken by students in their advanced course of study. It consists of a field practicum and participation in professional development opportunities. The overall goal of this course is to provide graduate level social work students with field related opportunities to continue to develop advanced level competencies in their area of concentration in the eight abilities by helping students apply knowledge of social work theory, skills, values and ethics acquired in the classroom in an agency setting. The periodic meetings with the field faculty advisor are designed to provide students with an opportunity to integrate classroom and field learning. These collective experiences provide students with a forum to develop social work skills, integrate and operationalize the values and ethics inherent in professional practice, and confront social injustice as self-reflective, competent, developing practitioners. Student, field instructor, and field faculty advisor all participate in the evaluation of the student’s work; the faculty advisor is responsible for assigning the grade. Students spend 336 hours in field and professional development in SASS 604. Prereq: SASS 603 or equivalent.

SASS 608. Philosophy of Science and Theory Building. 3 Units.
This is a required foundation course. The nature of theory is examined. Inductive and deductive methods for knowledge building are reviewed. Course content draws from philosophy of science as well as empirical and phenomenological research.

SASS 609. Theories of Social Welfare and Social Justice. 3 Units.
This is a foundation course required for all students. Theories of social welfare and social justice are examined. Course content draws from moral philosophy, economics, political science, cultural anthropology, sociology, history, psychology, and social welfare theory and provides students with a broad orientation to the field of theoretical social welfare.

SASS 610. Theories of Human Behavior: Macro and Micro Dimensions. 3 Units.
This is a required, foundation course and is designed to help students acquire a critical and reflective approach to theory in social work research and practice. The course provides a broad overview of theoretical perspectives at the individual, group, community, organizational and/or societal levels and addresses major theoretical perspectives used in social work and social welfare research.

SASS 613. Advanced Research Design. 3 Units.
This foundation course in research methods is required of all students. It is a prerequisite to the quantitative and qualitative courses. Topics covered include operationalization of variables, threats to validity, and experimental, quasi-experimental and non-experimental research design.

SASS 614. Models of Qualitative Research. 3 Units.
This course introduces students to the principles, approaches, methods, and analytical techniques utilized when conducting qualitative research in the social sciences. Five models of qualitative research design and methodology are studied, including narrative analysis, case study, ethnography, and grounded theory and phenomenology. This course is designed to provide students with the tools to critically evaluate as well as to enhance the academic rigor or “quality” of qualitative data. Prereq: SASS 608 and SASS 613.

SASS 615. Social Statistics and Data Analysis. 3 Units.
This foundation course (or its equivalent) is required of all students. Content includes univariate, bivariate and inferential statistics, and the use of electronic data processing technology to manage and analyze data. Prereq: SASS 613.

SASS 616. Applied Regression and the Linear Model. 3 Units.
This is the second required course in the research methods sequence for MSASS doctoral students. At the end of this course, students will be able to apply ordinary least squares regression and logistic regression in the analysis of social science data. They will learn to formulate research questions and hypotheses, specify statistical models, carry out the appropriate analyses, interpret their findings, and communicate their results clearly and effectively. Prereq: SASS 613 and SASS 615.

SASS 617. Specialization Seminar. 3 Units.
This course is a graduate level seminar; students and instructors share in the responsibility for presenting information and constructive criticism on the material. Topics include the selection and description of a social welfare topic, the theoretical explanations of that topic and the development of a focused, empirically-based literature review resulting in research questions and hypothesis.

SASS 618. Measurement Issues in Quantitative Research. 3 Units.
This course covers the operationalization of social science concepts and development of methods for their measurement. Issues covered include index and scale construction, validity, reliability, questionnaire design, factor analysis, measurement error, and missing data. Prereq: SASS 613, SASS 615 and SASS 616.

SASS 620. Theory and Research Base of Social Work Practice. 3 Units.
This course provides a critical overview of the major theories and the body of research informing contemporary social work practice. Theories will include the foundational, such as psychodynamic, ego-psychological, ecological and systems, along with trans-theoretical and post-modern theories. The course will integrate a discussion of the history of scientific inquiry in social work, particularly focusing on practice or intervention studies, systematic reviews and meta-analyses. Criteria for evaluating individual studies and the evidence base in specific practice areas will be included, along with material on the current state of Evidence-Based Practice. Recommended preparation: SASS 610.
SASS 621. Social Welfare Policy. 3 Units.
This course focuses on the critical review and application of policy analysis frameworks related to social welfare policy. The conceptual, historical, ideological, and political foundations contributing to the development, formulation, implementation, and monitoring and evaluation of social welfare policies will be critiqued. Social welfare policies intended to ameliorate social ills (e.g., poverty, education, housing) will be analyzed using policy analysis frameworks in a critical and comparative fashion. Policy alternatives to respond to current and future social problems will be critically discussed for feasibility, viability and economic effects. Recommended preparation: SASS 610.

SASS 630. Seminar on Social Work Education. 3 Units.
This seminar examines the structure and content of social work education within the context of higher education in American society. Emphasis is placed on curriculum design and course development. The course also is designed to help students develop a strategic approach to teaching based on learning theory. Finally, attention is given to current issues and future directions for social work education.

SASS 632. Research Project. 3 Units.
This course provides students with the opportunity to work with specific faculty engaged in research studies either on an individual or group basis. Prereq: 614 and SASS 615.

SASS 635. Methodological Issues in Qualitative Research. 3 Units.
This course builds on SASS 614, Models of Qualitative Research. It focuses on the application of specific qualitative data-collection methods, data-analytic approaches, and strategies for representing findings from qualitative investigations. Prereq: SASS 614.

SASS 637. Individual Reading. 1 - 18 Unit.
This is an individual reading course permitting students to select areas of interest and pursue these interests with specific faculty. (This also is the course number to register for dissertation credits before passing the qualifying examination.)

This course is intended for students who have passed the qualifying examination and are actively working on their dissertation. Prereq: Predoctoral research consent or advanced to Ph.D. candidacy milestone.

SPPP Courses

SPPP 500. Special Topics in Social Work Policy. 3 Units.
This seminar course is intended for students who are interested in exploring advanced topics in social policy.

SPPP 502. Alcohol and Other Drug Abuse Policy and Service Delivery. 3 Units.
This course explores selected current alcohol and other drug abuse (AODA) problems using a problem analysis framework. Emphasis is placed on current and past AODA problem definitions as they affect policy and program development. Conceptualization of the problems resulting from AODA patterns of use and abuse, causation theories, the impact of cultural and social diversity as well as discrimination upon all client systems, and the role of local and national institutions which advocate for this population group are reviewed. Prereq: SASS 470 or SASS 400-TR.

SPPP 510. Mental Health Policy and Service Delivery. 3 Units.
This course is designed for students preparing for careers as social workers in the mental health field with an understanding of mental health policy and service delivery at the federal, state, and local levels. Through readings, lectures, discussion, and written assignments, the course will aid students in developing a macro-level perspective of mental health policies and programs. Prereq: SASS 470 or SASS 400-TR.

SPPP 511. Issues in Health Policy and Service Delivery. 3 Units.
This course examines health care policy issues and options, and highlights the development of health care policy in the U.S., the influence of health policy development, and the role of social work. It also examines the problems, policy, and program issues in the subsidy, financing, reorganization, and regulatory capacity of health policy. National, state, and local issues will be stressed. The course is for students in the health concentration but also welcomes students from other areas. Prereq: SASS 470 or SASS 400-TR.

SPPP 512. Legislative and Political Process. 3 Units.
This course focuses on how to deal effectively with legislators, their staff, and legislative systems. The roles of money and information in legislative and political systems are examined. The process through which a bill moves to become law is explored, including critical points of intervention in that process. Lobbying legislators, including presentation of testimony and use of coalitions, is featured. Prereq: SASS 470 or SASS 400-TR.

SPPP 513. Aging Policy and Service Delivery. 3 Units.
This course reviews current income, health, and social service policies for older Americans. It also investigates patterns and levels of care for the elderly. Trends and issues in policies and programs for seniors are analyzed in the context of the dimensions and differential characteristics of the aging population in the country. Some cross-national comparisons of services for the elderly are included in this analysis. Prereq: SASS 470 or SASS 400-TR.

SPPP 520. Homelessness Policy and Service Delivery. 3 Units.
This course provides an understanding of homelessness and its incidence and prevalence, its origins, both historical and social, its consequences, and policy-based strategies for its prevention. The course investigates the impact of homelessness on single individuals, families with children, minorities, and vulnerable populations such as the mentally ill and alcoholics. Students, organized into a task force, examine a range of professional and community-based responses to the problem. The task force method enables students to assess the effects of public policy on homeless people, critique the effectiveness and adequacy of local shelter and service programs, and propose community-based strategies to prevent, stop, and better homelessness. Prereq: SASS 470 or SASS 400-TR.

SPPP 525. AIDS Seminar. 3 Units.
This course is designed to provide an understanding of HIV/AIDS. The nature and prevalence of the disease, including its impact upon vulnerable populations such as children and youth, women, gay and lesbian populations, people of color, prisoners, IV drug users, and street people are examined. The course focuses on public policies, programs, and service delivery for HIV/AIDS at local, state, and national levels. Topics include the policy-making role of advocacy groups, the function of AIDS service organizations, and the design of educational and preventive programs. Prereq: SASS 470 or SASS 400-TR.
SPPP 529. Child and Family Policy and Service Delivery. 3 Units.
This course focuses on major federal legislation impacting children, youth, and families, examined in the context of community-based social work policy/practice. It builds upon the foundation course in social welfare policy and enables students to use an advocacy approach to provide policy-informed services and to participate in policy and implementation and change. Prereq: SASS 470 or SASS 400-TR.

SRCH Courses

SRCH 530. Practice Evaluation. 3 Units.
This advanced course prepares direct practice students to examine their own practice with individuals, families, and groups. Attention is given to basic principles of measurement and selection of appropriate measurement instruments for use in direct practice settings. The course is intended to provide students with the technical skills necessary to investigate the components of social work practice and contribute to an empirically validated social work knowledge base. The student is asked to demonstrate the efficacy of his/her practice intervention in field placement by using a suitable design and method. A hands-on project is required using clinical experience from field practice. Prereq: SASS 426 and SRCH 426 or SASS 400-TR.

SRCH 536. Individual Research Practicum. 3 Units.
With instructor and research sequence chair approval, an individual program of supervised research experience may be undertaken. This course allows the student to tailor a program of applied research to a specific practice issue or program. Prereq: SASS 426 or SASS 400-TR.

SSBT Courses

SSBT 500. Special Topics in Sociobehavioral Theory. 1 - 3 Unit.
This seminar is intended for students who are interested in exploring advanced topics of current interest in sociobehavioral theory.

SSBT 502. Infant and Toddler Development. 3 Units.
In this course, students will focus on that segment of the human life span called infancy and toddlerhood, a period of development from conception to age three years. Students will be introduced to the major theories of development and will integrate theory and research as they relate to children's physical and motor development, perception, intelligence, language and communication development, and social and emotional development. The impact of the family and sociocultural contexts that affect development will be discussed. Discussion, case studies, and observations will be used to facilitate learning. Prereq: SASS 440 or SASS 400-TR.

SSBT 527. The Theory and Practice of Leadership. 3 Units.
This course assists students preparing for management and leadership roles in social service organizations to understand theories of leadership and translate them into effective leadership practices. The class explores leadership definitions, tasks and responsibilities, and the development of leadership capabilities. Students also examine their personal values, beliefs, skills, and understanding of ethical principles underlying leadership. Prereq: SASS 440 or SASS 400-TR.

SSBT 535. Human Sexuality. 3 Units.
The course addresses sexuality as an integral part of human functioning and human relationships throughout the life cycle. The formation of sexual identity is addressed, including gender identity, sexual orientation, and sexual intention. The physiological and psychological aspects of sexual behavior are covered, including the effects of aging, chronic illness, and sexually transmitted diseases. The course concludes with practical applications for social work, including an overview of assessment and treatment of sexual dysfunction. Prereq: SASS 440 or SASS 400-TR.

SSBT 546. Poverty Strategies for Social Workers. 3 Units.
This course provides an understanding of poverty. It examines poverty through an exploration of its causes, theory, policy strategies for its amelioration and practice implications. The course investigates the impact of poverty on single individuals, families with children, minorities, and vulnerable populations. The course will examine welfare reform and its impact in bringing people out of poverty. Students, in teams, will examine one facet of poverty--its theories, policies, impacts on individuals and families, potential solutions, and our approaches to the issues as social workers. In addition to assigned texts and readings, the course will be supplemented by practitioners, organizers, and low-income persons addressing the issues of poverty. Prereq: SASS 440 or SASS 400-TR.

SSBT 555. Women's Issues. 3 Units.
This course examines theories that are relevant to the development and socialization of women, and discusses issues that are relevant to women's lives within the context of oppression based on sexism, racism, ageism, homophobia, and other forms of discrimination. Emphasis is placed on assisting students in becoming more aware of the issues that are specifically relevant to their own development and socialization, and preparing for effective and sensitive professional practice by increasing knowledge about the issues facing women. Prereq: SASS 440 or SASS 400-TR.

SSWM Courses

SSWM 500. Special Topics in Social Work Methods. 1 - 3 Unit.
This seminar course is intended for students who are interested in exploring advanced topics of current interest in methods. Prereq: SSWM 400 or SASS 477 or SASS 400-TR.

SSWM 518. Social Work with Death, Grief and Loss. 3 Units.
This course focuses on the concept of death and related topics from a social work perspective. Such topics include the role of death in American culture; the dying process and its institutions; assessment and intervention strategies; life span and family life considerations; and end-of-life decisions. The course provides both theoretical and experiential exposure to the dying process as it relates to self, the dying person, and the bereaved. Students will gain insight into serving the terminally ill, those who need assistance with mourning and grief, and clients dealing with difficult life-and-death decisions regarding loved ones. Prereq: SASS 477 or SASS 400-TR.
SSWM 519. Children and Families in the School Setting. 3 Units.
This course prepares students to be certified school social workers. The course addresses major issues in American schools; a theoretical framework for school social work services; design, delivery, and evaluation of school social work services; legal and ethical issues; and the roles and intervention strategies of school social workers. It covers student and family problems and areas of need such as disability, truancy, divorce, teen pregnancy, youth depression and suicide, substance abuse, violence, and dropping out of school. This course is required for those participating in a planned program of study leading to state certification as a school social worker. If space permits, other students may enroll if they have or have had school social work experience. Prereq: SASS 477 or SASS 400-TR.

SSWM 531. Strategic Alliances. 3 Units.
This course provides organizational leaders with the concepts and practices critical to the development of interorganizational alliances, from affiliations to mergers and consolidations. Various strategies are examined and existing community-based national and international linkages are explored. Prereq: SASS 477 and SASS 478 and SASS 400-TR.

SSWM 544. Budgeting and Financial Management in Social Service Organizations. 3 Units.
Social service managers must be both responsible and accountable for the management of resources that enhance the provision of effective and efficient services to clients. In this course, students obtain an understanding of the skills, tools, and strategies needed to plan for the financial stability of their organizations. Students use a critical thinking perspective to examine budgetary and financial choices. They are able to understand the impact of power and politics in budget and financial processes. In addition, they are able to recognize ethical dilemmas that are often inherent in financial decision-making. Students demonstrate their understanding of program budgeting, financial reporting, and monitoring as well as other resource management concerns that affect human service managers and organizations. Prereq: SASS 477 or SASS 400-TR.

SSWM 546. International Social Work. 3 Units.
This is an advanced seminar designed for students interested in the international dimensions of the social work profession and social work practice. The seminar focuses on commonalities and differences in the roles and functions of social workers in different nations. It also gives attention to social work as a global profession and social work practice on an international level. Prereq: SASS 477 or SASS 400-TR.

SSWM 563. Social Work Intervent in Co-occurring Mental and Substance Abuse Disor. 3 Units.
This advanced methods course provides a basic orientation to substance use disorders in persons with mental illness (SAMI). A biopsychosocial framework will be used to explore the etiology, the maintenance and the recovery of both mental and substance use disorders. The historical background of practitioner, programmatic, and institutional barriers that impede the development and application of clinical skills to dually diagnosed individuals will be explored. Emphasis will be placed on strategies for the implementation of services to deal with individuals with co-occurring problems and their families using the evidence-based New Hampshire-Dartmouth Psychiatric Research Center Integrated Treatment (IT) Model. Current assessment techniques and treatment of special populations including, but not limited to: women, minorities, and adolescents will be discussed. Prereq: SASS 477 or SASS 400-TR.

SSWM 575. Social Work With Persons with Serious Mental Illness. 3 Units.
This course focuses on people who have severe mental illnesses. Students learn primary and tertiary community-based treatment and rehabilitative approaches, services, and programs. In helping people achieve recovery, students learn the theory and practice skills that underscore the four major approaches to community-based service delivery: the assertive case management model; strengths case management model, psychosocial rehabilitation model, and the recovery model. Within each model, specific attention is placed on practice similarities and differences, especially interviewing assessment, and intervention. Within these practice skills, students learn how to identify social justice and empowerment values that are supported or undermined. Advocacy is highlighted as a central social work value and practice skill that cuts across community-based practice models. Finally, lectures, readings, and discussions examine how gender, ethnicity, and social class produce various experiences of mental illness and various social work interventions. Prereq: SASS 477 or SASS 400-TR.

SSWM 579. Cognitive Behavioral Interventions. 3 Units.
This course acquaints students with the theoretical, conceptual, and skill bases of several cognitive-behavioral approaches to practice. Topics include assessment, use of tasks and homework, coping skills, cognitive restructuring, and problem solving approaches to practice. The course draws upon students’ field and work experiences to illustrate the application of the concepts and skills under discussion. Prereq: SASS 477 or SASS 400-TR.

SSWM 582. Social Work in Child Abuse and Family Violence. 3 Units.
This course addresses the etiology, investigation, and treatment of child abuse including sexual abuse and the roles of child welfare, health, and mental health agencies. Particular attention is given to direct work with children and adults who have experienced abuse, and to interventions in instances of family violence. Prereq: SASS 440 and SASS 477 or SASS 400-TR.

SSWM 584. Social Work with Couples. 3 Units.
This course provides an overview of assessment and intervention methods for working with couples around issues of marriage, divorce, and remarriage. Alternate couple forms are discussed. The course emphasizes systems and social learning approaches, communication and negotiation in problem solving and its relevance to assessment, treatment structure, and techniques. Special attention will be given to problem areas such as commitment, sexual dysfunction, chemical dependency, and destructive communication patterns. Prereq: SASS 477 or SASS 400-TR.

SSWM 585. Social Work with Groups. 3 Units.
A theoretical formulation of the social group work method as a problem solving process is addressed. Exercises are presented in the use of diagnostic skills to determine individual needs and problems for which groups may be helpful, the worker’s role in facilitating group functioning through his/her use of various program media. Attention is given to the significance of goals, agency environment, and policy for direct work with groups. Prereq: SASS 477 or SASS 400-TR.
# Mandel School of Applied Social Sciences Faculty

## Department Faculty

<table>
<thead>
<tr>
<th>Name</th>
<th>Title</th>
<th>Institutional Affiliation</th>
<th>Areas of Focus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kathryn Betts Adams, PhD</td>
<td>Assistant Professor, Social Work</td>
<td>(University of Michigan)</td>
<td>Depression in older adults, caregivers of persons with Alzheimer’s disease, mental health treatment methods, intervention research</td>
</tr>
<tr>
<td>Sarah S. Andrews, MSSA</td>
<td>Assistant Dean for Academic Affairs; Senior Instructor, Social Work; Director, Twelve-Month Advanced Standing Program</td>
<td>(Case Western Reserve University)</td>
<td>Family development, death, loss &amp; bereavement, women’s issues</td>
</tr>
<tr>
<td>Mark P. Aulisio, PhD</td>
<td>Associate Professor, Bioethics and Social Work; Director, MA Program in Bioethics; Director, Center for Biomedical Ethics, MetroHealth</td>
<td>(Bowling Green State University)</td>
<td>Family development, death, loss &amp; bereavement, women’s issues</td>
</tr>
<tr>
<td>David E. Biegel, PhD</td>
<td>Henry L. Zucker Professor of Social Work Practice; Associate Dean for Research and Training; Co-director, Center on Substance Abuse and Mental Illness; Professor, Psychiatry and Sociology</td>
<td>(University of Maryland)</td>
<td>Intersection of political philosophy and bioethics, consultation</td>
</tr>
<tr>
<td>Merri Elizabeth Brindo, MSSA</td>
<td>Clinical Instructor, Social Work; Field Faculty Advisor</td>
<td>(Case Western Reserve University)</td>
<td>Child welfare</td>
</tr>
<tr>
<td>Mark G. Chupp, PhD</td>
<td>Assistant Professor, Social Work</td>
<td>(Case Western Reserve University)</td>
<td>Inter-group dialogue and conflict transformation, citizen participation, community building, community organizing, appreciative inquiry, service learning</td>
</tr>
<tr>
<td>Cyleste C. Collins, PhD</td>
<td>Assistant Professor of Research, Social Work</td>
<td>(The University of Alabama)</td>
<td>Cultural consensus model, interpersonal violence, HIV/AIDS, poverty, family homelessness, health disparities</td>
</tr>
<tr>
<td>Claudia J. Coulton, PhD</td>
<td>Lillian F. Harris Professor of Urban Research and Social Change; Co-Director, Center on Urban Poverty and Community Development</td>
<td>(Case Western Reserve University)</td>
<td>Research in urban poverty, neighborhoods, community development</td>
</tr>
<tr>
<td>David Crampton, PhD</td>
<td>Associate Professor, Social Work</td>
<td>(University of Michigan)</td>
<td>Child welfare, community and social development, program evaluation</td>
</tr>
<tr>
<td>Kathleen J. Farkas, PhD</td>
<td>Associate Professor, Social Work</td>
<td>(Case Western Reserve University)</td>
<td>Co-occurring substance abuse and mental disorders, jail/prison-based treatment, women/elderly substance abuse assessment and treatment</td>
</tr>
<tr>
<td>Robert L. Fischer, PhD</td>
<td></td>
<td>(Vanderbilt University)</td>
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<tr>
<td>Daniel J. Flannery, PhD</td>
<td>Associate Professor of Research, Social Work; Co-Director, Center for Urban Poverty and Community Development</td>
<td>(The Ohio State University)</td>
<td>Program evaluation, social/behavioral intervention research, child/family interventions, nonprofit programming, policy studies</td>
</tr>
<tr>
<td>Sarah S. Andrews, MSSA</td>
<td>Research Professor, Social Work</td>
<td>(Case Western Reserve University)</td>
<td>Gangs, prisoner violence, cultural resilience</td>
</tr>
<tr>
<td>Mark G. Chupp, PhD</td>
<td>Clinical Instructor, Social Work</td>
<td>(Case Western Reserve University)</td>
<td>Community and social development</td>
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<td>Merri Elizabeth Brindo, MSSA</td>
<td>Clinical Instructor, Social Work; Field Faculty Advisor</td>
<td>(Case Western Reserve University)</td>
<td>Direct practice, adult and adolescent mental health, assessment and diagnosis, criminal justice</td>
</tr>
<tr>
<td>Peter J. Haas, PhD</td>
<td>Abba Hillel Silver Professor of Jewish Studies; Chair, Department of Religious Studies</td>
<td>(Brown University)</td>
<td>Judaic studies, anthropology of religion</td>
</tr>
<tr>
<td>Megan Holmes, PhD</td>
<td>Assistant Professor, Social Work</td>
<td>(University of California, Los Angeles)</td>
<td>Domestic violence, alcohol use and child maltreatment, research</td>
</tr>
<tr>
<td>David Hussey, PhD</td>
<td>Associate Professor, Social Work</td>
<td>(Case Western Reserve University)</td>
<td>Substance abuse, violence, social and behavioral science, psychopathology</td>
</tr>
<tr>
<td>Merl C. Hokenstad Jr., PhD</td>
<td>Merl C. Hokenstad Jr., PhD</td>
<td>(Ralph S. and Dorothy P. Schmitt Professor; Distinguished University Professor, Global Health and Disease, School of Medicine)</td>
<td>International social welfare, health and social services policy and programs for older people, social work education</td>
</tr>
</tbody>
</table>
Leila West Jackson, PhD  
(John Hopkins University)  
Assistant Professor, Epidemiology and Biostatistics, Environmental Health Sciences, and Social Work  
Lifestyle, environmental and occupational impacts on reproductive and prenatal health, endocrine disrupters, heavy metals exposure assessment

Deborah Regenbogen Jacobson, PhD  
(Tulane University)  
Assistant Professor, Social Work; Director, International Education Programs  
International education and administration, practice evaluation

Mark L. Joseph, PhD  
(University of Chicago)  
Associate Professor, Social Work  
Urban poverty, community development, mixed-income development, comprehensive community initiatives

Eva Kahana, PhD  
(University of Chicago)  
Pierce T. & Elizabeth D. Robson Professor of Humanities; Professor, Social Work; Director, Elderly Care Research Center  
Sociology of aging, medical sociology, social factors in stress and coping

Jeffrey Kahana, PhD  
( Brandeis University)  
Assistant Professor of Research, Social Work

Marjory Klein, MSSA  
(Case Western Reserve University)  
Clinical Instructor, Social Work  
Aging, mental health, alcohol and other drugs

Lenore A. Kola, PhD  
(Boston University)  
Associate Professor, Social Work; Co-Director, Ohio Center for Evidence Based Practices  
Alcohol and other drug abuse, co-occurring mental and substance use disorders

Jill E. Korbin, PhD  
(University of California, Los Angeles)  
Professor, Anthropology and Social Work; Director, Schubert Center for Child Studies; Co-Director, Childhood Studies Interdisciplinary Program; Associate Dean, College of Arts and Sciences  
Culture and human development, child well-being and child maltreatment, cultural, medical and psychological anthropology

Siran M. Koroukian, PhD  
(Case Western Reserve University)  
Associate Professor, Social Work; Associate Professor, Epidemiology and Biostatistics  
Methodological issues in the use of large databases in health services research, Medicare and Medicaid programs, cancer-related and other health disparities

Jeff M. Kretschmar, PhD  
(Miami University of Florida)  
Assistant Professor of Research, Social Work  
Violence and aggression, suicide, victimization, mental health and substance abuse

Jung-won Lim, PhD  
(University of Southern California)  
Assistant Professor, Social Work  
Ethnic minority and underserved cancer survivors, cultural and ethnic disparities in cancer outcome research, quality of life and behavioral outcomes, family care giving and health communication, culturally competent interventions

Sana Loue, PhD  
(University of Southern California at Los Angeles and Case Western Reserve University)  
Professor, Department of Epidemiology and Biostatistics; Director for Minority Public Health, School of Medicine  
Immigration law and health, impact of HIV on the family, HIV in underserved populations, ethics in research, public health and law

Gerald J. Mahoney, PhD  
(Vanderbilt University)  
Verna Houck Motto Professor of Families and Communities; Director, Center on Interventions for Children and Families  
Early childhood mental health, early intervention, parent education, disabilities

Soad Mansour, MSSA  
(Case Western Reserve University)  
Clinical Instructor, Social Work; Director of International Affairs  
Management, policy, international social work, community development

Gillian Marshall, PhD  
(University of Washington, Seattle)  
Assistant Professor, Social Work  
Aging/social gerontology, mental health disparities, cultural factors and immigrant health

David B. Miller, PhD  
(University of Pittsburgh)  
Associate Professor, Social Work  
African American fatherhood, violence as a public health problem, child maltreatment, adolescent resiliency factors, treatment of individuals exposed to violence

Dorothy C. Miller, DSW  
(Columbia University)  
Clinical Associate Professor, Social Work; Director, Flora Stone Mather Center for Women  
Women’s economic well-being, equality, public policy

Sharon E. Milligan, PhD  
(University of Pittsburgh)  
Associate Dean for Academic Affairs; Chair, Master’s Program; Associate Professor, Social Work; Associate Director, Center on Urban Poverty and Community Development  
Evaluation of community-based initiatives, community and social development practice and urban poverty research

Meeyoung Oh Min, PhD  
(Case Western Reserve University)  
Research Assistant Professor, Social Work  
Substance-using mothers and their children, childhood trauma and its correlates/consequences, research methods and statistics

Sonia Minnes, PhD  
(Case Western Reserve University)  
Assistant Professor, Social Work  
Behavioral and mental health outcomes of prenatally drug-exposed children

Diana Morris, PhD  
(Case Western Reserve University)
Florence Cellar Associate Professor of Gerontological Nursing; Executive Director, Case Western Reserve University Center on Aging and Health
Geriatric mental health, aging and quality of life, family care giving, science of unitary human beings

Nancy V. Neuer, MSSA
(Case Western Reserve University)
Clinical Instructor, Social Work
Clinical social work, health

G. Regina Nixon, PhD
(Howard University)
Instructor, Social Work
Poverty/high-risk populations, cultural diversity

Lori Longs Painter, MSSA
(Case Western Reserve University)
Clinical Instructor, Social Work
Social work practice

Andrea Goodloe Porter, MSSA
(Case Western Reserve University)
Assistant Dean for Student Services; Clinical Instructor, Social Work
Child abuse and child welfare, domestic violence, sexual abuse identification, crisis intervention

Robert J. Ronie, MD
(Case Western Reserve University)
Douglas Danford Bond Professor and Chair, Psychiatry; Professor, Social Work
Addiction psychiatry, public health, community mental health, co-occurring disorders

Anna Marie Santiago, PhD
(University of Wisconsin-Milwaukee)
Leona Bevis and Margaret Haynam Professor of Community Development
Housing and urban policy, social capital formation, neighborhood effects on child health and well-being, community development

Mark I. Singer, PhD
(Case Western Reserve University)
Leonard W. Mayo Professor in Family and Child Welfare; Co-Director, Center on Substance Abuse and Mental Illness; Deputy Director, Begun Center for Violence Prevention Research and Education
Adolescent mental health, adolescent substance abuse, youth-related violence

Louis Stokes, JD
(Cleveland Marshall Law School)
Distinguished Visiting Professor
Government, public policy, social change, community development

Gerald Strom, MSW
(Howard University)
Senior Instructor, Social Work; Director, Intensive Weekend Program
Child abuse, growth and development, sex abuse investigation and treatment, clinical practice

Aloen Townsend, PhD
(University of Michigan)
Professor, Social Work; Associate Professor, Sociology; Chair, Doctoral Program
Adult development and aging, research methods and statistics, adult physical and mental health, families and formal service systems

Elizabeth M. Tracy, PhD
(University of Washington)
Grace Longwell Coyle Professor of Social Work
Co-occurring substance use and mental health disorders, social networks, social support

James J. Werner, MSSA
(Case Western Reserve University)
Assistant Professor of Family Medicine, School of Medicine
Health behavior change, methods for mental health service delivery and direct practice in primary care, practice-based research networks, clinician education

Scott A. Wilkes, JD
(Case Western Reserve University)
Director of Field Education; Instructor, Social Work
Child welfare, mental health, nonprofit management, social work ethics

Rhonda Y. Williams, PhD
(University of Pennsylvania)
Associate Professor, History; Director, CWRU Social Justice Institute
Social justice, race/ethnicity, urban activism

Amy Blank Wilson, PhD
(University of Pennsylvania)
Assistant Professor, Social Work
Individuals with serious mental illness and co-occurring disorders, mental health services research, interconnections among the mental health and criminal justice systems, corrections and reentry

Zoe Breen Wood, PhD
(Case Western Reserve University)
Instructor, Social Work
Adoption, child welfare, policy and practice, social work methods, international travel and study, leadership, ability based learning
Master of Science in Social Administration (MSSA)

The Master of Science in Social Administration (MSSA) program prepares students for advanced social work practice in a variety of settings. The master’s curriculum is designed to address the wide range of skills and functions required of a professional social worker. Mandel School students are instructed on the various theories of individual and group behavior as well as community systems theory. The application of this knowledge, along with the appropriate use of practice principles and techniques, is a major educational objective.

The curriculum is divided into two levels: foundation and advanced. The foundation curriculum (27 credit hours) includes the knowledge, values, processes, and skills essential for the general practice of social work. It consists of general courses in social work methods, human development theory, social policy, research methods, and an introductory semester of field education. The advanced curriculum (33 credit hours) builds on the professional foundation and provides for advanced knowledge and practice skills in the concentration selected by the student. Concentrations include the following: aging; alcohol and other drug abuse; children, youth and families; health; mental health; and community development. School social work is available as a special emphasis.

Ability Based Learning Environment (ABLE)

The MSSA program incorporates an ability-based learning environment that enables students to develop and demonstrate mastery of eight core social work abilities. Classroom courses and field education are designed to help students develop each ability and continuously assess their learning throughout the educational experience. Mastery of the abilities is demonstrated in the field practicum and documented in a cumulative learning portfolio.

- **Identify as a Reflective Professional Social Worker:** Students will demonstrate an awareness of the potential influence of their actions and words as a professional social worker upon individuals, families, groups, organizations and communities. Students will demonstrate the ability to reflect on practice decisions and activities, using self-correction to assure continual professional development.
- **Advocate for Social, Economic and Environmental Justice:** Graduates will advocate for human rights and social and economic justice as one of their primary responsibilities.
- **Apply Social Work Methods:** Graduates of the MSASS master’s program are prepared to function as advanced practitioners in a changing arena of social work and social welfare. They are able to engage clients and client systems, assess client needs and strengths, provide or help arrange needed services and support, weigh intervention alternatives, implement change strategies, and evaluate results.
- **Uphold Social Work Values and Ethics:** Students will integrate social work values and ethics into their learning and professional practice.
- **Integrate Cultural, Economic and Global Diversity:** Students will integrate into their practice the knowledge, skills, and values needed for understanding and appreciation of a diverse world, and for ongoing development of competence in working with diverse populations and settings.
- **Think Critically About Theory and Research Knowledge:** Graduating students will be able to think critically about their practice and its knowledge base, and about the social problems and situations they encounter. Critical thinking in social work includes selecting appropriate theoretical approaches and strategies to apply in practice, using research findings to improve practice, evaluating one’s own practice, and making contributions to knowledge in the field.
- **Communicate Effectively:** Graduating students will have the oral, written, nonverbal, and information technology skills that will enable them to communicate effectively and appropriately in professional roles and settings.
- **Develop as a Social Work Leader:** Social workers recognize that the context of practice is dynamic, and use knowledge and skill to respond proactively. Social work leaders are informed, resourceful, and proactive in responding to evolving organizational, community, societal and global contexts at all levels of practice in ways that improve quality of life.

Mandel School faculty place a high priority on the integration of theory with practice. To facilitate this integration, field work is done concurrent with course work. Through field education, students have the opportunity to acquire new skills and apply their classroom learning in their practice setting. The school is affiliated with over 350 agencies in the Greater Cleveland area, creating a vast network of field education as well as employment opportunities. Students are required to complete over 1000 clock hours of field education. The school and the affiliated agency or field setting agree on the content and conditions of field education, including the qualifications of social workers who serve as field instructors. Field placement decisions are based on educational criteria, with student interests and career objectives taken into consideration.

**Concentrations**
- Community and Social Development
- Direct Practice

**Direct Practice Specializations**
- Aging
- Alcohol and Other Drug Abuse
- Children, Youth and Families
- Mental Health
- Health*

*Health specialization is offered only in the full-time format.

**Program Options**

**Full-Time Program**

Approximately one-half of Mandel School students are enrolled in the Full-Time Program. This program takes four semesters to complete. Students enroll for fall and spring semesters and are scheduled concurrently for classes and field work on a full-time basis. This program is demanding in depth and scope of experience. It is not advisable for students to assume extensive employment during their semesters of enrollment.

**Advanced Standing Program**

Advanced standing may be granted to students who have earned an Bachelor’s degree in Social Work (BSW) within the last seven years from an institution accredited by the Council on Social Work Education. Students must have earned a B or better in any social work course for which advanced standing is sought.
**Intensive Weekend Program**

The Intensive Weekend Program is designed to provide graduate-level education toward the MSSA to employed professionals who are maintaining full-time employment. Classes meet one weekend per month throughout the calendar year. Students are required to attend all classes. Students complete five courses each year and all program requirements in three years. Those who have graduated from an accredited BSW program in the last seven (7) years can complete the Intensive Weekend Program in two years.

**Senior Year in Professional Studies Program**

Undergraduate students of superior ability and achievement may be admitted to the Mandel School at the end of their junior year. This program enables qualified college seniors who are majoring in social work related fields to begin their first year of graduate study during what would normally be their last year of undergraduate work. Exceptional undergraduate students who are firmly committed to social work as a profession can earn both their undergraduate and graduate degrees in five years.

A student in the Senior Year in Professional Studies Program is permitted to substitute the first year (31 semester hours) at the Mandel School for the last year of undergraduate work. The bachelor’s degree will be granted by the undergraduate college when the student has completed his or her first year at the Mandel School.

Students applying for this program must be interviewed by an admissions officer as part of the application process to explore the candidate’s level of maturity, knowledge of social work, and readiness for professional education. Application for this program should be made prior to the second semester of the junior year.

To qualify for this program, students must demonstrate superior academic ability and achievement during their first three years of undergraduate study. All applicants must (a) have sufficient coursework in the social and behavioral sciences by the end of their junior year; (b) hold a cumulative grade point average of at least 3.25; and (c) have successfully completed three-quarters of the major and minor courses in their area of concentration. Acceptance into the Senior Year in Professional Studies Program is contingent upon receipt of a written statement from the dean of the applicant’s undergraduate college, outlining any remaining requirements.

Note: This program is available to students at Case Western Reserve University, Hiram College, College of Wooster, Baldwin Wallace University, John Carroll University, Fisk University, and Ohio Northern University by joint agreement with these institutions. Interested students from other institutions are encouraged to speak with the director of admissions.

**Part-Time Degree Program**

Students may opt to complete their degree work on a part-time basis during their first year. During the second, third, and fourth years students complete field education requirements and carry a full-time, or nearly full-time, load.

Part-time students select classes from the full-time weekday schedule. These classes meet once a week for two hours. Employed professionals may participate in this program if they can arrange a flexible work schedule.

The part-time program may be completed in three years. Students granted advanced standing may complete the program in fewer semesters. Part-time students are required to register for a minimum of six credit hours per semester. A student must complete all degree requirements in a maximum of five years.

**Non-Degree Study**

Some designated courses may be taken on a non-degree basis with the permission of the assistant dean of academic affairs and the course instructor. A maximum of 12 hours earned on a non-degree basis may be counted toward requirements for the master’s degree if the student is subsequently admitted as a degree seeking candidate. A bachelor’s degree is required for enrollment.

**Virtual MSSA Program (begins Spring 2013)**

The Virtual MSSA Program option is designed to provide online graduate social work education for employed professionals who plan to maintain full-time employment. Classes meet online to complete all program requirements in two years for advanced standing, and three years for non-advanced standing.

**Master of Nonprofit Organizations Degree Program**

*(begins Fall 2013 pending approval by the Ohio Board of Regents)*

The Master of Nonprofit Organizations (MNO) degree program prepares students interested in the nonprofit sector for management and leadership positions, by building their skills, competencies, knowledge and capacity. The MNO degree has five program educational objectives for its graduates: (1) to bring contextual understanding to managerial decision-making; (2) to develop, analyze and apply relevant data; (3) to inspire and engage volunteers and professionals in the creation and implementation of ethically-grounded strategies to advance organizational mission; (4) to develop and implement revenue generation strategies; and (5) to manage human and financial resources effectively, efficiently and ethically.

The full time program consisting of thirty-nine (39) credit hours can be completed in twelve (12) months over three (3) consecutive semesters, with students beginning each year in the summer semester (June 1) and concluding at University graduation in the following May.

The curriculum will provide education that instills analytical skills, knowledge relevant to ethical and entrepreneurial decision-making, and expertise in acquiring and managing resources. Graduates will be trained to enhance organizational effectiveness, harness passion, dedication, and vision, make the best use of available resources and seek new resources. Graduates will gain hard and soft management skills and knowledge needed to address a wide range of issues confronting nonprofits and become professionals who work to influence political and social decisions, create stronger organizations, building the capacity, and advancing the mission.

Students accepted for the MNO degree program must possess a Bachelor’s degree from an accredited college or university. They must have a record of excellent academic performance and potential evidenced by grade point average and scores on the Graduate Record Examination (GRE). Students must also evidence a strong interest in the nonprofit sector through volunteer activities, internship experiences or employment in a nonprofit organization.
Eighteen-Month Advanced Standing Program

Advanced Standing students who are not in the Twelve-Month program generally follow the Eighteen-Month program leading to a Master of Science in Social Administration (MSSA). Students follow a fall semester, spring semester, fall semester sequence of courses and they graduate in January. Up to 15 hours of advanced standing may be granted to students who have completed their bachelor’s degree in social work (BSW) in the last seven years from an institution that is accredited by the Council on Social Work Education (CSWE). Students pursue this option for the following reasons:

• One of the multi-disciplinary certificate programs or special focus areas
• Electives not offered during the summer semester
• Retaking core BSW courses in which they earned a grade of B- or below

### Aging

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Total Units in Sequence: 45

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### Mental Health-Children and Adolescent

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### Health

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### Children, Youth & Families-School of Social Work

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Twelve-Month Advanced Standing Program

The Twelve-Month Advanced Standing Program leading to a Master of Science in Social Administration (MSSA) is available to students who obtained a strong academic record in their bachelor of science (BSW) program.

Up to 15 hours of advanced standing may be granted to students who have completed their bachelor’s degree in social work (BSW). The Twelve-Month program follows a fall semester, spring semester, and summer session sequence of courses and is intended for students who have clear professional goals and can manage an accelerated program of study. Students complete their MSSA degree in August. Because of the short time frame for completing the Twelve-Month Program, dual degrees, individualized curricula, and the school social work emphasis are not available in this program.

Admission to the Twelve-Month Advanced Standing Program is open to students who have completed a bachelor’s degree in social work (BSW) in the last seven years from an institution which is accredited by the Council on Social Work Education (CSWE). Grades of B or better must be attained in all foundation social work courses.

Aging

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Alcohol & Other Drug Abuse Plus-Chemical Dependency Professional License Eligibility

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| Total Units in Sequence: | 45 |

Children, Youth & Families

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| Total Units in Sequence: | 45 |
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**Total Units in Sequence:** 45

### Health

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**Total Units in Sequence:** 45

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**Total Units in Sequence:** 45

### Intensive Weekend Program

The Intensive Weekend program offers human service professionals who are employed full time to pursue a Master of Science in Social Administration (MSSA). Classes meet one weekend per month through the calendar year and students are required to attend all classes. Students complete four courses each year (six during the first year), and complete all program requirements in three years.

Courses consists of four distinct components:

- A three-day weekend of classes (Friday, Saturday, and Sunday, 9:00 a.m.-5:00 p.m.)
- A four-week study period, during which additional readings and written assignments are completed
- A two-day weekend of classes (Saturday and Sunday, 9:00 a.m.-5:00 p.m.)
• A final study period of approximately three weeks, during which the final course assignment is completed and materials for the next course are received.

### Aging

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Total Units in Sequence: 60

### Alcohol & Other Drug Abuse

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| Total Units in Sequence: | 60 |

### Community and Social Development

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| Total Units in Sequence: | 60 |

### Mental Health-Adult

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Field Education III (SASS 603) 3
Theory/Practice Approaches in Direct Practice 3
Social Work (SASS 549) 3
Free elective 3
Research Methods in Social Work (SASS 426) 3
Free elective 3

Year Total: 6 9 6

### Year Total:

### Total Units in Sequence:

#### 60

### Intensive Weekend Advanced Standing

The Intensive Weekend program offers human service professionals who are employed full-time to pursue a Master of Science in Social Administration (MSSA). Classes meet one weekend per month through the calendar year and students are required to attend all classes. Up to 15 hours of advanced standing may be granted to students who have completed their bachelor’s degree in social work (BSE) in the last seven years from an institution that is accredited by the Council on Social Work Education (CSWE).

### Aging Specialization

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#### Total Units in Sequence:

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### Alcohol and Other Drug Abuses Specialization

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#### Total Units in Sequence:

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### Children, Youth and Families Specialization

#### First Year

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Free Elective 3
Year Total: 6 9 6

**Total Units in Sequence:** 45

### Community and Social Development Specialization

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### Children, Youth and Families: School Social Work Specialization

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### Aging

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### Full-Time Program

The Full-Time program takes four semesters to complete. Students are scheduled for classes and field education concurrently. In the first two semesters, students complete foundation courses which are prerequisites for concentration required courses. Advanced electives are completed in the last two semesters.

---

**Mental Health Policy and Service Delivery (SPPP 510)**

**Field Education IV (SASS 604)**

**Free Elective**

**Free Elective**

**Year Total:** 6 9 6

**Total Units in Sequence:** 45
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**Second Year**

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**Total Units in Sequence:** 60

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**Children, Youth, and Families**

**First Year**

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**Total Units in Sequence:** 60

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**Children, Youth, and Families: School Social Work**

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**Total Units in Sequence:** 60
### Community and Social Development

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#### Total Units in Sequence: 60

### Mental Health-Adult

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#### Total Units in Sequence: 60

### Health

#### First Year

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## Mental Health-Child

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**Total Units in Sequence:** 60
Professional Development and Continuing Education

Professional Development and Continuing Education Program

Opportunities to increase practical knowledge and skills are offered to human services practitioners in a variety of seminars, institutes, conferences, customized training, co-sponsored events, and online learning. Programs are geared to provide practitioners with learning that is immediately applicable at their workplace, skills to help to advance their careers and opportunities for lifelong learning. Programs are taught by renowned faculty and respected alumni and community practitioners.

Programs are offered at the Mandel School of Applied Social Sciences and convenient off-site locations. Distance programs allow “on demand” access to continuing education programs to accommodate busy work schedules and lives.

The Mandel School is an approved provider of professional continuing education for:

- State of Ohio Counselor and Social Worker and Marriage and Family Therapist Board
- Ohio Psychological Association (OPA)
- Ohio Chemical Dependency Professional Board (RCH)
- Ohio Nursing Home Administrators Board (BENHA)

Listings of current offerings in continuing education (http://msass.case.edu/ce) can be found on the Mandel School of Applied Social Sciences website.
Special Focus and Certificate

Special Focus and Certificate Programs

Certificate Programs

Global Health

The Certificate in Global Health (http://www.case.edu/med/cfgh/Certificate.html) focuses on the broadest concept of public health, including international aspects of disease transmission, diagnosis, treatment, policy, and prevention. The overall objective of this interdisciplinary certificate is to support MSASS students with interests in health problems, issues, and concerns that (a) transcend national boundaries, (b) may be influenced by circumstances or experiences in other countries, and (c) are best addressed by cooperative actions and solutions. Current participating departments and schools at Case Western Reserve University include Mathematics, Medicine, Public Health, Anthropology, Nursing, Bioethics, Epidemiology, Biostatistics, Biology, and Engineering.

The requirements to receive the certificate differ by discipline and emphasize discipline-specific and interdisciplinary coursework. For MSASS students, this includes completion of two required interdisciplinary courses and an additional MSASS elective. The certificate is most appropriate for students who choose to complete the Community and Social Development program, or the Health or Aging specializations in the Direct Practice program.

Gerontology

Students with an interest in serving the needs of the aging population may pursue the multidisciplinary graduate certificate program offered through the Case Western Reserve University Center on Aging and Health (http://jpb.case.edu/Centers/UCAH). This program is designed for gerontological researchers, educators, and practitioners. Participating faculty are from the Mandel School and the Case Western Reserve University Schools of Medicine, Dental Medicine, Nursing and Arts and Sciences. Students must be enrolled in the Aging specialization at the Mandel School.

School Social Work

The School Social Work program is designed to train school social workers and provide them with the competencies to practice in a variety of traditional and non-traditional primary and secondary education settings. Such competencies include assessing children’s needs; designing and implementing interventions; and making referrals to other professionals and agencies, as needed. School social workers function collaboratively with educators and other professionals to assist the schools and the communities in mobilizing resources on behalf of children and adolescents in order to help ensure academic success.

The program is consistent with the Ohio Department of Education, State of Ohio, regulations and professional standards developed by the National Association of School Workers, and is a jointly offered by the Mandel School of Applied Social Sciences at Case Western Reserve University and the Division of Education at Baldwin-Wallace University. Students in the program complete the Master of Science in Social Administration (MSSA) degree at the Mandel School with a specialization in Children, Youth and Families. As part of the MSSA degree, students complete three required education courses at Baldwin-Wallace University, SSWM 519 Children and Families in the School Setting, and a field practicum in an approved school social work setting. After the completion of all required coursework and field education, a student can apply to the State of Ohio Department of Education to receive a certificate in school social work.

This program can be completed only by two-year and eighteen-month students (not twelve-month students). Intensive weekend students can also complete this program if they are able to enroll in some full-time program courses.

Management and Leadership

This certificate allows students to pursue a set of focused coursework designed to prepare them for managing and leading in a range of social welfare settings. The certificate is available to all MSSA students regardless of concentration or specialization and can be completed within the normal masters framework. To do so, students forgo taking concentration-related electives and instead undertake the fifteen (15) academic credit courses required for the certificate. These courses include an introduction to management and leadership, supervision, budgeting and finance, and program design. In addition, students select one elective based on their interests from a set of approved courses.

Special Focus Programs

Louis B. Stokes Fellowship in Community and Social Development

The Louis Stokes Fellows Program in Community and Social Development provides full tuition scholarships to African American and Hispanic/Latino professionals who are currently working in community development. The goal of the Louis Stokes Fellows program is to:

- Support the graduate professional education of outstanding students from universities with Hispanic students and students from traditionally Black colleges and universities.
- Attract a greater number of African American and Hispanic students to advanced social work education to help meet the need for diversity in the social work profession.
- Foster future leadership in community building, community development, and housing.

ADAMHS Board Fellowship

The primary goal of the Alcohol, Drug Addiction and Mental Health Services Board program (ADAMHS) is to serve as an innovative and meaningful alternative for employed mental health and substance abuse social workers to pursue their graduate education objectives. Emphasis is placed on using evidence-based best practices to implement services that will assist individuals with mental health and substance abuse problems and their families. This weekend program makes it possible for employed individuals in Cuyahoga County to overcome the barriers of time and finances to pursue a degree in social work.

Child Welfare Fellowship

The primary goal of the Child Welfare Fellows program is to improve the public child welfare workforce in Northeast Ohio. Emphasis is placed on using evidence-based best practices in public child welfare and systems of care principles. The Mandel School’s Intensive Weekend program makes it possible for employed individuals in public child welfare agencies in Northeast Ohio to overcome barriers of time and finances to pursue a Master’s degree in social work.

Leadership Fellows Program

The Leadership Fellows Program focuses on exceptional students who want to assume leadership in clinical practice within an agency context. It is a two-year program of study for direct practice students in aging,
alcohol and other drugs, children, youth and families, health or mental health.

**Global Practice Opportunities**

At the Mandel School, students have numerous opportunities to explore beyond our own borders. The Mandel School faculty includes experts in international social work and social policy research. The Mandel School also hosts numerous international full-time students, exchange students, visiting scholars and researchers.

Qualified students may choose to participate in a number of multi-disciplinary study abroad opportunities. Many trips occur during winter and spring break. Students are able to familiarize themselves with a variety of social policies of other countries, which have in the past included the Netherlands, Guatemala, China, Bangladesh, and Israel, among others.
Office of Undergraduate Studies

Case Western Reserve University confers baccalaureate degrees based on programs offered by the faculties of the Case School of Engineering, the College of Arts and Sciences, the Frances Payne Bolton School of Nursing, the School of Medicine, and the Weatherhead School of Management. In addition, the university offers several baccalaureate programs jointly with the Cleveland Institute of Art and the Cleveland Institute of Music. The faculties and administration are dedicated to offering educational programs that enable undergraduates to achieve disciplinary literacy in one or more major fields, to acquire educational breadth through study across the natural sciences, humanities and arts, and social sciences, and to learn to think critically and to communicate effectively. Furthering the university mission, the educational programs aim to foster the development of qualities of integrity, creativity, leadership, and societal engagement.

The bachelor’s degree programs engage students in in-depth study in one field (the major), as well as general education or core requirements. Overlap among the general education and core curricula for the various bachelor’s degree programs allows students flexibility in the choice of majors and degree program. Foundational courses and seminars introduce students to modes of inquiry, thought, and communication in the natural sciences, humanities and arts, and social sciences.

Advisors for first-year students, major field advisors, other faculty, and deans assist students in selecting a field of study suited to each student’s interests and qualifications. Highly motivated and responsible students whose educational and career goals are better served through an individualized course of study may pursue academic programs of their own design through a Dean’s Approved Major.

Students with broad educational interests and goals may pursue concurrently two or more majors for the Bachelor of Arts degree or two or more majors for the Bachelor of Science in Engineering degree, or may earn two bachelor’s degrees, completing both a Bachelor of Arts degree and a Bachelor of Science degree, or fulfilling the requirements for two Bachelor of Science degrees. The Bachelor of Music degree offered by the Cleveland Institute of Music may be combined with either a Bachelor of Arts or a Bachelor of Science degree. Qualified students who wish to accelerate their undergraduate and graduate or professional studies may earn the opportunity to begin in the senior year advanced study toward a graduate or professional degree.

The university provides undergraduates with a rich variety of experiential learning opportunities off campus as well as on campus. Programs that engage students in curriculum-related employment include the Cooperative Education Program (http://engineering.case.edu/coop), the practicum Program (http://studentaffairs.case.edu/careers/jobs/practicums), and internships. Study abroad, the exchange program with Fisk University, and the Washington Semester immerse students in educational environments that build global and national knowledge and perspective. Research opportunities for undergraduates abound at the university, in University Circle institutions, and in Cleveland. Individual departments offer independent study opportunities to motivated and qualified students; some departments offer courses that incorporate practical field experience or community service. The location of the university in University Circle, with its outstanding array of cultural, educational, and health care institutions, and the proximity and accessibility of the university’s various professional schools and their facilities enable undergraduates to draw upon diverse and distinctive resources to enrich their education.

Administration

Jeffrey Wolcowitz, PhD
(NEW) - Dean of Undergraduate Studies
Lynmarie Hamel, MEd, JD
(Cleveland State University; Case Western Reserve University) - Senior Associate Dean of Undergraduate Studies

Support for First-Year Students

Michael R. Mason, MEd
(Kent State University) - Interim Assistant Dean for First-Year Students
Tiffany M. Favers, MA
(The Ohio State University) - Coordinator of First-Year Residence Education in Juniper Residential College
Katherine E. Grooms, MEd
(University of South Carolina) - Coordinator of First-Year Residence Education in Magnolia Residential College
Kaleena M. Rolitsky, MEd
(Ohio University) - Coordinator of First-Year Residence Education in Cedar Residential College

Support for Upperclass Students

Denise R. Butler, MA, MLIS
(Kent State University) - Assistant Dean of Undergraduate Studies
Nancy A. Dilio, PhD
(Pennsylvania State University College of Medicine) - Assistant Dean of Undergraduate Studies
Lynmarie Hamel, MEd, JD
(Cleveland State University; Case Western Reserve University) - Senior Associate Dean of Undergraduate Studies

Support for Transfer, Exchange, and Non-Degree Students

Claudia C. Anderson, BA
(Youngstown State University) - Assistant Dean of Undergraduate Studies
Advising about National Scholarships and Fellowships
Lynmarie Hamel, MEd, JD
(Cleveland State University; Case Western Reserve University)
Senior Associate Dean of Undergraduate Studies

Advising about Law School
Terri A. Mester, PhD
(Case Western Reserve University)
Pre-Law Advisor

Advising about Health Careers
Steven P. Scherger, MA
(The Ohio State University)
Director of Health Career Advising
Case School of Engineering Undergraduate Degree Requirements

Bachelor of Science in Engineering Degree

(Case School of Engineering)
Candidates for the Bachelor of Science in Engineering (BSE) degree, in addition to meeting the general requirements for bachelor’s degrees as described above, must also complete the following requirements:

1. A minimum of 128-133 hours as specified by the requirements for each BSE program.
2. The SAGES Engineering Core Curriculum.
3. The requirements for the specific engineering major as presented in this bulletin in the section devoted to each department or program.

Major Fields Available for the Bachelor of Science in Engineering degree:

- Aerospace Engineering
- Biomedical Engineering
- Chemical Engineering
- Civil Engineering
- Computer Engineering
- Electrical Engineering
- Engineering Physics
- Materials Science and Engineering
- Mechanical Engineering
- Polymer Science and Engineering
- Systems and Control Engineering
- Engineering (undesignated)

With the exception of the undesignated major in engineering, all of the engineering programs listed above are accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology (ABET).

Bachelor of Science in Computer Science Degree

(Case School of Engineering)
Candidates for the Bachelor of Science in Computer Science degree, in addition to meeting the general requirements for bachelor’s degrees as described above, must also complete the following requirements:

1. A minimum of 129 hours.
2. The SAGES Engineering Core Curriculum, with the exception of ENGR 200 Statics and Strength of Materials, ENGR 210 Introduction to Circuits and Instrumentation and ENGR 225 Thermodynamics, Fluid Dynamics, Heat and Mass Transfer.
3. The requirements for the computer science Bachelor of Science major as presented in this bulletin.

SAGES Engineering Core Curriculum of the Case School of Engineering

The SAGES Engineering Core curriculum of the Case School of Engineering provides a foundation in mathematics and sciences for programs in engineering and in computer science leading to the Bachelor of Science degree. The Engineering Core Curriculum is also designed to develop communication skills and to provide a body of work in the humanities and social sciences.

SAGES is an innovative undergraduate experience designed to establish foundations for academic inquiry. Students fulfill their Case School of Engineering General Education Requirements with a sequence of specially developed seminars and selected courses. Course credit earned by Advanced Placement, International Baccalaureate, proficiency examinations, and transfer may be used to satisfy general education requirements.

SAGES Program Seminars

The First Seminar*

(4 semester hours, to be taken in the first semester of enrollment)
The First Seminar focuses on the development of critical thinking and communication skills through the use of a variety of approaches, media, and perspectives to explore the human mind and the nature of inquiry. This course is designed to strengthen writing and analytical skills while building a foundation in ethics, information literacy, and cultural diversity. Select from:

- First Seminar: FSCC 100 First Seminar
- First Seminar: Natural World (FSNA 1xx)
- First Seminar: Social World (FSSO 1xx)
- First Seminar: Symbolic World (FSSY 1xx)

* Transfer Students only: Transfer students who have completed the English composition/expository writing requirement with a grade of C or higher at the college/university at which they previously matriculated will receive transfer credit for FSCC 100-TR (3 – 6 semester hours) and will be required to complete a supplemental 1-semester hour SAGES introductory seminar – FSTS 100 SAGES Transfer Supplement.

University Seminars

(6 semester hours, minimum of two seminars, to be completed in the first two years of enrollment as specified below)
After completion of the First Seminar with a passing evaluative grade, students must complete two University Seminars chosen from different thematic groups; one of these may fall in the same thematic group as the student’s First Seminar. Each University Seminar explores one of three themes, with the content determined according to the interests of the faculty. University Seminars provide continued experience in critical reading, writing, and oral communication as well as information literacy, ethics, and cultural diversity. Select from:

- University Seminar: Thinking About the Natural World (USNA 2xx)
- University Seminar: Thinking About the Social World (USSO 2xx)
- University Seminar: Thinking About the Symbolic World (USSY 2xx)

University Composition Requirement

Students develop a Writing Portfolio comprised of final graded writing assignments from the First Seminar and University Seminars. The Writing
Portfolio is submitted for evaluation after completing the final University Seminar.

**Department Seminar**
(3 semester hours)

The Department Seminar includes seminar-based discussion as well as instruction and experience in the kinds of writing characteristic of the Department Seminar's discipline. The Department Seminar may be taken in the department of the student’s major or in another department. A course used to fulfill the Department Seminar requirement may not also be used to fulfill a Breadth Requirement. Most students pursuing an Engineering degree will take ENGR 398 Professional Communication for Engineers and ENGL 398 Professional Communication for Engineers concurrently to complete the Department Seminar requirement.

**Senior Capstone**
(3 – 6 semester hours)

The Senior Capstone assimilates the knowledge and skills gained throughout the educational process. Students engage in a unique one or two semester experience designed in consultation with a faculty member. Each Senior Capstone must include key elements:

1. Demonstration of critical thinking and writing skills;
2. Regular oversight by the Capstone advisor;
3. Periodic reporting of progress;
4. Regular writing (e.g. drafts, progress reports, critiques) throughout the project including a final written report which may be a thesis or equivalent document associated with the project or activity (e.g., such pursuits as performance, experiment, live case analysis, or creative writing), as approved by the department of capstone origin;
5. Oral reports including a final public presentation at the Senior Capstone Fair, a conference, a performance, a public lecture, a teaching presentation, or another setting, as approved by the department of capstone origin.

Courses meeting this requirement include the designation "Approved SAGES Capstone" in their course descriptions. Some majors include and specify a senior capstone. Most Engineering students will complete an engineering senior project within their major that will satisfy the SAGES Senior Capstone requirement.

**Physical Education**
(Must total 2 full semesters at zero credits)

Students choose from half- and full-semester course offerings to be completed in the first year.

**Mathematics, Sciences, and Engineering Requirements**

<table>
<thead>
<tr>
<th>Mathematics, Science, and Engineering Requirements</th>
<th>14</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 121 Calculus for Science and Engineering I</td>
<td></td>
</tr>
<tr>
<td>MATH 122 Calculus for Science and Engineering II</td>
<td></td>
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<tr>
<td>or MATH 124 Calculus II</td>
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<tr>
<td>MATH 223 Calculus for Science and Engineering III</td>
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<tr>
<td>or MATH 227 Calculus III</td>
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<tr>
<td>MATH 224 Elementary Differential Equations</td>
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<tr>
<td>or MATH 228 Differential Equations</td>
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<tr>
<td>Chemistry *</td>
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<tr>
<td>CHEM 111 Principles of Chemistry for Engineers</td>
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<tr>
<td>Physics</td>
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<tr>
<td>PHYS 121 General Physics I - Mechanics</td>
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<tr>
<td>or PHYS 123 Physics and Frontiers I - Mechanics</td>
<td></td>
</tr>
<tr>
<td>or PHYS 124 Physics and Frontiers II - Electricity and Magnetism</td>
<td></td>
</tr>
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</table>

**Engineering**

<table>
<thead>
<tr>
<th>Engineering</th>
<th>18</th>
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</thead>
<tbody>
<tr>
<td>ENGR 131 Elementary Computer Programming</td>
<td></td>
</tr>
<tr>
<td>or EECS 132 Introduction to Programming in Java</td>
<td></td>
</tr>
<tr>
<td>ENGR 145 Chemistry of Materials *</td>
<td></td>
</tr>
<tr>
<td>ENGR 200 Statics and Strength of Materials</td>
<td></td>
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<tr>
<td>ENGR 210 Introduction to Circuits and Instrumentation</td>
<td></td>
</tr>
<tr>
<td>ENGR 225 Thermodynamics, Fluid Dynamics, Heat and Mass Transfer</td>
<td></td>
</tr>
</tbody>
</table>

**Total Units** 44


**Natural Sciences, Mathematics, or Statistics Requirement**

Course designated by major department (3 semester hours)

**Breadth Requirements—Humansities and Social Sciences**

| ENGL 398 Professional Communication for Engineers | 2 |
| ENGR 398 Professional Communication for Engineers | 1 |

Twelve semester hours comprised of 3 or 4 semester hour courses * 12

**Total Units** 15

* Humanities: Arabic (ARAB), Art History (ARTH), Art Studio (ARTS), Chinese (CHIN), Classics (CLSC), Dance (DANO), English (ENGL), French (FRCH), German (GRMN), Greek (GREK), Hebrew (HBRW), History (HSTY), Italian (ITAL), Japanese (JAPN), Latin (LATN), Music - General (MUGN), Music - History (MUHI), Music - Popular Music (MUPM), Music - Theory (MUTH), Philosophy (PHIL), Portuguese (PORT), Religious Studies (RLGN), Russian (RUSN), Spanish (SPAN), Theater (THTR), World Literature (WLIT) and/or Social Sciences: Anthropology (ANTH), Cognitive Science (COGS), Communication Sciences (COSI), Economics (ECON), Political Science (POSC), Psychology (PSCL), Sociology (SOCL)
College of Arts and Sciences
Undergraduate Degree Requirements

Bachelor of Arts Degree
(College of Arts and Sciences)
Candidates for the Bachelor of Arts (BA) degree, in addition to meeting the general requirements for bachelor’s degrees, must also complete the following requirements:

1. A minimum of 120 semester hours earned.
2. No more than 42 hours beyond the 100-level in any one department may be applied to the 120 hour total.
3. At least 90 semester hours in arts and sciences. These credits may be drawn from those offered by the College of Arts and Sciences, as well as those in economics, biochemistry, nutrition and computer science. (Students completing both a BA and BS degree are exempted from six hours of the 90 hour arts and sciences requirement for the BA.)
4. A minimum of 30 semester hours of courses at the 300-400 level.
5. The SAGES General Education Requirements of the College of Arts and Sciences.
6. The requirements for a major as specified in this bulletin for each department or program. A major requires a minimum of 30 semester hours, at least 24 of which are taken in the major department or program. For all courses taken in the major department and for which grades are averaged, and for all courses taken to satisfy major requirements and for which grades are averaged, a BA candidate must earn a minimum cumulative average of 2.000. Major requirements include all required and elective work completed in the major department combined with required courses completed in related fields. Transfer students must complete at Case Western Reserve University at least half the hours required in the major department.

Major Concentrations Available for the Bachelor of Arts degree:

• American Studies*
• Anthropology
• Art History
• Asian Studies
• Astronomy
• Biochemistry
• Biology
• Chemistry
• Classics
• Cognitive Science
• Communication Sciences
• Computer Science
• Dance
• Dean’s Approved Major**
• Economics
• Environmental Geology
• Environmental Studies*
• Evolutionary Biology*
• French
• French and Francophone Studies
• Geological Sciences
• German
• German Studies
• Gerontological Studies*
• History
• History and Philosophy of Science
• International Studies
• Japanese Studies
• Mathematics
• Music
• Natural Sciences*
• Nutrition
• Nutritional Biochemistry and Metabolism
• Philosophy
• Physics
• Political Science
• Pre-Architecture*
• Psychology
• Religious Studies
• Sociology
• Spanish
• Statistics
• Teacher Education*
• Theater Arts
• Women’s and Gender Studies
• World Literature

Footnotes

* May be taken only as a second major.
** Any student interested in developing for the BA a major of his or her own design may submit, before the end of the sophomore year, a program proposal for a Dean’s Approved Major to the Office of Undergraduate Studies for approval by the Dean’s Committee

Bachelor of Science Degree
(College of Arts and Sciences)
Candidates for the Bachelor of Science degrees, in addition to meeting the general requirements for bachelor’s degrees, must also complete the following requirements:

1. A minimum of 120-133 hours as specified by the requirements for each BS program.
2. A minimum of 30 semester hours of courses at the 300-400 level.
3. The SAGES General Education Requirements of the College of Arts and Sciences. For some BS programs, the SAGES General Education Requirements of the Arts and Sciences have been modified and incorporated into the degree requirements as presented in this bulletin in the section devoted to each department or program.
4. The requirements for a major field as presented in this bulletin in the section devoted to each department or program. For all courses taken in the major department and for which grades are averaged, and for all courses taken to satisfy major requirements and for which grades are averaged, a candidate for a BS from the College of Arts and Sciences must earn a minimum cumulative average of 2.0. Major requirements include all required and elective work completed in the major department combined with required courses completed in related fields. Transfer students must complete at Case Western Reserve University at least half the hours required for the major.

Major Concentrations for the Bachelor of Science degree:

- Applied Mathematics
- Art Education
- Astronomy
- Biochemistry
- Biology
- Chemistry
- Geological Sciences
- Mathematics
- Mathematics and Physics
- Music Education
- Nutrition
- Nutritional Biochemistry and Metabolism
- Physics
- Statistics
- Systems Biology

SAGES General Education Requirements of the College of Arts and Sciences

SAGES is an innovative undergraduate experience designed to establish foundations for academic inquiry. Students fulfill their College of Arts and Sciences General Education Requirements with a sequence of specially developed seminars and selected courses. Course credit earned by Advanced Placement, International Baccalaureate, proficiency examinations, and transfer may be used to satisfy general education requirements.

SAGES Program Seminars

The First Seminar*

(4 semester hours, to be taken in the first semester of enrollment)

The First Seminar focuses on the development of critical thinking and communication skills through the use of a variety of approaches, media, and perspectives to explore the human mind and the nature of inquiry. This course is designed to strengthen writing and analytical skills while building a foundation in ethics, information literacy, and cultural diversity. Select from:

- First Seminar: FSCC 100 First Seminar
- First Seminar: Natural World (FSNA 1xx)
- First Seminar: Social World (FSSO 1xx)
- First Seminar: Symbolic World (FSSY 1xx)

* Transfer Students only: Transfer students who have completed the English composition/expository writing requirement with a grade of C or higher at the college/university at which they previously matriculated will receive transfer credit for FSCC 100-TR (3 – 6 semester hours) and will be required to complete a supplemental 1-semester hour SAGES introductory seminar – FSTS 100 SAGES Transfer Supplement.

University Seminars

(6 semester hours, minimum of two seminars, to be completed in the first two years of enrollment as specified below)

After completion of the First Seminar with a passing evaluative grade, students must complete two University Seminars chosen from different thematic groups; one of these may fall in the same thematic group as the student’s First Seminar. Each University Seminar explores one of three themes, with the content determined according to the interests of the faculty. University Seminars provide continued experience in critical reading, writing, and oral communication as well as information literacy, ethics, and cultural diversity. Select from:

- University Seminar: Thinking About the Natural World (USNA 2xx)
- University Seminar: Thinking About the Social World (USSO 2xx)
- University Seminar: Thinking About the Symbolic World (USSY 2xx)

University Composition Requirement

Students develop a Writing Portfolio comprised of final graded writing assignments from the First Seminar and University Seminars. The Writing Portfolio is submitted for evaluation after completing the final University seminar.

Department Seminar

(3 semester hours)

The Department Seminar includes seminar-based discussion as well as instruction and experience in the kinds of writing characteristic of the Department Seminar’s discipline. The Department Seminar may be taken in the department of the student’s major or in another department. A course used to fulfill the Department Seminar requirement may not also be used to fulfill a Breadth Requirement.

Senior Capstone

(3 - 6 semester hours)

The Senior Capstone assimilates the knowledge and skills gained throughout the educational process. Students engage in a unique one or two semester experience designed in consultation with a faculty member. Each Senior Capstone must include key elements:

1. Demonstration of critical thinking and writing skills;
2. Regular oversight by the Capstone advisor;
3. Periodic reporting of progress;
4. Regular writing (e.g. drafts, progress reports, critiques) throughout the project including a final written report which may be a thesis or equivalent document associated with the project or activity (e.g., such pursuits as performance, experiment, live case analysis, or creative writing), as approved by the department of capstone origin;
5. Oral reports including a final public presentation at the Senior Capstone Fair, a conference, a performance, a public lecture, a teaching presentation, or another setting, as approved by the department of capstone origin.
Courses meeting this requirement include the designation "Approved SAGES Capstone" in their course descriptions. Some majors include and specify a senior capstone.

**Physical Education**
(Must total 2 full semesters at zero credits)

Students choose from half- and full-semester course offerings to be completed in the first year.

**Breadth Requirements**
(18 semester hours – minimum of six 3- or 4-semester hour courses)

NOTE: Two courses used to fulfill requirements for the major may be used also to fulfill the breadth requirements.

**Arts and Humanities**
(6 - 8 semester hours)

Two 3- or 4-semester hour Arts and Humanities courses. Select from:

- Arabic (ARAB)
- Art History (ARTH)
- Art Studio (ARTS)
- Chinese (CHIN)
- Classics (CLSC)
- Dance (DANC)
- English (ENGL)
- French (FRCH)
- German (GRMN)
- Greek (GREK)
- Hebrew (HBRW)
- History (HSTY)
- Italian (ITAL)
- Japanese (JAPN)
- Latin (LATN)
- Music - General (MUGN)
- Music - History (MUHI)
- Music - Popular (MUPM)
- Music - Theory (MUTH)
- Philosophy (PHIL)
- Portuguese (PORT)
- Religious Studies (RLGN)
- Russian (RUSN)
- Spanish (SPAN)
- Theater (THTR)
- World Literature (WLIT)

**Natural and Mathematical Sciences**
(6 - 8 semester hours)

Two 3- or 4-semester hour Natural and Mathematical Science courses. Select from:

- Astronomy (ASTR)
- Biochemistry (BIOC)
- Biology (BIOL)
- Chemistry (CHEM)
- Earth, Environmental and Planetary Sciences (EEPS)
- Mathematics (MATH)
- Nutrition (NTRN)
- Physics (PHYS)
- Statistics (STAT)

**Social Sciences**
(6 semester hours)

Two 3-semester hour Social Science courses. Select from:

- Anthropology (ANTH)
- Cognitive Science (COGS)
- Communication Sciences (COSI)
- Economics (ECON)
- Political Science (POSC)
- Psychology (PSCL)
- Sociology (SOCI)

**Quantitative Reasoning**
(3 - 4 semester hours)

Each student must complete at least one 3- or 4-semester hour course identified as a mathematical reasoning course. Such a course may also be used to fulfill a major or minor requirement, and/or one of the breadth requirements. Select from:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANTH 319</td>
<td>Introduction to Statistical Analysis in the Social Sciences</td>
<td>3</td>
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<tr>
<td>EECS 132</td>
<td>Introduction to Programming in Java</td>
<td>3</td>
</tr>
<tr>
<td>ENGR 131</td>
<td>Elementary Computer Programming</td>
<td>3</td>
</tr>
<tr>
<td>MATH 121</td>
<td>Calculus for Science and Engineering I</td>
<td>4</td>
</tr>
<tr>
<td>MATH 125</td>
<td>Math and Calculus Applications for Life, Managerial, and Social Science</td>
<td>4</td>
</tr>
<tr>
<td>MATH 150</td>
<td>Mathematics from a Mathematician’s Perspective</td>
<td>3</td>
</tr>
<tr>
<td>PHIL 201</td>
<td>Introduction to Logic</td>
<td>3</td>
</tr>
<tr>
<td>PSCL 282</td>
<td>Quantitative Methods in Psychology</td>
<td>3</td>
</tr>
<tr>
<td>STAT 201</td>
<td>Basic Statistics for Social and Life Sciences</td>
<td>3</td>
</tr>
</tbody>
</table>

**Global and Cultural Diversity**
(3 - 4 semester hours)

Each student must complete at least one 3- or 4-semester hour course identified as a global and cultural diversity course. Such a course may also be used to fulfill a major requirement and/or one of the breadth requirements. Students who matriculate as undergraduate degree candidates in August 2012 or later must select a course from the list below; students who matriculated at as degree candidates prior to August 2012 can find the list of options from which they may choose on their academic requirements report.

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>AMST 117</td>
<td>Exploring American History Through Biography</td>
<td>3</td>
</tr>
<tr>
<td>ANTH 233</td>
<td>Introduction to Jewish Folklore</td>
<td>3</td>
</tr>
<tr>
<td>ANTH 349</td>
<td>Cultures of Latin America</td>
<td>3</td>
</tr>
<tr>
<td>ANTH 353</td>
<td>Chinese Culture and Society</td>
<td>3</td>
</tr>
<tr>
<td>ARTH 101</td>
<td>Art History I: Pyramids to Pagodas</td>
<td>3</td>
</tr>
<tr>
<td>ARTH 102</td>
<td>Art History II: Michelangelo to Maya Lin</td>
<td>3</td>
</tr>
<tr>
<td>ARTH 220</td>
<td>Jewish Traditional Art and Architecture</td>
<td>3</td>
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<tr>
<td>ARTH 241</td>
<td>Medieval Art</td>
<td>3</td>
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<tr>
<td>ARTH 260</td>
<td>Art in Early Modern Europe</td>
<td>3</td>
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<tr>
<td>ARTH 301</td>
<td>Museums and Globalization</td>
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</tr>
<tr>
<td>ARTH 349</td>
<td>Gothic Art: Vision and Matter</td>
<td>3</td>
</tr>
<tr>
<td>ARTH 358</td>
<td>Medieval Body</td>
<td>3</td>
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<tr>
<td>ARTH 359</td>
<td>Visual Culture of Medieval Women</td>
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<tr>
<td>ARTH 360</td>
<td>Renaissance Art in Northern Europe</td>
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<tr>
<td>HSTY 246</td>
<td>People and the Land in Pre-Modern Europe</td>
<td>3</td>
</tr>
<tr>
<td>HSTY 252A</td>
<td>Introduction to African-American Studies</td>
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<td>HSTY 254</td>
<td>The Holocaust</td>
<td>3</td>
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<td>HSTY 257</td>
<td>Immigrants in America</td>
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<td>HSTY 259</td>
<td>Introduction to Latina/o Studies</td>
<td>3</td>
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<tr>
<td>HSTY 260</td>
<td>U.S. Slavery and Emancipation</td>
<td>3</td>
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<tr>
<td>HSTY 261</td>
<td>African-American History 1865-1945</td>
<td>3</td>
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<tr>
<td>HSTY 262</td>
<td>African-American History Since 1945</td>
<td>3</td>
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<tr>
<td>HSTY 270</td>
<td>Introduction to Gender Studies</td>
<td>3</td>
</tr>
<tr>
<td>HSTY 272</td>
<td>Sports in America: From Play to Profit</td>
<td>3</td>
</tr>
<tr>
<td>HSTY 278</td>
<td>Nineteenth-Century Europe</td>
<td>3</td>
</tr>
<tr>
<td>HSTY 280</td>
<td>History of Modern Mexico</td>
<td>3</td>
</tr>
<tr>
<td>HSTY 285</td>
<td>Modern Japan</td>
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<td>State, War, Drugs, and Coffee in Colombia: History of Modern Colombia</td>
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<td>HSTY 288</td>
<td>Imperial China: The Great Qing</td>
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<td>HSTY 289</td>
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<td>HSTY 327</td>
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<td>Comparative Perspectives on Museum and Archive History and Practice</td>
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<td>History of 19th Century Germany</td>
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<td>History of the American West</td>
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<td>Water</td>
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<td>HSTY 345</td>
<td>The European City</td>
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<td>HSTY 346</td>
<td>Guns, Germs, and Steel</td>
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<td>Women in American History I</td>
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<td>HSTY 354</td>
<td>Women in American History II</td>
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<td>Gender in America</td>
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<tr>
<td>HSTY 371</td>
<td>Jews under Islam and Christianity</td>
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<td>HSTY 375</td>
<td>Advance Readings in Latin American History</td>
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<td>Readings in PRC History</td>
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<td>Readings in Society and Culture in Modern Chinese History</td>
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<td>Growing Up in America: 1607 - 2000</td>
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<td>JDST 220</td>
<td>Jewish Traditional Art and Architecture</td>
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<td>JDST 228</td>
<td>The Jewish Image in Popular Film</td>
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<td>Jews in the Modern World</td>
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<td>JDST 233</td>
<td>Introduction to Jewish Folklore</td>
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<td>Introduction to Gender Studies</td>
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<td>State-Building and State Collapse</td>
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<td>The Politics of China</td>
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<td>POSC 370H</td>
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<td>POSC 377</td>
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<td>POSC 379</td>
<td>Introduction to Middle East Politics</td>
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<td>Introduction to Western Religions</td>
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<td>RLGN 223</td>
<td>Religious Roots of Conflict in the Middle East</td>
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<td>RLGN 232</td>
<td>DESi: Diaspora, Ethnicity, Southasian), Interrogate</td>
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<td>RLGN 238</td>
<td>Alternative Alternatives: Folk Religion in America</td>
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<td>Jews under Islam and Christianity</td>
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<td>History of the Early Church: First Through Fourth Centuries</td>
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<td>WLT 365E</td>
<td>The Immigrant Experience</td>
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<td>WLT 365N</td>
<td>Topics in African-American Literature</td>
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<td>WLT 365Q</td>
<td>Post-Colonial Literature</td>
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</table>
Frances Payne Bolton School of Nursing Undergraduate Degree Requirements

Bachelor of Science in Nursing Degree (Frances Payne Bolton School of Nursing)

Candidates for the Bachelor of Science in Nursing (BSN) degree, in addition to meeting the general requirements for bachelor’s degrees as described above, must also complete the following requirements:

1. A minimum of 126 hours
2. The SAGES General Education Requirements for the School of Nursing
3. The requirements for the major in nursing as presented in this bulletin
4. For all courses taken in nursing and science, a minimum grade of C

SAGES General Education Requirements of the Frances Payne Bolton School of Nursing

The SAGES General Education Requirements of the Frances Payne Bolton School of Nursing are based upon the SAGES General Education Requirements of the College of Arts and Sciences, and provide a broad educational foundation for the Bachelor of Science in Nursing program.

SAGES is an innovative undergraduate experience designed to establish foundations for academic inquiry. Students fulfill their Frances Payne Bolton School of Nursing General Education Requirements with a sequence of specially developed seminars and selected courses. Course credit earned by Advanced Placement, International Baccalaureate, proficiency examinations, and transfer may be used to satisfy general education requirements.

SAGES Program Seminars

The First Seminar*

(4 semester hours, to be taken in the first semester of enrollment)

The First Seminar focuses on the development of critical thinking and communication skills through the use of a variety of approaches, media, and perspectives to explore the human mind and the nature of inquiry. This course is designed to strengthen writing and analytical skills while building a foundation in ethics, information literacy, and cultural diversity. Select from:

• First Seminar: FSCC 100 First Seminar
• First Seminar: Natural World (FSNA 1xx)
• First Seminar: Social World (FSSO 1xx)
• First Seminar: Symbolic World (FSSY 1xx)

Transfer Students only: Transfer students who have completed the English composition/expository writing requirement with a grade of C or higher at the college/university at which they previously matriculated will receive transfer credit for FSCC 100-TR (3 – 6 semester hours) and will be required to complete a supplemental 1-semester hour SAGES introductory seminar – FSTS 100 SAGES Transfer Supplement.

University Seminars

(6 semester hours, minimum of two seminars, to be completed in the first two years of enrollment as specified below)

After completion of the First Seminar with a passing evaluative grade, students must complete two University Seminars chosen from different thematic groups; one of these may fall in the same thematic group as the student’s First Seminar. Each University Seminar explores one of three themes, with the content determined according to the interests of the faculty. University Seminars provide continued experience in critical reading, writing, and oral communication as well as information literacy, ethics, and cultural diversity. Select from:

• University Seminar: Thinking About the Natural World (USNA 2xx)
• University Seminar: Thinking About the Social World (USSO 2xx)
• University Seminar: Thinking About the Symbolic World (USSY 2xx)

University Composition Requirement

Students develop a Writing Portfolio comprised of final graded writing assignments from the First Seminar and University Seminars. The Writing Portfolio is submitted for evaluation after completing the final University seminar.

Department Seminar

(3 semester hours)

The Department Seminar includes seminar-based discussion as well as instruction and experience in the kinds of writing characteristic of the Department Seminar’s discipline. The Department Seminar may be taken in the department of the student’s major or in another department. A course used to fulfill the Department Seminar Requirement may not also be used to fulfill a Breadth Requirement. Most Nursing students will complete NURS 320 Theoretical and Evidence Bases for Best Practice in Nursing to fulfill the Department Seminar requirement.

Senior Capstone

(3 - 6 semester hours)

The Senior Capstone assimilates the knowledge and skills gained throughout the educational process. Students engage in a unique one or two semester experience designed in consultation with a faculty member. Each Senior Capstone must include key elements:

1. Demonstration of critical thinking and writing skills;
2. Regular oversight by the Capstone advisor;
3. Periodic reporting of progress;
4. Regular writing (e.g. drafts, progress reports, critiques) throughout the project including a final written report which may be a thesis or equivalent document associated with the project or activity (e.g., such pursuits as performance, experiment, live case analysis, or creative writing), as approved by the department of capstone origin; and
5. Oral reports including a final public presentation at the Senior Capstone Fair, a conference, a performance, a public lecture, a teaching presentation, or another setting, as approved by the department of capstone origin.

Courses meeting this requirement include the designation “Approved SAGES Capstone” in their course descriptions. Some majors include and specify a senior capstone. Most Nursing students will complete NURS 373 Global Health Practicum to fulfill the SAGES Senior Capstone requirement.

**Physical Education**
(Must total 2 full semesters at zero credits)

Students choose from half- and full-semester course offerings to be completed in the first year.

**Breadth Requirements**
(at least 30 semester hours – minimum of ten 3 or 4-semester hour courses)

NOTE: Two courses used to fulfill requirements for the major may be used also to fulfill the breadth requirements.

**Arts and Humanities**
(6 - 8 semester hours)

Two 3- or 4-semester hour Arts and Humanities courses. Select from:

- Arabic (ARAB)
- Art History (ARTH)
- Art Studio (ARTS)
- Chinese (CHIN)
- Classics (CLSC)
- Dance (DANC)
- English (ENGL)
- French (FRCH)
- German (GRMN)
- Greek (GREK)
- Hebrew (HBRW)
- History (HSTY)
- Italian (ITAL)
- Japanese (JAPN)
- Latin (LATN)
- Music - General (MUGN)
- Music - History (MUHI)
- Music - Popular Music (MUPM)
- Music - Theory (MUTH)
- Philosophy (PHIL)
- Portuguese (PORT)
- Religious Studies (RLGN)
- Russian (RUSN)
- Spanish (SPAN)
- Theater (THTR)
- World Literature (WLIT)

**Natural and Mathematical Sciences**

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<td>PSCL 282</td>
<td>Quantitative Methods in Psychology</td>
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<td>STAT 201</td>
<td>Basic Statistics for Social and Life Sciences</td>
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<td>BIOL 114</td>
<td>Principles of Biology</td>
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<td>BIOL 116</td>
<td>Introduction to Human Anatomy and Physiology I</td>
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<td>BIOL 119</td>
<td>Concepts for a Molecular View of Biology I</td>
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A student who successfully completes any one of these courses is not eligible to enroll in or receive credit for either of the other two.

**Social Sciences**

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* or approved course in human growth and development

** Any 3-semester hour course selected from: Anthropology (ANTH), Cognitive Science (COGS), Communication Sciences (COSI), Economics (ECON), Political Science (POSC), Psychology (PSCL), Sociology (SOCI)
Programs Toward Graduate or Professional Degrees

Acceleration Toward Professional Degrees

Senior Year in Professional Studies at Case Western Reserve University

Students of outstanding ability and attainment who are candidates for the BA and who are admitted to professional studies in Case Western Reserve University by the end of the junior year are offered an opportunity to shorten their entire course of studies by one year through the Senior Year in Professional Studies privilege. Application should be made during the second semester of the junior year through the dean of undergraduate studies. This privilege is extended to students who are candidates for the BA and who attend the School of Dental Medicine, the School of Medicine, the Frances Payne Bolton School of Nursing, or the Mandel School of Applied Social Sciences of Case Western Reserve University.

A student granted the senior year in professional studies privilege is permitted to substitute the work of the first year in a professional school for that required during the last year in the undergraduate college. Upon the satisfactory completion of the first year’s work in the professional school, the student will be granted the bachelor’s degree from the College of Arts and Sciences. To be eligible for the senior year in professional studies privilege, a student must:

1. Be accepted for admission to professional studies in Case Western Reserve University.
2. Meet the following degree requirements:
   A. Completion of the SAGES General Education Requirements of the College of Arts and Sciences and the physical education requirement.
   B. Completion of three-fourths of the courses required for the major, including three-fourths of the courses required in the major department.
   C. Completion of 84 hours of arts and sciences courses. These credits may be drawn from those offered by the College of Arts and Sciences as well as those in economics, biochemistry, nutrition, or computer science.
   D. Completion of at least 90 semester hours of academic credit, of which the final 60 hours must have been in residence. A student may include in that final 60 hours no more than six semester hours earned in courses completed in other institutions, either by cross registration in regular sessions or by approved transient registration in summer sessions. (Note: Students applying for the Senior Year in Professional Studies in the School of Medicine will generally be expected to have completed at least 117 hours towards the BA degree.)

Upon admission to the program, students register in the professional school to which they have been admitted and are subject to the policies, rules and regulations of the professional school. They may, however, continue to receive merit-based undergraduate scholarships and may continue to reside in undergraduate housing during what would normally be their senior year of undergraduate work.

For information, contact the Office of Undergraduate Studies (http://bulletin.case.edu/undergraduatestudies/gradprofessional/mailto:ugstudies@case.edu), 357 Sears Bldg., 216.368.2928.

Senior Year in Absentia Privilege for Students of Medicine and Dentistry

Students of outstanding ability and attainment who are candidates for the BA and are offered admission to a medical or dental school other than those at Case Western Reserve University at the end of the junior year are eligible for an opportunity to shorten their entire course of studies by one year through the Senior Year in absentia privilege. Application for this privilege should be made during the second semester of the junior year through the dean of undergraduate studies.

A student granted the Senior Year in absentia privilege is permitted to substitute the work of the first year in a professional school for that required during the last year in the undergraduate college. Upon the satisfactory completion of the first year’s work in the professional school, the student will be granted the BA from the College of Arts and Sciences. The privilege is extended to qualified students who attend medical schools in the United States or Canada approved by the Association of American Medical Colleges or dental schools in the United States approved by the American Association of Dental Schools.

To be eligible for the Senior Year in absentia privilege, a student must:

1. Be accepted for admission to professional studies.
2. Attain a cumulative grade point average of at least 3.200 in all courses attempted from the date of admission as an undergraduate.
3. Meet the following degree requirements:
   A. Completion of the Arts and Sciences SAGES General Education Requirements and the physical education requirement
   B. Completion of three-fourths of the requirements for the major, including three-fourths of the courses required in the major department
   C. Completion of 84 hours of arts and sciences courses. These credits may be drawn from those offered by the College of Arts and Sciences as well as those in economics, biochemistry, nutrition, or computer science
   D. Completion of at least 90 semester hours of academic credit, of which the final 60 hours must have been in residence. A student may include in that final 60 hours no more than six semester hours earned in courses completed in other institutions, either by cross registration in regular sessions or by approved transient registration in summer sessions

For information, contact the Office of Undergraduate Studies (http://bulletin.case.edu/undergraduatestudies/gradprofessional/mailto:ugstudies@case.edu), 357 Sears Bldg., 216.368.2928.

For Candidates for the BS in Accounting

There are two programs that integrate graduate and undergraduate work in accountancy. These programs are strongly recommended for those individuals planning to become certified accounting professionals, particularly as CPAs (Certified Public Accountants).
Joint BS in Accounting/Master of Accountancy (MAcc)

Students who are candidates for the BS in accountancy and who wish to earn a master’s degree in accountancy may apply to the BS/MAcc program. Students in the program enroll during the senior year in six hours of MAcc courses that will serve toward satisfaction of both the BS and MAcc degree requirements. Before taking graduate course work, the student must have completed all prerequisites for the course on the undergraduate level and have a “B” average in those prerequisites. Following completion of the BS, students in the program will enroll in the Weatherhead School of Management to complete an additional 30 hours of courses to satisfy MAcc degree requirements. For information, see Professor Larry Parker (http://bulletin.case.edu/undergraduatestudies/gradprofessional/mailto:larry.parker@case.edu), 459 Peter B. Lewis Building, 216.368.2065.

Accelerated BS in Accounting/Master of Accountancy (MAcc) Program

This program allows motivated students to accelerate their pursuit of both the BS and MAcc degrees. In addition to applying six credit hours of Weatherhead graduate course work towards their undergraduate degree program, students in this program may begin taking more graduate course work before completing all of their undergraduate degree requirements. To enroll in this program, students must have:

1. Completed 90 hours of undergraduate course work
2. Completed all of the undergraduate Weatherhead SAGES General Education Requirements
3. Completed 36 hours of the Weatherhead Management requirements (including 18 hours of the required Accountancy coursework)
4. Achieved at least a 3.00 overall grade point average. Students in this program will receive both the BS and the master’s degree at the end of the program. For the first eight semesters of study, the student will register as an undergraduate in Case Western Reserve University; thereafter, students will register in the graduate professional degree program in the Weatherhead School of Management. For information, see Professor Larry Parker (http://bulletin.case.edu/undergraduatestudies/gradprofessional/mailto:larry.parker@case.edu), 459 Peter B. Lewis Building, 216.368.2065.

Acceleration Toward Graduate Study

Integrated Graduate Studies Program

The Integrated Graduate Studies Program (IGS) is intended for highly motivated undergraduate students who are candidates for the BA and whose objective is a degree at the master’s or doctoral level. Qualified students may be admitted to graduate study for their senior year and pursue the simultaneous completion of requirements for both the master’s and bachelor’s degrees. The baccalaureate will normally be awarded upon completion of the requirements for both degrees, unless a student satisfies all BA requirements prior to completing the master’s degree requirements. Students in the IGS Program are exempted from the 42-hour restriction imposed on BA candidates for work above the 100-level in a single department. However, the exemption is granted only upon completion of the master’s degree requirements.

Eligibility requirements for participation in the Integrated Graduate Studies Program are:

1. 90 semester hours earned of which the last 60 hours must have been in residence at Case Western Reserve University
2. Completion of the SAGES General Education Requirements of the College of Arts and Sciences and the physical education requirement; students who have fulfilled all SAGES General Education Requirements except the Senior Capstone will be required to complete the capstone during their first year in the IGS program
3. Completion of three quarters of the requirements for the major concentration, including three quarters of the courses required in the major department
4. Admission to a master’s or doctoral program offered through the School of Graduate Studies

Upon admission to the program, IGS students register as students in the School of Graduate Studies and are subject to the policies, rules and regulations of the School of Graduate Studies. They may, however, continue to receive merit-based undergraduate scholarships and may continue to reside in undergraduate housing during what would normally be their senior year of undergraduate work.

For information, contact the Office of Undergraduate Studies (http://bulletin.case.edu/undergraduatestudies/gradprofessional/mailto:ugstudies@case.edu), 357 Sears Bldg., 216.368.2928.

Integrated BS/MS in Nutrition

Admission to the Integrated BS/MS in Nutrition program is subject to the same process and requirements as admission to the Integrated Graduate Studies Program described above. Upon successful completion of the program, students earn the BS in Nutrition and the MS in Nutrition.

BS/MS Program for Candidates for the BS in Engineering, Computer Science, Mathematics, Natural Sciences and Statistics

The Integrated BS/MS Program is intended for highly motivated candidates for the BS in engineering, computer science, mathematics, natural sciences, or statistics who wish to pursue an advanced degree. Application to the BS/MS program must be made after completion of 75 semester hours of course work and prior to attaining senior status (completion of 90 semester hours). Generally, this means that a student will submit the application during his or her sixth semester of undergraduate course enrollment and will have no fewer than two semesters of remaining BS requirements to complete.

A student admitted to the program may, in the senior year, take up to nine hours of graduate courses (400 level and above) that will count towards both BS and MS requirements. The courses to be double-counted must be specified at the time of application. Courses taken prior to admission to the program cannot count towards the MS unless they are in excess of BS degree requirements and permission to use them towards the MS has been granted by the dean of graduate studies and the dean of undergraduate studies.

To be considered for the BS/MS Program, a student must:

1. submit to the School of Graduate Studies an application for admission to the program, and
2. submit to the Office of Undergraduate Studies an MS Planned Program of Study Form, showing the courses to be double-counted.
Conditionally Guaranteed Admission to the University's Professional Schools

The Pre-Professional Scholars Programs in medicine, dentistry, law, and social work grant to a few outstanding, entering first year undergraduates conditional commitments of admission to the appropriate professional school at Case Western Reserve University. These commitments are honored upon successful completion of the requirements established by each professional school. Students admitted to these programs are relieved of much of the anxiety and uncertainty associated with pre-professional studies. Consequently, they feel free to undertake challenging courses of study and pursue a variety of interests as they prepare for professional studies. Pre-Professional Scholars are free to choose any of the bachelor’s degrees available in the university. Participants who wish to change their career goals or apply for admission to other professional schools are free to do so.

The Six-Year Dental Program gives exceptionally able and committed entering first year undergraduates the opportunity to accelerate their undergraduate and professional studies.

Pre-Professional Scholars Program in Dentistry

Each year, approximately 10 exceptionally well-qualified high school seniors who plan to pursue careers in dentistry are offered places in the Pre-Professional Scholars Program in Dentistry. This program requires eight years: four years of successful undergraduate study and four years at the School of Dental Medicine.

Pre-Professional Scholars in Dentistry are free to choose a major in an area of interest, but must take the following courses to fulfill admission requirements of the School of Dental Medicine:

Chemistry:

- CHEM 105 Principles of Chemistry I 3
- CHEM 106 Principles of Chemistry II 3
- CHEM 113 Principles of Chemistry Laboratory 2
- CHEM 223 Introductory Organic Chemistry I 3
- CHEM 224 Introductory Organic Chemistry II 3
- CHEM 233 Introductory Organic Chemistry Laboratory I 2
- CHEM 234 Introductory Organic Chemistry Laboratory II 2

Biology:

- BIOL 214 & 214L Genes, Evolution and Ecology 4
- BIOL 215 & 215L Cells and Proteins 4
- BIOL 216 & 216L Development and Physiology 4

Mathematics:

- MATH 125 Math and Calculus Applications for Life, Managerial, and Social Sci 4

Physics:

- PHYS 115 Introductory Physics I 4
- PHYS 116 Introductory Physics II 4

They are required to take the Dental Admission Test in the junior year and achieve an acceptable level of performance on the test.

Successful progress through the program and admission to dental studies will be based on the pre-professional scholar’s continuing to fulfill expectations for outstanding personal and academic development and on the scholar’s achievement of cumulative grade point average of 3.250 or higher for his or her work overall, as well as for his or her work in the required sciences. Successful progress in the program will be determined individually and reviewed at regular intervals during the student’s undergraduate career.

Pre-Professional Scholars in Dentistry who wish to accelerate their program may apply for the senior year in professional studies privilege.

Six-Year Dental Program

Each year a few exceptionally well-qualified high school seniors who plan to pursue careers in dentistry are offered places in the Six-Year Dental Program.

The first two years of the program are spent pursuing undergraduate studies, advised by the director of health career advising. Students are required to earn a minimum of 60 semester hours. They are required to take all of the science and mathematics courses listed above for the Pre-Professional Scholars Program in Dentistry. If Advanced Placement credit is used to satisfy some of these science requirements, a minimum of 30 semester hours in biology, chemistry, physics, and mathematics must be taken during the two years of undergraduate study. Additionally, to meet general education requirements, students must take one year of physical education, First Seminar, two University Seminars, one course in the area of Arts and Humanities, and one courses in the area of Social Sciences, and must complete a writing portfolio. To qualify for the place reserved in the School of Dental Medicine, a student in the program must achieve the following:

1. A cumulative grade point average of 3.250 or higher for all course work completed;
2. Grades of B or higher in the required courses in biology, chemistry, physics, and mathematics;
3. An average score of 18 or higher on both the academic and PAT portions of the Dental Admission Test of the American Dental Association. The test must be taken no later than April of the second year.

Pre-Professional Scholars Program in Law

Each year, approximately twelve exceptionally well-qualified high school seniors who plan to pursue careers in law will be offered places in the Pre-Professional Scholars Program in Law at Case Western Reserve University. Pre-Professional Scholars receive a conditional commitment of admission to the Case Western Reserve School of Law, to be honored upon completion of the bachelor’s degree at the university.

The Pre-Professional Scholars in Law are encouraged to gain a wide cultural experience in their undergraduate studies, to major in the area that most interests them, and to choose courses in which they will learn habits of rigor and logical analysis. The law school encourages
applications from all majors, including engineering and the sciences. The School of Law recommends that Pre-Professional Scholars in Law take courses in accounting, economics, history, and philosophy and that they gain as much writing experience as possible, because the ability to write effectively is critical to success in law school and legal practice.

Students admitted to the Pre-Professional Scholars Program in Law will be guaranteed a seat in the School of Law upon graduation from Case Western Reserve University if they satisfy the following requirements:

1. Graduation from Case Western Reserve University with rank in the top quarter of the class.
2. Demonstration of good moral character sufficient for admission to the bar of the State of Ohio.
3. Participation in the Law School Data Assembly Service and an LSAT score at or above the 65th percentile.

Pre-Professional Scholars Program in Medicine

Each year, 15 to 20 exceptionally well-qualified high school seniors who plan to pursue careers in medicine are offered places in the Pre-Professional Scholars Program in Medicine. Pre-Professional Scholars receive a conditional commitment of admission to the University Program of the Case Western Reserve University School of Medicine to be honored upon successful progress toward and completion of the bachelor’s degree. The Pre-Professional Scholars Program in Medicine requires eight years: four years of successful undergraduate study leading to the bachelor’s degree followed by four years in the University Program of the School of Medicine.

Pre-Professional Scholars in Medicine are free to choose from among all of the degree and major programs offered in the university, but must take the following courses to fulfill admission requirements of the School of Medicine:

**Chemistry:**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>CHEM 105</td>
<td>Principles of Chemistry I</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 106</td>
<td>Principles of Chemistry II</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 113</td>
<td>Principles of Chemistry Laboratory</td>
<td>2</td>
</tr>
<tr>
<td>CHEM 223</td>
<td>Introductory Organic Chemistry I</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 224</td>
<td>Introductory Organic Chemistry II</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 233</td>
<td>Introductory Organic Chemistry Laboratory I</td>
<td>2</td>
</tr>
<tr>
<td>CHEM 234</td>
<td>Introductory Organic Chemistry Laboratory II</td>
<td>2</td>
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</table>

**Biology:**

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<tr>
<th>Course</th>
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<th>Credits</th>
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<tbody>
<tr>
<td>BIOL 214</td>
<td>Genes, Evolution and Ecology</td>
<td>4</td>
</tr>
<tr>
<td>&amp; 214L</td>
<td>and Genes, Evolution and Ecology Lab</td>
<td>4</td>
</tr>
<tr>
<td>BIOL 215</td>
<td>Cells and Proteins</td>
<td>4</td>
</tr>
<tr>
<td>&amp; 215L</td>
<td>and Cells and Proteins Laboratory</td>
<td>4</td>
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<tr>
<td>BIOL 216</td>
<td>Development and Physiology</td>
<td>4</td>
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<td>&amp; 216L</td>
<td>and Development and Physiology Lab</td>
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**Physics:**

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<th>Credits</th>
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<tbody>
<tr>
<td>PHYS 115</td>
<td>Introductory Physics I</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 116</td>
<td>Introductory Physics II</td>
<td>4</td>
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**Additional Courses**

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<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>MATH 125</td>
<td>Math and Calculus Applications for Life, Managerial, and Social Science</td>
<td>4</td>
</tr>
<tr>
<td>STAT 201</td>
<td>Basic Statistics for Social and Life Sciences</td>
<td>3</td>
</tr>
<tr>
<td>or ANTH 319</td>
<td>Introduction to Statistical Analysis in the Social Sciences</td>
<td>3</td>
</tr>
<tr>
<td>or PSCL 282</td>
<td>Quantitative Methods in Psychology</td>
<td>3</td>
</tr>
</tbody>
</table>

Pre-Professional Scholars in Medicine are not required to take the Medical College Admission Test (MCAT) for the program. However, if they do take the MCAT, they are expected to earn 34 or higher on the exam. Program participants who have an interest in applying to any other medical schools, or who wish to be considered for a dean’s merit scholarship at the Case Western Reserve School of Medicine, should plan on taking this test.

Pre-Professional Scholars are expected to demonstrate successful progress by meeting the following levels of performance:

1. By the end of the sixth semester, Pre-Professional Scholars in Medicine are expected to attain a cumulative overall grade point average of 3.600, and to maintain that average for the rest of their undergraduate studies.
2. Pre-Professional Scholars in Medicine are expected to earn grades of B or higher in all courses in chemistry, biology and physics. By the end of the sixth semester, they should attain a cumulative grade point average of 3.600 for these courses, and should maintain this average for the rest of their undergraduate studies.
3. Pre-Professional Scholars in Medicine are expected to continue to fulfill expectations for outstanding personal development, including, but not limited to, maintaining academic integrity and adhering to the university’s standards of conduct. (All academic integrity and judicial offenses will be reported to the Case School of Medicine.)

Progress is reviewed with each student at regular intervals in the program. At the end of the third year, Pre-Professional Scholars in Medicine who have met the required levels of performance go through the normal admission procedures for the University Program of the School of Medicine, including submitting an application through the American Medical College Application Service (AMCAS) and an interview. Participants who do not meet the required levels of performance may still be admitted into the University Program of the School of Medicine, but such admission will be subject to review and approval by the School of Medicine’s Admissions Committee.

Successful completion of the Pre-Professional Scholars Program in Medicine guarantees admission only to the University Program of the School of Medicine. Students seeking admission to the Cleveland Clinic Lerner College of Medicine of the Case Western Reserve University School of Medicine must complete a separate application and will be considered in competition with all applicants for that program.

Pre-Professional Scholars Program in Social Work

Each year, as many as ten high school seniors who plan to pursue careers in social work are offered places in the Pre-Professional Scholars Program in Social Work. The program gives a conditional commitment of admission to the Case Western Reserve University Mandel School of Applied Social Sciences to be honored upon successful completion of the bachelor’s degree.

Admission to the master’s degree program in social work at MSASS is dependent upon the following requirements:

1. Graduation from the university with a cumulative grade point average of 3.000 in the junior and senior years.
2. Completion of a minimum of 24 semester hours in the social and behavioral sciences.
3. Continued evidence of a combination of personal qualities which are considered essential for the professional practice of social work.

Pre-Professional Scholars in Social Work who wish to accelerate their program may apply for the senior year in professional studies privilege.

**Application Procedures for Pre-Professional Scholars and Six-Year Dental Programs**

Prospective students who wish to apply to any of the Pre-Professional Scholars Programs or to the Six-Year Dental Program should apply for admission through the Office of Undergraduate Admission of Case Western Reserve University. All forms are included within the application materials.

The application for admission, supporting test scores and high school transcript, must be submitted to the Office of Undergraduate Admission as early as possible, but no later than December 1.

Students who are admitted to the university and are also deemed eligible for consideration for one of the Pre-Professional Scholars Programs or the Six-Year Dental Program will be notified by February 1 and will be invited for interviews at the appropriate professional schools. The basis for selection for these programs will be dedication to the pursuit of the particular profession, a distinguished high school record, high scores on the college entrance examinations (ACT or SAT), a record of personal accomplishments that attests to a student’s maturity, leadership, and interpersonal skills, and an interview with an admissions officer from the appropriate professional school. Decisions on admission to the programs will be communicated on or about April 1.

Students who are not admitted to these special programs are encouraged to pursue their undergraduate studies and to apply in the normal course to the professional school of their choice, including the professional schools of Case Western Reserve University.
SAGES Courses

SAGES Courses
For a full description of the SAGES Program, see the section on General Degree Requirements (p. 602).

This list of courses includes only those courses offered directly by the SAGES Program that have been approved as permanent offerings. Not all of the First Seminars and University Seminars listed are offered every year, but the list of offerings in any given year will include courses approved as one-time offerings. All Department Seminars are offered through the academic departments and are listed among their course offerings. Most Senior Capstone courses are offered through the academic departments, though several are offered through the SAGES Program and are included here with the course prefix UCAP.

FSCC Courses

FSCC 100. First Seminar. 4 Units.
This four credit-hour course provides an introduction to various dimensions of academic life. It will be characterized by intense yet open-ended intellectual inquiry, guided by reading from primary as well as secondary sources, and will include practice in written and oral communication in small groups. Each seminar is led both by a faculty member and a writing co-instructor. The goals are to enhance basic intellectual skills of academic inquiry, such as critical reading, thoughtful analysis, and written and oral communication; to introduce basic information literacy skills; to provide a foundation for ethical decision-making; to encourage a global and multidisciplinary perspective on the learning process; to facilitate faculty-student interactions; and, in the most general sense, to provide a supportive common intellectual experience for first-year students at Case.

FSNA Courses

FSNA 101. Flight: From Fantasy to Reality. 4 Units.
This four-credit-hour course provides an introduction to various disciplines with topics centered around the theme of flight. Topics include images of flying in myths and the arts; competing theories about the evolution of bird flight and the mechanism of insect flight; and human achievements in aviation. Through readings and open-ended discussion, we will touch on the nature of truth, the way science progresses, what makes a hero, and why flight appeals so much to the human imagination. Students are expected to enhance their skills at critical reading, thoughtful analysis, constructing logical arguments, and improving written and oral communication.

FSNA 103. Energy and Society. 4 Units.
This four-credit-hour course provides an introduction to collegiate writing and to various dimensions of academic life, but will focus on the critical appreciation of the world of energy. Currently, most of the world runs on non-renewable resources; this course is designed to help students develop viewpoints about these issues, and to express themselves in a clear, coherent way. The class will involve both literacy and numeracy, and students will learn to become comfortable handling some of the quantitative measures of energy use. The class will be characterized by intense yet open-ended intellectual inquiry, guided by reading, lectures and discussion, and will include practice in written and oral communication individually and in small groups.

FSNA 104. Archaeoastronomy: Monuments and Ideas. 4 Units.
The unifying theme of this course is how astronomical practice and knowledge is central to ancient civilizations and how that emphasis continues today as manifested through scientific endeavor and also as strongly through the power of unifying myth.

FSNA 107. Culture and Computers. 4 Units.
We live in a world that is increasingly shaped and dominated by computer systems. This seminar will explore ideas about the relationship between culture and computer/information technologies. Topics will range from the historical development of information systems to the shaping of online identities to the relationships between information systems and political ideology and conceptions of a digital future. The class will meet in three dramatically different spaces: our high technology seminar room, a virtual classroom of our own design, and the computer classrooms of the nearby Ashbury Senior Computing and Community Center (ASC-3). This course will have a service component that requires students to work six hours across the semester as teaching aides in the ASC-3 computing classes for senior adults. As students read about theories about information technologies and access, student service work will enable them to analyze these theories within the context of grass roots activism, participating in an adjoining neighborhood’s goal to expand access to the “computer revolution.” Students at all levels of computer literacy welcome.

FSCS Courses

FSCS 150. First Seminar Continuing Semester. 3 Units.
This is a continuation of the First Seminar experience for ESL students. The seminar will continue the introduction to various dimensions of academic life. It will be characterized by intense yet open-ended intellectual inquiry, guided by reading from primary as well as secondary sources, and will include practice in written and oral communication in small groups. The goals of the seminar are to continue to enhance basic intellectual skills of academic inquiry, such as critical reading, thoughtful analysis, and written and oral communication; to continue to introduce basic information literacy skills; to continue to provide a foundation for ethical decision-making; to continue to encourage a global and multidisciplinary perspective on the learning process; and to continue to facilitate faculty-student interactions. Prereq: 100 level first year seminar in USFS, FSCC, FSNA, FSSO, FSSY, or FSCS. Prereq or Coreq: FSTS 100.
FSNA 109. Science and Race. 4 Units.
This four-credit seminar examines the development and impact of the concept of race. We will first focus on the causes of biological variability in species, leading to an evaluation of whether race is a useful device for understanding biological variability in humans. Second, we will examine how the understanding of race has changed over time within the biological sciences. Third, we will examine how scientific conceptualizations about race have influenced, and been influenced by, cultural beliefs. Through readings and open-ended discussion, we will critically examine the scientific process as it has been (and still is) being applied to the study of human races so that each student will ultimately be equipped to develop a scientifically sound conceptualization of race. Topics which will be covered include Social Darwinism, the eugenics movement, legislation to restrict immigration into the U.S., race-based medicine, and race and intelligence. Students are expected to enhance their skills at critical reading, thoughtful analysis, constructing logical arguments, and improving written and oral communication.

FSNA 110. The Chemistry and Biology of Drugs. 4 Units.
How do drugs work? Using chemicals to alter biological processes has been documented since recorded history began. We ingest various chemicals to alter our mood, cure disease, or simply to make our lives more comfortable, however very few people take the time to ask how these molecules work. This seminar will touch on some historical aspects of how our society has discovered and used drugs in both social and medicinal settings, but will focus on the modern day process by which new drugs are identified.

FSNA 111. Chemical Aspects of the Aging Mind. 4 Units.
This seminar will focus on three age-related neurological disorders: Alzheimer’s, Parkinson’s and Huntington disease. These diseases pose enormous social and economic impact, and current drug-based therapeutic approaches are limited and may not be suited to deal with the imminent problems. The seminar will examine lifestyle changes (i.e., diet, exercise, vitamins, and other habits such as reading) that are implicated in preventing or slowing down these disorders. The focus on a medical topic with important socioeconomic ramifications will provide a novel approach to enhancing critical thinking and communication skills.

FSNA 112. Talking Brains: The Neuroscience of Language. 4 Units.
J speaks both Italian and English. After suffering a stroke, he finds himself switching to Italian in the middle of a sentence, even when he knows the person he’s talking to doesn’t speak Italian! He can’t stop himself no matter how hard he tries. In this discussion-based seminar, we’ll use cases like J’s to understand how a mass of cells can give rise to something as complicated as human language. We’ll use primary source readings from neuroscience to study topics such as the typical organization of language in the brain, bilingualism, sign language, and problems with language resulting from brain injury.

FSNA 113. Facts and Values in Environmental Decisions. 4 Units.
This four-credit seminar will guide students to critically evaluate the evidence, uncertainties, and value judgments pertinent to some of the world’s pressing environmental issues. We will begin by studying climate change. Students will decide the topics of exploration to follow. Through reading, field trips, discussions and writing we will investigate natural environmental processes and how they have changed with the growth in human population and technology. Students will learn about the scientific process and will consider the roll of science and technology and their limits in making decisions about shared resources.

FSNA 116. Cities (Under Construction). 4 Units.
Based on the premise that cities are never “finished,” and constantly being remade, we will look at the technological and cultural history of cities from the ancient world to the present day. Students will explore the history of building materials—wood, brick, steel, concrete, and glass—used in the construction of cities. We will also trace the development of city infrastructure such as water and sewage systems; streets, bridges, and subways; electricity, telephone and the internet. Specific technological innovations, such as the elevator and the automobile, will receive special consideration. We will move both geographically and temporally to visit the world’s great cities, Athens, Mexico City, Tokyo, and New York City. As we do, we will study the examples of significant building projects, such as the Brooklyn Bridge, the Chicago World’s Fair, Washington, DC’s Metro, and Cleveland’s first skyscraper, the Rockefeller Building. The course will cover the history of the professions—engineering, architecture, and urban planning—that have contributed to the construction of cities, and will review the works of these practitioners, as well as that of artists, reformers, and utopians that have imagined new directions for the city. We will also explore first person narratives of the city, the impact of the city on personal and collective memory, and the possibilities and pitfalls of the “virtual” city. Through lecture, discussion, textual analysis, computer simulations, and writing assignments, Cities (Under Construction) will help students gain a deeper understanding of their role in remaking and sustaining the built environment.

FSNA 120. The Impact of Materials on Societal Development. 4 Units.
This four credit-hour SAGES seminar provides an introduction to various dimensions of academic life through open-ended intellectual inquiry and guided by reading from primary and secondary sources. The course will require practice in written and oral communications in small groups. A primary focus of the seminar will be to examine the impact of engineering materials on societal development through human history using a few specific materials of interest as examples: concrete, steel, and semiconductors. At the conclusion of the course, students will be encouraged to explore the impact of other materials on the development of specific technologies as a group project.

FSNA 122. Science in the World of Harry Potter. 4 Units.
The Harry Potter books have attracted more readers than any other fantasy novel series. This seminar will discuss how science may account for or duplicate some of the magical endeavors described in the novels. We will assess the feasibility of certain means of transportation, such as traveling by the floo network, apparitions, and broomsticks, in the context of modern science and technology. Parallels between certain potions and contemporary drugs will be evaluated. The seminar’s conceptual framework, integrating fantasy with technology, will loosely follow the format of Michio Kaku’s nonfiction book "Visions: How Science Will Revolutionize the 21st Century.” In "Visions," Professor Kaku offers the provocative thesis that many "fairytale ideas" may be possible in the future thanks to advances in science and technology. A combination of Rowling and Kaku in one course should offer a unique opportunity for SAGES learning.
FSNA 125. The Right Stuff. 4 Units.
This course will examine the Space Race. A key text for the course will be Tom Wolfe’s The Right Stuff. By taking a historical approach to the study of the achievements and failures of NASA scientists and astronauts, it is possible to examine: 1) how individuals dedicated to achieving a particular scientific end draw on the scientific method, 2) the consequences of scientific inquiry, and 3) how science develops in specific historic contexts.

FSSO Courses

FSSO 103. Learning and Knowledge Creation. 4 Units.
The focus of this SAGES seminar is on the process of learning and knowledge creation. We will examine this process from two perspectives—from your perspective as a learner entering Case to choose and develop a career path and from the perspective of Case as an academic community characterized by a rich diversity of academic disciplines with different approaches to learning and knowledge creation. We will begin by exploring the learning process and your unique approach to learning with its strengths and challenges, and how it influences your academic interests and desired career path. Using philosophical analysis of the different forms of knowledge creation and criteria for truth, social analysis of the culture of academic fields and individual study of professors and scholars in different fields, we will examine the skills and values required for successful learning and knowledge creation in these fields. In particular we will compare and contrast ways of learning and knowledge creation in science and the arts studying Case and the Cleveland Institute of Art.

FSSO 108. Slavery from the Old World to the New. 4 Units.
This topical First Seminar will take a global perspective on slavery to fulfill three goals. The first is to explore the diversity of coercive bondage—from ancient Greece and Rome, to early-modern North Africa, to nineteenth-century America—and the ideologies that helped justify this ultimate form of human degradation. The second is to examine the historical memory of slavery and the legacy of slavery today. The third is to enhance critical thinking, public speaking and writing skills.

FSSO 109. American Myths and Movies: Stories We Tell Ourselves. 4 Units.
This First Seminar will explore the evolution and expression of American Mythology in literature and film. Through discussion, reading, viewing films, research, and writing students will examine how particular American myths have shaped American identity, values, and national vision. They will also explore the relationship between the myths and the reality and evaluate the extent to which these myths are meaningful today.

FSSO 110. Conflict and Cooperation. 4 Units.
Why is it that when cooperation seems so likely, conflict breaks out? Or why at other times when conflict looms, cooperation wins out? This course explores the social and political complexities of this basic human condition. Through seminar discussions of classic readings, the course will introduce students to the basic social science concepts and theories used to explain conflict and cooperation. In addition to general knowledge, the course will also allow students hands on experience. Classroom time will be dedicated to simulating the decision making and negotiating dynamics which lead to cooperation or conflict. Studies will include individual, historical, and international cases. Graded projects will include small group negotiation and decision making exercises as well as individual writing tasks.

FSSO 112. The Ethnic/Racial Experience in America. 4 Units.
This four credit hour course focuses on the ethnic/racial experiences of Native, African, Latino and Asian Americans through representative works of fiction, nonfiction and film. We will look at the way racial and ethnic identities are produced through political struggle on a local/national/global scale and how they are maintained and transformed over time. We also pay close attention to the ways in which race and ethnicity intersect with gender, sexuality, class, parental pressure, and nation in order to better understand how systems of power and inequality are constructed, reinforced, and challenged.

FSSO 113. College and City - and the Idea of UniverCity. 4 Units.
In this course we will look at ways in which universities and other major cultural institutions interact with the city. Cleveland is right now an excellent site for such researches. The city is pinning the hopes for its future on its ability to become an incubator of creativity, with particular attention to the arts. Local institutions are responding, including CWRU. Imagine yourself as a student in the late nineteenth century entering the granite fortress of Adelbert Hall (the oldest building on campus). This must have sent a very clear message: when you enter this building, you leave the city behind, and you are now in a different world. Or consider the even more fortress-like building, Crawford Hall, marking the western entrance to the campus. Like other cultural institutions in the Circle, CWRU is now concerned to present a very different face to the larger world. So we want to ask: How have things changed, and what further transformations are projected, and with what objectives?

FSSO 114. Music in Our Lives. 4 Units.
This seminar will examine the role, meaning, power, and influence of music in our lives. Readings, writing assignments, and four-hour events will focus on the following three themes: music is important, everyone is musical, and there are many uses of music and ways to be musical. Topics include the Cleveland music scene, the use of music in political movements, music in today’s media, and the use of music to heal. This course will be characterized by intense yet open-ended intellectual inquiry, guided by reading from primary as well as secondary sources. It will also include practice in written and oral communication in small groups. The goals are to enhance basic intellectual skills of academic inquiry, such as critical reading, thoughtful analysis, and written and oral communication; to introduce basic information literacy skills; to provide a foundation for ethical decision-making; to encourage a global and multidisciplinary perspective on the learning process; to facilitate faculty-student interactions; and, in the most general sense, to provide a supportive common intellectual experience for first-year students at Case.
FSSO 119. Philanthropy in America. 4 Units.
This four-credit course provides an introduction to various dimensions of philanthropy and volunteerism. Using the seminar format and an array of interactive activities, we will conduct a broad but intellectual inquiry into the systems and ethics of giving time and money to charitable causes. In four units of inquiry, we will consider the giving traditions that have influenced American culture and society since its colonial days. We will examine the role that the Third Sector (also known as the Independent or Nonprofit Sector) plays as an agent of social change in a functioning democratic republic. We will explore the nature of donors and volunteers and take a critical look at the missions and goals of a cross section of nonprofit organizations. We will wrestle with ethical issues related to philanthropy and consider the giving patterns of different social, religious, and ethnic groups. We will also turn our collective thinking to how the nonprofit sector might better serve the social needs of the nation and the world. At the end of the semester, we will reflect on how our ideas about philanthropy have changed over the course of fifteen weeks.

FSSO 120. Poverty and Social Policy. 4 Units.
This course has two major foci: poverty and social policies designed to ameliorate poverty. Sociologists in the United States and in other countries have made major contributions to studies of poverty. They have primarily focused on income-based poverty, but more recently, have also studied other forms of poverty. In this class, we will examine different conceptualizations and measures of poverty. We will then examine short-term and long-term poverty experiences and their potential consequences. We will then turn to explanations of poverty: why are some individuals more likely to experience periods of low income than others? While the United States will be the focus of the course, we will contrast the experiences of other countries. The second component will be an analysis of social policies designed to ameliorate poverty. In particular, we will examine the development and retrenchment of welfare states and other social policies, the various goals of social policy, and the different impacts social policies have had on individuals, families, other groups, and the country overall. This discussion will reflect on experiences of other countries.

FSSO 122. China in Modernization. 4 Units.
This four-credit hour course provides an introduction to various dimensions of modernization in contemporary China, especially cultural and social changes such as consumption, education, migration, and tourism as a result of economic reforms, trade expansion, foreign investments and technology transfer, especially the development of information technology. The seminar will also assess the impacts of these changes on various aspects of globalization and vice versa. It will be characterized by intense yet open-ended intellectual inquiry, guided by reading relevant material, and will include practice in written and oral communication in discussion forums and small groups. The goals are to enhance basic intellectual skills of academic inquiry, such as critical reading, thoughtful analysis, and written and oral communication; to introduce basic information on literacy skills; to provide a foundation for ethical decision-making; to encourage a global and multidisciplinary perspective on the learning process; to facilitate faculty-student interactions; and, in the most general sense, to provide a supportive common intellectual experience at CWRU.

FSSO 123. Ten Developments That Are Shaking The World. 4 Units.
This seminar is an introduction to some of the most important global developments of our times. We will examine these events through political, historical, economic, cultural, sociological, scientific and ethical lenses. Readings will come from a wide-range of sources, and assignments will include exercises in written and oral communication. The professor will choose the first three global developments to be investigated as well as the relevant readings. His topics will most likely be the proliferation of nuclear weapons, the rise of China as a great power and the fiftieth anniversary of the European Union. Each of the remaining seven will be chosen by small groups of students, who will assign the readings and run the sessions for their respective topic. Possible topics include the global food crisis, genocide and the failure of the world community to stop it, global warming and the growing gap between the world’s rich and poor.

FSSO 126. Religion and the Ethics of War. 4 Units.
Although war is a highly rational, organized and purposeful affair, it also is the most destructive and bloody of human activities. For this reason, war and warfare has always been subject to various religious and moral restrictions. As technology has developed, the conduct of war has changed and the definitions of just and unjust war, as well as what it means to fight justly, have undergone profound changes. This course looks at war and warfare from a variety of angles and examines how various religious and moral thinkers have tried to define just war, and create guidelines for fighting a war justly. At the end of the semester, the course looks at the moral challenges presented by new technologies and new concepts of war.

FSSO 128. Movers and Shakers: Leadership. 4 Units.
"Never doubt that a small group of thoughtful, committed citizens can change the world. Indeed, it is the only thing that ever has" (Margaret Mead, 1901-1978). This seminar is about understanding what enables people to make a generative impact on the world. Students will explore the socio-emotional and motivational characteristics of effective leaders and their ability to create positive change. Students will also be encouraged to develop their own theories of leadership and to explore their personal approaches to making a difference. The seminar will profile leaders from different occupations and walks of life. Seminar sessions will feature assigned readings on leaders and change agents, class discussion on what drives movers and shakers, and individual and group presentations on class members’ emergent leadership perspectives. A key objective of the seminar is the development of critical thinking skills, writing skills, and verbal skills. Consequently, the weekly class readings, reflection papers on class readings, class discussions, class presentations (individual and group), and final project are vital features of the seminar experience. Students will be expected to leave the seminar with a grounded perspective on leaders and leadership, and the ability to articulate their own personal views on making a difference in the world.

FSSO 129. Perspectives on Inequality. 4 Units.
We live in a world in which millions of people die every year in developing countries due to poverty-related conditions. Within the United States, where most commentators characterize the population as “middle class,” at least 35 million people live in poverty. This course examines social inequality from multiple perspectives. We will discuss the concepts of poverty, discrimination, and social change on a global and national level. The first third of the course assesses several economic, cultural, and environmental theories of inequality. We will then survey a wide range of scholarship that has addressed various types of social inequalities from diverse viewpoints.
FSSO 131. Social, Political, Economic Environment of Cleveland Northeast Ohio Region. 4 Units.
This First Seminar will focus on the socio/political/economic environment of the Cleveland/Northeast Ohio Region. Students will be encouraged to explore the agents that create change in our region; major employers and start-up innovative businesses, politicians, philanthropic funds and grassroots activists. Our analysis will also include the topic of growth. Definitions of it, creation of it, measurement of it, equity of it and sustainability of it.

FSSY Courses

FSSY 102. Intelligence. 4 Units.
We make judgments of our own intelligence as well as the intelligence of other people, of animals, of decisions and responses, and of descriptions of the world. What is intelligence? This course will examine a variety of ways in which we ascribe the concept of intelligence, and evaluate our measures of intelligence and the consequences of our use of the term. Intelligence, and the evaluation of its type, degree, presence, or absence is strongly linked to symbols and symbol use, and so the course is themed around segments that focus on specific aspects of symbol use and how they relate to intelligence. Segments include: Intelligence and Symbols, Mental Disorders, Moral Intelligence, Artistic Intelligence, Religion and Intelligence, Neurological Methods, Biographical Methods, and Animal Intelligence. Language as a dominant form of both symbol use and intelligence indication will recur as a topic throughout the course. At the end of the course, students will be well acquainted with a variety of notions of intelligence, common controversies surrounding such notions, measures of intelligence and their flaws, and different venues in which research on intelligence promises to be fruitful.

FSSY 106. Trauma and Memory: Modes of Remembrance and Representation. 4 Units.
The twentieth century has often been referred to as a traumatic century, characterized by unprecedented and unimaginable acts of violence. Traumatic events have engrained themselves into both individual and collective memory structures. Not surprisingly, trauma studies have become a central topic of investigation across disciplinary lines. Yet much of the field is still negotiated. We will try to recreate this ongoing discussion in our classroom, when learning, talking, and writing about trauma and its remembrance. The goal of this writing-intensive seminar is to give insight into the topic as well as introduce students to academic research, life, and expression. At first we will familiarize ourselves and take part in some fundamental debates: the distinction of memory and history, false memories, individual and collective memories, as well as the definitions of trauma across the disciplines. We will then have a closer look at the difficulty faced by researchers who grapple with trauma and its remembrance. In a final segment we will analyze representations of traumatic memories in public spaces, literature, and the visual arts.

FSSY 107. Thinking Animals. 4 Units.
This four-credit hour interdisciplinary seminar looks at the ways in which humans think about the animal and how they imagine their relationship to it. It examines representations of animal existence in literature, film, and critical essays and analyzes the attitudes and projections that underlie these constructs. The discussion will center on paradigm-shifting constructions of the animal such as post-modern anthropomorphism and the concept of becoming animal. Emphasis is placed on honing expressive and analytic skills, both written and oral. Various perspectives will be brought to bear on the theme. Questions we will explore include: What is “animal”? What is the connection between animals and ourselves? How do we know animals and what do we know? Is there “good” and “bad” anthropomorphism? How does language construct the “beast”? Does a documentary really document animal existence? Do animated films prevent a deeper understanding of animal existence or do they contribute to the discourse?

FSSY 108. First Seminar: The Language of Sport. 4 Units.
This seminar explores, through the medium of sport literature, significant periods of life: maturing, playing, living, loving, aging, and dying. Through the genre of sport literature, the course explores sport as metaphor, fantasy, and myth in context (1) time and death, (2) religion and philosophy, and (3) the human condition. Literal, symbolic, euphonic, mythical and figurative interpretations of poetic sport in literature and the plot, point of view, characterization, symbolism, and emotion consideration when reading sport fiction serve as the framework for discussion concerning self, the meaning of sport and life, and the interaction of sport, culture, and self.

FSSY 110. The Greek Hero Since Antiquity. 4 Units.
The Greek Hero and Heroic Culture since Antiquity: the Classical Tradition in Literature and the Arts is the specific topic of this seminar. The influence of ancient Greece on subsequent Western civilization has been profound. This course focuses on the impact of Greek mythology on the literature and arts of five later periods: the Middle Ages, the Renaissance, the Baroque, the Revolutionary Age (1750-1848), and the Modern period. While there are many aspects of Greek mythology that we might investigate, the story of the Trojan War will serve as a central, unifying myth for exploration. The concept of the hero evolved considerably between the time of Homer and the time of Euripides; yet, the Homeric heroes continued to appear in literature and the arts from ancient times onward. How has the concept of the hero inherited from Homer changed in literature and art since antiquity? Does the word “hero” still have value? Are there relevant and meaningful applications of this very specific Greek word outside literature and art in our time? These are just some of the questions we shall consider in our study of the Greek Hero and Heroic Culture since Antiquity in literature and the arts.
FSSY 112. Shakespeare - Still a Hit. 4 Units.
What is the enduring appeal of the works of William Shakespeare? Not only are the plays themselves popular today; there are also many film versions and adaptations, some recent and some dating back to the early days of cinema. In this First Seminar, students will read approximately six Shakespeare plays, including at least one history, comedy, and tragedy. In addition, they will view at least one film version or adaptation of each play. With the help of Kelvin Smith Library, the films will be made available on streaming video with password-protected access, enabling students to view them when convenient and as often as necessary. Since this class (like all First Seminars) is writing-intensive, students will complete four formal essays as well as frequent in-class writing activities. There will also be in-class readings from the plays, discussions of the various film adaptations, and one or two short oral presentations or activities.

FSSY 113. Movies and Meaning. 4 Units.
This course explores methods for interpreting films. To interpret a film is a more aggressive and creative activity than is simply viewing one. How do critics and researchers of cinema "make meaning"? What strategies do they use? How does one mount a film interpretation that is both novel and persuasive? The course will emphasize close reading of films as, each week, we screen a film and together discuss what meanings we can infer from it. Also each week, we'll read an essay that offers an interpretation of the film. We'll analyze the reading in light of our sense of the film under consideration. Students will write short essays, approximately one every two weeks, in which they analyze the rhetorical and interpretive strategies of a given film analysis. Students will share their essays with the class, and these readings will serve as bases for class discussions. Final writing projects will consist of student interpretations of a film. At least twice during the semester, the class will, in substitution for the weekly required evening screening, attend a film off campus--either at the Cleveland Cinematheque or at the Cleveland Museum of Art. The course emphasizes writing instruction and discussion in a seminar format. There will be required evening screenings each week.

FSSY 119. Art, Music and The Museum. 4 Units.
This four credit-hour course provides an introduction to art, music, and the museum, particularly the intersections between and among these three subject areas. Formal training in these disciplines is not required. The course will be characterized by intense yet open-ended intellectual inquiry and guided by readings and the experience of artworks from a wide range of styles and cultures. A strong emphasis will be placed on academic writing. The goals are to enhance basic intellectual skills including critical reading, thoughtful analysis, and written and oral communication (including PowerPoint presentation); to introduce basic information literacy skills; to encourage a global and multidisciplinary perspective on the learning process; to facilitate faculty-student interactions; and, in the most general sense, to provide a supportive intellectual experience for first-year students at Case.

FSSY 126. Fly Fishing: The Sport, the Metaphysics, and the Literature. 4 Units.
The seminar will explore the sport of fly-fishing—and an individual’s relationship to the natural world surrounding them—as presented in both fiction and non-fiction. Selected texts will provide the impetus for posing such questions as: What is the fundamental nature of sport, how does it vary from other forms of recreation, and can a sport be considered an art? What prompts the various authors to often imbue the fly-fishing with metaphysical, spiritual, or aesthetic dimensions? How does the intent and style of this genre of writing differ from those of traditional academic research? How might these elements of craft be applied and integrated into an effective academic writing style? In addition to considering the stylistic and philosophical approaches to the topic, seminar participants will also engage in several experiential learning sessions involving certain skill aspects of fly casting and tying, and consider those experiences both in discussion and written assignments.

FSSY 127. The Music of New Orleans. 4 Units.
This course focuses on the musical landscape of New Orleans from the late 18th century to the present. We will look at the diverse musics of the city, including opera and orchestral music, slave song, Gospel, solo piano, ragtime, jazz, rhythm and blues, rock and roll, and Cajun and zydeco. Through the course, students will develop a better understanding of music and music history and a deeper knowledge about the history of New Orleans. The course spends considerable time on communication: public speaking, discussion, and writing. Fourth Hour trips will include visits to the Rock and Roll Hall of Fame and the Western Reserve Historical Society.

FSSY 137. Cultural Representations: Ideologies, Images, and the World. 4 Units.
Narrative forms, such as myths, folktales, novels, films, and the media make significant contributions to the varied ways that people understand and imagine the spatial structures of the world. Specifically, this course will help you a) to develop an understanding of how narratives and the media have an impact on the ways we come to terms with geopolitical regions and how geopolitical regions are invented and imagined; b) to point out and address geopolitical assumptions, over-generalizations and to engage concepts such as the 'East' and 'West,' etc. critically; c) to analyze travel narratives, films, and current media representations of certain areas of the world and situate your observations into a wider set of theoretical problems; and d) to develop a set of reading skills that will help you to decipher texts (both primary and secondary) so that you can formulate productive questions and articulate your intellectual discoveries in a compelling way.
FSSY 141. "Renaissance" Men and Women: Polymaths from Late Antiquity to Leonardo Da Vinci. 4 Units.
The term "Renaissance man" is often used to refer to a polymath, someone whose expertise spans numerous and diverse subject areas. Leonardo da Vinci (1452-1519), perhaps the most famous polymath of all, was an artist, scientist, engineer, musician, and indeed a man who lived during the Renaissance. Yet already in late antiquity and the Middle Ages many of the great thinkers were polymaths, and they were not all men. This course examines the intellectual contributions of Leonardo da Vinci and two earlier polymaths: Saint Augustine (390-430CE), a north African bishop, philosopher, and theologian who became a Doctor of the Church; and Hildegard of Bingen (1098-1179), a German nun who was a composer, philosopher, herbalist, and mystic visionary. Through discussion of writings by these three figures and of secondary literature about them, the course explores their intellectual diversity and the cultural forces that shaped them. It also examines what it meant to be a polymath at various points in history, why polymaths have become associated with the Renaissance and with men specifically, and why there are relatively few polymaths today.

UCAP Courses

UCAP 390. Conservation of National Parks and Protected Areas: A Service Learning Capstone. 3 Units.
This capstone course explores environmental conservation with a focus on protected natural areas and community engagement. Limited to a small group that meets in weekly seminar, the course investigates the often competing interests of ecosystem protection, private development, historic preservation, and public use. A vital part of the capstone is a service learning trip during break when students travel to a National Park or other protected area to contribute to conservation efforts and to gain hands-on experience with environmental management activities. Each student chooses an issue relevant to protected areas to investigate throughout the semester and writes a significant paper about that issue, utilizing the service learning trip experience to deepen their understanding and analysis of the issue. At the end of the semester, each student makes a public presentation of his/her work. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSNA, FSCC, FSSO, FSSY or FSCS

UCAP 395. SAGES Capstone Experience. 1 - 6 Unit.
UCAP 395 affords students the opportunity to pursue a capstone experience outside the constraints of SAGES capstone courses offered by individual academic departments. Students must identify a project, a mentor and an oversight committee. If the mentor is not a Case faculty member, then the student must also identify a faculty advisor who does hold such an appointment and who will serve as the instructor of record. A capstone experience can take various forms but must include certain elements: critical thinking, regular oversight by the project advisor(s), periodic written and oral reporting of progress, a final written report which describes the project activity (which may be a performance, experiment, student teaching, live case analysis, creative writing endeavor, etc.), and a final public presentation. More details about course policies, including procedures for registering, are available via the SAGES office and web site. UCAP 395 may be taken as a one-semester or a two-semester course for 1-6 credits in any given semester and 3-6 credits total. Permit from Director of SAGES required.

UCAP 395A. Engage Cleveland Capstone Experience. 3 Units.
This community-based capstone provides a unique opportunity for students to learn about and become involved in community issues in greater Cleveland. Limited to a small group of students, the capstone weaves together hands-on experience and academic inquiry through which students learn about urban issues, community engagement, and about themselves as leaders and advocates for social change. The capstone has two parts - a summer community-based experience (non-credit) followed by a fall semester academic capstone course (3-credit), which utilizes and builds upon the summer experience.

USNA Courses

USNA 202. How Engineered Devices Work. 3 Units.
Engineered devices typically lend themselves to insightful description and explanation without involving all the detailed engineering science and mathematics that go into their development. The main agenda of this course is a series of six "how-things-work" modules, covering 1) automotive components and systems; 2) airplanes and flight mechanics; 3) power generation; 4) manufacturing machinery and processes; 5) heating, air conditioning, and refrigeration; and 6) rockets, satellites, and orbital mechanics. An on-campus laboratory demonstration or near-campus facility tour associated with each of these topical modules is included. This course also incorporates case-study-based open forum discussions on professional ethics. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSNA, FSCC, FSSO, FSSY or FSCS. Prereq or Coreq: FSTS 100.

USNA 204. The Evolution of Scientific Ideas. 3 Units.
Scientific understanding has evolved over the years. There are very few beliefs about the natural world that have remained intact over the past few centuries, or even the past few decades. The chief goal of the course will be to give students an understanding of how scientific ideas change and how newer ideas supersede the old. Questions to be investigated include: What is Science? How do disciplinary scientific communities (physicists, chemists, biologists, etc.) form and identify themselves? How does the community of scientists within a discipline come to a consensus that it is time to adopt a new paradigm: What scientific, social, political, and cultural factors come into play during the periods of transition? The course will be in seminar format. The students will be given opportunities to explicitly develop critical thinking skills (the specific skills to be developed will be selected by the class from an explicit list) and writing and speaking skills. Class meetings will be used to share their research results and to study the assigned texts and papers. The students will be required to demonstrate their understanding in a variety of ways. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSNA, FSCC, FSSO, FSSY or FSCS. Prereq or Coreq: FSTS 100.

USNA 206. Land and Life in the Americas. 3 Units.
This course investigates the physical processes that shape the Earth's environments and how these environments have influenced, and been influenced by, human history. A principle focus will be the evolution of the Americas since the end of the last ice age. We will apply what we learn to the history of cultural development and to debate environmental issues facing us today. This class is limited to students participating in SAGES. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSNA, FSCC, FSSO, FSSY or FSCS. Prereq or Coreq: FSTS 100.
**USNA 210. Forensic Sciences: How They Impact Your World. 3 Units.**

Forensic sciences provide a unique opportunity to apply basic science knowledge to help solve medicolegal problems. Expert input can be invaluable in improving the lives of the living along with providing crucial information for identification of the deceased, as well as cause, mechanism, and manner of death. This seminar will allow students to interview forensic scientists that relate to their careers and interests, for example, forensic pathology, trace evidence, DNA, toxicology, anthropology, radiology, and odontology. They will then be responsible for giving oral and written reports to the seminar class. Dr. Simmelink has over 25 years experience in forensic odontology and has arranged facility tours and expert interviews with staff from the Cuyahoga County Coroner’s Office in University Circle. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSNA, FSCC, FSSO, FSSY or FSCS. Prereq or Coreq: FSTS 100.

**USNA 211. Einstein, Space and Time. 3 Units.**

This course will explore the profound changes in our conception of space and time brought about by Einstein’s theories of special and general relativity. As a University Seminar, it will also integrate writing and discussion about these topics into the class and explore the philosophical and technological context in which the ideas were developed. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSNA, FSCC, FSSO, FSSY or FSCS. Prereq or Coreq: FSTS 100.

**USNA 216. Fuel Cells—Reality, Prospects and Myth. 3 Units.**

Fuel cells have been recently identified as a key source for non-polluting, oil-independent energy in the future. In this course, we will study and critically analyze the prospects, barriers, and impact of broad implementation of fuel cells, focusing primarily on the transportation sector. Major topics of the course include: (i) World and U.S. energy outlook; (ii) Potential role and impact of fuel-cells, their advantages, limitations and prospects for improvements; (iii) Alternative fuels—source, availability, distribution and cost; (iv) Potential political, public policy, economic, and environmental impact of large-scale implementation of fuel-cells technology. The course is designed for students from all disciplines. Students will be expected to read assigned texts and articles and critically analyze statements and points of view presented. Quantitative analysis is expected where appropriate. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSNA, FSCC, FSSO, FSSY or FSCS. Prereq or Coreq: FSTS 100.

**USNA 217. Astrobiology. 3 Units.**

This course will explore the possibilities for the existence of life on other planets in our solar system and galaxy. Using current understandings of the development of life on Earth we will discuss what habitats might be suitable for life on other worlds and the strategies scientists have developed to identify those habitats. Lastly, we will discuss the implication of the results for these ongoing searches. Students may receive credit for ASTR 206 or USNA 217—Astrobiology, but not for both Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSNA, FSCC, FSSO, FSSY or FSCS. Prereq or Coreq: FSTS 100.

**USNA 220. Suburban Landscapes: Nature, Technology, and Culture. 3 Units.**

This course will examine suburban neighborhoods by focusing on the design of technology and nature in these spaces. The way that people understand and operate in the world is so entangled with values and assumptions that the physical shape of the world cannot be separated from human culture. In this sense, suburban landscapes are not simply neighborhoods but also examples of culture. The form of the land and the technologies in the suburbs are continually reshaped to correspond with the cultures of the people occupying those spaces. By studying suburban landscapes we can see how the ideas in people’s heads become part of the physical world in which we live. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSNA, FSCC, FSSO, FSSY or FSCS. Prereq or Coreq: FSTS 100.

**USNA 223. Critical Science Fiction. 3 Units.**

The emphasis of this seminar will be on developing skills of critical analysis of science fiction. A goal of the course is that the students will be able to distinguish plausible from impossible when they read their next science fiction book or watch a sci-fi movie. Upon completion of the course, the students should be well equipped to recognize scientifically unrealistic assumptions and statements in pseudoscientific books, movies, TV programs and other mass media sources. The course will be sufficiently flexible to allow coverage of topics that are proposed by, and interesting to, students, or the topics which would arise during discussions. The course will encourage open-mined approach to understanding controversial areas, as well as emphasize the great achievements that humankind made in the short historical period of our civilization. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSNA, FSCC, FSSO, FSSY or FSCS. Prereq or Coreq: FSTS 100.

**USNA 224. Food, Farming, and Economic Prosperity. 3 Units.**

Intended to challenge conventional thinking about “progress”, this course will examine the evolution of food production and consumption in the U.S. over the past 50 years. We will begin with the topic of food, itself. We will explore fundamental questions such as, What is food? Why should we care? Where does food come from? Why does it matter what we eat, and equally important, what we eat eats? Students will explore their own eating habits by keeping a journal of what, when, where, and how they eat. Discussions will focus on the social, cultural, nutritional, and technological aspects of food. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSNA, FSCC, FSSO, FSSY or FSCS. Prereq or Coreq: FSTS 100.

**USNA 225. Science and Society. 3 Units.**

This seminar course is about the fascinating world of science and its role in society. The goal of the course is to develop in students appreciation of science and to show that science is probably the most exciting area developed by humankind. We will discuss history of science, development of scientific ideas, the scientific method, and modern state of affairs in science. We will talk about different scientific fields, from physics and mathematics to economics and history. The course topics will be sufficiently flexible to allow coverage of the areas that would be proposed by students or during our discussions. The course will encourage open-minded approach: we will discuss controversial areas, but we will do it in a respectful and intelligent way using logical arguments. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSNA, FSCC, FSSO, FSSY or FSCS. Prereq or Coreq: FSTS 100.
USNA 226. Evolution of Human Behavior. 3 Units.
Human behavior is a result of the complex interplay between our genes and the environment, both of which have been shaped by evolutionary forces over millions of years. To what extent does natural selection shape our behavior today? Are humans naturally monogamous? Why do conflicts arise even in our most intimate relationships? Is human behavior ultimately in the service of reproductive success, ensuring that our genes are passed into the next generation? This course reviews the history of evolutionary theories of mind and behavior, as well as current ideas about the ecological and genetic components of behavior. We will examine key principles of neurobiology, sociobiology, and evolutionary psychology to critically evaluate evolutionary interpretations of human behaviors, including those comprising cultural traditions and social institutions. Specific topics to be addressed include human mate choice, parenting strategies, interpersonal conflict, and altruism. The course is structured as a seminar, with emphasis on discussion and formation of logical arguments. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSNA, FSCC, FSSO, FSSY or FSCS. Prereq or Coreq: FSTS 100.

USNA 228. Time. 3 Units.
This seminar course will explore the nature of time from many stances, including those of Psychology, Biology, Technology and Philosophy. Yet time is central to Physics, and in Physics we will orient our explorations of time. Our understanding of time has sharpened a great deal in the last few centuries, the most obvious markers being Newton’s Absolute time, which remains entrenched in modern culture, and its subsequent physical overthrow by Einstein’s relativity. Given the physical primacy of Einstein’s time, many questions arise: How malleable is the concept of time? Is there a fact of time? Can the present be defined? The past? The future? The successes of modern Cosmology lead us to ask: Was there a beginning of time? Will time end? The symmetry of fundamental physical laws with respect to the direction of time, counterpointed by asymmetric phenomena, lead to: Is there a master arrow of time? Is the flow of time an illusion? In this course we will investigate what "Time" is telling us about the natural world and ourselves. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSNA, FSCC, FSSO, FSSY or FSCS. Prereq or Coreq: FSTS 100.

USNA 229. Astronomical Arguments: Pluto, Dark Matter, and Beyond. 3 Units.
This course explores how scientific controversies are resolved, using examples from astronomy and cosmology. We start with a discussion of the scientific process—both as an ideal and as a practical reality—and an overview of the scale of the universe in space and time. Then we address some historical controversies (with the benefit of scientific hindsight), before turning to modern examples of astronomical debates which remain unresolved. Examples include the Copernican Revolution, the nature of galaxies, the Big Bang, the elusive search for dark matter, and the identity of Pluto. In each case, we will examine the scientific basis of the controversy as well as the roles played by cultural and human biases. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSNA, FSCC, FSSO, FSSY or FSCS. Prereq or Coreq: FSTS 100.

USNA 230. ATTENTION! Understanding the Human Attention System. 3 Units.
You're in a crowded room, in the middle of a heated conversation. Suddenly you hear someone across the room say your name. How were you able to pick out that particular sequence of sounds from all the noise around you? Why did you even notice it, given that you were talking to someone else? This course looks at this phenomenon and others having to do with the human attention system. While much of what we read will be from the fields of psychology and neuroscience, we'll also consider aspects of attention that have to do with literature, the arts, and religion. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSNA, FSCC, FSSO, FSSY or FSCS. Prereq or Coreq: FSTS 100.

USNA 231. Cholesterol: The Good, the Bad, and the Money. 3 Units.
Cholesterol molecules are essential building blocks of human cells and are required for biosynthesis of some hormones. The word “cholesterol” has, however, become notorious as several diseases are linked to improper bio-processing of the molecule. Indeed, all middle-aged people are encouraged to have their cholesterol checked and monitored as needed. This course will educate students with respect to the role of cholesterol in human health and in specific disease states. Students will learn the difference between “good” and “bad” cholesterol, and the rationale for these labels. Additional topics include dietary contributions to cholesterol, cholesterol lowering drugs, the continuing evolution of what is considered to be a healthy blood cholesterol level and the factors driving this changing scale. Reading assignments will range from Newspaper articles to scientific publications. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSNA, FSCC, FSSO, FSSY or FSCS. Prereq or Coreq: FSTS 100.

USNA 235. Exploring a Sense of Place. 3 Units.
Having a sense of place, or a rooted understanding of where we live, shapes our identity, actions, and commitment to community. In this course, we will go beyond the “campus bubble” to explore the concept and development of a sense of place by studying and photographing the Doan Brook, our local watershed. Course readings, writing, and discussion will focus on Doan Brook’s natural history, local environmental issues, and sustainability. We will utilize photography as a primary tool for investigating and connecting to place as we undertake a photography project documenting the Doan Brook, which will be shared with the community. We will also consider our responsibility to place and learn about community-based initiatives in which people have committed to place and taken action to make a difference. Throughout the course, we will develop a stronger understanding of Case’s ecological address and the intersection of sense of place, environmental issues, and engagement with the watershed. We will explore firsthand where we are--and why it matters. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSNA, FSCC, FSSO, FSSY or FSCS. Prereq or Coreq: FSTS 100.
USNA 236. Upheavals in Astronomy. 3 Units.
Why the uproar over the invention of the telescope? How does the scientific method really work to advance knowledge? What do astronomers fear is the fate of the universe? This seminar begins with an introduction to the scientific instruments that brought about revolutionary changes in our understanding of the cosmos. Students will acquire historical and practical knowledge of such instruments in part through hands-on acquaintance with telescopes and other devices in the collection of the Cleveland Museum of Natural History. Students will also examine the historical context in which advances in astronomy were made, the divergent ways in which thinkers such as Galileo and Kepler responded to official disapproval of their ideas, and the consequences of humanity’s displacement when the model of a geocentric universe gave way to the current model of an expanding universe. The seminar will include assignments in expository and persuasive writing, with an emphasis on improving and revising one’s work and developing a well-researched final paper. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSNA, FSCC, FSSO, FSSY or FSCS. Prereq or Coreq: FSTS 100.

USNA 237. Landscape History and Conservation. 3 Units.
Human history is intimately intertwined with the natural landscape on which it occurred. From coastal preserves and their beach communities to Midwestern farmland and the preserved site of Thoreau’s Walden Pond cabin, and at places like the Grand Canyon, the American landscape itself holds many clues to our country’s natural, ecological, and cultural history. This course will investigate the lived landscape in two ways (which have a multitude of shades to them): as a place where humans shape the natural for their own memorial, productive, and aesthetic uses, or as a natural place that humans set aside or conserve. We will read landscape history and conservation theory, and we will consider global practices of conservation through UNESCO’s World Heritage Sites. Class work will entail a process-oriented project on the Cleveland landscape, which students are encouraged to approach through the lens of their major. We will visit the Wade Oval and the cultural gardens of Rockefeller Park as an example of current conservation practices working to protect the natural and cultural value of the local landscape. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSNA, FSCC, FSSO, FSSY or FSCS. Prereq or Coreq: FSTS 100.

USNA 238. The Role of Materials Science in Emerging Technologies. 3 Units.
The development of engineering applications is, and has historically been, closely related to the development of new engineering materials. In fact, specific civilizations and time periods in the past are classified by the materials used for engineering applications, e.g., the Bronze Age. This university seminar will examine the role of materials developments in the past, as well as explore the needs and impact of new materials in emerging technologies; areas of focus will be (i) Power generation, transmission and storage, (ii) Electronic devices and electronic applications, and (iii) Biomedical engineering and medical imaging applications. Prereq: 100 level first year seminar in USFS, FSCC, FSNA, FSSO, FSSY, or FSCS. Prereq or Coreq: FSTS 100.

USNA 239. The Musculoskeletal Machine. 3 Units.
This course is intended to explore the function of the musculoskeletal system from an engineering perspective. The coverage will not require a science or engineering background, although some physics background is desirable. Course topics include basic musculoskeletal anatomy, basic concepts of mechanics, mechanics of motion, energetics of motion, mechanics of sport and human-powered motion, animal motion, emulating systems (robotics), mechanisms of injury and disease, rebuilding and repair of the musculoskeletal system. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSNA, FSCC, FSSO, FSSY or FSCS. Prereq or Coreq: FSTS 100.

USNA 240. Technologies of the City. 3 Units.
Based on the premise that cities are never “finished,” and constantly being remade, the University Seminar, Technologies of the City, will look at the technological and cultural history of cities from the ancient world to the present day. Students will explore the history of building materials—wood, brick, steel, concrete, and glass—used in the construction of cities. We will also trace the development of city infrastructure such as electricity, water and sewage systems, streets bridges, and subways. Technological innovations, such as the automobile, will receive special consideration. We will move both geographically and temporally to visit the world’s great cities, studying examples of significant building projects, such as the Brooklyn Bridge, the Chicago World’s Fair, and Cleveland’s first skyscraper, the Rockefeller Building. The course will cover the history of the professions—engineering, architecture, and urban planning—that have contributed to the construction of cities, and will revisit the works of these practitioners, as well as that of artists, reformers, and utopians who have imagined new directions for the city. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSNA, FSCC, FSSO, FSSY or FSCS. Prereq or Coreq: FSTS 100.

USNA 241. Urban Transportation. 3 Units.
The course is intended to examine the variety of issues associated with urban transportation. To provide focus the Cleveland metropolitan area will be used as the example urban environment. The issues that will be addressed include the perceived transportation needs, the mutual influences of perceived needs and the transportation system, the effect on business, residence, recreation and entertainment, the variety of approaches that have been used or suggested in the United States and abroad and the approaches that might be used, the resources needed, and the time needed to make changes. It is expected that the students will further develop the ideas that should be addressed, do the necessary study of available information, discuss the issues, and finally report on their findings, conclusions and possibly recommendations. Prereq: 100 level first year seminar in USFS, FSCC, FSNA, FSSO, FSSY, or FSCS. Prereq or Coreq: FSTS 100.
USNA 243. CWRU’s Carbon Footprint. 3 Units.
CWRU has conducted dozens of energy efficiency projects addressing sustainability, energy, and climate issues. All of which aims at reducing the University’s environmental footprint. A core component of CWRU’s first carbon footprint inventory, is engaging in strategies for reducing greenhouse gas emissions. Using the campus as a living laboratory, participants will complete CWRU’s first carbon footprint inventory, and will collectively write the University’s first Climate Action Plan. Students will become familiar with general climate issues and will conduct an institutional greenhouse gas inventory using data on CWRU’s energy consumption and other pertinent institutional practices. Complimenting the practical aspects of the course, we will also explore organizational and economic opportunities in sustainability, energy, policy, and processes of organizational change for sustainability. Many examples from other campuses will be used in addition to expert guest speakers. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSNA, FSCC, FSSO, FSSY or FSCS. Prereq or Coreq: FSTS 100.

USNA 245. The Impact of Technology on Society. 3 Units.
There is commonly a lack of understanding and appreciation of how the spread of advanced technologies (the artifacts of engineering) has led to economic, social, and political changes on a global scale. As a result, young people do not think that careers in science and engineering are rewarding and useful or do they think of technology as one of the most powerful forces for social change. Furthermore, in a world where advanced knowledge is widespread and low-cost labor is readily available, U.S. advantages in the marketplace and in science and engineering have begun to erode. We want to be able to compete in the world. Economic growth is driven by technological innovation. Societies that foster it lead the pack, while others lag behind. An enlightened citizenry is essential both to support and to engage in new developments in science and engineering. Insights will be given on how engineering innovations develop and have changed the world, both good and bad and, hopefully, it will be clear that engineering is essential to meet many of the major global challenges of the future. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSNA, FSCC, FSSO, FSSY or FSCS. Prereq or Coreq: FSTS 100.

USNA 247. Epidemics in Human History. 3 Units.
This course will examine the role of epidemics (of all types) in human history. Disease has shaped our society in many ways and continues to do so. Despite the plethora of antibiotic and antiviral drugs since 1940, 90% of the decrease in (First World) infectious disease is due to simple public health measures and better hygiene. But overuse of antibiotics increasingly is causing the rapid evolution of "superbugs" that threaten new plagues and epidemics. Both historical and modern epidemics of plague, smallpox, Salmonella, cholera, tuberculosis, and HIV/AIDS will be examined. The interaction of these epidemics with societies and how the epidemics influence society, cultures, art, and literature will be major topics of discussion. The course is primarily discussion with short student presentations. In addition, 3-4 short “Front Lines" talks by and discussion with CWRU and University Hospital clinicians will explore today’s realities of epidemics, infection, and antibiotic resistance in the United States, Uganda, South Africa and elsewhere. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSNA, FSCC, FSSO, FSSY or FSCS. Prereq or Coreq: FSTS 100.

USNA 252. The Future of Food. 3 Units.
Since World War II, science and technology has transformed the way Americans produce and consume food. This transformation has been supported by government policies and accomplished through the application of industrial methods in agriculture, food processing, and food delivery. Such methods have allowed a tiny fraction of the American population to produce vast quantities of food products at very low prices for American consumers. But this American diet, while inexpensive, has turned out to be high in sugar, fat, and processed grains that are contributing to chronic disease such as diabetes and obesity. In addition, environmental impacts of confined animal feeding operations, vast monoculture grain production, and global food transport are raising questions about the sustainability of American agribusiness. This seminar will explore the evolution of food production in the United States since World War II and will ask the question: is it possible to nourish the world’s population using nutrition and flavor as guiding principals rather that cost? What is the true meaning of "sustainability" in agriculture? The last third of the course will be devoted to creating a plan for using part of the University Farm to grow food for the University. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSNA, FSCC, FSSO, FSSY or FSCS. Prereq or Coreq: FSTS 100.

USNA 258. Designing Urban Green Space. 3 Units.
In this course, we will investigate the history, theory and practical design of green space in cities. We will focus on types of green space and their community function, relationship to commerce, aesthetics, recreation, ecology, and health in particular. Students will engage in group projects where they locate all underused space in Cleveland (vacant space, gray or brown fields) and will propose a new use for it as green space of some kind. Individual research projects will be related to that site. Lively class discussion and frequent reading responses required. Mandatory field trip to sites in downtown Cleveland. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSNA, FSCC, FSSO, FSSY or FSCS. Prereq or Coreq: FSTS 100.

USNA 259. Bring Out Your Dead. 3 Units.
This course examines the interplay between history and plague outbreaks. Course readings draw largely on the writings and experiences of scientists, physicians, and public health officials. By taking a historical approach to the study of the relationship between human history and the history of disease, students will learn about the development of the scientific method (namely the slow process by which humans learned to identify, categorize, and respond to disease), how science develops in specific historic contexts, the consequence of scientific inquiry, and what humans do when they are faced with imminent death. A tentative list of plagues includes: the Athenian Plague, Black Death, Yellow Fever, TB, Malaria, Influenza in 1918, and AIDS. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSNA, FSCC, FSSO, FSSY or FSCS. Prereq or Coreq: FSTS 100.
USNA 266. Life After the Death of Print. 3 Units.
Around 1439, Johannes Gutenberg invented the moveable type printing press, a technological development that altered the world by ushering in an era of mass, reproducible communication. For nearly 500 years, print technologies have dominated communications. Scholars have shown that print’s ability to disseminate information led to revolutions in art, science and politics. In short, print technologies have largely defined what it means to be a thinking and communicating human being. The emergence of digital technologies has altered communications in ways that are only now being understood. This course examines how developments in digital technologies impact communication practices by threatening print’s historic stronghold. Consequently, the course also explores what impact new technologies have on human identity. We will consider the historical development of display technologies (printed materials and digital screens) to understand what is at stake in the move from print to digital communication. We will then investigate current phenomena associated with Web 2.0, including blogs and social networks, in order to understand how our communication choices construct and allow for our public and private identities. Additionally, the course will examine new display technologies, such as iPhones and Kindles, that allow for the possibly constant dissemination of those identities. Finally, we will hypothesize about how digital technologies force us to conceive of human identity differently from the ways that print invites. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSNA, FSCC, FSSO, FSSY or FSCS. Prereq or Coreq: FSTS 100.

USNA 270. Alternative Energy Sources. 3 Units.
Alternative energy sources are needed, because of limited fossil fuel resources, increased demand, and environmental impacts. This course will deal with the issues of alternative energy sources. Various sources such as solar (thermal and photovoltaic), hydroelectric, wind, geothermal, ocean thermal, wave, tidal and geothermal energy, as well as energy from biomass will be discussed in order to determine what is practical on a large scale, as well as on the scale of the individual homeowner. We will pay attention to the efficiency of each alternative energy source as well as what limitations exist in terms of extracting useable energy. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSNA, FSCC, FSSO, FSSY or FSCS. Prereq or Coreq: FSTS 100.

USSO 201. Society and Technology: How Do They Impact One Another?. 3 Units.
This course focuses on a systematic analysis of the relationships between society, and the specific institutional elements of technology and technological innovation. It describes the social aspects of computers and related technologies and explores the ways in which these technologies influence and impact organizations and individuals. The course explores the design, use and cultural significance of technologies and uses a historical focus to assess the integration of technology into all aspects of our society. The restructuring of traditional human interaction by information technology will provide a contemporary focus for the course. Offered in a seminar format, the course will provide opportunities for scholarly discussion, systematic inquiry and written communication. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSO, FSCC, FSNA, FSSY or FSCS. Prereq or Coreq: FSTS 100.

USSO 203. Law in Literature. 3 Units.
An interdisciplinary venture. This seminar will focus on law in literature by examining representations of the legal process in poems, plays, short stories, and novels. It will provide a taste of the vastness and variety of human life--and will broaden and deepen students’ understanding of the role law plays in society. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSO, FSCC, FSNA, FSSY or FSCS. Prereq or Coreq: FSTS 100.

USSO 205. The Human Struggle Through the Lens of Sport. 3 Units.
This seminar explores, through the medium of sport literature, the interaction of sport, society, and self. Students will examine the social and psychological effects on participants, consumer, and society of sport through the study of fiction, research studies, essays, and poetry having a sport motif. Topics include racism and sexism (valuing diversity), love (cooperating), death (losing), transformation (aging), and achievement (winning). This class is limited to students participating in SAGES. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSO, FSCC, FSNA, FSSY or FSCS. Prereq or Coreq: FSTS 100.

USSO 209. Face First. 3 Units.
Human beings greet the world face first. In fact, the ability to process facial features seems to be innate. A baby easily recognizes its mother’s face yet the most powerful computers have difficulty using facial features to identify people. This is because all human faces are similar while fine details make each face unique. This course will begin by studying the human face as an anatomic construction of hard and soft tissue skeletal components. We will discuss how we use anatomic facial features to recognize individuals. One homework exercise will be to construct faces using an FBI identikit. Each student will create an FBI composite sketch of their own face. Seminar time will then be used to view each sketch and try to match the sketch with the seminar participant. Discussion will focus on how facial anatomy is similar or different. Following this introduction, the seminar will shift focus from anatomy to sociology. We will discuss facial attractiveness and beauty. Seminar topics will also include manipulation of facial appearance i.e., cosmetics, body piercing, veils, and plastic surgery. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSO, FSCC, FSNA, FSSY or FSCS. Prereq or Coreq: FSTS 100.

USSO Courses
USSO 212. Sport and American Culture in the Twentieth Century. 3 Units.
This seminar will examine the role of athletics in U.S. society throughout the century, examining in particular its influence on issues of race and gender as well as the religious and mythic aspects of sport. The focus will be on the grasp athletics has, at all levels, on our collective psyche, and as such the influence it wields on vast realms of U.S. society. The tendency in popular press is to cast sports in absolute terms. It is evil: look at the millions spent on professional players and sports complexes, unrelenting wagering and the corruption of college athletics through the near-endless accounts of recruiting violations, under-the-table booster payments and fudged test scores. Or it is noble: consider the Olympic ideal, the pursuit of excellence for its own sake, the power athletes have to inspire spectators and play a key role in influencing public attitudes about everything from race (Jackie Robinson) to gender (Billie Jean King). The following topics will be explored through readings, movies, guest speakers, and writing assignments based on controversial issues within each topic: Sport and Race, Sport and Gender, Sport and Community, Sport and Celebrity, Sport and the individual, Sport and the Academy. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSO, FSCC, FSNA, FSSY or FSCS. Prereq or Coreq: FSTS 100.

USSO 213. Accountability and Governance in Corporations. 3 Units.
Who is minding the store for the shareholders/owners? Why do CEOs get paid so much? How did corporate scandals such as Enron, WorldCom, and Tyco occur? This seminar focuses on issues of accountability and governance in the modern corporation. While the main emphasis is on the business corporation, the relevance of these concepts to not-for-profit corporations and governments agencies will also be addressed. Much of the economic wealth of the modern society is generated by corporations. To understand the role of the corporation in society, it is important to gain an insight into the mechanics of corporate governance, both in theory and in practice. As such, what these entities do and how they are held accountable is at the heart of the social contract that binds the citizens together in a democracy. This seminar uses readings, cases, independent inquiry, role playing, guest lecturers, and discussions to allow students to develop an understanding of the challenges of accountability and governance. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSO, FSCC, FSNA, FSSY or FSCS. Prereq or Coreq: FSTS 100.

USSO 217. Ethics, An Interdisciplinary Introduction: Truth and Trust. 3 Units.
What is truth? Whom/what should we trust? Is it morally acceptable to trust in someone’s stupidity or cowardice? What are the criteria for being a trustworthy friend or parent? What is entrusted to professionals of various types? What is a lie? Is there a moral difference between types of lies? What factors are relevant to deciding when, if ever, lying is justified? What does lying do to the liar? What is the effect on the person who is deceived? What does lying do to trust within a culture? This course introduces students to classical and contemporary methods of ethical reflection and reasoning from several disciplines, including philosophy. The goal of the course is to enhance students' understanding of ethical concepts and moral reasoning, to prepare them for a life-time of ethical reflection, discussion, and problem-solving, as well as for more advanced study in the disciplines introduced. We will examine issues of truth, honesty, trust, trustworthiness, and responsibility in contemporary public, private, and professional life. Discussion, active learning methods, and short written assignments and oral reports are the principle methods of learning used. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSO, FSCC, FSNA, FSSY or FSCS. Prereq or Coreq: FSTS 100.

USSO 219. Native American Cultures: Issues Past and Present. 3 Units.
Who are Native Americans? How has their identity been defined? Too often, it is thought that all Native Americans share similar cultural and physical characteristics, rather than understanding them as culturally diverse peoples. In addition, many perceive Native American cultures as static and unchanging. The goal for this course is to challenge these myths and explore the dynamic and diverse nature of Native American communities. Within this framework, students will also examine shifting Native American identities over time. The course is divided into three sections: (1) Contemporary Native Issues, (2) The Problem of Culture Area: Real Cultural Surveys, and (3) Two Case Studies. The purpose of these divisions is to help students develop a strong understanding of some of the important issues of social identity and representation in Native American communities today. The purpose of the second division is to explore historically how these issues developed and the diversity of Native American cultures within specific regions. In the final section, we will explore two specific Native American cultures in a historical and contemporary context. The requirements for this course include article reviews, a midterm and final, and a final paper with presentation. Native American speakers will be invited periodically to discuss particular issues of relevance with students. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSO, FSCC, FSNA, FSSY or FSCS. Prereq or Coreq: FSTS 100.
**USSO 222. Science and Society Through Literature. 3 Units.**
This course will examine the interaction of scientific investigation and discovery within the context of the society it occurred in. What is the effect of science on society and, as importantly, what is the effect of society on science? An introduction will consider the heliocentric controversy with focus on Galileo. Two broad areas: tuberculosis and the Frankenstein myth, will then be discussed covering the period 1800-present. With tuberculosis, fiction, art and music will be examined to understand the changing views of society towards the disease, how society's perception of tuberculosis victims changed, and how this influenced their treatments and research. With Frankenstein, the original novel in its historical context will be examined. Using fiction and viewing several films, the transformation of the original story into a myth with different connotations and implications will be discussed. Most classes will be extensive discussions coupled with student presentations of assigned materials. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSO, FSCC, FSNA, FSSY or FSCS. Prereq or Coreq: FSTS 100.

**USSO 223. Seven Debates on Globalization. 3 Units.**
The sense that the world is entering a new phase of global social, economic and political integration ("globalization") has provoked debate and demonstrations around the world. In this seminar students will actively study, discuss and write about seven contentious issues surrounding globalization; 1) Is there anything new about today's wave of globalization?: 2) Do the institutions for globalization do more harm than good?: 3) Is globalization creating economic value?: 4) Is globalization good for the U.S.?: 5) Is globalization good for the emerging economies?: 6) Does globalization make the world safer?: 7) Is globalization creating a McDonald's world? Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSO, FSCC, FSNA, FSSY or FSCS. Prereq or Coreq: FSTS 100.

**USSO 224. Women as Ordinary and Extraordinary Leaders. 3 Units.**
This seminar will explore the lives of women who are leaders or who influence culture in everyday life and/or in public life, today and across past centuries. Characteristics of women and their environment that contribute to the development of leadership and/or influence on society will be explored and analyzed along with the barriers to leadership. Themes exhibited across various types of women leaders or women of influence will also be identified. Guest speakers of local leadership and/or influence who have expertise in identified areas of interest will also be utilized. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSO, FSCC, FSNA, FSSY or FSCS. Prereq or Coreq: FSTS 100.

**USSO 228. Our Plastic World. 3 Units.**
If one were to look around the general store of 1900, few man-made "synthetic" items would be evident. One hundred years later, the shelves of any Walmart would be filled with plastic items, plastic packaging, and clothing produced from synthetic fibers. Questions that might be posed include: 1) How did this change happen? 2) How are the historical events of the 20th century and the development of the U.S. chemicals/plastics industry interconnected? 3) What are the societal benefits and costs of this change? 4) What can we learn from the past 100 years, and how can we use these insights going forward into the coming century? These issues will be discussed at length. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSO, FSCC, FSNA, FSSY or FSCS. Prereq or Coreq: FSTS 100.

**USSO 229. A Study of Power: Criteria Essential to Its Rise and Fall. 3 Units.**
This SAGES seminar will coordinate examinations of major historical events and their influence on the future. Particular emphasis will focus on the development and/or demise of powerful countries and people, and political and religious infrastructures. Sample topics include: the rise and fall of the Roman empire, the Barbarian empires, the British empire, the National Socialists, the Soviet empire, etc. Development and practice of religious behavior from praying to pagan Gods and spiritual Gods may also be analyzed. The idea is to demonstrate the similarities and differences in each of these broad categories as they progressed. An examination of the impact of greater world "enlightenment" as civilization expanded over time is also discussed. The evolution and eventual demise or change and the continuing impact on contemporary civilization shall be explored. Conclusions shall be used to suggest a model for the future. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSO, FSCC, FSNA, FSSY or FSCS. Prereq or Coreq: FSTS 100.

**USSO 230. Leadership and the Global Agenda. 3 Units.**
The pervasive media climate of the 21st century has put the challenges of world in front of all of us: four billion of the world's people are living on less than $2.00 a day, whole continents are under siege by pandemics of the HIV/AIDS virus, and instances of man's inhumanity to man are daily headline news. The earth itself is weakened by emissions in the atmosphere, toxins in the rivers and oceans, and soil that is so thin and exhausted that the food it produces is a fraction of what it once was. In this seminar, students will develop an executive view of the state of the world, build skills in "Appreciative Inquiry," for conducting action research into the best practices of organizations, and develop a global consciousness, not only about the common issues experienced by peoples the world over, but also about a larger set of global values. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSO, FSCC, FSNA, FSSY or FSCS. Prereq or Coreq: FSTS 100.

**USSO 231. Evolution as Metaphor and Model: Why Don't We Live Forever?. 3 Units.**
Evolution will be used to examine biological, historical, and social issues associated with health, illness and aging. In this overview course, evolution is a paradigm that is used to understand how systems change over time. The readings and discussions will identify universal processes and patterns in order to understand the effect of disease on history and explain how and why humans remain vulnerable to aging. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSO, FSCC, FSNA, FSSY or FSCS. Prereq or Coreq: FSTS 100.
USSO 232. Economic Challenges. 3 Units.
This course examines economic challenges from a wide array of perspectives including philosophical, historical, psychological and practical. This course provides an avenue for a non-analytical yet economic and intellectual discourse on some of the most challenging present day economic issues, such as welfare reform, technological progress, changes in privacy norms, globalization, efficiency and the role of religion. We will explore these challenges through diverse readings from both classic economic thinkers such as Marx and Smith and modern academic scholars and journalists; analyzing the validity of their views for timely issues such as environmental questions, minimum wage laws, redistribution and educational policies. The seminar style in-depth discussions and flexible reading and project choices will provide students with an opportunity to examine and share knowledge related to their particular interests. We will also regularly discuss topical news items related to the class themes. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSO, FSCC, FSNA, FSSY or FSCS. Prereq or Coreq: FSTS 100.

USSO 233. The Pursuit of Equity and Quality in Public Education. 3 Units.
Public schools are regularly excoriated at the hands of the press, politicians, taxpayers, parents, employers, and just about every other segment of the general public. Yet our system of public education has long been regarded as the gateway to the American Dream and is (arguably) what has made our country (arguably) great. What is the status and future of this original American institution? The stakes are high: nothing less than the future of 90% of our country’s children, the fabric of our society and the strength of our nation. This seminar will explore current challenges facing public schools, such as resegregation, the impact of high-stakes testing, the “achievement gap,” and the political, moral, legal, and public policy issues surrounding the quest for equity and adequacy in funding and programming. We will discuss various visions for reform including pedagogical and legislative “solutions.” Our discussions will be informed by some historical and authoritative sources, but we will also give attention to continuously unfolding local and national events. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSO, FSCC, FSNA, FSSY or FSCS. Prereq or Coreq: FSTS 100.

USSO 234. Questions of Identity. 3 Units.
Who we are informs the ways in which we act in the world. How we respond to society in the individual, local, and global community is impacted by the way we see ourselves, the way others see us, and the way we see others. Who am I? How do I look at myself in relationship to others? How does the way in which society views me affect the way I think of myself? How have writers, historians, and philosophers dealt with the challenges of self and group identity? We will explore these issues through readings from the Civil Rights Era, the Holocaust, and the period of decolonization in Africa. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSO, FSCC, FSNA, FSSY or FSCS. Prereq or Coreq: FSTS 100.

USSO 236. What is a Nation? Reinventing China for the Modern World. 3 Units.
What makes a nation a nation? Is it a common history traceable to a primordial antiquity? Must a nation retain racial commonality? Does representative democracy mark “legitimate” nationhood? The history of modern China is used as a template against which we will ponder these questions: what is a nation, what is modernity, how did we come to assume certain characteristics of nationhood, and is there only one model for all the nations? We will study these issues by examining the views held by different Chinese figures on the meaning of China’s modern nationhood: old and young, northerners and southerners, politicians and students, and people from the heartland of China to the peripheries. We will examine the tension between the nationalist rhetoric of unity and cohesion versus the political and military reality of disunity and fragmentation. This seminar will explore the interactions between notions of democracy and dictatorship, military and civil discourse, economic development, diplomacy and geo-politics, and political parties and ideologies and how they influenced and detracted from stated nationalist objectives. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSO, FSCC, FSNA, FSSY or FSCS. Prereq or Coreq: FSTS 100.

USSO 238. The First Amendment. 3 Units.
The First Amendment to the United States Constitution states that “Congress shall make no law ... abridging the freedom of speech.” In this seminar we will explore what this right has meant in America and how it has been limited throughout American history. We will discuss the importance of free speech in a democratic society and how the government balances the freedom of speech with other government interests. This course is also designed to give you a glimpse of law school and what being a lawyer is like. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSO, FSCC, FSNA, FSSY or FSCS. Prereq or Coreq: FSTS 100.

USSO 239. Change Agents: Past, Present, and Future. 3 Units.
Though it is often said that we are living in a time of constant change, surprisingly few people take the time to understand who makes change happen and how. This seminar will explore the phenomenon of change on multiple levels. We begin by looking at change through an historical lens, examining social movements in the 1960’s. We will then investigate organizational turnarounds of the late 20th century and today. In each instance, we will consider the role of the individual, groups, and organizations as change agents, and examine the influence of environmental factors on change processes. Throughout this course, we will study the dynamics of effective change, identify change strategies, and move to develop a personal understanding of how each one of us can initiate change. In addition to diagnosis and analysis, we will engage in creative thinking and writing about our own capacity to become change agents. We will apply what we read and learn to our current and future lives. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSO, FSCC, FSNA, FSSY or FSCS. Prereq or Coreq: FSTS 100.
USSO 243. The Art of Fact. 3 Units.
As evidenced by the tragedy that unfolded in New Orleans in the wake of Hurricane Katrina, we ignore the consequences of endemic poverty at our peril. How do you evacuate a city filled with thousands of people too poor to own cars? Where do you house them after they’ve been rescued from their drowned neighborhoods? Although Cleveland won’t likely be erased by flood, it’s one of the poorest big cities in the nation making it vulnerable to disaster in times of crisis and an incubator for a host of thorny social problems. Often, it’s up to journalists to bring attention to these issues, give voice to the voiceless and force policymakers to come up with solutions to seemingly intractable problems. In this seminar, we’ll read and dissect the works of journalists who’ve written stories about complex social problems and have done so using many of the conventions employed by writers of fiction. Writer Ben Yagoda described this literary journalism as “making facts dance.” We’ll spend our time researching numerous social issues and learn to write about them in a clear and compelling voice. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSO, FSCC, FSNA, FSSY or FSCS. Prereq or Coreq: FSTS 100.

USSO 253. A Widening World. 3 Units.
This course introduces students to globalization debates. It begins with a broad overview that addresses core questions: What is globalization? Is it occurring? Is it novel, and what are its effects? The course then turns to contrasting perspectives on the relationships among markets, political units, culture and individuals, and the causes, extent, effects and desirability of economic globalization. Students use these theoretical lenses to develop arguments of their own and debate contentious contemporary and historical issues. Topics include: foreign economic strategies for the United States and poor countries; the origins of and solutions to financial crises; fair prices for basic commodities; intellectual property rights of medicines; workers rights and sweatshops; disputes over ‘frankenfoods;’ film wars; and the environment. The course is writing intensive. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSO, FSCC, FSNA, FSSY or FSCS. Prereq or Coreq: FSTS 100.

USSO 254. Global Health Issues and Culture. 3 Units.
In this course, we will explore health and medical issues across the globe from anthropological, biological, historical and economic perspectives. To begin this process, we examine the issues of cultural relativism and universal human rights. Then, we use this framework for our discussion and analyses of four key global issues in the health and medical sciences: (1) poverty, labor and public health in Latin America; (2) HIV/AIDS in sub-Saharan Africa; (3) the practice of female genital cutting; and, (4) ethical issues related to rapid developments in medical technologies (such as genetic cloning or stem cell research in the West). This course offers a “sampler” to students who think they may be interested in one of the health, medicine, or allied fields. This is a seminar course, and students will be evaluated based on their attendance, participation, three short papers and a final term paper. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSO, FSCC, FSNA, FSSY or FSCS. Prereq or Coreq: FSTS 100.

USSO 255. Hinduism. 3 Units.
This course will provide an introduction to Hindu thought and culture. We will read a wide range of texts and secondary sources. Two readings, the Ramayana and Samskara, will focus on issues of ethics and proper dharma. We will also be watching Deepa Mehta’s Fire. There will be a visit to the Shiva-Vishnu Temple in Parma. Heavy emphasis on research and writing. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSO, FSCC, FSNA, FSSY or FSCS. Prereq or Coreq: FSTS 100.

USSO 256. Cognitive Archaeology. 3 Units.
Have you ever wondered how it is that humans have developed self-reflection minds capable of meta-representation and other cognitive capabilities? Have you ever pondered how the human mind operates in relation to its cultural context? These are the kinds of questions that cognitive archaeologists explore and the sorts of questions we will discuss in this course. Intersecting several fields including anthropology, psychology, and philosophy, cognitive archaeology is a truly multi-disciplinary field that has contributed significantly to our understanding of the human mind. Cognitive archaeology not only deals with how the mind works and how it evolved, but also it also deals with how archaeologists utilize what is known of how the mind operates in order to interpret the archaeological record. Students are expected to enhance their skills at critical reading, thoughtful analysis, constructing logical arguments, and improving written and oral communication. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSO, FSCC, FSNA, FSSY or FSCS. Prereq or Coreq: FSTS 100.

USSO 257. The Economics of Cooperation. 3 Units.
Economists have focused on competition, not cooperation as a mechanism for allocating and transforming resources, and lawyers have relied on an adversarial process to resolve disputes. However, many firms and other institutions have found cooperation to be quite beneficial. In this course, we will discuss topics such as: features common to many types of cooperation. We will examine questions such as the following: What do World War I trench warfare and urban living have in common? Does the public suffer when some groups (such as the American Medical Association, the Mafia, and Japanese firms) cooperate? Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSO, FSCC, FSNA, FSSY or FSCS. Prereq or Coreq: FSTS 100.

USSO 260. Spin, P.R., and America Today. 3 Units.
Live today surrounded by spin--corporations don't fire, they downsize; government pronouncements are assumed to be cynically slanted and misleading; even scholarly medical articles are written by public relations (p.r.) flacks. The guiding principle isn’t truth or reality but the right message and staying on it. How and why has p.r. become such a seemingly potent force in our time? What does this say about America and its values—about even the meaning of truth? In this seminar we will explore the role of public relations and image-making, in American society today. Our objectives are (1) Examine the users of p.r. today in business, politics and popular culture to shape images and define reality; (2) explore the tools used to construct and sell those messages and perceptions and (3) Analyze the values underlying these activities--to the end of deepening our understanding society today. This seminar explores these issues through reading, both academic and popular writing, discussion, and research. The writing assignments will be both academic and various forms of media and public relations formats. We will use class time to discuss and review student writing. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSO, FSCC, FSNA, FSSY or FSCS. Prereq or Coreq: FSTS 100.
USSO 262. Shame, Honor, and the Self. 3 Units.
Cultural conceptions of shame and honor register different understandings of the self, revealing how identities are created and maintained. Shaming can be a way of separating insiders from outsiders and cementing communal identity, but it can also be a very visceral feeling of inadequacy. Thus, shame and honor are ways whereby individuals negotiate their place in a social community. Considering the transformation of these ideas at different temporal moments, this course will look at literary depictions of shame and honor from the classical period to the present including works by Seneca, Marlowe, and contemporary films to uncover the different conceptions of selfhood, and their relationship to their social context, at work in these texts. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSO, FSCC, FSNA, FSSY or FSCS. Prereq or Coreq: FSTS 100.

USSO 263. The Politics of Consumption. 3 Units.
How do the things we like and the things we buy indicate who we are? What role has consumption played in the development of ideas about masculinity and femininity? Has the emergence of modern consumerism altered the way we interact with art and history? In this course, we will consider the political and ethical implications of consumerism. We will investigate the history of commodity culture, read about the early department stores in Paris and the first cases of kleptomania, and look at Victorian advertisements and popular magazines for collectors from the turn of the century. We will use the works of Karl Marx and Oscar Wilde to theorize the ethical implications of taste. The philosophical, economic, and literary texts we read will help us to understand why it is pleasurable and why it might be problematic to be manipulated by the marketplace. In addition, we will ask if there are methods for maneuvering within the possibilities of commodity culture in an ethical manner. Can we express our politics or preserve cultures and traditions with the right kinds of shopping? Can we be moral consumers? Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSO, FSCC, FSNA, FSSY or FSCS. Prereq or Coreq: FSTS 100.

USSO 264. Government and Race Relations. 3 Units.
Current debates over such issues as immigration and affirmative action raise core questions about the government’s influence upon American race relations. What roles have various governmental entities—e.g., federal courts, state governors, and city councils—played in promoting racial equality or defending racial hierarchies? What roles should they play? And how much can the government (re)shape cultural attitudes and social practices? How much authority over race relations should remain with states and localities, and how much should be exercised by the federal government? This course offers a forum to investigate and debate such questions more thoroughly by examining a range of instances in the period from the late 19th century to the present day in which different kinds of government action have significantly influenced American race relations. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSO, FSCC, FSNA, FSSY or FSCS. Prereq or Coreq: FSTS 100.

USSO 265. Social Structures of Courtship and Love. 3 Units.
How have dating practices changed over the past centuries? What links exist between on-line dating and sixteenth century love poetry? This course will explore western forms of courtship in literature (poetry, fiction, magazines, guidebooks, film, and critical studies) from the Renaissance to the present day. By tracing how practices of courtship and the expectations of relationships have changed over time, we will explore how romantic relationships both reflect and shape cultural attitudes about women, men and social and political order. We will consider particularly how changes in acceptable practices of dating are linked with the development of the women’s movement. By exploring how the lovers’ discourse remains stable and/or varies over time and place, students will be encouraged to question the often unspoken social rules and expectations that govern romantic relationships, and thus to consider how the private affair of love is a subject of intense public concern. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSO, FSCC, FSNA, FSSY or FSCS. Prereq or Coreq: FSTS 100.

USSO 266. Framing Our Legal System: Law in the Movies. 3 Units.
This course explores important themes in the study of law, lawyers, and legal institutions by regarding their representations in movies. We will cover such issues as race/class/gender and the law, legal ethics, legal education, the adversarial system, and the image and status of the lawyer in American culture. We will also look at the ways in which law and the legal profession affect popular culture and, conversely, the ways in which popular views of legal problems and lawyers affect law. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSO, FSCC, FSNA, FSSY or FSCS. Prereq or Coreq: FSTS 100.

USSO 269. Create-A-College. 3 Units.
In seminar format, students will develop plans for a new institution of higher learning, shaping and communicating in several different formats its mission, goals, academic focus, and physical and financial needs. Supporting the course’s research, writing, and presentation expectations will be documents from existing colleges, information on the policy and social environment for such a venture, and requirements imposed by external entities such as governmental and accrediting agencies. Course will include interactions among two sets of student teams and several intermediary presentations, culminating in a group presentation of plans for the new college to a panel of experts including current or former members of the University’s Board of Trustees and the Ohio Board of Regents. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSO, FSCC, FSNA, FSSY or FSCS. Prereq or Coreq: FSTS 100.
USSO 270. The Geography of Wealth. 3 Units.
While many of us are familiar with thinking about wealth in social, political and economic terms, wealth can also be understood as a function of geography. This seminar will look at American history and culture to seek a deeper understanding of how place and wealth interact; some of the government policies that affect those interactions; and some of the grand experiments in philanthropy, law, and social policy that have tried to reverse the perceived evils of “concentrated poverty.” The seminar will not require an advanced mathematical or statistical background. However, we will analyze how statistics can illuminate (and disguise) issues and problems. We will look at the business corporation as both an aggregator of wealth and as a wealth allocation system. Of necessity we will wander into matters of race, employment, power, class, culture, history, and government. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSO, FSCC, FSNA, FSSY or FSCS. Prereq or Coreq: FSTS 100.

USSO 271. Schoolhouse Rocked: Education Reform. 3 Units.
Today, the term “education reform” may bring to mind standardized tests and No Child Left Behind. Many believe that our schools must become more rigorous, with stricter rules and definable goals. “Reform,” however, used to be defined differently. John Dewey, Maria Montessori, and Paulo-Freire, for example, struggled to make schools freer and more humane. They hoped not to make the classroom less challenging, but more child-centered. Some disciples of such reformers, discouraged by schools’ resistance to change, eventually turned to homeschooling—pulling kids out of school and educating them with real-life learning experiences. In this seminar, we will explore progressive educational theory and connect it with contemporary alternative schools and homeschooling. Visits to nearby Montessori and Waldorf schools and discussions with homeschoolers will make real-life connections to seminar reading and classwork. Challenging assumptions about how well our schools work and raising questions such as, “How do we learn?” and “What is good teaching?” will provoke thought, conversation, and interesting writing. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSO, FSCC, FSNA, FSSY or FSCS. Prereq or Coreq: FSTS 100.

USSO 274. Passion, Insult, and Virtue in Ancient Athens. 3 Units.
Students explore the social fabric of Athens at its height—the various social and economic institutions that shaped households and the city-state in the fifth and fourth centuries BCE. Primary source material will include courtroom speeches, two comedies of Aristophanes, and Aristotle’s Ethics. Topics: lust, love, marriage, prostitution, slavery, elite drinking parties, street life, hubristic violence, competition, feuding murder, the legal system, diverse concepts of virtue, and how ordinary people were expected to treat one another in good times and bad. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSO, FSCC, FSNA, FSSY or FSCS. Prereq or Coreq: FSTS 100.

USSO 275. Psychology of Creativity. 3 Units.
The purpose of this course is to explore how individuals become creative. What are the most important qualities, emotional and cognitive, that are related to creativity? Is there a creative personality? What is the difference between artistic and scientific creativity? How does creativity relate to mental illness? How can we foster creativity in people? The course will study creativity in children and adults and will include research studies as well as descriptions of creativity from creative individuals. We will also discuss how different cultures view and effect creativity and the ethical issues involved. This course is a seminar and will use a discussion format. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSO, FSCC, FSNA, FSSY or FSCS. Prereq or Coreq: FSTS 100.

USSO 279. Making Men: Boyhood and the Making of Masculinity. 3 Units.
Aphorisms like "boys will be boys" simultaneously suggest that boyhood is a social problem to be solved and a privileged position. This course will explore what it means to be a boy in different historical contexts. In some texts, boys are understood as incorrigible miscreants. In others, they are the repositories of their families’ hopes and dreams. What is at stake in the way boys are treated differently from girls or from men? We will consider the relationship between boyhood and manhood not only in contemporary culture but also in texts ranging from ancient Rome to 19th century. Through memoirs, advice books, psychological explorations, and contemporary film, this class will examine both conceptions of boyhood and their place in the production of masculinity. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSO, FSCC, FSNA, FSSY or FSCS. Prereq or Coreq: FSTS 100.

USSO 280. Democracy?. 3 Units.
"Democracy?" poses democracy as a question, in two forms. First, what do we mean by democracy? Second, where should democracy be practiced? Although conventional understandings link democracy to political systems and issues of governance, the course will consider democracy in other institutions and locations. Course questions include: What is democracy? Why do we value democracy? Does democracy in the state require democracy in the economy? What would that look like? What are the potential conflicts between economic and political democracy with full citizen involvement? Is direct democracy democratic? Does democracy in the state require democracy in the family? In universities? In the workplace? In prisons? Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSO, FSCC, FSNA, FSSY or FSCS. Prereq or Coreq: FSTS 100.

USSO 282. Community Policing: A Comparative Study. 3 Units.
Community Policing is becoming increasingly popular around the globe, as well as in the U.S., where it is only found in a few cities. The objective of this course is to expand the student’s knowledge and understanding of the police systems in Japan and Sweden, since these nations are leaders in the successful introduction of community policing in their societies. It is instructive to go beyond one’s political boundary in order to draw on different experiences in other countries. While it may not be possible to “adopt” some ideas from another country’s police system, we might be able to benefit from “adapting” them to our own community needs. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSO, FSCC, FSNA, FSSY or FSCS. Prereq or Coreq: FSTS 100.
USSO 283. Life is a Contact Sport. 3 Units.
This class will take students places most people have never been. We'll come face-to-face with the homeless, explore the realities of prison life, and meet people who struggle to survive in the wealthiest country in the world. We'll also meet people who have demonstrated both the vision and commitment to be change agents making a difference in the world. The interdisciplinary course will examine the shadow-line between self-interest, greed, and the common good in a capitalist society. We will look at the needs and (sometimes competing) values in democracy. We will examine ethical systems and discuss the role that leaders, managers, and ordinary citizens play as moral agents in promoting integrity and social responsibility for a just society. From interactions with real people, readings, and class discussion, the course challenges assumptions and explores core values to stretch your intellectual, ethical, and social muscles. Life is a contact sport that asks you to engage, to participate in making your talents and presence felt, not merely sit on the sidelines watching. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSO, FSCC, FSNA, FSSY or FSCS. Prereq or Coreq: FSTS 100.

USSO 284. The Kaleidoscope of Birth. 3 Units.
The course will explore topics in science, technology and culture across time as they relate to the social construction of birth. Students and faculty will critically examine the seminar topics through an interdisciplinary approach. The learners will develop their own understanding of how science and technology related to birth have and continue to change. What happens when newer technologies supersede the old? What happens when older ideas are revived? Students will be introduced to the influence of culture and technology. Methods of oral and written communication will be enhanced via assignments. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSO, FSCC, FSNA, FSSY or FSCS. Prereq or Coreq: FSTS 100.

USSO 285A. Ethnicity and Local History. 3 Units.
This course will explore the many different kinds of ethnic communities to which we belong. Why have local ethnic groups formed arts and cultural organizations, sports clubs, charities, and other groups which highlight their difference? How have these local groups operated within larger, national ethnic groups and how have they helped us negotiate our identities as citizens, members of religious communities, and/or members of other nations? To what extent have these groups been successful in encouraging future generations to identify with the ethnic group? Our starting point and focus will be an examination of theories of how science and technology related to birth have and continue to change. What happens when newer technologies supersede the old? What happens when older ideas are revived? Students will be introduced to the influence of culture and technology. Methods of oral and written communication will be enhanced via assignments. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSO, FSCC, FSNA, FSSY or FSCS. Prereq or Coreq: FSTS 100.

USSO 285B. Going to the Movies: Film Spectatorship, Reception, Exhibition. 3 Units.
Audiences clearly contribute something to the movie-going experience besides the price of admission--but what? This class examines different conceptualizations of the role of the film viewer, from abstract theories of the spectator to investigations into the historical reception of particular films to studies of the concrete and material circumstances of film exhibition. In particular, we'll be interested in how these three ways of conceiving of the act of movie-going relate to one another. With an emphasis on Hollywood cinema, we'll consider a film as a text with a context that includes the circumstances of the film's production, cultural factors weighing on both the film's production and consumption, and the mental activities of viewers. Do viewers merely "come after" the meaning-making activity that gives a film its form and significance? Are we mere passive receivers of the director's and screenwriter's messages? This course argues no, and places the viewer at the center of a dynamic process in which films only "come alive" when someone watches them. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSO, FSCC, FSNA, FSSY or FSCS. Prereq or Coreq: FSTS 100.

USSO 285D. Advertising and the American Dream. 3 Units.
This SAGES seminar will explore advertising in America, its social and cultural roots, and its impact (or lack thereof) on our values, tastes, and behavior as consumers and citizens. It is hard to find a space in the contemporary world that is not plastered with ads--from the Coke cups next to the judges on "American Idol" to stencils on the sidewalks we walk on. This blizzard of advertising images may, in fact, define our age. We will examine the forces that created this giant American industry and ask: Why do we have advertising? How is it created? What social functions does it serve? How has it changed? Where is it going? Central to this seminar is discussion, research, and writing to analyze and critique this in-our-face, but little understood, social institution. Some of our discussions will flow from advertising industry news (e.g., the Super Bowl ads), a contemporary or early 20th century ad campaign, or the backstage insights of a guest from one of Cleveland's major ad agencies. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSO, FSCC, FSNA, FSSY or FSCS. Prereq or Coreq: FSTS 100.

USSO 285H. Music and Cultural Expression. 3 Units.
In this seminar, we will focus on the recent history of music and the role it plays in our culture today. Music is a form of cultural expression that creates meaning with narrative elements in a way similar to novels, poetry, drama, and other typically literary forms; we will consider various genres of music as well as various genres of literature that depend on music to complete their expression. But music is also one of the most obvious ways we participate in our culture, and musical taste can help define our sense of ourselves and where we belong in culture. We will read some identity theory to determine how and why music helps us create identity from and within the culture around us. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSO, FSCC, FSNA, FSSY or FSCS. Prereq or Coreq: FSTS 100.
USSO 285J. The Limits of Science. 3 Units.
Can science provide answers to the deeper puzzles of human existence, or do some questions lie beyond the scope of the scientific world view? Specifically, can science explain human consciousness, free will, and morality; and can it reveal the origins of religion? Students cannot, nor will they be expected to, provide a definitive answer to these questions. Instead, this seminar will provide students with an opportunity to engage in a conversation with each other against a backdrop of some of the most interesting and provocative research in cognitive science. In addition to learning about relevant psychological and neuroscientific research, students will engage with philosophical issues and arguments. This course aims to stretch student’s beliefs about what they know now, and what they think can be known. The seminar will aim to cultivate productive and rhetorical skills, especially analytical thought, oral expressiveness, and writing skills, all of which will be useful in future pursuits. It will help students to develop a more nuanced view of human nature and the ability of science to transform our view of it. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSO, FSCC, FSNA, FSSY or FSCS. Prereq or Coreq: FSTS 100.

USSO 285K. The Economics of Global Poverty. 3 Units.
Developing countries make up at least three-fourths of the world population. This course focuses on international aspects of economics of the developing world. Questions we will ask include: why are the poorest countries failing to thrive, what can be done about it, and can the rich afford to help the poor? The term “developing country” means a country that exhibits low per capita income, high poverty level, little industrialization, or low life expectancy. However, these problems also affect developed countries. Why, then, do we study poor countries’ economies separately from those of industrialized nations? The answer lies not in the types of problems but in the severity and causes of these problems. It is these issues, the causes and consequences of global poverty, and solutions to help the world's poorest, that concern us here. Raising people out of poverty requires economic growth, a more even income distribution, investment in education, health care, and infrastructure, social safety nets, honest political leaders, reliable social and financial institutions, and international aid from rich countries. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSO, FSCC, FSNA, FSSY or FSCS. Prereq or Coreq: FSTS 100.

USSO 285U. Cities (Deconstructed). 3 Units.
This seminar will look at the history of cities, real and imagined, in terms of deconstruction, both in the sense of physical destruction and literary analysis. We will explore how societies have brought about, and reacted to, the destruction of buildings, neighborhoods, and entire cities at the hands of economic development, terrorism, war, neglect, decay, and natural disasters such as fire, flood, and earthquake. In addition we will read cities themselves as texts. Architecture, public parks, billboards, graffiti, surveillance cameras, sidewalks and alleys all contribute to the discourse of what a city means. Part of that discourse includes the depiction of cities in the creative arts. We will examine works of fiction, still photography and motion pictures, art installations, and music that imagine, or comment on, the deconstructed city. Through lecture, discussion, textual analysis, multimedia presentations, and writing assignments, including a research project in which students will be asked to write a cultural biography of a building, Cities (Deconstructed) will help students confront these questions, and will prepare them to make informed decisions about sustaining the built environment. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSO, FSCC, FSNA, FSSY or FSCS. Prereq or Coreq: FSTS 100.
USSO 285P. China in Transformation and Globalization. 3 Units.
This seminar introduces students to major economic, social, and cultural developments in China over the past quarter century, taking as its particular focus the way in which China experienced changes such as consumption, education, migration, and tourism as a result of economic reforms, trade expansion, foreign investments and technology transfer, and the development of information technology. The seminar will also assess the impacts of various aspects of globalization on these changes and vice versa. This seminar promotes broad knowledge of—and increased appreciation of—the importance of diversity in China’s cultural past, social frameworks, economic conditions, and natural environment. In a close connection to the primary readings, which include several recent relevant works, the students will be exposed to a variety of related primary and secondary materials (such as texts, photos, film clips, music, songs, and websites). In addition to receiving informative yet concise instruction, the student will also be involved in practice in critical reading and thinking, in writing and orally presenting research papers. In these activities, the students will be introduced to basic methods and concepts critical to the understanding of important economic, social, and cultural developments and changes as products of movements rather than isolated incidents. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSO, FSCC, FSNA, FSSY or FSCS. Prereq or Coreq: FSTS 100.

USSO 285Q. Paradigms, Ideologies, and World Views. 3 Units.
The purpose of this class is to analyze the different ways in which people view the world, and the consequences of adopting any particular perspective. Our first primary area of inquiry will be the degree to which the scientific community meets its ideals. We will explore how dominant paradigms develop and slowly change based on sociological and psychological principles that are far from the idealized notion of scientific process. Then, we will explore modern political ideologies in order to assess how fundamentally different assumptions about how the world works lead to fundamentally different conclusions about ideal policies. We will then discuss the degree to which ordinary citizens follow such ideologies. As an alternative to an ideological world view, we will then examine the concept from psychology known as the, "schema," and we will discuss how schemata affect political perceptions. Finally, we will discuss how even so-called experts are subject to errors in judgment based on their assumptions about the world. This is a University Seminar, so the class will also set aside time to discuss writing. The schedule has several sessions set aside for writing instruction (labeled, writing day or, writing week). On these days, class will be led jointly by the professor and the writing liaison to discuss writing technique. For most of these sessions, you will be asked to participate in a writing exercise, to be discussed immediately afterwards. For some sessions you will be asked to bring in outlines, thesis statements, sample paragraphs, or other preparation work for course assignments. You will be informed the week prior when you will need to bring such a sample to the writing session. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSO, FSCC, FSNA, FSSY or FSCS. Prereq or Coreq: FSTS 100.

USSO 285S. Correspondence. 3 Units.
Correspondence will look at the practice of writing and reading letters, and explore the use of letters as biographical, historical, and forensic evidence. Students will read love letters, "Letters to the Editor," letters from the battlefield, and correspondence between scientists and theologians. We will gain access to the experience of tourism through post cards, and the world of the modern corporation through business letters, emails and text messages. We will read examples of fiction where the letter acts as a plot device, as in the epistolary novels of the 18th century. We will think about the function of the letter as an instrument of persuasion, as an opportunity to develop ideas in a private and informal manner, and as a forum for expressing emotion. In addition, we will study the communication systems and technologies, such as the post office, the telegraph, and the internet, that have facilitated, and changed the nature of, correspondence throughout history. Students will be asked to write letters based on their personal experiences and their political opinions, and write analytical essays based on topics related to the practice and history of correspondence. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSO, FSCC, FSNA, FSSY or FSCS. Prereq or Coreq: FSTS 100.

USSO 285T. Why We Believe Weird Things. 3 Units.
How, in such a skeptical age, can people maintain questionable beliefs regarding urban legends, alternative medicine, superstitions, and paranormal phenomena? How do cults manage to attract and maintain large memberships? How can so many seemingly normal people come to the conclusion that they have been abducted by aliens? We will explore the idea that these behaviors are not examples of pathological thought processes, but rather natural consequences of the biases that characterize everyday reasoning. Emphasis will be placed on critical examination of questionable phenomena with a goal of understanding why people might want to hold such beliefs. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSO, FSCC, FSNA, FSSY or FSCS. Prereq or Coreq: FSTS 100.

USSO 285V. Travel Literature in the Age of Discovery. 3 Units.
The discovery of the Americas in the 15th century challenged European constructions of the known world and tested assumptions about nature, culture, and the workings of intellectual inquiry. Although before 1492 Europeans traveled, they usually read new landscapes in light of familiar religious paradigms. The discoveries forced Europeans to draw the world anew, literally and metaphorically. Students will read works of travel fiction and real-life travelers’ tales, and will address the following questions: how did travel literature reflect successive discoveries? What new maps (geographical or metaphorical) did this literature help draw? How did the discoveries bear on literary genres? After a brief foray into medieval literature, students will read The Tempest, Oronoko, excerpts from The Persian Letters, excerpts from Gulliver's Travels, Robinson Crusoe, Candide, and A Sentimental Journey. Additionally, students will read brief accounts of actual travels. Students will write three papers and prepare presentations on topics such as pilgrimage routes, map making, the search for longitude, and America in the visual arts. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSO, FSCC, FSNA, FSSY or FSCS. Prereq or Coreq: FSTS 100.
USSO 285Y. Quest for Perfection: Law as a Vehicle for Social Improvement. 3 Units.
Americans often seek to use U.S. law to create "fairness" and "civility"--in a world that can sometimes be brutal and fundamentally unjust. Increasingly, we rely on courts and statutes to "fix" identified social problems and to achieve a more just society. This course will examine our reliance on law to improve human behavior and to achieve social goals. Can statutes and lawyers lead the way to a better world? What are the limits (if any) of our ability to improve society by passing new laws and mandates? Are there unforeseen, negative consequences that arise from our legal efforts to improve public and personal behavior? This course will examine those questions in the context of selected social issues. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSO, FSCC, FSNA, FSSY or FSCS. Prereq or Coreq: FSTS 100.

USSO 285Z. Mastering the Masterpiece: Looking Closely at Great Works of Visual Art. 3 Units.
Masterpiece: This oft (ab)used epithet, applied to everything from a pre-schooler’s finger painting to a Picasso portrait, suggests a creative enterprise of unrivalled achievement and quality. Using some of the finest examples of human creative expression--specifically, work on view at the Cleveland Museum of Art--this SAGES seminar will celebrate, critique, and question the "masterpiece" designation. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSO, FSCC, FSNA, FSSY or FSCS. Prereq or Coreq: FSTS 100.

USSO 286E. Global Tourism. 3 Units.
Tourism can be viewed as a metaphor for contemporary existence in an increasingly globalizing world where attachments and ties to a concrete place are often temporary. Besides capturing the essence of present-day mobility, tourism is a phenomenon that can be researched both politically and economically. Indeed, 10 percent of global GNP comes from tourism and many poor countries rely on the tourism industry to sustain national economic development. In this class, we will touch on the economic and political significance of tourism, but will spend most of our time thinking of what happens in the tourist encounter, what tourists expect, what drives them, and who loses as well as benefits in the encounter. Some of the specific themes include: the nature of tourist destinations, quest for authentic sites, entertainment tourism (Disneyland, Dracula-Park), tourism to Auschwitz, culinary tourism, sex tourism, and eco-tourism. By reading theoretical works, travel blogs, and literature, we will gain insight to the motivations of tourists, the inhabitants of the places being visited, and international organizations as well as governments who oversee this industry. Prereq: 100 level first year seminar in USFS, FSCC, FSNA, FSSO, FSSY, or FSCS. Prereq or Coreq: FSTS 100.

USSO 286F. Environment and Civic Culture in the Developing World. 3 Units.
Can the fight against environmental degradation lead to an improved civic culture and political reform in developing nations? Developing nations typically sacrifice environmental protection in favor of economic development. Only when the costs of environmental degradation become obvious do nations consider a sustainable development regime that includes environmental protection. This seminar addresses whether implementing a sustainable development model requires a new civic culture that encourages political reform. In doing so, students will examine and write about literature on economic development, environmental degradation, and several international initiatives that encourage reforms to aid sustainable development. The seminar will use the People’s Republic of China as a case study, but will also draw on evidence from other developing countries. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSO, FSCC, FSNA, FSSY or FSCS. Prereq or Coreq: FSTS 100.

USSO 286G. Race in the Americas. 3 Units.
This course examines the history of race relations in the US and Latin America. Its premise is that modern race relations are not only the legacy of a distant slave past, but also the product of continuous cultural and political readjustments to new times and conditions. The class starts by examining the colonial development of race-based political and economic system in the Americas. It continues by exploring how racial hierarchies were re-created as nations in the Americas went through enormous political and economic changes in the 19th and 20th centuries. Students will conduct a small history research project on how race relations have affected a person, institution, city or neighborhood’s history. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSO, FSCC, FSNA, FSSY or FSCS. Prereq or Coreq: FSTS 100.

USSO 286I. Society through Online Videos: The Broadcast of the Self. 3 Units.
In this course we will discover and explore the interrelationships of self, technology, and society in the 21st century through digital video on the internet. We will watch online videos and read about social theory as part of a rigorous examination of media and society. This course will examine the intended and unintended consequences of mass information sharing and communication via online video. Students will work with the seminar leader and build upon existing academic knowledge to extend their understanding of the structure and meanings inherent in our video-active lives. In addition to completing regular writing assignments, students will learn about digital video production and produce a short digital video essay. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSO, FSCC, FSNA, FSSY or FSCS. Prereq or Coreq: FSTS 100.
USSO 286J. Women's Education at CWRU: The Flora Stone Mather Oral History Project. 3 Units.
This seminar will offer a discussion-based exploration of the history of women's education in America. Much of the discussion will focus on the emergence of coordinate colleges, including the College for Women (later renamed Flora Stone Mather College) at Western Reserve University. The seminar will also give students an opportunity to contribute to the historical literature by conducting interviews with Flora Stone Mather alumnae. Students will be instructed in the basic principles and techniques of oral history and engage in the creation of primary source materials—tapes and transcriptions—essential for historical documentation. They will then reflect on the relationship between the stories they have collected and the present-day educational experiences of women at Case Western Reserve University. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSO, FSCC, FSNA, FSSY or FSCS. Prereq or Coreq: FSTS 100.

USSO 286L. Exploring Non-Profit Organizations. 3 Units.
This seminar is structured to expose students to the opportunities and challenges of working in and running non-profit organizations. Students will explore the importance and significant roles non-profit organizations play in our society. The class will learn how non-profits are organized and regulated and the importance of the organization’s mission is to determining the impact of the non-profit organization in the community. Additionally, the students will learn how non-profits are funded and how these organizations maintain their financial stability and sustainability in the community. These goals will be accomplished through group analysis of non-profit organizational principles, and investigation of existing non-profit organizations. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSO, FSCC, FSNA, FSSY or FSCS. Prereq or Coreq: FSTS 100.

USSO 286M. Hip-Hop Narrative in Film. 3 Units.
This course explores films of the Hip-Hop Generation and, by presenting certain films in chronological order, draws out the common threads. Hip-Hop culture is a conversation, an argument between the have-nots and the rest of us. The goals and objectives of that conversation have evolved and changed in timbre and urgency. Tracking that dialog through the late 60s, the post-civil rights era, the emergence of the b-boy, Reaganomics, and the rise of the new Black middle class helps us to get a better look at where it is and where it’s going. By isolating the stories told by filmmakers within a certain period and then analyzing their place in the larger Hip-Hop narrative, the instructor and the students can infer truths about the politics and zeitgeist of the times in which the film works were conceived. This course will consist of lots of film, yes, but also lots of reading and writing. Upon successful completion, the student should be able to recognize and define the Hip-Hop narrative in popular cinema, focus critical thinking skills, pull the narrative from certain films and discuss it, note and discuss the visual aesthetic and how it impacts the story, and discuss the marketing, packaging, and cultural impact of the Hip-Hop narrative. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSO, FSCC, FSNA, FSSY or FSCS. Prereq or Coreq: FSTS 100.

USSO 286N. Nazi Art Theft and Its Aftermath. 3 Units.
During World War II the German government perpetrated one of the most egregious and extensive art thefts in the history of human kind. The Nazi party’s desire to gain control of Europe involved their prolific confiscation of the great art treasures of European public and private collections, particularly those belonging to European Jews. This seminar will explore the Nazi’s deliberate war looting campaign, its aftermath, and the current issues surrounding the reclamation of stolen works and the restitution claims yet to be settled. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSO, FSCC, FSNA, FSSY or FSCS. Prereq or Coreq: FSTS 100.

USSO 286O. Place, Religion, and Public Life. 3 Units.
What is the place of religion in everyday life? How do people contend with conflicting beliefs about the proper relationship between religion, politics, and personal conduct? How do they decide which kinds of religious behavior belong in public and which belong in private? How do they decide what counts as a “private” or “public” place to begin with? Where does religion belong? In this seminar, students will explore these questions at a range of scales, from the local to the global. They will ask how secular and religious thought interact to shape social life in a range of material and virtual spaces, from Case to Facebook. In so doing, they will learn to approach the religious/secular divide from a broadly ethnographic perspective. Focusing mostly on the United States but also considering case studies from other parts of the globe, students will examine how diverse groups practice their faiths, express their beliefs, and contend with secular institutions and expectations in everyday life. Coursework will include trips to local neighborhoods and institutions, readings from a broad range of fields in the social sciences and humanities, and a fieldwork-based research paper. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSO, FSCC, FSNA, FSSY or FSCS. Prereq or Coreq: FSTS 100.

USSO 286P. Immigrant Entrepreneurs—Can They Drive Cleveland’s Economy Once Again?. 3 Units.
This seminar will focus on the impact of immigrant entrepreneurs in Cleveland—past, present and future. The class will take a look back at the historic contributions immigrant entrepreneurs played in creating economic prosperity in Cleveland during the 20th century. While immigrant entrepreneurs once played a central role in driving Cleveland’s economic success, in recent years the city has attracted much less foreign talent than other faster growing U.S. metropolitan areas. Cleveland’s population is at its lowest level since 1903 and continues to shrink. Chicago, Philadelphia and Louisville, among other cities, have embarked on efforts to attract foreign talent to not only address the “brain drain” of young people leaving their cities but also to spur economic development. In a March 29, 2009 editorial, The Plain Dealer argued for a more proactive approach in Cleveland to attract foreign talent: “If Cleveland is to regain (its) lofty status—especially in a global economy that rewards intelligence, creativity and innovation—it needs to re-establish itself as a magnet for new Americans. We need their fresh ideas, entrepreneurial zeal and optimism. We need them to help reverse decades of migration away from the region’s urban core.” The culmination of the seminar will examine the question of whether Cleveland should proactively recruit foreign talent and look closely at the public policy, regulatory and political challenges that must be overcome in order to effectively do so. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSO, FSCC, FSNA, FSSY or FSCS. Prereq or Coreq: FSTS 100.
USSO 286Q. History of Late 20th Century Popular Culture. 3 Units.
This course focuses on American popular culture of the late twentieth century (c. 1970 to 2001). Students will analyze this period using a variety of historical texts and primary sources (everything from more "traditional" sources such as printed materials to films, television episodes and clips, music and sound lyrics, fanzines ["zines"], graphic novels, and music videos). Secondary sources include history essays and monographs, as well as articles by scholars employing critical theory. Students will explore whether "products" of popular culture perpetuate power structures and help to shape the discourse of late twentieth century American culture. Moreover, they will examine how individuals contribute to and challenge the discourses as consumers and creators of pop culture. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSO, FSCC, FSNA, FSSY or FSCS. Prereq or Coreq: FSTS 100.

USSO 286S. Mystics, Inquisitors, and Deviance in the Early Modern Spanish World. 3 Units.
What role does religion play in constructing social norms? Does religion function primarily to enforce social conformity and maintain the status quo, or does it give a voice to protest and dissent from marginalized individuals and groups? Within the Christian tradition, these questions have transcended time and place. This course explores these questions in the context of sixteenth-century Spain. Similar to contemporary American society, sixteenth-century Spain seemed to encourage religious fervor, but did not tolerate religious figures or groups that threatened the status quo. During this time, Spain experienced an explosion of individuals who claimed to have direct experiences of the divine, and authorities invested much time and energy to differentiate between authentic, orthodox mysticism, and fraudulent heresy. In the last 40 years, social theory has allowed historians to unlock the relationship between religion, gender, authority, and social structure. These issues are at the forefront of contemporary approaches to sixteenth-century Spanish mysticism, as the vast majority of individuals claiming mystical experiences were women. Even those who were judged to be orthodox had voiced strong criticisms of Spain's church and government while alive, but after death were celebrated for their obedience. We will examine a variety of media that represent mystical experience in Spain's Golden Age, including: short stories, autobiography and biography, mystical texts, inquisition trials, and works of art. Additionally, we will encounter how the legacy of Golden Age Spanish mysticism has been transmitted to our own time in historical narratives and film. Thus, the goals of this course are twofold. Students will learn to employ a contemporary academic lens and gain understanding of a historical context that is both similar to, and different from, our own. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSO, FSCC, FSNA, FSSY or FSCS. Prereq or Coreq: FSTS 100.

USSO 286U. Ideal Communities, Utopian Visions, and Totalitarian Nightmares. 3 Units.
This course will study communal attempts to form ideal societies and will offer a transcultural, transhistorical view of how various authors and filmmakers have imagined the best and worst possibilities of human society. Its central questions are: How can society be improved? What role does education play in improving society? How do you define freedom? How can we combine freedom with social order? How can social problems be critiqued through representations of ideal or dysfunctional societies? The course will be interdisciplinary by combining historical study with analysis of literature, film, art, and music. In studying and discussing utopian communities, students will examine the problems that each community attempted to solve, their philosophical approach to solving these problems, the success or failure of their solutions, and the similarities and differences among these communities. In studying utopian and dystopian literature and film, we will analyze the problems and solutions that each text or film examines and proposes, and will look at each text or film in its social and historical context. We will also explore how authors and filmmakers have used their utopian and dystopian visions to respond to the positive or negative trends in their own societies. In addition, we will discuss how each text or film coincides with or challenges our perceptions of the strengths and problems in our society and how we might solve those problems. This course will encourage students to think about the kind of world they would like to help bring about, as well as the various social problems that may darken the future of the human race. Students will write in class regularly about these issues as well as the assigned readings that raise these issues, and will write essays about ideal communities, utopian texts, and dystopian texts. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSO, FSCC, FSNA, FSSY or FSCS. Prereq or Coreq: FSTS 100.

USSO 286V. Management of Chronic Illness in a Cultural Context. 3 Units.
This course will explore the cross cultural, self-care approaches to health problems. It covers substance-based (e.g., herbs, acupuncture), mind-body (e.g., yoga, qigong), spiritual (e.g., prayer) and social (e.g., communal, family) approaches that have been used to manage chronic diseases and promote wellness in various cultural settings. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSO, FSCC, FSNA, FSSY or FSCS. Prereq or Coreq: FSTS 100.

USSO 286X. The Future of News. 3 Units.
The saying goes, "Strong Press, Strong Democracy." But what of strong democracy in the Internet Age when the traditional press seems weak? That's this seminar's big question. Can the "old" media, struggling to avoid financial collapse, still deliver the news necessary to be democracy's watchdog, as in the past? Can the new internet media--blogs, YouTube, viral videos, "hyperlocalism" experiments, pro publica investigations, crowd sourcing, instant news, Facebook, Gawker, True/Slant, Drudge and the proliferation of the other news and entertainment sources--take its place or complement traditional journalism? How do these new entrants change the nature of news and the role of the media in our society? These are uncharted developments, but they go to the heart of the continued success of America's democratic experiment. Our goal is to grasp more clearly the connections between news, citizenship and democracy in this new age. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSO, FSCC, FSNA, FSSY or FSCS. Prereq or Coreq: FSTS 100.
USSO 286Y. The Holocaust and Local History. 3 Units.
The Holocaust and Local History will focus on how the events that make up the Holocaust affected communities in both Eastern Europe, where the most horrific crimes of the Holocaust occurred, and in the United States, where the Jewish community responded to the events with both astonishment and action. A focus on local histories will illustrate the legacy of the Holocaust and help students understand how history directly affects their own lives and the lives of those around them. The goal is to uncover the role that this complex history continues to play in our daily lives, whether in the small towns of Eastern Europe or the suburbs of greater Cleveland. Topics will include the course of the Holocaust in towns in Eastern Europe, the effects of the Holocaust in American communities like Cleveland, and the commemoration of the Holocaust and memory of local Jewish communities in Eastern Europe. Students will examine these topics with the help of primary and secondary sources, hear from local survivors of the Holocaust, and learn more about how the Holocaust is represented in local museums. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSO, FSCC, FSNA, FSSY or FSCS. Prereq or Coreq: FSTS 100.

USSO 287B. Migration in Human History. 3 Units.
The movements of individuals and groups, along with the ideas, technologies, and diseases that accompanied them, have played an integral role in shaping human history. Migration has continually created, challenged and shaped societies from the most ancient periods through to the present. It has a transformative effect on communities at the points of origin, along migration routes, and at temporary and final destinations. This seminar will introduce students to several different ways of thinking about migration throughout history, from the contacts between nomadic and settled societies, to colonial settlement and diasporas and migration from rural towns and villages to industrial cities, as well as the ongoing mobility at the highest and lowest levels of modern society. Indeed, many contemporary conflicts of class and culture can be traced back to migration, in the interactions between those seen as migrants and those who consider themselves natives. This seminar will also encourage students to consider the importance of different forms of migration in their own lives, in the histories of their families, and in the city around them. Cleveland is a city founded by migrants from Connecticut (hence the ‘Western Reserve’ in the name of the university), populated by both transatlantic and internal American migration, and shaped by the local migrations that affected ethnic neighborhoods, suburbs, and smaller towns throughout the region. Compared to historical migrations of thousands and millions of people, such movements may seem minor, but they can be studied and understood in similar terms. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSO, FSCC, FSNA, FSSY or FSCS. Prereq or Coreq: FSTS 100.

USSO 287C. Murder in the Jazz Age. 3 Units.
Having lived through the devastation and consequences of World War I, you might think that Americans would have been appalled by the violent murders that marred the 1920s. To be sure, they were. Americans were also drawn to the infamous murders as though understanding these crimes would enable them to explain the changes in society, such as changes to gender rules and urbanization, brought about and accelerated by the war. In this class, we will examine the major crimes of the decade in the hopes of gaining the insight that the people at the time sought. The course readings include secondary sources that provide an analysis of the decade and primary sources from the murder cases themselves. In addition, students will become familiar with the historical context and scientific advancements that gave birth to modern forensics. A tentative list of cases to be discussed includes: Sacco and Vanzetti, William Desmond Taylor, Ruth Snyder, and the St. Valentine’s Day Massacre. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSO, FSCC, FSNA, FSSY or FSCS. Prereq or Coreq: FSTS 100.

USSO 287O. Utopia and Social Change in American Fiction. 3 Units.
In this course we will read American utopian fiction alongside selections from other academic disciplines in order to consider the issues, problems, and conflicts for creating meaningful social change. We will consider questions such as: What has it meant/does it mean to imagine a perfect American society? Who is excluded from these visions and on what grounds? How has the radically different social order represented in utopian fiction been used to critique American society’s injustices? In our readings we will think through the ways in which historical perceptions of equality, hope, and political action have been portrayed in imagining ideal communities. We will also examine how academic theories have influenced and reacted to American utopian literature. Our coursework may include essay responses, service learning, and primary research (interviews and surveys), and will culminate in a project in which you will present your vision of a utopian future in a creative form and interpret and explain this “future” through a research paper analyzing the decisions that went into its creation. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSO, FSCC, FSNA, FSSY or FSCS. Prereq or Coreq: FSTS 100.

USSO 287Q. Social Constructs Associated with Marginalization: Making a Difference. 3 Units.
The purpose of this course is to increase the students’ awareness of selected social constructs within the global society (i.e., vulnerability) that have the potential to generate circumstances that place some individuals or groups at risk for marginalization and diminished well-being. The course will be conducted within a seminar format and will provide opportunities for scholarly inquiry and debate regarding the nature of the constructs posited. Students will critique each others’ social constructs with intent to generate innovative strategies to reduce individual and global marginalization. Each student will prepare a formal written report of their findings related to their construct of interest. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSO, FSCC, FSNA, FSSY or FSCS. Prereq or Coreq: FSTS 100.
#### USSY 204. System Thinking. 3 Units.

This is a seminar course in which students critically examine the way language is used to model and analyze the social world and its organizations. System thinking is used by business leaders, economists, policy analysts and planners to represent the socio-economic world so that they can manage it. During the seminar, students will read and discuss key works that lay the foundations of system thinking and will apply system thinking techniques to a socio-economic situation of interest to them. The emphasis will be on questioning the premises of system thinking, surfacing its strengths and weaknesses, and grappling with its ethical implications. Some key ideas related to system thinking that will be explored include: information theory, cybernetics, system modeling, language, meta language, modeling and intervention in social systems. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSY, FSCC, FSNA, FSSO or FSCS. Prereq or Coreq: FSTS 100

#### USSY 205. Religious and Ethical Bodies. 3 Units.

This course focuses on religious and ethical views of the body and embodiment. Among the questions we explore are: Does a particular tradition value or devalue the body? What role does the body play in the actualization of religious and ethical values? How is the body conceived, symbolized, represented, and otherwise disciplined through religious and ethical discourse? We also consider representations of the body in contemporary popular culture and the values these images engender. This class is limited to students participating in SAGES. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSY, FSCC, FSNA, FSSO or FSCS. Prereq or Coreq: FSTS 100

#### USSY 209. Art and Math. 3 Units.

Students in this University Seminar will explore relationships between art and mathematics. Topics include: pattern, symmetry and beauty in natural forms; symmetry and proportion in art, architecture, ornament and design; perspective and optics; number, iteration, and infinity; mathematical and computer techniques and themes in art, architecture and design. Note: This class is limited to students participating in SAGES. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSY, FSCC, FSNA, FSSO or FSCS. Prereq or Coreq: FSTS 100

#### USSY 211. Beethoven and the Age of Revolution. 3 Units.

Beethoven's music is symbolic of the age and spirit of change which reached is zenith with the French Revolution. Fueled by political, social, and emotional reactions, his oeuvre was remarkable in every way. From the early works, imitative of Haydn and Mozart, through his truly unique later compositions, Beethoven was revolutionary in his person and in his music. The course will center around specific Beethoven masterworks which are being presented by University Circle Institutions, and student attendance at these concerts will be required. Class sessions will involve discussions concerning the historical and cultural setting, influences, and analytic investigation into these masterworks. Readings will be taken from Joseph Kaman and Alan Tyson (The New Grove Beethoven), Frida Knight (Beethoven and the Age of Revolution), and George Marek (Beethoven: Biography of a Genius). This course is directed towards the general university student, and no specialized knowledge of music is necessary, although certain rudimentary aspects of musical discourse will be covered. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSY, FSCC, FSNA, FSSO or FSCS. Prereq or Coreq: FSTS 100

#### USSY 215. Learning to See: Architecture and Aesthetics in Context. 3 Units.

From the temples of Dynastic Egypt through the magnificent cathedrals of Europe to your own back door, explore the transformations of the built environment and aesthetics in the context of politics, sociology, biology, and scientific advancements. Investigate the choices we make as a society as we continue to shape our personal and urban environment. Active discussion, critical thinking, local field trips, and thoughtful writing are essential parts of this seminar which attempts to elucidate connections between art, architecture, and the currents that move society. Learn to read the language of stone and steel that is written all around us. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSY, FSCC, FSNA, FSSO or FSCS. Prereq or Coreq: FSTS 100
USSY 219. Everyone’s a Critic: Writing About the Arts. 3 Units.
A practical, reading- and writing-intensive course requiring attendance at local theater productions, films, art exhibitions, classical music concerts, and dance events. Some events will take place off-campus on weekends or evenings. Transportation and tickets will be provided if necessary. Using these events and published materials as fodder for discussion and analysis, students will develop appreciation skills and refine their ability, write and converse critically, accurately, concisely and insightfully about the arts. Writing projects will include short weekly reviews and one longer research paper. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSY, FSCC, FSNA, FSSO or FSCS. Prereq or Coreq: FSTS 100

USSY 220. Digital Storytelling: Creating Meaning with Sight, Sound, & Language. 3 Units.
Storytelling can be a powerful tool to communicate and share experiences, explore meaning, and help people connect to one another. Storytelling bridges age, race, gender, and culture. It explains myth and creates a way to express individual voice. In today’s digital age, there is an opportunity to illuminate, and express our stories with sensory images. Students in this course will learn to tell their own story, create collaborative stories, and understand other viewpoints through the use of digital media. For example, students can hear and record an elderly relative’s journey, digitize photos from the past, and present that story in the context of their own lives. A group of students can explore a myth or past historical event by gathering images (letters, photos, music, art) and through crafting the story. This seminar draws upon students’ creativity, symbolic representation, and personal expression. The tools for crafting stories include written text, multimedia presentation, and learning to verbally tell a story. In each of these venues students will explore ways in which sights, sounds, and language can be used to create meaning. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSY, FSCC, FSNA, FSSO or FSCS. Prereq or Coreq: FSTS 100

USSY 221. Bard to the Bone: The Twenty-First Century Shakespearience. 3 Units.
Why are students still being forced to read Shakespeare? Why does Shakespeare matter today? This course will examine the cultural and linguistic legacy of Shakespeare, paying particular attention to its place in the twenty-first century. Shakespeare, despite his antiquity, is contemporary in the extreme. Shakespeare today is not only a pillar of the academy; he is ubiquitous in Hollywood and has even manifested a presence in the arenas of government and corporate politics. This course will examine Shakespeare’s notoriously challenging language in the same way that we will examine his attitudes toward government, politics, sex, and human relations—by first considering them in the context of his early modern world, and then filtering them through the lens of our own. Is Shakespeare a consummate conservative who believes in the absolute authority of the church and crown, or is he a political radical who wants to uproot the social order? This course will examine those questions in the context of Shakespeare’s time, with its unique cultural and historical perspective, as well as considering them through the lens of our own time. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSY, FSCC, FSNA, FSSO or FSCS. Prereq or Coreq: FSTS 100

USSY 222. Writing Rock and Roll: From the Critical to the Ethnographic. 3 Units.
To write about music is finally an act of translation. When one writes about music, s/he attempts to bring a thing conceived in one symbolic world into another. The task is neither simple nor straightforward. As one musician, fed up with the critics who put pen to paper in the effort to capture his music, put it: “Writing about music is like dancing about architecture.” And for a moment, this musician’s point might seem apt. The experience of music, often intense, is arguably “beyond words.” Why try to tame it by putting it in the cage of language? This course considers the pitfalls and the possibilities of the symbolic translation that is at the heart of writing about music. Focusing on the writings associated with rock and roll culture (1954-2005), the class will consider the multiplicity of approaches and styles used to capture music. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSY, FSCC, FSNA, FSSO or FSCS. Prereq or Coreq: FSTS 100

USSY 222. Probability in Modern Thought. 3 Units.
The idea of probability is ubiquitous in the modern world, appearing in everything from quantum physics to business decision theory, from DNA evidence in court to the insurance industry. Yet there is controversy about the very meaning of probability itself, and any person who encounters probability—which is everyone—should be familiar with that controversy. This seminar examines what we mean by probability assignments. Although there will be some computational work, especially early in the semester, the seminar is not primarily a course on the mathematics of probability. Most of our focus is philosophical, sociological, and psychological, attempting to answer questions like these: In what different ways do we use the concept of probability? To what domains of knowledge can it be rightly applied? Do all legitimate conceptions of probability obey the standard mathematical axioms? How good are people at estimating probabilities? Do all the coherent uses of probability have a common conceptual core? These and other questions will be explored through class discussions and experiments, two papers, and group presentations on a variety of topics. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSY, FSCC, FSNA, FSSO or FSCS. Prereq or Coreq: FSTS 100

USSY 227. Travel Writing on Screen. 3 Units.
Through the image of the traveler in a wide range of films, we will examine such issues as border crossing, culture shock, and the nature of memory. Topics include: The Grand Tour, pilgrimage, exile, and imaginary journeys. A group presentation, 5 short-reaction papers, and a take-home final essay are required. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSY, FSCC, FSNA, FSSO or FSCS. Prereq or Coreq: FSTS 100

USSY 228. Women in Outer Space. 3 Units.
We will study the history of women astronauts and the representation of women as aliens and astronauts in popular culture. We will see films such as Alien, Apollo 13, and Contact, and will also read two novels. Film and women’s studies theory and criticism will be used to examine the texts. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSY, FSCC, FSNA, FSSO or FSCS. Prereq or Coreq: FSTS 100
**USSY 229. Art Mirrors Art. 3 Units.**
At the beginning of the Renaissance, about the year 1400, an important new theme arose in painting, sculpture and printmaking—the theme of art about art. At a time when the status of artists in society was rising, new subjects began to appear in western European art that depicted both the artist and the process of making art. Self portraits of artists, depictions of Saint Luke painting the Virgin Mary, images of women as artists and muses, classical and mythological stories of art making (Pygmalion and Galatea, Apelles painting the mistress of Alexander the Great), depictions of painting and sculpture studios and of art academies and instruction, scenes of art galleries and collections, still lifes about art, all reflected this new cultural interest in art as a topic in itself. This seminar will look at individual works of art and subject types to understand what they tell us about the role of the arts and the changing status of the artist in the Renaissance and early modern period, up to the eve of the French Revolution, about 1789. The works we study will thus be understood as symbolic indicators of social status and ideas about what art meant to European society. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSY, FSCC, FSNA, FSSO or FSCS. Prereq or Coreq: FSTS 100

**USSY 230. Sexuality, Citizenship, and Social Action. 3 Units.**
This course will explore themes in both the symbolic and cultural domains. While sexuality and citizenship, in reality and in academic discourse, cuts across the areas, this course will consider methods and concepts (see syllabus for details) in the human sciences and humanities. In the humanities, students will learn fundamental ideas in the philosophy of social science. They will be taught how to recognize, in social theory(s) and theorizing, underlying arguments: ontological, epistemological, and methodological. It is not our purpose to add these ideas to our conceptual language within a discipline or to a specific topic; we will explore how they can be applied to other areas of learning and practice. They will then be applied to a current and highly controversial aspect of academic and political practice: to explore the relationship between sexuality and citizenship. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSY, FSCC, FSNA, FSSO or FSCS. Prereq or Coreq: FSTS 100

**USSY 235. Towards a New Museum. 3 Units.**
How do you know a museum when you see one? How has our idea of a museum evolved, and where is it going? How do we go from mummies to multimedia? Museums are more popular than ever and include some of today’s most exciting architectural designs. Explore the changing nature of museums as buildings, institutions, and cultural symbols. Uncover controversies in the museum community. Are museums sacred spaces or entertainment—or both? How does the architecture reflect what they are and who built them. Active discussion, critical thinking, local field trips, guests from local museums, and thoughtful writing are essential parts of this seminar. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSY, FSCC, FSNA, FSSO or FSCS. Prereq or Coreq: FSTS 100

**USSY 236. Romance--The Most Comic of Catastrophes. 3 Units.**
From ancient Athens to Hollywood, romantic comedies have enjoyed continuous widespread popularity in the theater. In this course we will read a broad spectrum of romantic comedies, from the genre’s beginnings with the Greek New Comic playwright Menander to the Roman Plautus, and on to Shakespeare. We will also watch a modern romantic comedy, Pretty Woman. We will begin the course with some ancient and modern literary theories of intertextuality and metatheatre that shed light upon the relationship between Comedy and Tragedy. Some questions we will ask in this course are: What’s the historic relationship between Comedy and Tragedy? What’s the connection between sex and comedy? What can Romantic Comedies tell us about the audience that is addressed from the space of the stage or screen? Does laughter depend on personal and cultural values and variables? Does comedy have a personal and social function? Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSY, FSCC, FSNA, FSSO or FSCS. Prereq or Coreq: FSTS 100

**USSY 237. The Transformation of the American South. 3 Units.**
The purpose of the course is to increase the student’s understanding of the remarkable transformation of the American South from an isolated regional backwater committed to racial segregation to a vibrant, complex, rapidly growing, diverse biracial society that has rejoined the national mainstream. In fact, a quick look at where our national political leaders have come from recently—President Bill Clinton of Arkansas and President George W. Bush of Texas, to name the two most prominent examples—indicates how central the South has become to the nation. We will explore all aspects of the transformation of Dixie during our course. Central to the story will be political change, although, of course, politics cannot be easily isolated from social and economic life. Thus, it was a grassroots social development—the Civil Rights Movement—that gave important impetus to the key political changes that occurred in the mid-1960s and beyond, as we shall see. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSY, FSCC, FSNA, FSSO or FSCS. Prereq or Coreq: FSTS 100

**USSY 241. The Birth of the Modern: 1905-1925. 3 Units.**
"The Birth of the Modern: 1905-1925" will attempt to answer the question "What is the modern?" by exploring some of the breakthrough works of literature, music, art, and scientific theory in the first decades of the twentieth century. We will study what characterizes the new modes of thinking or "language" of modernity, developed in experimental work across the arts, the sciences, and the social sciences. We will be examining some of the major manifestos of and statements about the nature of Modernism in order to see how they illuminate, for example, a novel by James Joyce or a painting by Picasso, a composition by Stravinsky, a scientific theory of Einstein’s, or a psychological theory of Freud’s. At the conclusion of the seminar, students will present their findings and write a research paper about "the modern" as it relates to a field of particular interest to them. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSY, FSCC, FSNA, FSSO or FSCS. Prereq or Coreq: FSTS 100
USSY 246. How to Make a Leader. 3 Units.
Leaders are both born and made. Some seem to naturally know what to do and some need to study and practice to gain the necessary skills. Both groups can be successful and it usually requires a combination of natural ability and effort to become the very best. Leaders often point to role models as being important to the development of “natural” or acquired ability. This course is appropriate for both those who are intellectually curious about leadership. The course will be divided into three sections. The first part will involve reading and discussions to explore and identify what leaders are like and what they do. During the second part you will observe leaders in action and talk to them about what they think makes them successful. Some examples of what you may observe will include a surgeon in the operating room (theater), a coach with his/her players, an executive in the board room, a concertmaster with his/her musicians and a judge in a courtroom. The third part of the course will involve readings and discussions during which you will develop a personal approach to the level of leadership to which you aspire. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSY, FSCC, FSNA, FSSO or FSCS. Prereq or Coreq: FSTS 100

USSY 249. Paris: From Revolution to Globalization. 3 Units.
This course explores the history of Paris as it became the center of French national life, international culture and politics in the 19th century and a global city in the late 20th. The course acquaints students with the history of Paris as a dynamic environment deeply influenced by industrializing forces during this period. We will study contemporary writings, art and popular culture economic developments, political and military events, and architectural and engineering projects that have profoundly shaped the city and popular responses to it. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSY, FSCC, FSNA, FSSO or FSCS. Prereq or Coreq: FSTS 100

USSY 250. Medical Narratives. 3 Units.
This course examines the relationship between medicine and narrative by exploring the representational structures and narrative conventions that have been used to understand and communicate the experience of illness, to tell stories about the human body, and to diagnose and treat disease. The course focuses on literary texts (including novels, plays, short stories and memoirs) written by doctors, patients, nurses and creative writers, as well as on medical case histories from different cultures and historical periods. It examines such topics as the uses of narrative in medical practice; the uses of metaphor in conceptualizing and representing disease; the ethical dilemmas posed by medical research and practice; the therapeutic value of narrative; the structural similarities (and historical links) between detective fiction and medical case histories; the imaginative function of illness in literature; the cultural myths and iconography of disease in different historical periods; the representation of physical and mental illness and the human body in language and art, and cultural responses to major health crises such as bubonic plague, syphilis, and AIDS. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSY, FSCC, FSNA, FSSO or FSCS. Prereq or Coreq: FSTS 100

Leonardo da Vinci is often regarded as the Renaissance epitome of the “universal man.” This seminar will help students reach a deeper understanding of Leonardo’s achievements and working methods as an engineer, anatomist, architect, and artist. As our own age moves towards narrow specialization, the myth of Leonardo looms large as an unreachable ideal of “genius.” Yet some contemporary artists and collaborative groups do claim to be a part of Leonardo’s legacy. This seminar will include debate over the relevancy of Leonardo’s example, the success of uniting humanistic and artistic thinking with the latest advances in science and engineering, and the ethical issues of “art” emerging in the fields of robotics and genetic engineering. Students will learn fundamental methods of art historical analysis, formulate ethical positions, and discover some of the basic scientific methods used to analyze and authenticate artworks. The course will begin with historical study, then move to modern applications. In the process, each student will be encouraged to find ways to make Leonardo’s example relevant to his or her own intellectual development. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSY, FSCC, FSNA, FSSO or FSCS. Prereq or Coreq: FSTS 100

USSY 254. Nonverbal Communication. 3 Units.
Our purpose is to explore the nature of nonverbal communications and analysis in several different contexts. Because nonverbal communication is so closely related to emotional processes, we will also become acquainted with basic ideas surrounding communication and emotion. Within this framework, we will discuss and apply a variety of theoretical approaches to understanding this channel of human communication. Upon completion of this course, students will have a better understanding of decoding and encoding nonverbal messages. Additionally, the student will have a thorough understanding of the functions of nonverbal communication in social and rhetorical life. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSY, FSCC, FSNA, FSSO or FSCS. Prereq or Coreq: FSTS 100

USSY 256. Violence and Identity. 3 Units.
One need only look at the “War on Terror” to see the deep relationship between violence and identity. Can violence help to create identities as well as destroy them? By exploring historical and cultural constructions of violence, the processes by which identities are created and maintained through violence come to light. Starting from the assumption that cultural positions are always multiply defined, this course will look not only at contemporary film and print media, but also Renaissance texts such as Marlowe, Malory, and Shakespeare to try and understand how these texts both create identities for their characters and impact our own understanding of ourselves. We will use the comparison of these two cultural moments to explore how different representations of violence impact constructions of identity categories such as race, gender, and class. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSY, FSCC, FSNA, FSSO or FSCS. Prereq or Coreq: FSTS 100
USSY 257. Women and Folklore in the Bible. 3 Units.
From Ishtar to Esther, the Virgin Mary to Mary Madalene, we will examine women in biblical text to determine how these texts came to be, and how their traditional interpretation has shaped images of, and attitudes toward, women in western civilization. Following this line of inquiry, we will examine key distinctions between traditional and academic sense-making strategies to account for differences between traditional and modern visions of womanhood. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSY, FSSC, FSNA, FSSO or FSCS. Prereq or Coreq: FSTS 100

USSY 258. What is Soul? A Cross-cultural Investigation. 3 Units.
Soul food. Soul music. Soulless. No-soul. Over-soul. Who will save your soul? WHAT IS SOUL? Do some people have it while others don’t? Do some things (a song, a chicken wing) have it while others don’t? Can it be lost? Found? Does it live beyond the body, the grave? In this seminar, we will explore the different meanings of soul in different cultural contexts, from the teachings of Moses, Jesus, and the Buddha to the music of Sam Cooke, Zap Mama, and the Black Eyed Peas, from the church to the kitchen to the hospital bed. Co-led by a professor of medicine and a professor of religion, we will be especially interested in how people understand illness and death in relation to ideas about the soul. How do different concepts of soul figure into the ways people make sense of their sickness and mortality? Course requirements include class preparation and participation, weekly short papers, discussion leadership in one seminar session, and a final essay. Three field trips (to the Rock Hall, the VA Hospital, and a good soul food joint) will be scheduled. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSY, FSSC, FSNA, FSSO or FSCS. Prereq or Coreq: FSTS 100

USSY 260. Divisiveness or Dialogue: How We Deal with Difference. 3 Units.
Students in this seminar will explore how the language and images that shape our national discourse contribute to the increasing polarization of American society. What techniques do partisan media manipulators, including politicians, political pundits, bloggers, documentary film makers and televangelists use to shape the perceptions of their audience to reflect an "us vs. them," "good vs. evil" worldview? Students will also learn how individuals like Martin Luther King and Robert Kennedy used language and imagery to draw us together, and we will explore and practice the use of dialogue as a method of non-polarizing communication in discussions of contemporary issues. The primary reading will be "The Argument Culture," by Deborah Tannen, a well-known, linguist, and this will be supplemented with articles on dialogue and social psychology. In addition to these readings, the class will view samplings of recent documentaries, political speeches, print and television punditry. Students will be asked to write several papers designed to help them identify polarizing language and see through its manipulation. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSY, FSSC, FSNA, FSSO or FSCS. Prereq or Coreq: FSTS 100

USSY 264. Censorship and Iconoclasm. 3 Units.
How are new symbols created out of the ashes of the old? In this seminar we explore the history and interpretation of the destruction of images. We will consider several diverse world historical case studies: from Byzantium and the Reformation to Islamic art, the Modernist avant garde, and attacks against monuments during the fall of the Soviet and apartheid ideologies in Russia and South Africa. We will read classic theoretical texts on the question of iconoclasm, and examine the connections between a number of categories of the "Image" that often share symbolic destruction as one of their important aspects: propaganda, pornography, avant-gard art, and censorship. We will also explore how destruction is integral to the creation of new symbols, new ideas, and new ideologies. This seminar is reading-and writing-intensive. It is a student-led reading group whose object is to understand the symbolic life of destructive acts and the destructive life of symbolism. Individual students will be responsible for introducing readings and initiating class discussion several times during the semester. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSY, FSSC, FSNA, FSSO or FSCS. Prereq or Coreq: FSTS 100

USSY 265. Nature Writing: From the Arctic to the Gulf Coast. 3 Units.
From the Galapagos to the Arctic, from the Laguna Pueblo to the barrier islands of Mississippi, the course explores the territory of "nature writing." We’ll read Aldo Leopold’s account of life in a Wisconsin "sand county," a short book nicknamed "the environmentalist’s Bible." With Barry Lopez as our guide and interpreter, we’ll imagine visiting the frozen tundra. In a memoir of life with the artist and nature writer Walter Anderson, we’ll ponder the limits of passion and sacrifice. Through reading a poetic novel by Leslie Marmon Silko, we’ll experience an unforgettable vision of a journey toward salvation and harmony. Additional readings include essays, poems, and other short works, plus a survey of commentary from interdisciplinary fields like environmental ethics; ecocriticism; feminism; and biography. We’ll visit Cleveland nature centers and museums, and we’ll hope to have a few guest speakers. After several short assignments (both written and oral), each student’s individually designed research project will recommend a specific means of integrating nature writing into the activities of a local organization or school. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSY, FSSC, FSNA, FSSO or FSCS. Prereq or Coreq: FSTS 100

USSY 266. Writing Difference. 3 Units.
How does one attempt to understand people who seem radically different from oneself? This is a question that fiction writers and anthropologists grapple with in different ways. In this course, we will examine how difference is performed in a variety of texts ranging from ethnographic studies to science fiction. By juxtaposing fiction with ethnography, we will explore the history and interpretation of the destruction of images. We will consider several diverse world historical case studies: from Byzantium and the Reformation to Islamic art, the Modernist avant garde, and attacks against monuments during the fall of the Soviet and apartheid ideologies in Russia and South Africa. We will read classic theoretical texts on the question of iconoclasm, and examine the connections between a number of categories of the "Image" that often share symbolic destruction as one of their important aspects: propaganda, pornography, avant-gard art, and censorship. We will also explore how destruction is integral to the creation of new symbols, new ideas, and new ideologies. This seminar is reading-and writing-intensive. It is a student-led reading group whose object is to understand the symbolic life of destructive acts and the destructive life of symbolism. Individual students will be responsible for introducing readings and initiating class discussion several times during the semester. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSY, FSSC, FSNA, FSSO or FSCS. Prereq or Coreq: FSTS 100
USSY 267. Medieval Love Songs: Poetry, Music, Spirituality. 3 Units.
In the high and late Middle Ages (c1100-c1450), love songs accounted for much of the poetry and music composed at the secular courts and urban centers of Europe. At the same time, spiritual love songs were an important element of medieval Christian theology and worship. What may surprise a modern audience is that the worldly love songs were often intensely spiritual, while the religious ones were often highly sensual and erotic. This seminar investigates the convergence of worldly and spiritual elements in the poetry and music of medieval love songs. Students will learn basic tools for analyzing medieval poetry and music, and through such analysis, coupled with discussion of readings from the scholarly literature, they will explore the provocative interactions between literal and allegorical, sacred and profane, and ascetic and erotic elements in medieval culture. Primary texts will be drawn from Bernard of Clairvaux's commentaries on the Song of Songs, the courtly lyrics and melodies of the troubadours and trouvères, and the lyric poetry of Dante, Petrarch, and Boccaccio. No prior musical training required. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSY, FSCC, FSNA, FSSO or FSCS. Prereq or Coreq: FSTS 100

USSY 269. The Symbolism of Evil. 3 Units.
The tapestry of history is replete with the irrational, complex, and hidden motives, genius, madness, deeds of religious inspiration, frenzy, and devotion. From the Slaughter of the Innocents, to the Crusades, to the rise of the Third Reich, we know evil from violence and destruction, from insidious and malicious acts, from immoral choices and the sting of conscience. But is evil what one intends to do, or is evil what happens when we remain ignorant, apathetic, unconcerned, or just follow orders? Do we define evil according to religious inspiration or by what frightens us? Tribal religions often conceive of evil as taboo, pollution, and dangerous magic. Religion in the Western tradition has alternately defined evil as the breaking of covenants, straying from the path of God, sinful acts, and malicious thoughts. Kierkegaard experienced evil as the experience of dread at one's finiteness and nothingness. This course will attempt to understand evil as the symbolization of human fear, rage, shame, and suffering. Readings will bridge anthropology, psychology, sociology, and history to delve into the nature of the human encounter and imagination of evil. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSY, FSCC, FSNA, FSSO or FSCS. Prereq or Coreq: FSTS 100

USSY 273. Intellectual Property: Pirates and Privateers. 3 Units.
We take it for granted that our cars and camels are our “property” but what about intangible objects like poems or songs on CDs? In this seminar we will examine the development of this relatively recent form of property through the lens of piracy. We will begin with piracy on the high seas. Through analysis of historical, literary, and cinematic representations of piratical activity in the early modern era we will develop a critical methodology to aid us when we turn our attention to the newer “intellectual” property. Intellectual property is rapidly becoming the linchpin of the burgeoning global “information economy,” and the U.S. is among its staunchest and most powerful enforcers. Yet only a century ago the U.S. was itself a pirate nation. After examining this piratical moment in the history of intellectual property we will turn for comparison to a selection of present-day transgressions--from peer-to-peer file sharing, to Asian software and CD/DVD bootlegging, and South American patent busting. Our aim will be to develop an informed position in the current public debate about the legitimacy and limits of private ownership of ideas in our globalizing information economy. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSY, FSCC, FSNA, FSSO or FSCS. Prereq or Coreq: FSTS 100

USSY 275. Colors, Capes, and Characters: American Comics Symbolism. 3 Units.
The history of the comic book is a vital site for critical questions about intersections of art and popular culture in America. In this course we will not simply read “funny books,” but will examine a genre that is as unique as its many colorful protagonists: from Popeye to Superman, Wonder Woman to the X-men, comics have given us larger-than-life characters who are often caricatures of dominant (and sometimes subversive) American ideologies. We will learn not only the history of this unique genre, but will interrogate what it means to truly read comics artistically, politically, culturally, and symbolically. At heart, reading comics in an exercise in interpretation: given visual symbols, what meanings can we take from them? What can comics tell us? And how can we write about them in intelligent, critical ways? In this course we will learn to approach comics through critical thinking strategies; that is, questioning what they are, what they say, and where they come from. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSY, FSCC, FSNA, FSSO or FSCS. Prereq or Coreq: FSTS 100

USSY 278. Cognitive Estrangement: Science Fiction and Otherness. 3 Units.
The idea of estrangement or alienation is seen as being central to science fiction; after all this is a genre that explores worlds that are different from ours. However, influential theorists of the genre have made the claim that science fiction offers ways of representing the present while appearing to be focused on the future. According to Darko Suvin’s classic definition of science fiction, a tension between cognition and estrangement is built into this genre. The alien worlds of science fiction are perhaps not that strange and distant from our own, even when they seem to be on the surface. In this seminar, we will read a variety of science fiction texts in order to explore the idea of cognitive estrangement that is crucial to these narratives. We will also attempt to situate these narratives in specific historical and cultural contexts. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSY, FSCC, FSNA, FSSO or FSCS. Prereq or Coreq: FSTS 100

USSY 279. Navigating Contemporary Art. 3 Units.
Art has always had a shifting, complicated relationship to the general public. In today’s world, contemporary art is sometimes regarded as a detached, self-reflexive, and elite mystery reserved for in-the-know connoisseurs and aspiring scene-makers. Yet there are many points of entry for meaningful dialogue about the art, the artists, and the audience that comprise the world of contemporary art. This seminar will explore the critical and cultural contexts that can help foster this conversation. It will include visits to local museums, galleries, and artists’ studios, and culminate in a tour of the Progressive Art Collection. The goal of the seminar is to inspire a genuine interest in contemporary art and provide students with the tools required to think, speak, and write more clearly about it. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSY, FSCC, FSNA, FSSO or FSCS. Prereq or Coreq: FSTS 100
USSY 280. Passport to Eastern Europe. 3 Units.
Images and texts shape rather than merely reflect the world and its geopolitical structures. Novels, films, and myths make significant contributions to the varied ways that people make sense of continents, nations, and other (often too conveniently used) geopolitical categories such as the East and West. After considering the ways in which the European continent has been imagined over the centuries, we will explore texts and films that have contributed to the invention of East Central Europe and the Balkans and continue to shape our understanding of the eastern parts of Europe. The class will include analyses of current news coverage of this area to unpack representations disseminated by the media and to reflect on the forces that aim to shape our understanding of geopolitical entities. Ultimately, the course hopes to address geopolitical assumptions, evaluate cultural contexts, and help you think critically about the constructed nature of geopolitical categories. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSY, FSCC, FSNA, FSSO or FSCS. Prereq or Coreq: FSTS 100

USSY 281. Defining the Animal. 3 Units.
Since the Darwinian revolution of the mid-nineteenth century, the relationship between humans and animals has become an increasingly significant area of inquiry in fields as diverse as literature, the fine arts, anthropology, evolutionary theory, the biological sciences and philosophy. In this course, we will explore the way humans have sought to understand and explain the animal, beginning with several contemporary ethical debates surrounding animal treatment. Such works will lead us to a range of related social and institutional places and practices, such as the zoo, the insane asylum, biometrics, the treatment of women, and the concentration camp. At the same time, we will examine the way artists, writers and filmmakers explore the human/animal divide through painting (Franz Marc, Marc Chagall and Max Ernst), literature (Franz Kafka, D. H. Lawrence and Rainer Marie Rilke), and cinema, through representations of a donkey (Bresson, Au hasard Balthazar), a fly (Cronenberg, The Fly), a Great White shark (Spielberg, Jaws) and a grizzly bear (Herzog, The Grizzly Man). We will end with J.M. Coetzee’s The Lives of Animals, which moves seamlessly between moral philosophy and literature, tying together a wide variety of concerns and themes raised throughout the semester. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSY, FSCC, FSNA, FSSO or FSCS. Prereq or Coreq: FSTS 100

USSY 283. Popular Culture, Collective Memory, and History. 3 Units.
In this seminar, we will investigate how popular culture reflects and shapes our understanding of the past. In the process, we will explore the interplay between history, popular culture, and collective memory. Examples of the questions we will ponder throughout the semester are: What is popular culture and how does it shape and reshape our grasp of history? Is there a difference between collective memory, historical memory, and “plain” history? Any number of possible case studies could help us answer these questions. We may look at how successive generations of Japanese anime writers have reinterpreted the nature of the Pacific War; how movies and television shows have influenced or reflected changing understandings of the Roman Empire; or how “The Simpsons” has asserted a coherent historical interpretation of the 1980s in the United States. What we read and discuss in the seminar will depend on the research topics you propose; you may choose a particular historical event, personage, or controversy, or a specific pop cultural medium Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSY, FSCC, FSNA, FSSO or FSCS. Prereq or Coreq: FSTS 100

USSY 284. The Art of Madness. 3 Units.
Taking a historical approach, this course will examine the relationship between the evolution of social and medical attitudes toward mental illness and fictional representations of madness in literature. Beginning with the early modern period, students will compare period sociological and medical narratives on mental illness to fiction works with representations of madness. In so doing, students will consider how the interactive dynamics of art and science contribute to cultural and social thought. Specific areas of inquiry will include: the development of psychology and its effect on societal perceptions of mental illness; cultural developments that occurred in response to changing perceptions of mental illness over the centuries; and the use of representational structures and narrative conventions in understanding and communicating the experience of mental illness. Other interrogations will include the imaginative function of mental illness in literature (e.g., melancholy’s role in creativity); the cultural myths in iconography of mental illness in different historical periods; and ethical dilemmas regarding mental illness as reflected in both medical and literary narratives. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSY, FSCC, FSNA, FSSO or FSCS. Prereq or Coreq: FSTS 100

USSY 285C. Conviction and Fiction. 3 Units.
How do our beliefs shape who we are? How do they shape how we tell others who we are? What can fiction tell us about our beliefs and about ourselves? This seminar will explore how authors reflect their beliefs through their writing--how fiction becomes a form of self expression, particularly of worldview, even when that is not the intent. Students will analyze 20th century fiction and the religious, cultural or psychological texts which influenced that fiction. Students will also be encouraged to think about how their own writing is influenced by belief systems, and to explore how our convictions cannot help but affect our writing and the way we understand our minds, our live, our inner selves. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSY, FSCC, FSNA, FSSO or FSCS. Prereq or Coreq: FSTS 100

USSY 285D. The World of African Literature. 3 Units.
In this seminar, we will look at how a diverse number of African writers have responded, in both form and content, to three periods in Africa’s literary history: the 1960s, or the decolonization period, which produced nationalist literature; the 1970s and 1980s, or the neocolonial period, which produced revolutionary novels; and the 1990s through the present, a period producing literature that contends with globalization. In an attempt to answer the riddle of what makes an African novel African, we shall grapple with fundamental questions concerning the origin of the novel; how it came to Africa; African literary traditions; and the language of the African novel. We will also use African literature to explore universal questions about politics and literature: What is a protest novel? What is the role of the writer and of art in society? The goal of the seminar is to increase your appreciation of African literature and literature in general, and at the same time sharpen your analytical, critical, oral and written skills. You will be expected to lead discussions, engage in peer critiques and, through scholarly essays, engage African literature. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSY, FSCC, FSNA, FSSO or FSCS. Prereq or Coreq: FSTS 100
USSY 285F. Embattled Images of War. 3 Units.
Throughout history, from Pompeii to Abu Ghraib, images of war have captivated, inspired, shocked, and repulsed viewing audiences. As historical reflection, propaganda, documentation, a call-to-arms, a plea for peace, and/or personal creative expression, many of these images are fraught with controversy, questions of intentionality, integrity, and multiple agendas. From Pollaiuolo to Ken Burns, this course will examine how artists have confronted large-scale human conflict over the centuries in paintings, sculptures, and prints, photographs and film as a way to consider the cultural and historical effect of war images within and outside the original context in which they were produced. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSY, FSCC, FSNA, FSSO or FSCS. Prereq or Coreq: FSTS 100

USSY 285H. Renaissance Figures. 3 Units.
This course explores the period of European history from 1400 to 1600. Is this period better understood as the Renaissance, the "rebirth" of Antiquity, or the Early Modern Period, the emergence of a world that leads directly to our own? We will look at the period and its famous figures from two different perspectives: Machiavelli in a bio-intro and in his work, The Prince; Luther as history's first best-selling author (the importance of the printing press) and in John Osborne's play; Elizabeth I in a short biography and a recent "Hollywood" bio-pic; Galileo in the historic accounts and in Bertolt Brecht's play; Joan of Arc in a short biography and Bernard Shaw's play; and Hamlet, the play and the character, in text and performance. Do the two different representations present two different people (characterizations) or a unified composite that we understand in greater depth? Do Shaw, Brecht, and Osborne depict three figures from the period to understand better the person, the history, or the 20th Century/Modernity? Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSY, FSCC, FSNA, FSSO or FSCS. Prereq or Coreq: FSTS 100

USSY 285I. Representing the Immigrant. 3 Units.
For many the world over AMERICA is a dream, a powerful myth, whether imagined through TV and movies, metaphors such as The Gold Mountain, or as symbolized by the Statue of Liberty. Following those visions may lead to success or disenchantment or both. Through fiction, memoir, films, and photographs we will explore the experience of immigrants: the tensions, generational conflicts, and difficulties with communication and culture their families undergo. We will examine expressions of those varied and complex experiences, especially how language represents them. We will also look at the significance of language itself--think about what and how words mean, and the difficulties of linguistic and cultural translation. Students will share their reactions to what we read and see in class discussion and also in writing informally, even (if they wish) personally. Formal requirements: two shorter analytical papers and a longer paper using sources and possibly interviews, also to be presented in oral reports. There will be conferences on papers and revision. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSY, FSCC, FSNA, FSSO or FSCS. Prereq or Coreq: FSTS 100

USSY 285K. African American Performance. 3 Units.
This course follows the historical trajectory of African American performance from slavery to the present. The "texts" of the course are wide-ranging, and include poems, songs, stage plays, stage musicals, comedy acts, films, and music videos. Our objectives are to understand the nature of performance, how performances and their meanings changed over time, how media were adapted to serve historical people's needs, and what performances can convey about performers and audiences. Through the course, students will build an understanding of the history and evolution of American and African American cultural production, while developing tools to analyze the arts. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSY, FSCC, FSNA, FSSO or FSCS. Prereq or Coreq: FSTS 100

USSY 285N. The American Dream: Real and Imagined. 3 Units.
What is meant when we or our leaders talk about "the American dream"? Is it a political cliché, a myth, or something fundamental to our national ethos? In this seminar students will explore what is meant by "the American dream." We will pose the questions: how it has been defined by artists, writers, political leaders, immigrants and the native-born; how it has changed over time; and to what extent the dream is real and/or imagined? Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSY, FSCC, FSNA, FSSO or FSCS. Prereq or Coreq: FSTS 100

USSY 285Q. The Documentary Impulse. 3 Units.
The course is structured around a historical overview of documentary film from 1920 to the present. We begin with Robert Flaherty's Nanook of the North (1922) and focus on a different documentary style each week, from the city symphony films of the late 20s and early 30s (Jean Vigo, On the Subject of Nice, 1930) to avant-garde experiment (Dziga Vertov, The Man with a Movie Camera, 1929), to cinema verite (Rouch and Marin, Confessions of a Summer, 1955) and its effects on the French New Wave (Jean-Luc Godard, Breathless, 1959). Other style will include direct Cinema (Drew and Pennebaker, Primary, 1960), the improvisational style of John Cassavetes, the use of time-lapse photography (Reggio, Koyaanisqatsi, 1982), and, finally the documentary (Bob Roberts, 1992). The course will emphasize the importance of ideology, bias, and efforts to capture the "real" through the work of Leni Riefenstahl (Triumph of the Will, 1935), and 1970's examples of Third Cinema in Cuba, Brazil, and Argentina. Each student in The Documentary Impulse will be required to create on five-minute video using a particular documentary mode examined in class, paying attention to ideology, narrative structure, transitions, sounds, and video editing techniques. The final project will use either found stills, or newly shot filmed images, and will include a sound track either from the Freedman Center's archives, or of the student's own creation. Equal time will be devoted to written assignment that analyze the documentary style of particular films. The first half of the course will include a weekly film screening in KSL; after midterms, the location will alternate with the Freedman Center, where students will spend time creating and editing video projects. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSY, FSCC, FSNA, FSSO or FSCS. Prereq or Coreq: FSTS 100
USSY 285R. Crime and Punishment in German Literature. 3 Units.
How societies define and punish crime is related to a web of interconnected considerations including the form of government, the legal code, social mores, evolving conceptions of justice, the purpose of punishment, and attitudes toward individual criminals and criminality in general. These social, historical, and ethical norms give rise to questions such as: What constitutes a crime? How is the violation of the law different from or similar to transgressions of morality or ethical norms? What is the purpose of punishment and why is this important? To what extent are we interested in the circumstances that lead to crime? In what ways is punishment an insufficient answer to crime? This course will explore the social and historical questions raised by the perpetrators and victims of crime as well as attending punishment in the literary works of Friedrich Schiller, Heinrich von Kleist, Annette von Droste-Hulshoff, Franz Kafka, Bertolt Brecht, Primo Levi, Hannah Arendt, and Bernhard Schlink. Focusing on short stories, detective fiction, novels, drama, and personal essay, we will pay particular attention to the way that criminal transgression is defined, the role of society and history in producing criminals, when and why punishment is justified or necessary, and the degree to which these resolutions are "just." Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSY, FSCC, FSNA, FSSO or FSCS. Prereq or Coreq: FSTS 100

USSY 285T. Art, Music and Culture. 3 Units.
This course uses the intersections of art and music as a way to understand how the arts reflect, interact with, and influence the cultures in which they develop. After an introduction to research and writing in the arts (week 1), the course continues with a survey of certain historical periods and masterpieces of European and American art and music from 1700 to the present (weeks 2-6). It then takes up a few important themes in the interaction of music and the visual: 1) the concert hall as the intersection of architecture and acoustics (week 7); 2) the art museum and its music (week 8); 3) music and film (week 9); 4) the Broadway musical (week 10), and 5) rock music and its artifacts (week 11). A full week (12) of instruction on writing and oral presentation then prepares students for a seminar paper and seminar report, the creation and refining of which constitutes the final phase (weeks 12-15) of the course. Requirements and activities include, in addition to the seminar paper and report, a series of activities including three optional and three required events centered on the Cleveland Museum of Art and its concerts, the Cleveland Orchestra at Severance Hall, and the Rock and Roll Hall of Fame Museum. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSY, FSCC, FSNA, FSSO or FSCS. Prereq or Coreq: FSTS 100

USSY 285U. Popular Music and Film. 3 Units.
This course takes an interdisciplinary approach to studying music in American film. Students will learn to analyze film and music with greater sophistication, to contextualize them in time and place, and to interpret their meanings. The films predominantly feature jazz and popular music. We will discuss several aspects of a film: filmmaking techniques, visual composition, the film's available interpretations, audience reception, and so on. We will also discuss musical composition and performance, artists' self-representation, the link between music and commerce, and so on. Course sources include films and critical literature. The primary focus of the class will be on the ways music and film intersect as entertainment and art. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSY, FSCC, FSNA, FSSO or FSCS. Prereq or Coreq: FSTS 100

USSY 285X. Living in the Digital Age. 3 Units.
Digital technologies have changed the world we live in. This brave new world is populated by new-media, video, games, and social networks. To survive this world we need a vocabulary of criticism and authorship, a "New Media Literacy" that we can use to effectively and efficiently embrace our roles as both artist and critic. This course explores a wide variety of New Media themes in both contemporary and historical contexts. Students in the course will analyze their ever-evolving relationship to New Media as both viewers and creators. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSY, FSCC, FSNA, FSSO or FSCS. Prereq or Coreq: FSTS 100

USSY 285V. Castaways and Cannibals: Stories of Empire. 3 Units.
Through a study of texts that exploit "new world" images like the castaway, the cannibal, the wild man, and the exotic woman, this course explores the ideologies that propelled nineteenth-century imperialism, particularly regarding the British in Australia and South Africa. The class will consider how British settlers made "homes" in hostile and unfamiliar climates, how they addressed the problem of unfriendly and unequal contact with indigenous peoples, and how contemporary novelists reevaluate the historical past. The course will work under the premise that contemporary geopolitical realities have been shaped by the imaginative work of British colonialists who, under the principle of terra nullius or "no man's land," claimed the land and the resources of these southern territories and dismissed the very existence of the indigenous peoples that populated them. The scope of the course will be broadly historical, exploring works that participated in British imperialism, as well as those that take a modern perspective. Course materials will be drawn from a variety of genres, including fiction, poetry, film, ethnography, natural history, history, and criticism. Ultimately, students will consider how narratives participate in the shaping of reality and of real-world relations of power. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSY, FSCC, FSNA, FSSO or FSCS. Prereq or Coreq: FSTS 100

USSY 285Y. Musical Acts: The Performer in Western Culture. 3 Units.
Much of music history emphasizes the text/composition and its author/composer. Yet music is unique among the arts in that a musician must bring the work to life; arguably, a piece of music can only be said to exist in real time, in performance. This course will examine musical performance as it has evolved over the centuries and consider how thinking about performance and performers continues to change. Although an understanding of the rudiments of music will be helpful, students will not need advanced training in music for this course to be of interest. Readings will include historical accounts and reviews as well as articles about performance and musical aesthetics. Further sources will be recorded audio, video and live performances, as well as interactions with performers (and teachers of performers) from the Cleveland Institute of Music and the university’s departments of music, theater and dance. The interests and needs of the students will help set the tempo and line of our class discussions. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSY, FSCC, FSNA, FSSO or FSCS. Prereq or Coreq: FSTS 100
USSY 285Z. The Ubiquitous Frankenstein. 3 Units.
This seminar will explore the birth, evolution, devolution, and undead nature of the Frankenstein myth in popular culture. Using Mary Shelley’s novel, her source texts, 19th- and 20th-century critical accounts, and 19th- and 20th-century popular cultural manifestations, the seminar participants will discover how “Frankenstein” found its way into the Western mind and continues to provoke responses both in those familiar and in those completely unfamiliar with the novel. The course will touch on issues of literary influence, science/technology, religion, ethics, education, literary merit, popular culture relevance, and adaptation as art form. Central questions for the seminar include: (1) Does the Frankenstein myth as we perceive it today have anything to do with Mary Shelley’s original novel? (2) What were the moral and ethical implications of Shelley’s novel for her time and for the generations afterward? (3) Is an “accurate” film adaptation of a literary work possible or needed? (4) Is being ubiquitous a blessing or a blight for a literary work? Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSY, FSCC, FSNA, FSSO or FSCS. Prereq or Coreq: FSTS 100

USSY 286C. How Photos Shape What We See. 3 Units.
Because of both its special ability to convince and its ubiquity, photography has had a major impact on the way we view the world, and particularly in our view of “the other.” Just like other major forms of discourse, photography should be approached with a thoughtful and critical attitude. Some of the techniques of critical looking are different from the techniques of critical reading, but the fundamental tasks are very similar. The aim of this seminar is to help students develop an awareness of why and how photographs are such effective media of communication, and to help them develop an ability to read photographs critically. This is, of course, set within a general context of developing critical reading and writing skills. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSY, FSCC, FSNA, FSSO or FSCS. Prereq or Coreq: FSTS 100

USSY 286J. Creativity and Constraint. 3 Units.
The purpose of this course is to explore creative problem-solving as it relates to different disciplines and types of problems and to encourage a passion for finding best solutions, not merely obvious ones. We will use and evaluate case studies of real-world projects and complex decisions, readings about creativity, firsthand accounts from creative professionals, and in-class exercises to hone strategic thinking skills. The seminar is specifically concerned with how constraints—ranging from budgets and schedules to the laws of physics—can encourage, rather than inhibit, creative solutions. But we will also consider general questions about the process and psychology of problem-solving. Areas of investigation will include steps in establishing problem scope and defining and recognizing successful solutions; the dynamics of group versus individual problem-solving; and strategies for communicating complex ideas to teammates and leading the creative process. Students will be expected to participate actively in shaping class discussions and activities. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSY, FSCC, FSNA, FSSO or FSCS. Prereq or Coreq: FSTS 100

USSY 286S. Shakesploitation of an Icon: Four Hundred Years of Shakespeare Marketing. 3 Units.
Following the interregnum in England, William Shakespeare began a long, sustained trajectory as a cultural icon, first in England, but eventually among all English-speaking cultures. In the process, Shakespeare’s works have been reinterpreted, adapted, re-contexted, commoditized, and re-purposed for the sake of art, educational relevance, and entertainment. In the process, Shakespeare has often become the tool of unabashed commercialism, a practice which has come to be known as “Shakesploitation.” But why is Shakespeare’s work so frequently purloined? Why are out of context references to him so ubiquitous? Why do people tend to equate the name of Shakespeare with qualities of genius? Why have his works been continually adapted (often shamelessly) not only for the stage, but into other genres, including operas, paintings, novels and films? How do we account for the proliferation of Shakespeare-based self-help books such as Shakespeare on Leadership? Why is the infant stimulation video Baby Shakespeare a best-seller? This course will explore these questions not only by reading a selection of Shakespeare’s most enduring works, but also by examining criticism, adaptations, and marketing strategies that have been applied to Shakespeare’s image and works over the last four centuries. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSY, FSCC, FSNA, FSSO or FSCS. Prereq or Coreq: FSTS 100

USSY 286U. Puzzled. 3 Units.
"Puzzled" will look at the practice of puzzle making and puzzle-solving and explore the meaning of puzzles for different cultures throughout history. We will read works from the disciplines of math, history, anthropology, philosophy, and literature. We will explore why certain types of puzzles became popular and how puzzles have transferred from one culture to another. We will examine the role of code writing and code-breaking in the military and in the world of business. We will read examples of fiction and watch films that adopt the form of the puzzle as a narrative device. We will think about the function of puzzles as instruments to exercise the faculties of reason and logic and as a means of leisure or pleasant distraction. Students will be asked to both solve and create puzzles over the course of the semester. They will write analytical essays on topics related to the practice and history of puzzle making and puzzle solving, and they will pursue a research topic that revolves around an issue or problem that has "puzzled" them. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSY, FSCC, FSNA, FSSO or FSCS. Prereq or Coreq: FSTS 100
USSY 286V. Food Craze: (No) Reservations. 3 Units.
The great number of food-related TV-shows indicate an unprecedented interest in questions about and fascination with food; in fact, these TV shows allure viewers with the appeal of a myth: eating involves discovery (Anthony Bourdain’s No Reservations, On the Road Again with Mario Batali, Planet Food), thrill (Bizarre Foods), or “supernatural” competition (Man vs. Food, Top Chef). These television shows and food-related writings that accompany them in earnest “worship” food and often promote ideas of multiculturalism by which exciting and novel locales, foods, and meal preparatory techniques are discovered. The objective of this course is to “indulge” in these shows and food writings and scrutinize them: What explains such fascination with the viewing of and reading about food? In what ways can food-exploration trips expand on ideas and critiques of multiculturalism and globalization? What explains the centrality and “mythical” nature of food in the twenty-first century? To begin these conversations, we will touch on a plethora of food writing works including works motivated by environmental and health concerns such as Michael Pollan’s essays. Then we look at the world of cookbooks (including the cookbooks of Julia Child and Rachel Ray), food blogs and TV-shows, and essays by Bill Buford and Calvin Trillin among many others. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSY, FSCC, FSNA, FSSO or FSCS. Prereq or Coreq: FSTS 100

USSY 287F. Telling True Stories: Literary Journalism in America. 3 Units.
Literary journalism is a genre of nonfiction writing that employs all of the reportorial and truth-telling covenants of traditional journalism, while employing rhetorical and storytelling techniques more commonly associated with fiction. In short, it is journalism as literature. This course will introduce you to major themes in American literary journalism, the genre’s representative writers, and the enduring questions of the field. For example, we will ask how these stories work as narratives, as scientific explanations, as political tools, and as entertainment. How do these categories overlap? How do they motivate us to act? Where are these stories published and who is the readership? How do historical and cultural contexts influence and appear in the works? What is the relationship between (literary) journalism and democracy? What is the relationship between form and content? Is there a difference between physical truth and emotional truth? In the process of answering these questions, this course will emphasize close reading, interdisciplinary thinking, and the writing process. Through reading assignments, class discussions and presentations, and paper writing we will have the opportunity to examine, analyze, and develop our own interpretations about these multifaceted writings and the diverse cultural experiences and meanings they chronicle. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSY, FSCC, FSNA, FSSO or FSCS. Prereq or Coreq: FSTS 100

USSY 287G. Shadowplay/East and West. 3 Units.
Shadows flicker across the screen, drawing us back to the precursors of the cinema and forward to digital effects. To borrow Gorki’s phrase, the cinema is truly a “train of shadows.” This course focuses on interactions between shadow theatre, dance, visual arts, the cinema, and traditional forms of play. While the main focus is on traditional artistic forms, we also explore modern variants, including the use of shadows in contemporary photography. We will look at shadows in different (yet overlapping) contexts, and compare the effects of still and moving shadows. All of these contexts involve moments of narrative and silence. Through a series of short papers which will be integrated into a longer paper, each student will explore his/her approach to a central question: What does it mean to play with shadows? Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSY, FSCC, FSNA, FSSO or FSCS. Prereq or Coreq: FSTS 100

USSY 287H. Cityscapes in 20th-Century and Contemporary Visual Culture. 3 Units.
This seminar will explore the dynamic meanings of modern and contemporary urban environments through visual representation. What does a city look like? As great complex entities of constant change, we will see that cities have been portrayed in a myriad of ways. What social ideals have engaged the vision of architects, urban planners, and landscape designers in the making of the metropolis since the late 19th century? How have artists interpreted major cities as sites of modernity, technological advancement, civilization and cultural vanguard; or, in contrast as sites of failed experiment? How can forms of representation help us envision the entirety of urban spaces of diverse geographies, including typically un-aesthetic forms of fringe areas, the abandoned zones of prior use, and infrastructures? What recent developments in convergent media might be employed as catalyst for achieving an enhanced understanding of the interrelationship of urban structures, spaces, and human need? Our chief objective is to begin to comprehend the enormity of these questions. Thus, we will view and discuss selected examples of architecture, design, art, photography, film and video, in essence sampling the roles they have played in the process of conceiving and imagining the design and significance of cities. Our examination of visual material will be organized over the course of the semester according to three major overlapping themes: the utopian and visionary city, the visual culture of cities, and the emerging city. The methods by which we will seek to interpret the visual component of our studies in the three categories will be adapted from the perspectives of visual culture, urban studies, urban design and landscape urbanism, and architectural history. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSY, FSCC, FSNA, FSSO or FSCS. Prereq or Coreq: FSTS 100
USSY 287N. Fantasy and Philosophy. 3 Units.
Fantasy novels and films can be philosophical catalysts. One can read philosophical arguments and debate ethical and epistemological issues. Or, one can become immersed in a work of art and imagination that presents a fiction expressing the same profound human issues. Such a work dramatizes philosophical debates and conflicts, and hurls readers and viewers into poignant, gripping, suspenseful, horrific, or beautiful stories that convey those very same struggles with truth and morality. Indeed, while many philosophical works are inaccessible to everyone but those with a specialized vocabulary (or prescient ability to discern tortured language), literary and cinematic works actually stimulate a different part of the brain. The ideas are conveyed and processed differently, and this is why works of fiction can have such poignant and lasting effects on the emotions, provoke us to meditate on the grave and constant in human sufferings, and revisit those works as we relive our own struggles with truth, morality, love, identity, conflict, violence, and death. In this course students will read short works of fiction and philosophy, and watch films that delve into philosophical issues. These include selections from The Seventh Seal, Dr. Strangelove, Lord of the Rings, Harry Potter and the Half-Blood Prince, Star Trek, Futurama, House, M.D., True Blood, Dexter, Woman in the Dunes, The Denial of Death, The Dharma of Dragons and Daemons, Death's Dream Kingdom, Thus Spake Zarathustra, Philosophy and the Mirror of Nature, Serial Killers and Philosophy, and The Bhagavad Gita. Students who have taken USSO 286W for credit may not take this course. Prereq: Passing letter grade in a 100 level first year seminar in USFS, FSSY, FSCC, FSNA, FSSO or FSCS. Prereq or Coreq: FSTS 100
Undergraduate Academic Advising

Academic Advising

Academic advising is an important component of the educational program at Case Western Reserve University. Academic advisors assist students in the exploration of academic opportunities at the university and in the selection of courses. Advisors may refer students to other sources of information and assistance at Case Western Reserve. Students are expected to initiate and maintain regular contact with their advisors to address the student’s curricular and career concerns, and to review progress towards graduation. Students are expected to meet with advisors when declaring a major or minor, before registering for classes each semester, and when making corrections to their academic requirements reports.

Advising during the First Year

During a student’s first year at Case Western Reserve University, the faculty member instructing the student’s SAGES First Seminar serves as the student’s academic advisor. Students and their advisors are expected to explore the student’s academic interests and concerns, as well as educational and career goals, and to seek expert information and advice about academic policies and procedures and about specific academic programs from the General Bulletin, from newsletters and websites, from the academic representatives in the majors and minors designated as first year resources, and from other sources of advice and counseling on campus. Staff in the Office of Undergraduate Studies (http://www.cwru.edu/provost/ugstudies/undstud.html) (including the coordinators of first-year residence education in the First-Year Residential Colleges), the University Career Center (http://studentaffairs.case.edu/careers), Educational Services for Students (http://studentaffairs.case.edu/education), the Office of Multicultural Affairs (http://studentaffairs.case.edu/multicultural), the University Counseling Service (http://studentaffairs.case.edu/counseling), and specialized programs such as Co-op (http://engineering.case.edu/coop) (co-operative education), SOURCE (http://www.cwru.edu/source) (research and creative projects), the Center for International Affairs (http://case.edu/international) (study abroad, international student services), and the Center for Civic Engagement and Learning (http://studentaffairs.case.edu/civicengagement) (community service) are available to support first year students and their advisors with publications, workshops, websites, experiential learning opportunities, and individual communications.

Advising in the Majors and Minors

Although some first year undergraduates enter with definite goals, they are not assigned to advisors in the majors until they have declared their major. Opportunities for exploration of majors and minors during the first and second semesters include a Choices Fair, departmental information sessions, and individual conversations with faculty and academic advisors. First year students who are ready to declare a major in their first year may do so beginning in November.

Students engaging in further exploration of majors are expected to declare a major no later than the end of the second year (See Declaring a Major in the section on Academic Policies and Procedures). When a student selects a specific major or minor, the academic representative assigns a faculty advisor. A choice or change of major or minor is not recorded for any student until the major or minor declaration form, bearing the signature of the student, the name of the advisor, and the signature of the academic representative of the major or minor, has been completed and submitted to the Office of Undergraduate Studies, 357 Sears Bldg.

After the first year, students who have not declared a major should consult their assigned advisor (noted in their online student information) or the academic representative of an academic department of interest for advice and schedule approval.

Advising in the Office of Undergraduate Studies

The deans and advisors in the Office of Undergraduate Studies, including the coordinators of first-year residence education in the First-Year Residential Colleges, are available to answer student and faculty questions about university rules, practices, programs, and resources and to meet with students who are interested in accelerated undergraduate to graduate and professional school programs, academic awards, and fellowship and scholarship opportunities. All students who have not declared a major should consult with their first year advisor or with one of the advisors in the Office of Undergraduate Studies for advising and schedule approval. Students with interests in health professions and/or law school are encouraged to seek advice from the director of health career advising, Steven Scherger (http://www.cwru.edu/provost/ugstudies/prehlth.htm), and the pre-law advisor, Terri Mester (http://www.case.edu/provost/ugstudies/prelaw.htm), in the Office of Undergraduate Studies.
Undergraduate Academic Policies and Procedures

Academic Regulations

All academic regulations governing undergraduates are administered by the Office of Undergraduate Studies. Academic regulations are subject to change by action of the Faculty Senate, its Committee on Undergraduate Education, and the various committees responsible for the oversight of curriculum and academic standing.

When circumstances so warrant, a student may submit to the Office of Undergraduate Studies a petition requesting an exception to a specific regulation. Petition forms are available in the Office of Undergraduate Studies, 357 Sears Bldg.

Academic Grievance Policy

A student who wants to register a complaint about course instruction or evaluation should first bring the matter to the direct attention of the professor or instructor involved. If the matter is not satisfactorily resolved, the student should go to the chair of the academic department in question and seek departmental review. If neither step resolves the complaint, the student may take the matter to the faculty member's college or school dean for final review and decision.

Academic Integrity Policy

See the Case Student Handbook for more information about the academic integrity policy.

Attendance

Students are expected to attend classes regularly. Each instructor is free to determine the extent to which absences affect the final grades of students but should make the policy regarding attendance known at the start of the course. Instructors should report excessive absences to the Office of Undergraduate Studies. Instructors who judge a student's absences from class to be excessive may drop the student from the course with a grade of F. Instructors taking such action must notify the student's dean in writing.

Students unable to attend classes because of illness should notify their instructors and make the appropriate arrangements directly with the instructor. The University Health Service and the Office of Undergraduate Studies do not provide medical excuses for class absence. Information concerning the policy of the Health Service and the Office of Undergraduate Studies is available in those offices.

Any student who is unable to attend classes or participate in any examination, study, or work requirement on a particular day because of his or her religious beliefs is excused from any such activity. The student will be given the opportunity to make up the examination or work that is missed, provided the make-up work does not create any unreasonable burden upon the university. When possible, students should give notice to instructors early in the semester about missing classes because of religious observance.

Audit

A student may audit a course with the dean's or advisor's approval and the consent of the instructor of the course. An auditor receives no credit for the course. Registration in a course cannot be changed from audit to credit or the reverse after the end of the drop/add period. However, a student may take for credit a course he or she audited in an earlier semester. At the beginning of the course, the student and instructor should reach agreement regarding the requirements to be met for a grade of AD. The grade of AD is entered on the student’s transcript if approved by the instructor of the course. If the instructor does not approve the grade AD, the enrollment is not posted on the transcript.

Course Loads and Overloads

In order to be classified as a full-time student, a student must enroll for a minimum of 12 semester hours by the end of the drop/add period. The normal full-time load is 12-19 semester hours. Eligibility for many forms of financial aid and for participation on intercollegiate, varsity sports teams requires full time status. Students registering for fewer than 12 semester hours are classified as part-time and charged tuition on the basis of the number of semester hours being taken.

Continuing students may carry 20-21 hours if they have a cumulative average of 3.200 or better. To register for 22 or 23 hours, a minimum average of 3.500 is required. Any schedule of more than 19 hours requires a dean’s approval. Graduating seniors may be approved for overloads if they need such a schedule in order to graduate at the end of the semester in question.

Course Placement

No credit will be allowed to count towards degree requirements for foreign language or mathematics courses which duplicate work taken earlier in high school or in another institution. First year undergraduates who have questions regarding their eligibility to receive credit for foreign language or mathematics courses should see the assistant dean for first year students in the Office of Undergraduate Studies.

Course Repetition

Students have the opportunity to retake a course in which they have received an evaluative grade (A, B, C, D, or F) in order to improve their performance. When a course is repeated, the first grade will remain visible on the transcript, but will be removed from the calculation of the cumulative grade point average and the grade point average for the semester in which the course was first taken. Also, credits earned for that enrollment will be deleted. The new grade will then be used for calculation of the cumulative grade point average and the grade point average for the semester in which it was earned, regardless of whether the new grade is higher or lower than the first grade. The student’s transcript will show the comment “REPEATED: NO CREDIT AWARDED” directly below the original grade. Similarly, if a student repeats a course for which he or she has already received either test (AP, IB, etc.) or transfer credit, the original credit will be removed and the transcript will show the comment “REPEATED: NO CREDIT AWARDED;” credit will instead be awarded for the course taken at Case Western Reserve University and the grade will be included in grade point average calculations. However, if the first attempt of the course resulted in a passing grade, but the second attempt results in a failing grade, then the original grade will remain, both grades will be included in the grade point average calculation, and the student will continue to earn credit for the first attempt. Similarly, if a student withdraws from a course that is being repeated, the original grade will stand. Course repetition may be exercised according to the following conditions:

1. A student may not use the Pass/No Pass Option on a course that is being repeated.
2. An academic action that occurred under the earlier grade is neither reversed nor removed from the record as a result of a change in the semester or cumulative averages that results from the repetition of one or more courses.
3. All grades earned at Case Western Reserve University, including those grades removed as a result of the application of the course repeat policy, will be applied to the Scholarship GPA that is reviewed in order to determine retention of certain Case Western Reserve University scholarships awarded to students who matriculated prior to August 2011.

4. The course repeat option may not be exercised after a degree has been awarded.

CAUTION: Students who are the recipients of any form of federal financial aid (grants, loans, work study, etc.) and repeat a course that previously earned a passing grade must enroll for a minimum of 12 credits for which credit had not been earned previously.

Credit by Examination

Advanced Placement/International Baccalaureate Examinations

Students may earn degree credit on the basis of advanced examinations taken while in secondary school. Examinations eligible for credit and/or advanced placement include, but are not limited to College Board Advanced Placement Examinations and International Baccalaureate Higher Level Examinations. Determination of the criteria for granting credit and/or placement is made by the appropriate department. In assigning credit or granting advanced placement for credentials from outside the United States, the university is guided by the placement recommendations and grade equivalencies approved by the National Council on the Evaluation of Foreign Educational Credentials.

Proficiency Examinations

Departments within each academic unit offering undergraduate programs may choose to offer students the opportunity to earn course credit in specific courses by proficiency examination. To qualify for proficiency examination credit for a course, the student’s examination performance must demonstrate knowledge and skills at a level no lower than that of an average student who successfully completes the course. Upon notification from the academic department, the Office of Undergraduate Studies will post credit for the course on the transcript. The grade will be recorded as PR, and will not be included in a student's grade point average.

Declaring a Major or Minor

Students who enroll at Case Western Reserve University as first-year students are expected to declare a major before registering for classes for their fifth semester of enrollment. Transfer students are expected to declare a major before registering for their third semester at Case Western Reserve. Beyond that point, students who have not declared a major will have a registration hold placed on their accounts until they have done so. Those who will have earned fewer than 60 credit-hours (including transfer, AP, IB, and proficiency credit) by the end of the fourth semester for students who started as first-year students, or by the end of their second semester for transfer students, may request that their dean in Undergraduate Studies allow them to register for the next semester by lifting the registration hold. Students may later change their majors should their academic interests change.

A choice or change of major or minor is not recorded for any student until the major or minor declaration form, bearing the signature of the student, the name of the advisor, and the signature of the academic representative for the major or minor, has been completed and submitted to the Office of Undergraduate Studies, 357 Sears Bldg.

Enrollment Changes

Drop/Add

Changes in course schedules must be submitted to the Registrar’s Office using the Student Information System or a drop/add form before the end of the second week of classes during the fall and spring semesters and on or before the second day of classes during the summer session.

Withdrawal from a Course

The First Undergraduate Year:

For the first two semesters of enrollment, matriculated students who are beginning their college studies may withdraw from a course at any time during the semester, but no later than the last day of classes. Any course for which a grade of W is assigned will be deleted from the transcript at the end of the semester. This policy is not available for transfer students and does not apply to the summer session.

After the First Undergraduate Year:

A student may withdraw from a course no later than the end of the 11th week of the semester and receive a grade of W. In extenuating circumstances, a student may petition for permission to withdraw from a course after the final date and receive a W. The grade of W will be posted on the student's transcript.

For all course withdrawals:

Students in good academic standing (i.e., not on probation, probation incomplete, or continued on probation) may withdraw from courses through the Student Information System, provided that this does not take them to be actively enrolled in fewer than 12 credit hours. All other course withdrawals (those by students who are not in good standing and those that take a student below 12 credit hours of active enrollments) must be transmitted by the student to the Registrar’s Office on the appropriate form, signed by a dean in the Office of Undergraduate Studies. Failure to attend class, or providing notice only to the instructor, does not constitute an official withdrawal from a course. Such an unofficial withdrawal normally will result in the student’s being assigned the grade of F.

Withdrawal from the University

To withdraw from the university during a semester or session, a student must complete an official withdrawal form in the Office of Undergraduate Studies. If unable to complete the withdrawal in person, the student must send written notice to the Office of Undergraduate Studies. If the withdrawal is necessary for reasons of health, a statement from the student’s physician to the University Health Service may be required as a condition of readmission. Grades of WD will be assigned in all courses in which a student is registered at the time of withdrawal, provided that a student follows the procedures stated above. Failure to attend classes or notification of instructors only, does not constitute withdrawal from the university. A student who ceases to attend or otherwise participate in courses without officially withdrawing will be assigned the grade F for each course in which he or she is enrolled.

Students who do not plan to return for the following semester must notify the Office of Undergraduate Studies (http://bulletin.case.edu/undergraduatestudies/policies/mailto:ugstudies@case.edu), 357 Sears Bldg., 216.368.2928, in person or in writing.

Final Examinations

Final examinations normally are required in all courses and must be given during the final examination period at the time assigned by the Registrar; they may not be given during the final week of classes or on Reading
Days. Any exception must be approved by the dean of undergraduate studies.

No student will be required to take more than two final examinations on a single day. A student who has three final examinations scheduled for a single day should go to the Office of Undergraduate Studies and obtain the assistance of the dean in arranging to take one of those examinations on an alternative day during the final examination period. Similarly, a student with conflicting examinations should seek the assistance of the dean of undergraduate studies in arranging to have the time of one examination changed.

A student must explain immediately and in writing to the dean of undergraduate studies an absence from a final examination. If the explanation is acceptable, the dean will authorize the assignment of the grade Incomplete and the administration of a make-up examination by the instructor. In the event of an unexcused absence from a final examination, the instructor should assign the student a final grade that assumes a grade of zero on the final examination and is consistent with the grading policy established for the course.

Incompletes
See section on Grades

Pass/No Pass
See section on Grades

Promotion
The standards for promotion are:
- To the sophomore class, 27 hours completed
- To the junior class, 60 hours completed
- To the senior class, 90 hours completed

Reading Days
Prior to and/or during the final examination period two weekdays are set aside as Reading Days to be used by students for completing assignments and preparing for final examinations. In the fall semester there will be one reading day on Monday of the first exam week and one reading day on Friday of the first exam week. In the spring semester, the two days prior to the beginning of the final exam period are set aside as reading days. These days are not to be used by faculty for scheduling examinations or other course activities that require the attendance of students. They can be used by faculty to schedule review sessions for which attendance is optional.

Readmission After Separation
See section on Academic Standing

Re-Enrollment After Voluntary Withdrawal
Students who have voluntarily withdrawn from the university and have not taken courses elsewhere following their withdrawal may re-enroll in any semester. Students who have taken courses elsewhere following withdrawal must provide official transcripts of their work with their request for re-enrollment. Upon re-enrollment following a voluntary withdrawal, students retain the hours earned and quality points for courses completed prior to withdrawal. In the first semester of re-enrollment, their academic status is the status in effect at the time of withdrawal, unless that status is changed by action of the Academic Standing Board.

Registration
For continuing students, registration for the fall semester begins in April, and registration for the spring semester begins in November. Complete registration instructions and regulations appear on-line on the web site of the University Registrar (http://www.case.edu/registrar).

Student Access to Records
The academic records of all students are in the Office of Undergraduate Studies, 357 Sears Building. Students may review their files in that office by appointment. A student must sign a request and present his/her ID card at the time of the appointment.

Study at Other Colleges and Transfer Credit
Students may receive transfer credit for work completed at another accredited college, university, or technological institute in the United States or from institutions of higher education outside the United States.

At the time of admission to Case Western Reserve University and upon presentation of an official transcript from each institution previously attended, credit will be awarded for courses equivalent or comparable to those offered by the university and completed with a grade of C or better. Any such courses taken prior to the student’s graduation from high school must be listed in the college’s catalog among courses offered for degree credit to the college’s undergraduates, taken in the company of matriculated college students, and organized and taught by college faculty. In addition, to be considered for transfer credit, such courses must not have been used to fulfill high school graduation requirements. The awarding of transfer credit is determined by the Office of Undergraduate Studies in consultation with the appropriate department.

After matriculation at Case Western Reserve University, students are permitted to earn at other accredited colleges or universities no more than a total of 15 semester hours, including courses taken through the cross-registration program. However, students participating in approved study abroad programs may earn up to 36 credit hours for work completed during the program. Permission of a dean in the Office of Undergraduate Studies must be obtained in advance if the student wishes to enroll elsewhere. Further, if a student wishes to take elsewhere a course to satisfy a major or minor requirement, it must also be approved by the department chair or academic representative.

Upon presentation of an official transcript from each institution previously attended, credit will be awarded for courses equivalent or comparable to those offered by the university and completed with a grade of C or better. Credit earned elsewhere after matriculation at Case Western Reserve University is not applied toward the residence requirement of a minimum of 60 hours, including at least 30 after achieving senior status, earned at Case Western Reserve. The Off-Campus Study Request Forms are available in the Office of Undergraduate Studies, 357 Sears Bldg.

Credit is not awarded for work done at an unaccredited institution in the United States except by proficiency examination in those departments of Case Western Reserve University offering that opportunity. The awarding of transfer credit for work done at institutions outside the United States is subject to departmental evaluation and to the recommendations of the National Council on the Evaluation of Foreign Credentials.

A student separated for poor scholarship may not earn transfer credit for courses taken in the first two sessions after that dismissal.
Grades for courses taken at other institutions will not be entered on the student’s record nor will they be computed in the student’s grade point average.

In addition to the regulations concerning transfer credit outlined above, the following special restrictions apply to credit for summer courses taken at other colleges, universities, or technical institutes:

1. Students ordinarily will not be permitted to take elsewhere in Cuyahoga County courses offered at Case Western Reserve University. Exceptions to this policy will be permitted only in the event of significant extenuating circumstances. Students who desire the opportunity to take elsewhere in Cuyahoga County a course being offered at Case Western Reserve must petition the Office of Undergraduate Studies in advance for permission to do so.

2. Students must be in good standing. If a student is placed on probation between receiving permission and the start of off-campus enrollment, the student is no longer eligible to enroll for and receive transfer credit for this work. Students on probation require special approval and should contact a dean in the Office of Undergraduate Studies.

3. Students may register for no more than 12 semester hours of credit. One quarter-hour equals two-thirds of one semester-hour.

4. Students may transfer credit only for courses in which a student’s work is completed in a minimum of four weeks.

**Academic Standing Regulations**

The Academic Standing Board monitors the progress of all undergraduate degree candidates at the end of each fall and spring semester to ensure that they are making appropriate progress toward earning their degrees in terms of the grades and number of credit hours earned each semester; see below for information about the summer session. All degree candidates begin their academic careers in good standing. Those who fail to meet the requirements to continue in good standing, as defined below, are automatically placed on academic probation for the following semester in order to signal the need to improve their academic performance. Those who fail to meet a minimum set of academic standards defined below or who do not return to good standing after a semester of academic probation are ordinarily separated from the university for a period of two academic sessions, including the summer session.

### Good Academic Standing

**Full-time First Year Students and Transfer Students in the First Semester**

In order to maintain good academic standing at the end of the first semester at Case Western Reserve University, a full-time (i.e., enrolled in at least 12 credit hours at the end of the drop/add period) first year student or new transfer student must:

1. earn a semester grade point average of 2.000 or higher AND
2. earn a minimum of 9 credit hours in that semester.

**Full-time Students After the First Semester**

Following the first semester of the first year, full-time students (i.e., those enrolled in at least 12 credit hours at the end of the drop/add period) will be in good standing provided they:

1. earn a semester grade point average of 2.000 or higher AND
2. earn a minimum of 12 credit hours in that semester.

### Part-time Students

Part-time students (i.e., those enrolled in fewer than 12 credit hours at the end of the drop/add period) will be in good standing if he or she earns a semester grade point average of 2.000 or higher.

**NOTE:** Any student with incomplete grades at the end of a semester may be placed on “probation (incomplete)” or made “ineligible to register,” as described below.

### Academic Probation

Students who, at the end of any semester, fail to maintain the standard of performance required for good standing as specified above will be automatically placed on probation. Students placed on probation are ineligible to represent the university in intercollegiate activities and may not hold an elective or appointed office or chair a committee in any campus organization. In addition, they may not earn degree credit for work completed at another college or university during the period of probation without special permission.

When placed on academic probation students will be expected to perform at a level that will return them to good standing at the end of the next semester. If they fail to return to good standing at the end of the following semester, they will be considered for separation from the university for a period of two academic sessions, the summer session being the second.

A full-time student placed on probation who subsequently enrols as a part-time student will not be reviewed for further academic action until he or she has completed sufficient semesters to total at least 12 credit hours. At that time, the student will be reviewed on the basis of a composite of those semesters.

Similarly, a student who goes on probation as a part-time student will not be reviewed for further academic action until he or she has completed sufficient semesters to total at least the number of credit hours attempted in the semester for which the student was placed on probation. At that time, the student will be reviewed on the basis of a composite of those semesters and will be expected to have earned at least the number of credit-hours attempted in the semester for which he or she was placed on probation.

### Probation (Incomplete):

A student will be placed on Probation (Incomplete) if he or she has Incomplete grades which would result in the student’s being placed on academic probation if those Incomplete grades were converted to F’s. Once the Incompletes are converted to grades, the student shall be restored to good standing or placed on academic probation as determined by the semester grade point average and the number of credit hours earned.

### Separation

Students on academic probation who fail to return to good standing at the end of the following semester will be considered for separation from the university for at least two academic sessions, including the summer session.

Also, full-time students at the end of their first semester at Case Western Reserve University will be considered for separation without a semester of probation if they:

1. earn a semester grade point average less than 1.000 AND
2. earn fewer than 9 credit hours in that semester.

After the first semester, full-time students will be considered for separation without a semester of probation if they:
1. earn a semester grade point average less than 1.000 OR
2. earn fewer than 9 credit hours in that semester.

Part-time students are not eligible for separation without already being on probation, but will be considered for separation if they fail to return to good standing after a period of probation.

Separation because of academic performance is not an automatic process. Students being considered for separation will be asked to prepare a statement explaining the difficulties that interfered with their ability to earn a satisfactory record; if a student thinks he or she should not be separated, the statement should include an explanation of why the Academic Standing Board should have confidence in the student’s ability to return to good standing at the end of the next semester. The Academic Standing Board will decide to separate the student or to place the student on academic probation or to continue the student on academic probation based on a review of the student’s statement and the academic record.

Students separated for reasons of academic performance may not earn transfer credit for work completed elsewhere.

**Readmission from Separation**

Students who have been separated because of poor academic performance may petition for readmission after two academic sessions, including the summer session, have elapsed. Students readmitted after being separated for reasons of academic performance will retain the credits they earned before separation only for those courses passed with a grade of C or better. Readmitted students do not retain quality points earned before separation, and the cumulative grade point average will be restarted and include only those grades earned after readmission.

**Permanent Separation**

A second academic separation following review by the Academic Standing Board will ordinarily be permanent.

**Ineligible to Register**

Students will be declared “ineligible to register” when they have Incomplete grades which would make them eligible for separation if those Incomplete grades were converted to F’s. Such students will be required to finish the incomplete courses with grades that justify their retention before they will be allowed to continue for the next academic session, unless they successfully petition the Academic Standing Board for permission to enroll.

**Summer Enrollment at Case Western Reserve University**

Students will not be reviewed for academic action at the end of the summer session except in the following two situations:

1. A student on academic probation as of the end of the spring semester will be returned to good standing at the end of the summer session if he or she has completed at least 6 credit hours at Case Western Reserve University with a summer grade point average of at least 2.000.
2. Nursing students who enroll during the summer session for a full course load (at least 12 credit hours) that includes the capstone course will be reviewed according to the standards of a regular fall or spring semester.

**Application for Graduation**

A student who has completed all graduation requirements in fewer than four years has the choice of graduating early or deferring graduation in order to graduate with his or her class. A student who completes all graduation requirements in four years or more must graduate at that time.

The student must file an on-line application for the degree through the Student Information System by October 1 for January graduation, by February 1 for May graduation, and by June 1 for August graduation; and the student must have discharged all financial obligations to Case Western Reserve University.

**Graduation Check**

Students must ensure that their Academic Requirement reports reflect accurately their progress toward their degrees. All requested corrections and exceptions must be submitted to the Office of Undergraduate Studies at least one semester prior to graduation. Academic Requirement reports are available on-line through the Student Information System.

**Participation in Commencement**

Students are eligible to participate in May commencement activities provided that they have completed all degree requirements during that spring semester or the immediately preceding fall semester or summer session, or have an appropriate plan to complete their degree requirements in the upcoming summer session or fall semester. A student may participate in Commencement only once as a bachelor’s degree candidate, though exceptions are sometimes made for students receiving a second bachelor’s degree at least one year after the first.
Undergraduate Collaborative Programs

Collaborative Programs with Other Colleges

Cross Registration in Northeast Ohio

If approved by the Office of Undergraduate Studies, full-time undergraduates in good academic standing may cross-register at Baldwin-Wallace College, Chanellor University, the Cleveland Institute of Art, the Cleveland Institute of Music, Cleveland State University, Cuyahoga Community College, Hiram College, John Carroll University, Lake Erie College, Lakeland Community College, Lorain County Community College, Notre Dame College of Ohio, and Ursuline College for one course per semester. Approval is normally limited to courses that are not offered at Case Western Reserve University.

To cross-register for studio courses at the Cleveland Institute of Art, a student must have permission from Case Western Reserve University’s director of art studios, Mr. Timothy Shuckerow (http://bulletin.case.edu/undergraduatestudies/collaborativeprograms/mailto:timothy.shuckerow@case.edu), 2215 Adelbert Road, 216.368.2714.

Private music lessons can be arranged through the Department of Music in collaboration with the Cleveland Institute of Music. Students interested in pursuing this opportunity must obtain a permit at the Music Department in Haydn Hall to enroll for credit in Applied Music. Charges for private lessons will be covered by the full tuition rate for music and music education majors only. All other students will pay an additional fee.

Joint Program in Art Education

The joint program in art education of Case Western Reserve University and the Cleveland Institute of Art (CIA) enrolls students pursuing the BS in Art Education, combining studio art courses at the Cleveland Institute of Art with liberal arts and education courses at Case Western Reserve University. Admission to the program requires application to Case Western Reserve University and presentation of an art portfolio to the Cleveland Institute of Art; credentials must be acceptable to both institutions.

Joint Program in Music

All programs in music are conducted jointly by Case Western Reserve University and the Cleveland Institute of Music, and provide the intimacy and specialization of a professional conservatory, together with the resources of a comprehensive university. Students pursuing a major in music or music education take music theory and lessons at the Cleveland Institute of Music, and take music history and other liberal arts and music education courses at Case Western Reserve University. Students pursuing the BA with a major in music, or the BS in Music Education apply to and enroll in Case Western Reserve University, while students seeking the BM degree apply to and enroll in the Cleveland Institute of Music.

Joint Program in Teacher Licensure

Ohio teacher licensure may be attained by those undergraduate students who complete the approved curriculum of the Case Western Reserve University/John Carroll University Joint Program in Teacher Licensure (http://www.cwru.edu/artsci/teachlic/secondary.html?nw_view=13093798998). Degrees in these programs are awarded by Case Western Reserve University and licensure is obtained through John Carroll University. Adolescence/Young Adult Teacher Licensure (grades 7-12) is available in Integrated Language Arts (English major), Integrated Social Studies (history major), Integrated Mathematics (mathematics major), Life Sciences (biology major), and Physical Sciences (chemistry or physics major). Multi-age licensure is available in French, Latin, and Spanish. The program requires 35 credit hours in professional education: 15 taken at Case Western Reserve University and 20 taken at John Carroll University.

The undergraduate/graduate programs in art education and music education meet the requirements for teacher licensure, grades pre-K-12. For further information, see departmental information in this bulletin.

Reserve Officer Training Corps (ROTC)

Reserve Officer Training Corps (ROTC) programs are available to Case Western Reserve University students through cooperative arrangements with Kent State University for Air Force ROTC and with John Carroll University for Army ROTC. Each of these universities offers military studies, leadership and training courses. Participating students may seek transfer credit at Case Western Reserve for these courses, and may be exempted from the undergraduate physical education requirement. Students who are not recipients of ROTC scholarships may enroll in the first and second year ROTC courses without incurring any military obligation. University students enrolling in ROTC programs are eligible to compete for ROTC scholarships awarded by the Air Force or the Army.

Air Force ROTC

The Air Force Reserve Officer Training Corps (http://www.kent.edu/afrotc) (AFROTC) program provided by Kent State University prepares students for service as officers in the United States Air Force. Through courses in history, management, and leadership, and through practical training, students acquire leadership and management skills, and learn about Air Force career opportunities, the role of the military in American society, the history of air power, and national defense policy.

An agreement between Case Western Reserve University and Kent State University allows full-time Case Western Reserve students to complete aerospace studies courses. The courses are held at Kent State University, which is approximately 35 miles from Case Western Reserve, and are usually scheduled on one or two afternoons during the week. This arrangement allows Case Western Reserve students to participate in either the four- or two-year AFROTC program. Students wanting to enter the two-year program in the junior year must contact the professor of aerospace studies before March of the year before their planned entry.

Air Force ROTC scholarships are available on a competitive basis. Information about courses, registration, and scholarships may be obtained from the Air Force ROTC DET 630, 125 Terrace Drive, Kent State University, Kent, Ohio 44242; telephone: 330-672-2182. Case Western Reserve students planning to register for AFROTC courses at Kent State University should consult with the Office of Undergraduate Studies for information regarding registration procedures.

Army ROTC

The Army ROTC (http://www.jcu.edu/rotc) program is designed to prepare students for service as a commissioned Army officer in either the active duty U.S. Army or the reserve components of the Army Reserve or National Guard. Classes and practical training focus on military skills, officer professionalism, leadership training, and the development of military-related officer and management techniques and procedures. Army ROTC is offered as part of a collaboration with John Carroll University with some of the first- and second-year courses ROTC classes being offered on the Case Western Reserve University campus.
those courses offered at Case Western Reserve (MLSC 101, MLSC 102, MLSC 199, MLSC 201, MLSC 202, and MLSC 299), students register in the ordinary way. For other Army ROTC classes, students may enroll through cross-registration in the Department of Military Science at John Carroll University, which is approximately five miles from Case Western Reserve.

Army ROTC scholarships are available on a competitive basis. Information about courses, registration, and scholarships may be obtained from the Department of Military Science (ARMY-ROTC), John Carroll University, University Heights, OH 44118-4581; telephone: 216.397.4421. Case Western Reserve students planning to register for Army ROTC courses at John Carroll University should consult with the Office of Undergraduate Studies for information regarding registration procedures.

Fisk University Exchange Program

An exchange program between Fisk University and Case Western Reserve University enables up to four Case Western Reserve students to spend a semester as visiting students at Fisk each year. Up to four Fisk students may spend a semester at Case Western Reserve each year. Fisk University was founded in 1866 as the first integrated, coeducational school in the United States, and, at its founding, focused on providing a quality liberal arts education to the children of former slaves. Fisk University has a distinguished history as a liberal arts institution. Fisk University was the first historically black college to have chapters of the Phi Beta Kappa and Mortar Board national honorary societies.

Case Western Reserve students who participate in the Case Western Reserve-Fisk Exchange pay tuition to Case Western Reserve University, pay the Fisk room and board fees, and maintain their student status during the period of the exchange. Information about the exchange program is available from the Fisk exchange advisor in the Office of Undergraduate Studies.

The Dual Degree (3-2) Program in Engineering

Students of superior scholarship who have attended one of a group of select liberal arts colleges with which Case Western Reserve University has a dual degree agreement are eligible to participate in the Dual Degree (3-2) (http://engineering.case.edu/desp) program at Case Western Reserve University. This program allows outstanding students to begin their studies at a liberal arts college for three years and pursue an engineering degree at Case Western Reserve University for two years. Once requirements at both institutions are completed, students will receive a degree from the liberal arts college and a degree from Case Western Reserve University in a designated engineering discipline. For additional information, contact Debbie Fatica (http://bulletin.case.edu/undergraduates/programs/collaborativeprograms/mailto:dxf3@case.edu), 304 Nord Hall, 216.368.4449.
Undergraduate Criteria for Scholarship Retention

Undergraduate Criteria for Scholarship Retention

Students who are awarded scholarships based on academic achievement or potential by Case Western Reserve University are expected to perform at an appropriate academic level and maintain good conduct in the community. These scholarships will be automatically renewed each semester, provided that the student meets the retention criteria established for his or her scholarship at the time of the initial award. These retention criteria, as defined for students who matriculated at Case Western Reserve University prior to August 2011 and for students who matriculated at the university in August 2011 or later, are outlined on the following pages, along with information about the duration of these scholarships and the appeal process for students who fail to meet the established retention criteria.

Criteria for Scholarship Retention for Students Matriculating in August 2011 or Later

Full-Tuition (Andrew Squire, Albert W. Smith, Adelbert Alumni, Alexander Treuhaft, and Warren E. Rupp), University, Michelson-Morley STEM, and Bolton Scholarships

The academic records of scholarship recipients are ordinarily reviewed at the end of each semester. To have a scholarship renewed for the following semester, the student must be in good academic and disciplinary standing.

In exceptional cases, Academic Standing Board will continue a scholarship for a student whose achievement or whose attendance does not meet the standards outlined above. It is the student's responsibility to write to the Academic Standing Board, c/o the Office of Undergraduate Studies, within 7 business days of the end of the exam period each semester to request special consideration for continuation of a scholarship. This appeal should inform the committee of any special circumstances which may have affected performance and/or attendance during the preceding academic semester, provide any relevant documentation, and describe a plan for how academic performance will be improved in the future.

Students who lose their scholarships because of unsatisfactory academic or disciplinary standing will have their scholarships automatically reinstated at the start of the next semester if they return to good standing. However, students lose a semester of scholarship eligibility for each semester that they fail to achieve good standing; that is, students will not receive these scholarships while on probation or during their first semester back from an academic separation, and the maximum number of semesters for which they can receive their scholarships will be reduced.

Other Scholarships Awarded by Case Western Reserve University

Recipients of scholarships other than the ones listed above should refer to their scholarship award letter for specific scholarship retention criteria.

Duration

A student who meets the standards for scholarship retention may receive scholarship assistance for no more than eight semesters of full-time undergraduate study (less any semesters lost due to falling out of good academic or disciplinary standing, as described above). The scholarship is awarded for full-time enrollment in regular (fall and spring) semesters.

A scholarship recipient who does a complete withdrawal during a semester will have used up a semester of scholarship eligibility, but will be eligible to receive the scholarship again when he or she next enrolls, provided that his or her leave of absence does not last more than one semester (as described below). If a scholarship recipient completes a bachelor's degree in fewer than eight semesters of full-time study at Case Western Reserve University, the scholarship will be terminated upon completion of the degree.

In the eighth semester (or in the final semester for a student completing the bachelor's degree in fewer than eight semesters), a recipient may request permission for part-time enrollment with pro-rated scholarship support if completion of the degree does not require full-time enrollment in that final semester.

Semesters spent participating in the Cooperative Education Program or on a leave of absence are not counted against a student’s eight full-time semesters of scholarship eligibility.

Leave of Absence Policy

A scholarship recipient may take a one-semester leave of absence during the student's undergraduate career and put his/her scholarship “on hold” for reactivation upon the student’s return to Case Western Reserve University. Requests for a one semester leave of absence must be submitted in advance to the Office of Undergraduate Studies. Requests for leaves of absence longer than one semester must be submitted to the Academic Standing Board and will be reviewed on an individual basis.

A scholarship is automatically terminated upon a student’s transfer to another institution or upon permanent separation from the university.

Criteria for Scholarship Retention for Students Who Matriculated Prior to August 2011

Full-Tuition (Andrew Squire, Albert W. Smith, Adelbert Alumni, Alexander Treuhaft, and Warren E. Rupp), Trustees’, President’s, Provost’s, Dean’s, Faculty Honors, and Faculty Scholarships

The academic records of scholarship recipients are ordinarily reviewed at the end of each spring semester. To have a scholarship renewed for the following academic year, a recipient is expected to satisfy two requirements: a minimum number of hours earned after enrollment at Case Western Reserve University and a minimum cumulative scholarship grade point average**. The cumulative scholarship GPA requirement is 2.500 at the end of the first year and 3.000 at the end of each succeeding year. Scholarship recipients will be required to have earned at Case Western Reserve University at least 24 semester hours in the first year, 54 semester hours by the end of the second year, and 84 semester hours by the end of the third year.

Students participating in the Cooperative Education Program or taking a leave of absence or who completely withdraw from a semester will have
their scholarship reviewed based on an adjusted credit hour standard: first-year students will be expected to earn at least 12 semester hours and a 2.500 cumulative scholarship GPA while upper class students will be expected to earn 15 semester hours fewer than the expected credit hour criterion and a 3.000 cumulative scholarship GPA (e.g. a second year student will be expected to earn 39 hours as opposed to 54 hours).

Students who study abroad and for whom official overseas transcripts have not been received at the time of scholarship review will retain their scholarships provided that they meet the overall semester hours required when their records are complete or that they successfully complete a full courseload during study abroad as defined by the host institution.

**Scholarship Grade Point Average:** All courses completed for an evaluative grade at Case Western Reserve University are included in the computation of the scholarship GPA. The scholarship GPA matches the student's cumulative GPA unless the student has repeated a course. If a scholarship recipient has used the Course Repeat Option, both the original grade and the subsequent grade will be included in the computation of the cumulative average for the purpose of determining eligibility for scholarship continuation.

**Provost’s Special Scholarships**

Recipients of Provost’s Special Scholarships must maintain academic good standing to be eligible for continuation of their scholarships. Students who do a complete withdrawal for a semester will still have their scholarship reviewed on the basis of good academic standing.

**Other Scholarships Awarded by Case Western Reserve University**

Recipients of scholarships other than the ones listed above should refer to their scholarship award letter for specific scholarship retention criteria.

**Duration**

A student who meets the standards for scholarship retention may receive scholarship assistance for no more than eight semesters of full-time undergraduate study. The scholarship is awarded for full-time enrollment in regular (fall and spring) semesters. A scholarship recipient who does a complete withdrawal for a semester will lose that semester of scholarship eligibility. If a scholarship recipient completes a bachelor’s degree in fewer than eight semesters of full-time study at Case Western Reserve University, the scholarship will be terminated upon completion of the degree. In the eighth semester (or in the final semester for a student completing the bachelor’s degree in fewer than eight semesters), a recipient may request permission for part-time enrollment with pro-rated scholarship support if completion of the degree does not require full-time enrollment in that final semester.

**Leave of Absence Policy**

A scholarship recipient may take a one-semester leave of absence during the student’s undergraduate career and put his/her scholarship “on hold” for reactivation upon the student’s return to Case Western Reserve University. Requests for a one semester leave of absence must be submitted in advance to the Office of Undergraduate Studies. Requests for leaves of absence longer than one semester must be submitted to the Academic Standing Board, c/o the Office of Undergraduate Studies, and will be reviewed on an individual basis. The leave of absence policy does not apply to a student who transfers to another institution and subsequently returns to Case Western Reserve University.

**Scholarship Termination**

Once a scholarship has been terminated for failure to meet the retention standard, it cannot be reinstated unless reinstatement has been granted by the Academic Standing Board after review of an appeal. A scholarship is automatically terminated upon a student’s transfer to another institution.

**Appeal Process**

Evaluation of student records for scholarship renewal will take place at the end of each academic year, in June. In exceptional circumstances, the Academic Standing Board will continue a scholarship for a student whose achievement or whose attendance does not meet the standards outlined above. It is the student’s responsibility to write to the Academic Standing Board, c/o the Office of Undergraduate Studies, before June 1, to request special consideration for continuation of a scholarship. This appeal should inform the committee of any special circumstances which may have affected performance and/or attendance during the preceding academic year, provide any relevant documentation, and describe a plan for how academic performance will be improved in the future.
Undergraduate Experiential Learning

Experiential Learning

Case Western Reserve University offers undergraduates a variety of experiences inside and outside the classroom that are built on a process of guided inquiry, preparation, action and reflection. Many research, internship, and employment opportunities are aligned with academic programs. Linguistic and cultural immersion characterize the study abroad experience. Courses that incorporate community service or internships into the curriculum forge links between Case Western Reserve undergraduates and schools, neighborhoods, businesses, and governmental and health care institutions in Cleveland and elsewhere.

Course-Based Experiential Learning

In disciplines as diverse as psychology, journalism, engineering, Spanish, Russian, nursing, anthropology, history, and biology, Case Western Reserve students engage in experiential learning beyond the on-campus classrooms and laboratories. Experiences that form the basis for reflection and synthesis under the guidance of faculty include working with hospitalized children, designing engineering solutions for a problem presented by a municipality, interning at a local media outlet, tutoring in Cleveland’s Hispanic community, gaining experience in public health clinics, studying history with “the city as classroom,” or collecting aquatic specimens from the ponds at the university’s 389-acre farm.

International Experience

Undergraduate students who have completed at least 24 semester hours of coursework at Case Western Reserve University, have declared a major, and are in good academic and disciplinary standing, with no pending judicial actions, and are otherwise eligible to register on campus at Case Western Reserve University for the proposed semester(s) (no financial holds, e.g.) are eligible to participate in programs of study or practical experience that immerse them in the culture and language of another country. Up to 36 semester hours of credit may be granted for an approved program of study at a foreign university by enrollment as an exchange student at a university with which Case Western Reserve University has an agreement, by direct enrollment at a foreign university, or by enrollment in a foreign study program offered through an accredited American university or program provider.

Case Western Reserve does not require students to complete any foreign language prerequisites before studying abroad, though students wishing to study in a country where the native language is not English are advised to develop their language skills to the extent possible. However, students studying in a single location where English is not an official language for at least a semester must take a course that advances their skills in a language of the host country during each semester of study abroad, provided such courses are available; this may be a course of language instruction or a course taught in a language of the host country. Students participating in study abroad experiences that are comparative in nature and visit several sites with the same semester are not required to include language study in their academic programs.

Specific study abroad programs may have their own admissions guidelines that exceed these standards; students need to be accepted by those programs.

Students participating in study abroad pay tuition to Case Western Reserve University and maintain their student status during the period of study abroad. Case Western Reserve University will, in turn, pay the tuition costs for the student’s program, but the student will be responsible for all non-tuition costs associated with study abroad. Students eligible for financial aid continue their eligibility during study abroad.

In addition, some Case Western Reserve courses for undergraduates incorporate short-term overseas experience into the curriculum. Students are encouraged to seek such opportunities by contacting academic departments of interest.

Bilateral Exchange Programs

Case Western Reserve University has bilateral exchange agreements enabling students from overseas institutions to attend the University as visiting students and permitting Case Western Reserve undergraduates to receive academic credit for study at the following institutions:

- University of Lancaster, UK (all majors)
- University of Manchester, UK (humanities, social sciences)
- University of Sheffield, UK (all majors)
- University of Sydney, Australia (management, accounting, economics, sociology, political science)
- ESC de Montpellier, France (management, accounting)
- University of Frankfurt, Germany (management, accounting)
- Universidad Carlos III, Spain (management, economics)
- Bilkent University, Turkey (all majors)
- National University of Singapore (all majors)
- Chulalongkorn University, Thailand (engineering)
- Wuhan University, China (nursing)
- University of the Virgin Islands (nursing)

Information about bilateral exchange programs with other overseas universities is available from the study abroad advisor in the Office of International Affairs, Tomlinson Hall.

Global Engineering Exchange Program (GE3)

The Global Engineering Education Exchange (http://www.iie.org/programs/globe3) (GE3) program enables qualified engineering and computer science students to receive academic credit for courses taken at selected engineering institutions and universities in Europe, Asia, Mexico, and Australia, and to have an internship experience in a foreign setting. The program is administered by the Institute for International Education in collaboration with an international consortium of universities offering engineering programs that includes Case Western Reserve. Information about the GE3 program is available from the study abroad advisor in the Office of International Affairs, Tomlinson Hall.

Other Approved Study Abroad Programs

Opportunities exist for students to study abroad in almost all parts of the world through direct enrollment at leading foreign universities or by enrolling in a foreign study program offered through an accredited American university or program provider. In recent years, Case Western Reserve University undergraduates have studied in Argentina, Australia, Austria, Chile, Denmark, England, Finland, France, Germany, Ghana, India, Ireland, Israel, Italy, Japan, Kenya, Nepal, the Netherlands, New Zealand, Russia, Scotland, Senegal, South Africa, Spain and Sweden. The selection of location and institution for study abroad is made in consultation with the study abroad advisor in the Office of International Affairs, Tomlinson Hall.
Research Experience

Undergraduate Research

Case Western Reserve University is a research-intensive community with a historic tradition of involving undergraduates in research and creative endeavors. Regardless of a student’s major or academic interests, there are numerous opportunities to engage in research either on campus with Case Western Reserve faculty or elsewhere during both the academic year and the summer. The SOURCE (http://www.case.edu/provost/source) (Support of Undergraduate Research and Creative Endeavors) Office provides assistance to students in identifying research and creative project opportunities, provides funding for on-campus summer research and travel for students presenting their work at national conferences, and sponsors “Intersections: SOURCE Symposium and Poster Session” and Discussions, the University’s peer-reviewed undergraduate research journal. For more information, contact the SOURCE Director, Sheila Pedigo (http://bulletin.case.edu/undergraduatestudies/learningprograms/mailto:sheila.pedigo@case.edu), Sears 451, 216.368.8508.

In many cases, students pursuing research under the guidance of a faculty member may earn degree credit by registering for “Undergraduate Research” or “Independent Study” in the appropriate department. These are advanced-level courses and require departmental approval. However, students may not earn both degree credit and pay for the same work.

Work Experience

The Center for Civic Engagement and Learning

The Center for Civic Engagement and Learning (p. 601) connects students and the community through service. The center coordinates both curricular and co-curricular activities that promote learning through service to communities locally, nationally, and internationally. Service learning venues include academic course work, work-study positions, residence hall and Greek Life programs, the University Circle Literacy Corps, and weekly service opportunities.

The Center for Civic Engagement also offers regular, weekly and bi-monthly opportunities for community service through the Case SERVES projects; assists faculty and students in designing and implementing community-based courses and SAGES capstone projects; coordinates on-going volunteer and work-study tutoring; and schedules Days of Service for one-time community service projects.

Cooperative Education

Cooperative Education (Co-op) (http://engineering.case.edu/coop) is an academic program that enables students to alternate classroom studies with career based experiences in industry. It is a learning experience designed to integrate classroom theory with practical experience and professional develop. Co-op is a paid full time work experience designed to enhance the student’s education. Case co-op assignments are typically for two seven-month periods, each period consisting of a summer and a contiguous spring or fall semester. While participating in co-op, students maintain their full-time student status. This program is available to students pursuing degrees in engineering, accounting, management and all science majors except astronomy. For additional information, contact Ms. Mary Rose Tichar (http://bulletin.case.edu/undergraduatestudies/learningprograms/mailto:mrt2@case.edu), 304B Nord Hall, 216.368.4447.

Professional Practicum

Practicum (http://studentaffairs.case.edu/careers/jobs/practicums) is an experiential learning collaboration between a student, an employer, and the student’s practicum advisor (a faculty member), that is coordinated by the Career Center’s Experiential Learning Specialist. The program is open to undergraduate students enrolled in the College of Arts and Sciences and/or the Weatherhead School of Management. The primary goal of a practicum is the intellectual, personal and professional growth of the student. In order to ensure that this goal is achieved, the collaborators establish and agree upon learning objectives prior to the start of the practicum. These objectives are reviewed throughout the semester, and the student’s progress is evaluated at both the mid-point and end of the practicum.

While completing a practicum assignment, a student works full-time for a minimum of 14 weeks in a professional setting and does not take classes. The student will maintain full-time student status during the practicum period. Though credit is not awarded, students who successfully complete the practicum assignment will receive transcript notation. A student may participate in up to two practica, but it is recommended that at least one intervening semester be spent on campus. Students interested in participating in a practicum should contact the Career Center a semester prior to the intended practicum assignment.

Washington Study Program

The Washington Study Program (http://politicalscience.case.edu/undergraduate/washington-center-program) provides students with the opportunity to complete a full-time, research-intensive internship in Washington, D.C. By participating in a semester-length program during the fall or spring (WASH 2A (p. 440) Washington Center Internship), students earn 9 credit hours; for a summer internship (WASH 2D (p. 440) Washington Center Summer Internship), they earn 3 credit hours. In addition, students earn 3 credit hours by developing a portfolio based on their internship experiences (WASH 2C (p. 440) Washington Center Summer Internship). The credits earned can be counted as general electives or applied to a student’s major or minor, with the prior consent of the individual department(s). Finally, as part of the Washington Study Program, students participate in a seminar and attend a weekly lecture/discussion group (WASH 2B (p. 440) Washington Center - Politics and Public Policy Course).

To be eligible for the program, a student is expected to be a junior or senior and have at least a 3.000 GPA. The program director (Professor Kathryn Lavelle (http://bulletin.case.edu/undergraduatestudies/learningprograms/mailto:kathryn.lavelle@case.edu), 111 Mather House, 216.368.2691), the student’s major advisor, and the appropriate dean must approve each application. Students must ensure that their participation will not prevent them from meeting on-campus residency or other university requirements.
Undergraduate General Degree Requirements

Case Western Reserve University offers a broad range of programs in the liberal arts and sciences, engineering, management, accountancy, and nursing leading to the Bachelor of Arts (BA) and the Bachelor of Science (BS) degrees. These programs provide depth through concentrated study in a major field, breadth through the fulfillment of general education or core curriculum requirements, and open electives.

The BA is available in more than forty fields in the humanities and arts, the social and behavioral sciences, and the natural sciences and mathematics. In addition, BS programs are offered in accounting, management, the natural sciences, mathematics, computer science, statistics, nutrition, art education, music education, and nursing. The BS in Engineering is available in twelve major fields.

The Bachelor of Music (BM) degree is offered through the Joint Program in Music of Case Western Reserve University and the Cleveland Institute of Music. Students who are candidates for the BM enroll in the Cleveland Institute of Music.

General Requirements for all Bachelor’s Degrees

The bachelor’s degree programs require students to study one field in depth (the major) and to complete general education requirements or a core curriculum as appropriate to the major field and degree program selected. There is overlap among core curricula and general education requirements, which allows students flexibility in the choice of majors and degree programs.

Every candidate for a baccalaureate degree from the university must:

1. complete a foundation curriculum (core curriculum or general education requirements), as specified for the degree sought, that incorporates the requirements of the Seminar Approach to General Education and Scholarship (SAGES);
2. complete two semesters of physical education. This is completed through a combination of half and/or full semesters in Physical Education activity courses;
3. complete a course of studies with a cumulative grade point average of no less than 2.00 for work taken at Case Western Reserve University; and
4. earn in residence at Case Western Reserve University a minimum of 60 semester hours, of which at least 30 must be earned after the student achieves senior status.

There are four foundation curricula that incorporate the SAGES requirements:

1. Arts and Sciences General Education Requirements, required for the Bachelor of Arts (BA) and the following Bachelor of Science (BS) degrees: applied mathematics, art education, astronomy, biochemistry, biology, chemistry, geological sciences, mathematics, mathematics and physics, music education, nutrition, nutritional biochemistry and metabolism, physics, statistics, and systems biology.
2. Engineering Core Curriculum, required for the Bachelor of Science in Engineering (BSE) degree and, with specific course exceptions, for the Bachelor of Science (BS) degree in computer science.
3. School of Nursing General Education Requirements, required for the Bachelor of Science in Nursing (BSN) degree.
4. Weatherhead School of Management General Education Requirements, required for the Bachelor of Science (BS) degree in accounting, and in management.

SAGES

The Seminar Approach to General Education and Scholarship (SAGES) provides a foundation in critical thinking, written and oral communication, the use of information, quantitative reasoning, engagement with ethical issues and diversity, and exposure to experimental and theoretical approaches to understanding human culture and behavior, scientific knowledge, and methods of research through the following:

1. First Seminar, taken in the first semester, introduces students to the seminar format through reading, discussion, and intensive writing, and incorporates activities with University Circle institutions. First Seminar will be selected from offerings in the Life of the Mind, the Natural World, the Social World, or the Symbolic World.

*Transfer Students only: Transfer students who have completed the English composition/expository writing requirement with a grade of C or higher at the college/university at which they previously matriculated will receive transfer credit for FSCC 100-TR (3 – 6 semester hours) and will be required to complete a supplemental 1-semester-hour SAGES introductory seminar – FSTS 100 SAGES Transfer Supplement.

2. Two University Seminars, taken after the First Seminar and before the end of the student’s second year, and selected from seminars that address specific topics that fall under broad themes: Thinking About the Social World, Thinking About the Symbolic World, Thinking About the Natural World.

3. Writing Portfolio, comprising writing assignments selected from the First Seminar and University Seminars. The Writing Portfolio is submitted for evaluation after completing the final University Seminar.

4. Department Seminar, generally taken in the junior year in the student’s major field, that focuses on discipline-specific methods and modes of inquiry and communication.

5. Senior Capstone, a one- or two-semester capstone project integrating the knowledge, initiative, problem-solving skills, and powers of communication developed by the student. Substantial writing and a final public presentation are required.

Information about specific department seminars and capstones is available from department academic representatives and on the searchable schedule of classes on the University Registrar’s website (http://www.case.edu/registrar).

Requirements for Specific Degrees

Students are expected to complete a bachelor’s degree in a timely fashion and will ordinarily be subject to the degree requirements in place at the time of matriculation at Case Western Reserve University, although they may choose to update their requirements to those included in a later General Bulletin.

If a student extends study towards a bachelor’s degree beyond 10 years after first matriculating as an undergraduate student, the major-field department(s) will review the student’s academic record and may update major field requirements. Also, if the student has not already completed the applicable general education requirements in place at the time of matriculation, the appropriate dean in the school offering the major will also review the student’s academic record and may update general education requirements.
Dual Undergraduate Degree Programs

To qualify for two undergraduate degrees, i.e., a BA and a BS degree, or two BS degrees, a student must satisfy all requirements for each degree, and complete for the second degree thirty semester hours of study beyond the hours required for the first degree. A student may, however, complete two or more Arts and Sciences majors within the 120 hour minimum requirement for the BA degree or two or more Engineering majors within the 128-133 hour minimum requirement for the BS in Engineering degree. Students who seek a dual-degree program that involves the BM must meet Cleveland Institute of Music and Case Western Reserve admission requirements, and seek approval of both the Cleveland Institute of Music and Case Western Reserve University.

Students completing both a BA and a BS degree are exempted from six hours of the 90-hour arts and sciences requirement for the BA.

A student pursuing two degrees is encouraged to meet with a dean in the Office of Undergraduate Studies, 357 Sears Bldg., to discuss requirements.
Undergraduate Grades

Grades

Grades at Case Western Reserve University are issued on the following scale with good standing based on the Academic Standing Regulations presented in the section on Academic Policies and Procedures and the requirement of a 2.000 average for graduation. Academic averages are computed by dividing the number of quality points earned by the number of hours completed, excluding transfer credit, credit based on examinations (AP, IB, proficiency, etc.), and courses graded P/NP.

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<tr>
<th>Letter Grade</th>
<th>Meaning</th>
<th>Quality Points</th>
<th>Notes</th>
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<tr>
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<td>W</td>
<td>Withdrawal for a class</td>
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<td>Withdrawal from all classes during a given semester</td>
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<tr>
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<td>Passing in a Pass/No Pass Course</td>
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<tr>
<td>NP</td>
<td>Not Passing in a Pass/No Pass Course</td>
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<td>R</td>
<td>For courses which extend over more than one semester</td>
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<td>AD</td>
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Grade of Incomplete

Assignment of the Incomplete Grade:
The Incomplete grade (I) is assigned by and at the discretion of the instructor when a) there are extenuating circumstances, explained to the instructor before the assignment of the grade, which clearly justify an extension of time beyond the requirements established for and met by other students in the class, and b) the student has been passing the course and only a small segment of the course, such as a term paper, remains to be completed. It is the student's responsibility to notify the instructor of the circumstances preventing completion of all assigned work. In the absence of notification or adequate justification, the instructor has the authority to assign the student a final grade that assumes a failing grade for the missing work. An Incomplete grade should not be assigned a) when a student has been absent for much of the semester and/or has done little of the work required for a course, or b) because a student is absent from a final examination, unless the dean of undergraduate studies has authorized the grade.

The amount of additional time allowed the student to make up incomplete work should serve to accommodate the student while being fair to other students in the course. It should be proportional to the duration of a student's illness or absence and might be no more than a few days or weeks. At the extreme, it should not extend past the eleventh week of the session following the one in which the Incomplete grade was received. In certain cases (such as students on probation) the dean of undergraduate studies may establish an earlier date for completion of courses with Incomplete grades.

Changing the Incomplete Grade:
When the student has completed the required work, the instructor shall enter in the Student Information System a final evaluative grade to replace the Incomplete. When a student fails to submit the work required for removing the Incomplete by the date established, the instructor shall enter a final grade that assumes a failing performance for the missing work. In the absence of the assignment of a grade by the instructor, the Registrar will convert the I to F when the deadline for making up Incomplete grades from a previous semester has passed.

Audit
See section on Academic Policies and Procedures

Pass/No Pass

Undergraduate students (degree candidates and non-degree students enrolled at the undergraduate level), other than students participating in the Pre-College Scholars program, may elect to take one course each fall and spring semester on a Pass/No Pass grading basis, provided they remain enrolled in at least 3 semester hours of courses for regular evaluative grades. Enrollment in courses that are graded on a Pass/No Pass basis (e.g., PHED 55A Cardio-Fitness (First Half)) does not preclude a student's use of the Pass/No Pass option in another courses taken that same term. The Pass/No Pass option is not available during the summer session or to undergraduate degree candidates enrolled at the graduate or professional levels through the IGS program or Senior Year in Professional Studies.

Instructors are not notified of a student’s use of this option. They submit evaluative grades for all students and these are converted to Pass/No Pass in the Registrar’s Office. Courses elected on a Pass/No Pass basis and completed with a grade of D or higher will be entered with the grade P on the student's transcript. Courses taken Pass/No Pass for which a grade of F is earned will have NP entered on the transcript. Students who earn a P grade will earn credit for the course, while those who earn NP will not. Grades of P and NP are not included in computing the grade point average.

Students may submit an on-line Pass/No Pass Option form at any time in the fall or spring semester after the end of the drop/add period and before 5:00 p.m. on the day of the course withdrawal deadline for that semester (currently the 11th Friday of the semester for upperclass students, including new transfer students; and the last day of classes for first year students).

Use of the Pass/No Pass option is subject to the following restrictions:
1. All courses to be counted toward major, minor, or SAGES/general education/core requirements must be taken for regular evaluative grades. If a student opts for the Pass/No Pass option in a course, that course will not be counted toward any of these requirements.
2. Students majoring in any Weatherhead School of Management major (accounting or management) may not use the Pass/No Pass option for any Weatherhead School of Management courses (ACCT, BAFI, BLAW, ENTP, LHRP, MGMT, MIDS, MKMR, OPMT, ORBH, OPRE, PLCY), either required or elective.

Students who earn a P grade will earn credit for the course. If a student opts for the Pass/No Pass option in a course, that course will not be counted toward any of the requirements.
3. The Pass/No Pass Option cannot be used for courses that are being repeated.

4. A decision to use the Pass/No Pass option is irrevocable unless the student needs that course to complete requirements for a major or minor declared in a subsequent semester. In that event, the student may request that the Office of Undergraduate Studies reveal the grade on the transcript at the start of the student’s final term at Case Western Reserve University.

Course Repetition
See section on Academic Policies and Procedures.

Grade Reports and Transcripts
Students may view their grades on the Student Information System (https://sis.case.edu/psp/saprd/EMPLOYEE/PSFT_HR/c/CW_SR_MENU.CW_CONFID_AGREEMNT.GBL?). Students can request official copies of their transcripts (http://www.case.edu/registrar/transcripts.html) from the Registrar’s Office. The University considers the grades earned by a student and other information about the student’s performance at the University confidential and will release such information only upon written request by the student. Transcripts will not be issued to or on behalf of students who have not discharged all obligations to the University.

Midterm Grades
Midterm grades are assigned in undergraduate courses at the end of the eighth week of each semester. The purpose of midterm grades is advisory; the grades are not part of a student’s official academic record or transcript. At midterm, an instructor may assign to undergraduates evaluative letter grades (A, B, C, D, or F) or grades to indicate satisfactory (S) or unsatisfactory (U). (S and U may not be assigned as final course grades in undergraduate courses). Students may view their midterm grades on the Student Information System (https://sis.case.edu/psp/saprd/EMPLOYEE/PSFT_HR/c/CW_SR_MENU.CW_CONFID_AGREEMNT.GBL?). Students who have any low or unreported midterm grades should discuss their progress with their instructors and with their advisors.
Undergraduate Honors and Awards

Dean's Honor Lists
The Dean's Honor Lists consist of the names of those undergraduate students who have distinguished themselves by achieving during the previous semester the grade point averages required with a minimum of 12 hours earned and who have no Fs or NPs, during the same period. Students with a grade point average of 3.750 or higher will be placed on the Dean's High Honors List. Students with a grade point average of at least 3.500 but less than 3.750 will be placed on the Dean’s Honors List. Students whose records include Incompletes become eligible for the Dean’s Honor Lists once all Incompletes have been converted to final grades. Having earned a place on the Dean’s Honors List or Dean’s High Honors List is noted on the transcript.

Commencement Honors
Commencement Honors are awarded to the top 35 per cent of the graduating class.

- Top 10 per cent: summa cum laude
- Next 10 per cent: magna cum laude
- Next 15 per cent: cum laude

The specific GPA cutoffs are determined each year after the awarding of August degrees on the basis of the GPAs of students who graduated over the past five years. These cutoffs are then applied to degrees awarded in the following January, May, and August.

To be eligible for commencement honors, candidates must have:
1. Earned a minimum of 54 hours for evaluative grades (A, B, C, D) in residence at the university.
2. Attained the required percentile ranking on the basis of all work for which grades are averaged at the university, including any grades earned before an academic separation.

Honors in the Major
Some majors offer outstanding students the opportunity to complete an honors program. Students who participate in an honors program in the major and satisfy the requirements for such a distinction, as specified by the major, may qualify to receive the degree “with honors in the major.” The academic representative for the major can provide information regarding requirements for graduation with honors in the major.

Phi Beta Kappa
Phi Beta Kappa, a national honor society, recognizes outstanding scholarship in the arts and sciences. The Alpha Chapter of Ohio, established in Western Reserve College in 1847, was one of the first ten established nationally. Students may qualify for election to membership in the second semester of the senior year. A few outstanding students may be elected to membership as juniors.

Tau Beta Pi
Tau Beta Pi is a national honor society that recognizes full-time engineering students for outstanding scholarship, leadership, and service.

Mortar Board
Mortar Board is a national honor society that recognizes full-time senior students for outstanding scholarship, leadership, and service.

Fellowships and Scholarships
Outstanding students may obtain information about national competitive scholarships (Goldwater, Truman, Rhodes, etc.) in the Office of Undergraduate Studies, 357 Sear Building.

Departmental and Collegiate Awards
At honors assemblies at the end of each spring semester, the university presents awards recognizing the outstanding achievement of individual students. The departmental awards are based on achievement in specific academic disciplines. Some of the departmental and collegiate awards are based on a combination of leadership, scholarship, and service. The collegiate awards for students with the best academic records take into account credit load, grades, and the proportion of courses taken for evaluative grades (i.e., not taken Pass/No Pass).

Accountancy
- The Apple Growth Partners Scholarship Award
- The Beta Alpha Psi Award for excellence in accounting
- The Beta Alpha Psi Scholars Recognition Award for outstanding scholarship among members of the Pi Chapter
- The Andrew D. Braden Award for Excellence in Auditing and Financial Reporting Studies
- The Cashy Family Scholarship Award
- The Cohen & Co./Beta Alpha Psi Leadership Award
- The Dean's Award in Accounting
- The Dean’s Award in Accounting/The Deloitte Award to an outstanding junior majoring in Accounting
- The Department of Accountancy Academic Achievement Award
- The Thomas Dickerson Award for Excellence in Professional Accountancy Studies
- The Accounting Achievement Award/Ernst and Young Award
- The Louis E. Levy Scholars in Accountancy
- The Ohio Society of Certified Public Accountants Cleveland Endowment Scholarship
- Saltz, Shamis & Goldfarb/SS&G Scholarship Award
- The Dean's Award in Accounting/Skoda, Minotti & Company Award for an outstanding underclassman
- The Wallach-Lee Families Scholarship Award

Anthropology
- The Callender Memorial Award for outstanding achievement in anthropology
- The James Dysart Magee Award for the senior year to an outstanding student in social and behavioral sciences
- The Jonathan F. Plimpton Award to a graduating senior for outstanding achievement in anthropology
- The Ruth and Newbell Niles Puckett Award to a graduating senior for outstanding achievement in anthropology

Art History
- The Muriel S. Butkin Art History Prize for overall best performance and highest grade point average by an undergraduate art history major
- The Noah L. Butkin Award for the best term paper on an art history topic written by an undergraduate
- Friends of Art Prize awarded to an undergraduate senior art history major for distinction in the field of art history
Art Studio
• The Charles E. Clemens Prize for outstanding talent and accomplishment in art
• The William Grauer Award for excellence in art studio courses
• The Doris Young Hartsook Prize for excellence in art education
• The Hazel Gibbs Herbruck Prize for excellence in art education
• The Kennedy Prize for creative work in art
• The Arnold Philip Award for excellence in art

Astronomy
• The Jason J. Nassau Prize to an outstanding senior student in astronomy

Biochemistry
• The Merton F. Utter Prize to a candidate for the BA majoring in biochemistry for outstanding achievement
• The Harland G. Wood Prize for outstanding performance by a graduating senior majoring in biochemistry who is a candidate for the BS in Biochemistry

Biology
• The Daniel Burke Prize for excellence in both biology and chemistry
• The Francis Hobart Herrick Prize for outstanding biological research and academic excellence in biology
• The Russell M. Lawall Prize in Biological Sciences for excellence in biology
• The Flora Stone Mather Alumnae Award in Biology for outstanding academic performance in biology
• The Carl F. Prutton Chemical Engineering Award to the senior whose academic performance merits his or her selection as outstanding.
• The William H. Schuette Memorial Award to an outstanding senior in chemical engineering
• The A. W. Smith Prize to a senior for academic achievement in chemical engineering in the junior and senior years
• Outstanding Sophomore Student in Chemical Engineering

Chemical Engineering
• The Monroe J. Bahnsen Award to a senior for achievement in chemical engineering whose work in design and research projects has been outstanding.
• The Connie Ilcin Award to the student who exhibits outstanding performance in chemical engineering
• The Carl F. Prutton Chemical Engineering Award to the senior whose academic performance merits his or her selection as outstanding.
• The William H. Schuette Memorial Award to an outstanding senior in chemical engineering
• The A. W. Smith Prize to a senior for academic achievement in chemical engineering in the junior and senior years

Biomedical Engineering
• The Jose Ricardo Alcala Memorial Award for biomedical engineering research
• The Mark Bernstein Memorial Award to a senior biomedical engineering major for outstanding achievement in academics and leadership, contributions to research, and service to the university, department or community
• The Biomedical Engineering Chairman’s Award for outstanding academic achievement and service to the biomedical engineering community
• The Biomedical Engineering Faculty Award for outstanding academic achievement, and service to the biomedical engineering community
• The Biomedical Engineering Research and Engineering Award for outstanding performance in biomedical engineering research combined with outstanding academic achievement
• The Biomedical Engineering Scholarship Award
• The Cristina A. Camardo Award to a biomedical engineering student in recognition of his or her leadership and service within the university community
• The Srinivasa (Vasu) P. Gutti Chairman’s Award to a biomedical engineering student for outstanding scholarship and leadership in biomedical engineering
• Outstanding Senior Project Presentation Award
• Outstanding Undergraduate Teaching Assistant Award
• The Gheorghe and Claudia Mateescu Award for Research in Imaging
• The J. Thomas Mortimer Cooperative Education Award

Civil Engineering
• The Kenneth M. Haber Award to the outstanding senior in civil engineering
• The Roy Harley Prize to a promising senior or graduate student in civil engineering
• The Craig J. Miller Memorial Award to a student who has shown outstanding academic achievement
• The Allison C. Neff Memorial Award in recognition of high proficiency in professional studies and participation in professional activities to a junior whose major field is civil engineering
• The Richard and Opal Vanderhoof Award to an outstanding senior in civil engineering

Classics
• The Crawford Summer Scholarship to the American School of Classical Studies in Athens
• The Abraham Lincoln Fuller Prizes for excellence in the study of Greek or Latin
• The Emma Maud Perkins Prize for excellence in classical studies

Cognitive Science
• The Cognitive Science Award to the graduating senior for outstanding academic achievement in cognitive science
• The Award in Cognition and Culture

Dance
• The Lily Dreyfuss Memorial Award for excellence in dance
• The Bradford W. Petot Award for Excellence in Dance for a non-major

Earth, Environmental and Planetary Sciences
• The Charles S. Bacon Award for outstanding contributions to the Department of Geological Sciences
• The Philip O. Banks Award for outstanding academic achievement in geological sciences
• The Carol W. Walker Award for an outstanding senior project in the Department of Geological Sciences

Economics
• The Robert N. Baird Award for academic excellence and leadership in extracurricular activities
• The Marvin J. Barloon Book Award for outstanding performance in economics
• The Dean’s Achievement Award for scholarship and leadership in economics
• The Gardiner Scholarship to a junior majoring in economics and also interested in finance
• The H. W. Kniesner Prize to an outstanding senior in economics
• The James Dysart Magee Award to an outstanding student in economics for the senior year
• The Howard T. McMyler Award to an outstanding student majoring in economics

Electrical Engineering and Computer Science
• The ACM Award to the senior judged by the student chapter of the Association for Computing Machinery most likely to have an outstanding professional career
• The Chairman’s Award to a student in the Department of Electrical Engineering and Computer Science who shows exceptional academic or leadership potential
• The Donald P. Eckman Award to the outstanding senior in systems and control engineering
• The Electrical Engineering and Computer Science Award for the best senior project in electrical and computer engineering
• The Senior Project Award in Systems and Control Engineering
• The Best Senior Project Award
• The Electrical Engineering Service Award to the senior performing outstanding service to his or her class
• The IEEE/HKN Award to the senior judged by the student chapters of the Institute of Electrical and Electronics Engineers and Eta Kappa Nu to possess the qualities necessary for an outstanding professional career in a general field of electrical engineering
• The National Electrical Engineering Consortium William L. Everitt Award to a student who has excelled academically in communications or computers
• The Andrew R. Jennings Award to a senior for excellence in Computer Engineering and Sciences
• The Carolyn J. and John A. Massie ’66 Prize for Computer Engineering and Science awarded to the outstanding junior in computer engineering and science with exceptional research and leadership potential
• The Carolyn J. and John A. Massie ’66 Prize for Computer Engineering and Science awarded to the outstanding sophomore in computer engineering and science with exceptional research and leadership potential
• The W. Bruce Johnson Award to a senior for an outstanding project in the area of electrical sciences and applied physics
• The EECS Research Award to the senior demonstrating exceptional research potential
• The Undergraduate Alumni Capital Award in Systems and Control Engineering to a senior for academic excellence and professional promise.

Engineering
• First Robotics Scholarship

English
• The Charles E. Clemens Award for talent and accomplishment in writing
• The Finley Foster/Emily M. Hills Poetry Prize for the best poem or group of poems
• The Emily M. Hills Award for the best poem or essay written by a woman in the College of Arts and Sciences
• The Holden Prize for the best English paper written by an upperclass student
• The Kennedy Prize for creative work in English
• The Edith Garber Krotinger Prize for excellence in creative writing
• The Karl Lemmerman Prize for the best paper by a first-year student
• The Eleanor Leuser Award for outstanding writing for or about children by a student enrolled in a creative writing course at the university
• The Nemet Scholarships for the demonstration of excellence in creative writing
• The Harriet Pelton Perkins Prize to an outstanding student majoring in English
• The Helen B. Sharnoff Award for formal poetry submitted by undergraduate students

Environmental Studies
• The Henry David Thoreau Award for an outstanding senior in environmental studies

History
• The Donald Grove Barnes Award to a senior for excellence in history
• The Clarence H. Cramer Award for excellence in research and writing of history
• The Annie Spencer Cutter Prize to a senior for outstanding achievement in history
• The History Department Award for outstanding achievement in history
• The Sigma Psi Prize for excellence in history
• The John Hall Stewart Prize for excellence in historical studies

Judaic Studies
• The Ira and Ruth Bressler Prize to a student who has done outstanding work in the area of Jewish studies
• The Eudese and Elmer Paull Prize to one or several undergraduate or graduate students who demonstrate an interest in Jewish studies or Jewish contemporary life

Macromolecular Science and Engineering
• The Hal Loranger Award to the outstanding senior in polymer science
• The Samuel Maron Memorial Award to an undergraduate for excellence in polymer research

Management
• The Robert O. Berger Jr. Award to a junior who demonstrates overall achievement in scholarship, as well as notable community participation and leadership
• The Nellie Chittenden Carlton Prize to a senior in management whose outstanding work in the general field of economics shows the greater promise
• The Dean's Achievement Award for excellence in scholarship and leadership in management
• The Excellence in Finance Award
• The Excellence in Marketing Award
• The Outstanding Marketing Student Award
• The Roulston Performance Award for outstanding performance in management
• The Kevin J. Semelsberger Prize for excellence in management
• The Iris Wolstein Award for Excellence in Business Venture History to a student whose work on projects and/or course work related to the study of Cleveland business venture history is determined to have made a significant contribution to the understanding of the business development in Northeast Ohio and related environs
• The Wolstein Family Award for Excellence in Business Venture Plan Development to a student enrolled in a major or minor in Weatherhead undergraduate programs whose business venture development plan is considered to have the highest promise to be successfully initiated

Materials Science and Engineering
• The Wesley P. Sykes Prize to a senior majoring in materials science and engineering who shows outstanding ability in scientific research, especially as evidenced by the quality of his or her senior project.
• The Professor Jack F. Wallace Award to the materials science and engineering student who embodies the dedication and spirit of Professor Wallace

Mathematics
• The Case Alumni Award to an outstanding senior mathematics major
• The Chair’s Award to a student contributing to the intellectual life of the majors program
• The Max Morris Prize to an outstanding undergraduate student in mathematics who is pursuing the BS degree.
• The Webster Godman Simon Mathematics Award to a sophomore or junior pursuing a BA degree, for excellence in mathematics

Mechanical and Aerospace Engineering
• The Robert and Leona Garwin Prize to a student who has demonstrated theoretical scientific ability with experimental competence and inventive talent
• The Gustav Kuerti Award to the senior in mechanical and aerospace engineering who has demonstrated the highest level of scholarship
• The Anish Shah '91 Award to an outstanding senior in mechanical and aerospace engineering based on academic achievement, extracurricular activities, and community service
• The Fred Hale Vose Prize to the senior in mechanical engineering who has demonstrated the greatest promise for professional leadership

Modern Languages and Literatures
• The Arabic Book Prize for high achievement in Arabic
• The Louise Burke French Prize to an outstanding French student
• The Chinese Book Prize for high achievement in Chinese
• The Susie Scott Christopher Prize for excellent contributions to the French program
• The Department of Modern Languages and Literatures Award for outstanding achievement
• The Emile B. deSauze Award for attaining the highest honors in modern languages and literatures
• The Folberth German Prize for excellence in German language and literature
• The French Book Prize for high achievement in French
• The German Book Prize for high achievement in German
• The Hebrew Book Prize for high achievement in Hebrew
• The Italian Book Prize for high achievement in Italian
• The Japanese Book Prize for high achievement in Japanese
• The Max Kade Excellence in German Award
• The Florence Keuerleber Prize to an undergraduate student who has seriously pursued and excelled in the study of a modern language while majoring in another area
• The Russian Book Prize for high achievement in Russian
• The Spanish Book Prize for high achievement in Spanish

Music
• The Arthur H. Benade Prize to a senior with a major other than music who has made a notable contribution to music on campus during his or her undergraduate years
• The Charles E. Clemens Prize for talent and accomplishment in music
• The Doris Young Hartsock Prize for outstanding performance in music education
• The Kennedy Prize for creative work in music
• The Lyman Piano Award
• The Joan Terr Ronis Recital Prize to an outstanding undergraduate majoring in music who has made an exceptional contribution to the musical life of the University

Nursing
• The Bolton Scholar Award for Excellence in Acute Care Nursing
• The Bolton Scholar Award for Excellence in Community Health Nursing
• The Bolton Scholar Award for Excellence in Critical Care Nursing
• The Bolton Scholar Award for Excellence in Gerontology
• The Bolton Scholar Award for Excellence in Maternal-Child Nursing
• The Bolton Scholar Award for Excellence in Nursing Informatics
• The Bolton Scholar Award for Excellence in Pediatric Nursing
• The Bolton Scholar Award for Excellence in Psychiatric/Mental Health Nursing

Nutrition
• The Mary Eliza Parker Award for excellence in nutrition and dietetics

Philosophy
• The Truman P. Handy Philosophical Prizes to outstanding juniors or seniors for excellence in philosophy

Physical Education
• The Emily Russell Andrews Award to the senior woman who makes the greatest contribution to the physical education department through scholarship, leadership, participation, and service
• The Philip K. “Nip” Heim Award to the senior man who makes the most outstanding contribution to Case Western Reserve University through the athletic program
• The Dorothy L. Hoza Award to the outstanding freshman, sophomore or junior who has made a strong contribution to the department and university
• The Patricia B. Kilpatrick Award to the four-year varsity participant with the highest grade point average
• The Arthur P. Leary Award to the outstanding first-, second- or third-year student who has demonstrated leadership, good sportsmanship, maintained good academic standing, and made contributions to the department and university

Physics
• The B.S. Chandrasekhar Prize awarded upon completion of the junior year to a physics major who has demonstrated superior performance
• The Leslie L. Foldy Award to the outstanding senior in physics
• The Dayton C. Miller Award to an outstanding senior in physics for the best thesis
• The Elmer C. Stewart Memorial Award to an outstanding senior in Physics who has demonstrated achievement in the applications of physics
• The Senior Award for service and scholarship in physics

Political Science
• The James Dysart Magee Award for the senior year, to an outstanding student in social and behavioral sciences
• The Flora Stone Mather Alumnae Award for outstanding academic performance in political science

Psychological Sciences
• The Stephen Bednarik Memorial Award to an outstanding senior majoring in psychology
• The James Dysart Magee Award for the senior year, to an outstanding student in social and behavioral sciences
• The Professor Edwin P. Hollander, Adelbert 1948, and Mrs. Patricia A. Hollander Capstone Research Award
• The Flora Stone Mather Alumnae Award for outstanding academic performance in psychology
• The National Student Speech-Language-Hearing Association Award for outstanding leadership and achievement in communication sciences

Religious Studies
• The Ratner Family Prize to a graduating senior for the highest academic achievement in the study of religion

Sociology
• The Stella Berkeley-Friedman Award to a graduating senior for the highest academic achievement in the study of sociology
• The Robert C. Davis Award for demonstrated commitment to sociological studies
• The Mark Lefton Award for excellence in sociological studies
• The James Dysart Magee Award for the senior year, to an outstanding student in social and behavioral sciences
• The Schermerhorn Award for an outstanding student in sociology

Theater
• The Dionysus Award for an outstanding contribution to theater for a student not majoring in theater arts
• The Barclay Leathem/Nadine Miles Award for creativity and general excellence in theater

Women’s and Gender Studies
• The George Sand Award in Women’s and Gender Studies to a graduating senior majoring or minoring in the field for excellence in academic performance
• The Sojourner Truth Award to an outstanding student who combines academic excellence in Women’s and Gender Studies with commitment to community service, advocacy of women’s and gender-related issues, and activism
• The Mary Wollstonecraft Award to a graduating senior majoring or minoring in the field for excellence in academic performance

Awards for Study Abroad
• The Brookes Friebohm Award to an outstanding student for study in France
• The Eva L. Pancost Memorial Fellowship for graduating senior women in the College of Arts and Sciences or women students in the School of Graduate Studies interested in extending their education by foreign travel or study
• The Alice Seagraves Award to outstanding students for study abroad

Collegiate Awards
• The Robert J. Adler Award to the senior student in the Case School of Engineering who, through high scholarship, technical creativity, and service to his or her peers, best exemplifies the ideals and talents of Professor Robert J. Adler
• The Bolton Scholar Award for Academic Excellence
• The Bolton Scholar Award for excellence in leadership and community service
• The Bolton Scholar Award for Excellence in Nursing for the student who has attained the highest academic record at the junior level
• The Bolton Scholar Award for Excellence in Nursing for the student who has attained the highest academic record at the sophomore level
• The Carol and Edward Breznyak G’64 Cooperative Education Student of the Year Award to a student in the Case School of Engineering who has demonstrated outstanding performance in the Cooperative Education Program based on industry evaluations, written reports and student initiative
• The Case Alumni Association Prize for Achievement to the senior with the best academic record in the Case School of Engineering
• The Case Western Reserve University Women’s Club Prize for a student completing an outstanding Capstone Project
• The Edward J. “Ted” Corcoran Award to a senior for outstanding leadership, character and service
• The Director’s Award for the Outstanding BSN Graduate
• The Russell A. Griffin Award to a senior in the College of Arts and Sciences who has made the most significant contribution to campus life
• The George T. Hunt Awards to a junior and a senior outstanding in leadership, scholarship, and service
• The Junior Award of the College of Arts and Sciences to juniors with the best academic records at the end of five semesters
• The Matthew Leskiewicz Award to a senior in the Weatherhead School of Management for outstanding leadership and service
• The Louis K. Levy Prize for an outstanding junior in the College of Arts and Sciences
• The P. G. “Jerry” Lind Award for a graduating senior in engineering or science who has made a significant contribution to campus life
• The Flora Stone Mather Alumnae Award for outstanding academic performance in the humanities
• The Outstanding Junior Awards of the Case School of Engineering to juniors with the best academic records at the end of five semesters in the Case School of Engineering
• The Outstanding Sophomore Awards of the Case School of Engineering to the sophomores with the best academic record at the end of three semesters in the Case School of Engineering
• The Phi Beta Kappa Prize to sophomores with the best academic records in a liberal arts curriculum after three semesters
• The Harriet Levion Pullman Award to a sophomore outstanding in scholarship, leadership, and service
• The John Schoff Millis Award to the senior with the best academic record in the College of Arts and Sciences
• The Sylvia Green Rosenberg Award to a part-time or full-time non-traditional student
• The Robert L. Shurter Prize to a senior for leadership in extracurricular activities in the 2009-2010 Award to an outstanding premedical student for the senior year
• The Joseph Skigin Memorial Award to an outstanding premedical student for the senior year
• The Kent H. Smith Award to an outstanding senior displaying extraordinary leadership, character, and scholarship in the Case School of Engineering
• The Stephanie Tubbs-Jones Award for significant contributions to campus life, scholarship and community service
• The Weatherhead School of Management Award to a senior, for outstanding achievement in the Weatherhead School of Management
• The Stanley E. Wertheim Prize for an outstanding junior in the Case School of Engineering who has demonstrated leadership skills through involvement in campus or co-op activities
• The Peter Witt Scholarship to a deserving student who demonstrates a vital and active interest in the improvement of life in Cleveland
## Undergraduate Majors and Minors

### Majors and Minors

<table>
<thead>
<tr>
<th>Department Subject</th>
<th>Degree</th>
<th>Available as</th>
<th>Foundation Curriculum</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACC Accounting</td>
<td>BS</td>
<td>Major or Minor</td>
<td>WSOM - Sages</td>
</tr>
<tr>
<td>EAR Aerospace</td>
<td>BSE</td>
<td>Major</td>
<td>EC - SAGES</td>
</tr>
<tr>
<td>AMS American Studies</td>
<td>BA</td>
<td>MA or Minor</td>
<td>A&amp;S - SAGES</td>
</tr>
<tr>
<td>ANT Anthropology</td>
<td>BA</td>
<td>MA or Minor</td>
<td>A&amp;S - SAGES</td>
</tr>
<tr>
<td>APM Applied Physics</td>
<td>BS</td>
<td>MA</td>
<td>A&amp;S - SAGES</td>
</tr>
<tr>
<td>ARE Art Education</td>
<td>BA</td>
<td>MA</td>
<td>A&amp;S - SAGES</td>
</tr>
<tr>
<td>ARH Art History</td>
<td>BA</td>
<td>MA or Minor</td>
<td>A&amp;S - SAGES</td>
</tr>
<tr>
<td>ARS Art Studio</td>
<td></td>
<td>Minor</td>
<td></td>
</tr>
<tr>
<td>AIN Artificial Intelligence</td>
<td></td>
<td>Minor</td>
<td></td>
</tr>
<tr>
<td>ASI Asian Studies</td>
<td>BA</td>
<td>MA or Minor</td>
<td>A&amp;S - SAGES</td>
</tr>
<tr>
<td>AST Astronomy</td>
<td>BA or BS</td>
<td>MA or Minor</td>
<td>A&amp;S - SAGES</td>
</tr>
<tr>
<td>BAF Banking and Finance</td>
<td></td>
<td>Minor</td>
<td></td>
</tr>
<tr>
<td>BCG Biochemistry</td>
<td>BA or BS</td>
<td>MA or Minor</td>
<td>A&amp;S - SAGES</td>
</tr>
<tr>
<td>BIO Biology</td>
<td>BA or BS</td>
<td>MA or Minor</td>
<td>A&amp;S - SAGES</td>
</tr>
<tr>
<td>BIB Biomedical Engineering</td>
<td>BSE</td>
<td>MA or Minor</td>
<td>EC - SAGES</td>
</tr>
<tr>
<td>BUS Business Management</td>
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<td>Minor</td>
<td></td>
</tr>
<tr>
<td>ECE Chemical Engineering</td>
<td>BSE</td>
<td>MA or Minor</td>
<td>EC - SAGES</td>
</tr>
<tr>
<td>CHE Chemistry</td>
<td>BA or BS</td>
<td>MA or Minor</td>
<td>A&amp;S - SAGES</td>
</tr>
<tr>
<td>CHS Childhood Studies</td>
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<td></td>
</tr>
<tr>
<td>CIC Chinese</td>
<td></td>
<td>Minor</td>
<td></td>
</tr>
<tr>
<td>ECI Civil Engineering</td>
<td>BSE</td>
<td>MA or Minor</td>
<td>EC - SAGES</td>
</tr>
<tr>
<td>CLS Classics</td>
<td>BA</td>
<td>MA or Minor</td>
<td>A&amp;S - SAGES</td>
</tr>
<tr>
<td>COG Cognitive Science</td>
<td>BA</td>
<td>MA or Minor</td>
<td>A&amp;S - SAGES</td>
</tr>
<tr>
<td>COS Communication Sciences</td>
<td>BAE</td>
<td>MA or Minor</td>
<td>A&amp;S - SAGES</td>
</tr>
<tr>
<td>ECM Computer Engineering</td>
<td>BSE</td>
<td>MA or Minor</td>
<td>EC - SAGES</td>
</tr>
<tr>
<td>CGM Computer Gaming</td>
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<td>Minor</td>
<td></td>
</tr>
<tr>
<td>CMP Computer Science</td>
<td>BA</td>
<td>MA or Minor</td>
<td>A&amp;S - SAGES</td>
</tr>
<tr>
<td>CMP Computer Science</td>
<td>BS</td>
<td>MA or Minor</td>
<td>EC - SAGES</td>
</tr>
<tr>
<td>DAN Dance</td>
<td>BA</td>
<td>MA or Minor</td>
<td>A&amp;S - SAGES</td>
</tr>
<tr>
<td>DAM Dean’s Approved Major</td>
<td>BA</td>
<td>Individually Designed</td>
<td>A&amp;S-SAGES</td>
</tr>
<tr>
<td>DAM Dean’s Approved Minor</td>
<td></td>
<td>Individually Designed</td>
<td>Minor</td>
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<tr>
<td>ECO Economics</td>
<td>BA</td>
<td>MA or Minor</td>
<td>A&amp;S - SAGES</td>
</tr>
<tr>
<td>EAP Electrical Engineering</td>
<td>BSE</td>
<td>MA or Minor</td>
<td>EC - SAGES</td>
</tr>
<tr>
<td>ELN Electronics</td>
<td></td>
<td>Minor (for BA only)</td>
<td></td>
</tr>
<tr>
<td>EGR Engineering - Undesignated</td>
<td>BSE</td>
<td>MA</td>
<td>EC - SAGES</td>
</tr>
<tr>
<td>EPH Engineering Physics</td>
<td>BSE</td>
<td>MA</td>
<td>EC - SAGES</td>
</tr>
<tr>
<td>ERL Environmental Geology</td>
<td>BA</td>
<td>MA</td>
<td>A&amp;S - SAGES</td>
</tr>
<tr>
<td>ENT Entrepreneurial Studies</td>
<td></td>
<td>Minor</td>
<td></td>
</tr>
<tr>
<td>GNV Environmental Geology</td>
<td>BA</td>
<td>MA</td>
<td>A&amp;S - SAGES</td>
</tr>
<tr>
<td>EST Environmental Studies</td>
<td>BA</td>
<td>MA or Minor</td>
<td>A&amp;S - SAGES</td>
</tr>
<tr>
<td>ETS Ethnic Studies</td>
<td></td>
<td>Minor</td>
<td></td>
</tr>
<tr>
<td>EVB Evolutionary Biology</td>
<td>BA</td>
<td>MA or Minor</td>
<td>A&amp;S - SAGES</td>
</tr>
<tr>
<td>FLM Film</td>
<td></td>
<td>Minor</td>
<td></td>
</tr>
<tr>
<td>FRC French</td>
<td>BA</td>
<td>MA or Minor</td>
<td>A&amp;S - SAGES</td>
</tr>
<tr>
<td>FFS French and Francophone Studies</td>
<td>BA</td>
<td>MA or Minor</td>
<td>A&amp;S - SAGES</td>
</tr>
<tr>
<td>GEO Geological Sciences</td>
<td>BA or BS</td>
<td>MA or Minor</td>
<td>A&amp;S - SAGES</td>
</tr>
<tr>
<td>GEM German</td>
<td>BA</td>
<td>MA or Minor</td>
<td>A&amp;S - SAGES</td>
</tr>
<tr>
<td>GES German Studies</td>
<td>BA</td>
<td>MA or Minor</td>
<td>A&amp;S - SAGES</td>
</tr>
<tr>
<td>GER Gerontology</td>
<td>BA</td>
<td>MA or Minor</td>
<td>A&amp;S - SAGES</td>
</tr>
<tr>
<td>HCO Health Communication</td>
<td></td>
<td>Minor</td>
<td></td>
</tr>
<tr>
<td>HST History</td>
<td>BA</td>
<td>MA or Minor</td>
<td>A&amp;S - SAGES</td>
</tr>
<tr>
<td>HSP History &amp; Philosophy of Science</td>
<td>BA</td>
<td>MA or Minor</td>
<td>A&amp;S - SAGES</td>
</tr>
<tr>
<td>IST International Studies</td>
<td>BA</td>
<td>MA</td>
<td>A&amp;S - SAGES</td>
</tr>
<tr>
<td>ITL Italian</td>
<td></td>
<td>Minor</td>
<td></td>
</tr>
<tr>
<td>JPN Japanese</td>
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<td>Minor</td>
<td></td>
</tr>
<tr>
<td>JPS Japanese Studies</td>
<td>BA</td>
<td>MA</td>
<td>A&amp;S - SAGES</td>
</tr>
<tr>
<td>JDS Judaic Studies</td>
<td></td>
<td>Minor</td>
<td></td>
</tr>
<tr>
<td>MGT Management</td>
<td>BS</td>
<td>MA</td>
<td>WSOM - SAGES</td>
</tr>
<tr>
<td>EMS Materials Science and Engineering</td>
<td>BSE</td>
<td>MA or Minor</td>
<td>EC - SAGES</td>
</tr>
<tr>
<td>MAT Mathematics</td>
<td>BA or BS</td>
<td>MA or Minor</td>
<td>A&amp;S - SAGES</td>
</tr>
<tr>
<td>MAP Mathematics and Physics</td>
<td>BS</td>
<td>MA</td>
<td>A&amp;S - SAGES</td>
</tr>
<tr>
<td>EMC Mechanical Engineering</td>
<td>BSE</td>
<td>MA</td>
<td>EC - SAGES</td>
</tr>
<tr>
<td>MDM Mechanical Design and Manufacturing</td>
<td></td>
<td>Minor</td>
<td></td>
</tr>
<tr>
<td>MUS Music</td>
<td>BA</td>
<td>MA or Minor</td>
<td>A&amp;S - SAGES</td>
</tr>
<tr>
<td>MUE Music Education</td>
<td>BS</td>
<td>MA</td>
<td>A&amp;S - SAGES</td>
</tr>
<tr>
<td>NAT Natural Sciences</td>
<td>BA</td>
<td>MA or Minor</td>
<td>A&amp;S - SAGES</td>
</tr>
<tr>
<td>NUR Nursing</td>
<td>BSN</td>
<td>Major</td>
<td>FPB - SAGES</td>
</tr>
<tr>
<td>NTR Nutrition</td>
<td>BA or BS</td>
<td>MA or Minor</td>
<td>A&amp;S - SAGES</td>
</tr>
<tr>
<td>NBM Nutritional Biochemistry and Metabolism</td>
<td>BA or BS</td>
<td>MA</td>
<td>A&amp;S - SAGES</td>
</tr>
<tr>
<td>PHI Philosophy</td>
<td>BA</td>
<td>MA or Minor</td>
<td>A&amp;S - SAGES</td>
</tr>
<tr>
<td>PHY Physics</td>
<td>BA or BS</td>
<td>MA or Minor</td>
<td>A&amp;S - SAGES</td>
</tr>
<tr>
<td>POS Political Science</td>
<td>BA</td>
<td>MA or Minor</td>
<td>A&amp;S - SAGES</td>
</tr>
<tr>
<td>POL Polymer Science and Engineering</td>
<td>BSE</td>
<td>MA or Minor</td>
<td>EC - SAGES</td>
</tr>
<tr>
<td>PAR Pre-Architecture</td>
<td>BA</td>
<td>MA or Minor</td>
<td>A&amp;S - SAGES</td>
</tr>
<tr>
<td>PSY Psychology</td>
<td>BA</td>
<td>MA or Minor</td>
<td>A&amp;S - SAGES</td>
</tr>
<tr>
<td>PYP Public Policy</td>
<td></td>
<td>Minor</td>
<td></td>
</tr>
<tr>
<td>RLG Religious Studies</td>
<td>BA</td>
<td>MA or Minor</td>
<td>A&amp;S - SAGES</td>
</tr>
<tr>
<td>RUS Russian</td>
<td></td>
<td>Minor</td>
<td></td>
</tr>
<tr>
<td>SOC Sociology</td>
<td>BA</td>
<td>MA or Minor</td>
<td>A&amp;S - SAGES</td>
</tr>
<tr>
<td>SPA Spanish</td>
<td>BA</td>
<td>MA or Minor</td>
<td>A&amp;S - SAGES</td>
</tr>
<tr>
<td>SPM Sports Medicine</td>
<td></td>
<td>Minor</td>
<td></td>
</tr>
<tr>
<td>STA Statistics</td>
<td>BA or BS</td>
<td>MA or Minor</td>
<td>A&amp;S - SAGES</td>
</tr>
<tr>
<td>ESY Systems and Control Engineering</td>
<td>BSE</td>
<td>MA or Minor</td>
<td>EC - SAGES</td>
</tr>
<tr>
<td>SYB Systems Biology</td>
<td>BS</td>
<td>MA</td>
<td>A&amp;S - SAGES</td>
</tr>
<tr>
<td>EDP Teacher Education</td>
<td>BA</td>
<td>MA or Minor</td>
<td>A&amp;S - SAGES</td>
</tr>
<tr>
<td>THR Theater</td>
<td>BA</td>
<td>MA or Minor</td>
<td>A&amp;S - SAGES</td>
</tr>
<tr>
<td>WMN Women’s and Gender Studies</td>
<td>BA</td>
<td>MA or Minor</td>
<td>A&amp;S - SAGES</td>
</tr>
<tr>
<td>WLT World Literature</td>
<td>BA</td>
<td>MA or Minor</td>
<td>A&amp;S - SAGES</td>
</tr>
</tbody>
</table>

**Major**

Available only as 2nd major for a BA; may be sole major for a BA student who also completes a BS.

### Minor

Minors are not required. Students have the option of completing a minor in a discipline other than the major. A minor concentration normally requires 15-18 semester hours and will be indicated on a student’s transcript if the following requirements are fulfilled:

**Major**

A program of ten or more courses (required)

**Minor**
1. A minor program shall consist of no fewer than 15 and no more than 18 semester hours of specified course work.

2. The responsibility for designating the requirements for a minor shall lie with the department or program offering the minor.

3. With the exception of minors offered by the Case School of Engineering, students must earn a minimum cumulative average of 2.000 for all courses taken to satisfy minor requirements and for which grades are averaged. Transfer students who wish to complete a minor must complete at Case Western Reserve University at least half the requirements for the minor.

**Foundation Curriculum**

For each degree/major a student must complete the foundation curriculum required for that degree/major:

- A&S - SAGES = based on College of Arts and Sciences - SAGES
- EC - SAGES = based on Case School of Engineering - SAGES CORE
- FPB - SAGES = based on FPB School of Nursing – SAGES
- WSOM - SAGES = based on Weatherhead School of Management - SAGES
Undergraduate Non Degree Students

Non-Degree Students

Transient (Visiting) Students

A transient student is one who has begun his or her education at another college or university and intends to return there. The university permits full- or part-time study as a transient student in the summer as well as during the fall and spring semesters. Enrollment must be for credit-bearing courses.

Applications for enrollment as a transient student may be obtained from the Office of Undergraduate Studies, 357 Sears Building. Before enrollment, the transient student must present a statement of good standing from the registrar of his or her home college. A degree candidate from another institution may not enroll as a transient student at Case Western Reserve University if the student would not be eligible to enroll for that semester at his or her home institution. Exceptions may be granted by appeal to the Academic Standing Board, c/o the Office of Undergraduate Studies.

Enrollment is limited to 30 semester hours and is subject to the regulations of the student’s college. Transient students must meet all requirements for prerequisites before being admitted to specific courses. Transient students are expected to perform at the same academic standards as degree candidates. In particular, transient students whose records would make them eligible for separation as degree candidates may not continue as transient students unless they successfully petition the Academic Standing Board.

Transient students are not eligible to receive financial aid from Case Western Reserve University. If the student’s home institution has entered into a consortium agreement with Case Western Reserve University, the student should inquire of the home institution regarding eligibility to receive aid through the home institution.

Non-Degree Students

Adults who do not already hold a bachelor’s degree may apply through the Office of Undergraduate Studies to enroll for credit in courses for which their education or experience has qualified them, even though they are not pursuing a baccalaureate degree. These non-degree students may study full- or part-time and enroll in the same classes as degree students. They are required to perform up to the same academic standards as degree students.

Non-degree students may be eligible for admission to candidacy for an undergraduate degree program if they meet the requirements for admission to the university. Courses taken for credit as a non-degree student may be applied toward the degree upon acceptance as a degree candidate. A non-degree student who wishes to become a degree candidate must apply through the Office of Undergraduate Admission.

Persons who already hold degrees and wish to continue their studies without actively pursuing an additional degree are welcome to apply to the School of Graduate Studies.

Pre-College Scholars

The Pre-College Scholars Program (http://www.cwru.edu/provost/ugstudies/precollege.htm) at Case Western Reserve University is designed to give highly motivated and able secondary school students the opportunity to enroll in challenging college courses prior to graduation from high school, either in the summer or during the academic year.

Admission to the Pre-College Scholars Program is selective and competitive. Case Western Reserve University has limited seats available for this program and preference is given to qualified juniors and seniors who have exhausted academic options at their high schools and who are looking for unique educational opportunities. Students must have pursued a rigorous curriculum and achieved academic excellence in all course work. Additional factors considered in admission are the applicant’s standardized test scores (ACT, PSAT, SAT, or other tests of aptitude and/or academic achievement), and the applicant’s academic goals and level of maturity. Pre-College Scholars attend regularly scheduled classes with undergraduate students at Case Western Reserve, and must be able to work well independently at the college level. Questions about the program should be directed to the Office of Undergraduate Studies at 216.368.2928.

Special Audit

The Special Audit Program provides the adult student with the opportunity to attend a regular university course as a serious but informal observer at half the regular tuition. This program is available only to those not enrolled in a degree program at Case Western Reserve University. Special audit students receive no grades and no academic credit for the courses attended. No transcripts will be issued, but a certificate of attendance will be provided if requested.

Registration for this program is handled by the Office of Undergraduate Studies. No transcripts are necessary to register.

Course Audit Program for Senior Citizens

Case Western Reserve University’s Course Audit Program for Senior Citizens (http://www.case.edu/provost/seniorauditprogram) (CAPSC) allows senior citizens (age 65 and older) to take on campus courses at a reduced tuition rate.
Weatherhead School of Management Undergraduate Degree Requirements

Bachelor of Science Degree
(Weatherhead School of Management)
Candidates for the Bachelor of Science in Accounting and the Bachelor of Science in Management degrees, in addition to meeting the general requirements for bachelor’s degrees as described above, must also complete the following requirements:

1. A minimum of 122 hours.
2. The Weatherhead School of Management SAGES General Education Requirements.
3. A minimum of 30 semester hours of courses at the 300-400 level.
4. The requirements for a major field as presented in this bulletin in the section devoted to each department or program. For all courses taken in the major department and for which grades are averaged, and for all courses taken to satisfy major requirements and for which grades are averaged, a candidate for a BS from the Weatherhead School of Management must earn a minimum cumulative average of 2.000. Major requirements include all required and elective work completed in the major department combined with required courses completed in related fields. Transfer students must complete at Case Western Reserve University at least half the hours required for the major.

Bachelor of Science degrees conferred by the Weatherhead School of Management are offered in the following fields:

- Accounting
- Management

SAGES General Education Requirements of the Weatherhead School of Management
The SAGES General Education Requirements of the Weatherhead School of Management are based upon the SAGES General Education Requirements of the College of Arts and Science, and provide a broad educational foundation for programs in accounting and management, leading to the Bachelor of Science degree.

SAGES is an innovative undergraduate experience designed to establish foundations for academic inquiry. Students fulfill their Weatherhead School of Management General Education Requirements with a sequence of specially developed seminars and selected courses. Course credit earned by Advanced Placement, International Baccalaureate, proficiency examinations, and transfer may be used to satisfy general education requirements.

SAGES Program Seminars
The First Seminar*
(4 semester hours, to be taken in the first semester of enrollment)
The First Seminar focuses on the development of critical thinking and communication skills through the use of a variety of approaches, media, and perspectives to explore the human mind and the nature of inquiry.

This course is designed to strengthen writing and analytical skills while building a foundation in ethics, information literacy, and cultural diversity. Select from:
- First Seminar: Social World (FSSO 1xx)
- First Seminar: Natural World (FSNA 1xx)
- First Seminar: Symbolic World (FSSY 1xx)

- Transfer Students only: Transfer students who have completed the English composition/expository writing requirement with a grade of C or higher at the college/university at which they previously matriculated will receive transfer credit for FSCC 100-TR (3 – 6 semester hours) and will be required to complete a supplemental 1-semester hour SAGES introductory seminar – FSTS 100 SAGES Transfer Supplement.

University Seminars
(6 semester hours, minimum of two seminars, to be completed in the first two years of enrollment as specified below)
After completion of the First Seminar with a passing evaluative grade, students must complete two University Seminars chosen from different thematic groups; one of these may fall in the same thematic group as the student’s First Seminar. Each University Seminar explores one of three themes, with the content determined according to the interests of the faculty. University Seminars provide continued experience in critical reading, writing, and oral communication as well as information literacy, ethics, and cultural diversity. Select from:
- University Seminar: Thinking About the Natural World (USNA 2xx)
- University Seminar: Thinking About the Social World (USSO 2xx)
- University Seminar: Thinking About the Symbolic World (USSY 2xx)

University Composition Requirement
Students develop a Writing Portfolio comprised of final graded writing assignments from the First Seminar and University Seminars. The Writing Portfolio is submitted for evaluation after completing the final University seminar.

Department Seminar
(3 semester hours)
The Department Seminar includes seminar-based discussion as well as instruction and experience in the kinds of writing characteristic of the Department Seminar’s discipline. The Department Seminar may be taken in the department of the student’s major or in another department. A course used to fulfill the Department Seminar Requirement may not also be used to fulfill a Breadth Requirement. Most students pursuing a degree from the Weatherhead School of Management will take three one-credit MGMT 395 Advanced Seminar seminars to complete the Department Seminar requirement.

Senior Capstone
The Senior Capstone assimilates the knowledge and skills gained throughout the educational process. Students engage in a unique one or two semester experience designed in consultation with a faculty member. Each Senior Capstone must include key elements (3 – 6 semester hours):

1. Demonstration of critical thinking and writing skills;
2. Regular oversight by the Capstone advisor;
3. Periodic reporting of progress;
4. Regular writing (e.g. drafts, progress reports, critiques) throughout
   the project including a final written report which may be a thesis or
   equivalent document associated with the project or activity (e.g.,
   such pursuits as performance, experiment, live case analysis, or
   creative writing), as approved by the department of capstone origin;
   and

5. Oral reports including a final public presentation at the Senior
   Capstone Fair, a conference, a performance, a public lecture,
   a teaching presentation, or another setting, as approved by the
   department of capstone origin.

Courses meeting this requirement include the designation “Approved
SAGES Capstone” in their course descriptions. Some majors include and
specify a senior capstone.

**Physical Education**
(Must total 2 full semesters at zero credits)

Students choose from half-semester and full-semester course offerings to
be completed in the first year.

**Breadth Requirements**
(at least 27 semester hours – minimum of nine 3 or 4-semester hour
courses)

NOTE: Two courses used to fulfill requirements for the major may be
used also to fulfill the breadth requirements.

**Arts and Humanities**

Two 3- or 4-semester hour Arts and Humanities courses. Select from (6 –
8 semester hours):

- Arabic (ARAB)
- Art History (ARTH)
- Art Studio (ARTS)
- Chinese (CHIN)
- Classics (CLSC)
- Dance (DANC)
- English (ENGL)
- French (FRCH)
- German (GRMN)
- Greek (GREK)
- Hebrew (HBRW)
- History (HSTY)
- Italian (ITAL)
- Japanese (JAPN)
- Latin (LATN)
- Music - General (MUGN)
- Music - History (MUHI)
- Music - Popular Music (MUPM)
- Music - Theory (MUTH)
- Philosophy (PHIL)
- Portuguese (PORT)
- Religion (RLGN)
- Russian (RUSN)
- Spanish (SPAN)
- Theater (THTR)
- World Literature (WLIT)

**Natural and Mathematical Sciences**

<table>
<thead>
<tr>
<th>Course</th>
<th>Description</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 125</td>
<td>Math and Calculus Applications for Life, Managerial, and Social Sci I</td>
<td>4</td>
</tr>
<tr>
<td>MATH 126</td>
<td>Math and Calculus Applications for Life, Managerial, and Social Sci II</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Two Natural Sciences courses</td>
<td>6</td>
</tr>
<tr>
<td>OPRE 207</td>
<td>Statistics for Business and Management Science I</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Total Units</td>
<td>17</td>
</tr>
</tbody>
</table>

* Any two 3- or 4-semester hour Natural Science courses. Select from:
  Astronomy (ASTR), Biochemistry (BIOC), Biology (BIOL),
  Chemistry (CHEM), Earth, Environmental, and Planetary
  Sciences (EEPS), Nutrition (NTRN), Physics (PHYS)

**Social Sciences**

**Management majors:**

Any two 3-semester hour Social Science courses except ECON
102 Principles of Microeconomics*, ECON 103 Principles of
Macroeconomics*, or ECON 326 Econometrics**. Select from:
Anthropology (ANTH), Cognitive Science (COGS), Communication
Sciences (COSI), Economics (ECON), Political Science (POSC),
Psychology (PSCL), Sociology (SOCI)

**Accounting majors**

<table>
<thead>
<tr>
<th>Course</th>
<th>Description</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>COSI 200</td>
<td>Interpersonal Communication</td>
<td>3</td>
</tr>
<tr>
<td>or COSI 280</td>
<td>Organizational Communication</td>
<td>3</td>
</tr>
</tbody>
</table>

* ECON 102 Principles of Microeconomics and ECON 103
  Principles of Macroeconomics are included in Accounting
  and Management major requirements.

** ECON 326 Econometrics is a Management major
  requirement.

*** Any 3-semester hour Social Science course except
ECON 102 Principles of Microeconomics* or ECON
103 Principles of Macroeconomics*. Select from:
Anthropology (ANTH), Cognitive Science (COGS),
Communication Sciences (COSI), Economics (ECON),
Political Science (POSC), Psychology (PSCL), Sociology
(SOCI)
Physical Education and Athletics

The Department of Physical Education and Athletics (http://studentaffairs.case.edu/athletics/default.html) offers the student a variety of opportunities from challenging academic classes to vigorous recreational activities.

Case Western Reserve University sponsors 19 intercollegiate varsity sports. These are football, soccer, cross country, basketball, wrestling, swimming, baseball, tennis, and indoor and outdoor track for men and volleyball, basketball, swimming, indoor and outdoor track, tennis, cross country, soccer, and softball for women.

The Spartans are charter members of the University Athletic Association, (UAA), sharing the belief that academic excellence and athletic excellence are equally important. The UAA includes Brandeis University, Carnegie Mellon University, Emory University, New York University, University of Chicago, University of Rochester, and Washington University in St. Louis.

The department sponsors a variety of intramural and club sport activities, including archery, cheerleading, crew, cycling, fencing, ice hockey, lacrosse, kendo, kung fu, squash, table tennis, taekwondo, ultimate frisbee, and volleyball. Sport clubs are available to all students, faculty, and staff. Intramural competition is available in more than 40 activities, and more than one-half of undergraduates participate for relaxation, physical fitness, and a chance to improve skills.

Lifetime Sports Program

The department has designed an instructional program of modern activities and lifetime sports. Each semester, fifteen to twenty-five co-educational lifetime sports classes are offered.

Undergraduates have a one-year physical education requirement to be completed in the first year. Required classes, for zero credits, are offered for either half-semester or full-semester. First year students have first priority in electing PHED 010-199. Others who have completed the requirement may audit classes.

A number of popular, advanced lifetime sports activities are also offered for one hour of academic credit. Advanced skills, strategy, and coaching are taught (PHED 200-299).

Recreational Activities and Intercollegiate Athletics

The intramural program provides a continuous schedule of activities throughout the year. Individual and team sports are available to students in several divisions: university housing, fraternity, women, coed, graduate, and open. Intercollegiate varsity athletic competition is available in ten sports for men and nine sports for women.

Sports Medicine Minor

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
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</thead>
<tbody>
<tr>
<td>PHED 332</td>
<td>Introduction to Sports Medicine</td>
<td>3</td>
</tr>
<tr>
<td>PHED 334</td>
<td>Orthopedic Assessment of the Upper Extremity</td>
<td>3</td>
</tr>
<tr>
<td>PHED 339</td>
<td>Orthopedic Assessment of the Lower Extremity</td>
<td>3</td>
</tr>
<tr>
<td>PHED 341</td>
<td>Physiology of Exercise</td>
<td>3</td>
</tr>
<tr>
<td>PHED 342</td>
<td>Kinesiology</td>
<td>3</td>
</tr>
<tr>
<td>PHED 350</td>
<td>Therapeutic Rehabilitation and Modalities</td>
<td>3</td>
</tr>
</tbody>
</table>

Total Units 18

Contact Jessica White (http://bulletin.case.edu/physicaleducationandathletics/mailto:jessica.m.white2@case.edu), Assistant Head Athletic Trainer, for more information at Veale Center, 216.368.2863.

Department Faculty

Jody Burrows, BA
(Northeastern University)
Instructor
Assistant Women’s Basketball Coach

James Cerullo, PhD
(University of Pittsburgh)
Instructor
Head Athletic Trainer

Mariana Cobra, MA
(Northern Illinois University)
Instructor
Assistant Women’s Tennis Coach

Tiffany Crooks, BS
(Ashland University)
Instructor
Head Women’s Soccer Coach

Greg Debeljak, MA
(John Carroll University)
Assistant Professor
Head Football Coach

David Diles, EdD
(University of Michigan)
Professor
Director of Athletics & Chair, Department of Physical Education and Athletics

Matthew Englander, BA
(The College of Wooster)
Instructor
Head Baseball Coach

Karen Farrell, MS
(University of Massachusetts at Amherst)
Assistant Professor
Head Women’s Volleyball Coach; Associate Athletic Director; Senior Woman Administrator

Jeff Gorski, BA
(Utica College)
Instructor
Assistant Men’s Basketball Coach

Mark Hawald, MBA
(John Carroll University)
Instructor
Head Wrestling Coach

Josie Henry, MA
(Minnesota State University)
Instructor
Head Fast Pitch Softball Coach

Kevin Kamlowsky
Instructor

Patrick Kennedy, MS
(University of Maryland)
Assistant Professor
Associate Athletic Director & Intramural and Club Sports Director

Kathy Lanese, BS
(Ohio University)
Instructor
Head Women’s Cross Country Coach and Assistant Men’s Track and Field Coach

Marcus Macalla, MA
(John Carroll University)
Assistant Professor
Assistant Head Football Coach

Sean McDonnell, MS
(LeMoyne College)
Assistant Professor
Head Men’s Basketball Coach

Doug Milliken, MS
(Indiana State University)
Instructor
Head Men’s and Women’s Swimming & Diving Coach

Dan Palmer, MA
(Northeastern Illinois University)
Assistant Professor
Head Men’s and Women’s Track Coach

Jennifer Reimer, MEd
(Bowling Green State University)
Instructor
Head Women’s Basketball Coach

Stephen Rubin, BA
(Emory University)
Instructor
Head Men’s and Women’s Track Coach

Jerry Schuplinski, MBA
(John Carroll University)
Instructor
Special Teams Coordinator/Linebackers, Football

Dereck Slesh, MBA
(Cleveland State University)
Assistant Professor
Offensive Coordinator, Football

Jessica White, MA
(Defiance College)
Instructor
Assistant Head Athletic Trainer

Todd Wojtkowski, MBA
(The Citadel)
Instructor
Head Men’s and Women’s Tennis Coach

Emily Wylam, MA
(University of the Pacific)
Instructor
Assistant Men’s & Women’s Swimming and Diving Coach

Courses

PHED 100. Independent Activity. 0 - 10 Units.
This course is designed to allow the student to write individual fitness goals, compose an individual fitness program specific to the goals and execute the individual program. Students are required to participate in a pre- and post-testing program and must achieve a minimum of 75% for each test component (national norms) in order to participate in Independent Activity. The course instructor must approve all programs. The student will be required to maintain a detailed activity log.

PHED 108. Fencing. 0 Units.
Fencing is the art of swordsmanship. Students will learn fencing skills such as on guard, lunge, attack, parry and touch. Students will learn the rules of competition and have the opportunity to compete during class time.

PHED 10A. Cardio Games (First Half). 0 Units.
Cardio Games emphasizes conditioning of the aerobic and anaerobic systems through fun and energetic games such as Ultimate Frisbee, Tag, Dodge Ball, Flicker Ball and more. This class is appropriate for most students. Prereq: Undergraduate degree seeking student.

PHED 10B. Cardio Games (Second Half). 0 Units.
Cardio Games emphasizes conditioning of the aerobic and anaerobic systems through fun and energetic games such as Ultimate Frisbee, Tag, Dodge Ball, Flicker Ball and more. This class is appropriate for most students. Prereq: Undergraduate degree seeking student.

PHED 111. Sport Orienteering/Rock Wall Climbing. 0 Units.
This course combines the sport of orienteering in which orienteers use a map and compass to locate points in the landscape and the activity of rock climbing.

PHED 11A. Jump Rope Training (First Half). 0 Units.
This class is designed to help students develop quickness, agility, balance, strength, power, and endurance through jump rope training. Students will learn rope-handling skills, jumping techniques and training routines to help supplement training for fitness and performance. Workouts and progressions are included for warm-up, cool-down, fitness components and sport-specific training. Prereq: Undergraduate degree seeking student.

PHED 11B. Jump Rope Training (Second Half). 0 Units.
This class is designed to help students develop quickness, agility, balance, strength, power, and endurance through jump rope training. Students will learn rope-handling skills, jumping techniques and training routines to help supplement training for fitness and performance. Workouts and progressions are included for warm-up, cool-down, fitness components and sport-specific training. Prereq: Undergraduate degree seeking student.

PHED 12A. Badminton (First Half). 0 Units.
This class provides the student with the basic skills, footwork and strategies necessary to play the sport of badminton. Emphasis is placed on skill development through instruction and drills as well as singles and doubles match play. This class is appropriate for all students. Students with special needs can be accommodated. Prereq: Undergraduate degree seeking student.
PHED 12B. Badminton (Second Half). 0 Units.
This class provides the student with the basic skills, footwork and strategies necessary to play the sport of badminton. Emphasis is placed on skill development through instruction and drills as well as singles and doubles match play. This class is appropriate for all students. Students with special needs can be accommodated. Prereq: Undergraduate degree seeking student.

PHED 130. Wellness. 0 Units.
This lecture class teaches the components of physical fitness as well as evaluation techniques, fitness assessment, body composition, nutrition and weight control information. This class is appropriate for all students.

PHED 131. Personal Fitness. 0 Units.
Personal Fitness is a full semester class that teaches the components of physical fitness through both lecture and activity. Students will assess their fitness levels and learn conditioning activities to improve flexibility, cardiovascular endurance, muscular strength and endurance. Nutrition, weight control and concepts of wellness are covered in this class. This class is appropriate for most students.

PHED 13A. Rock Wall Climbing (First Half). 0 Units.
This course is designed to give students a comprehensive introduction to the skills, safety, terminology and equipment used in the sport of recreational activity of rock climbing. Prereq: Undergraduate degree seeking student.

PHED 13B. Rock Wall Climbing (Second Half). 0 Units.
This course is designed to give students a comprehensive introduction to the skills, safety, terminology and equipment used in the sport of recreational activity of rock climbing. Prereq: Undergraduate degree seeking student.

PHED 141. Dance. 0 Units.
This course is designed to introduce the student to dance. Students will be exposed to a variety of dances including contemporary, jazz, folk and formal dancing. Students will learn how choreography is mounted and how dancers remember it. The class is appropriate for beginners as well as students with dance experience.

PHED 14A. Indoor Rowing (First Half). 0 Units.
This course introduces the student to basic indoor rowing techniques, skills, and equipment. Students will learn conditioning programs to prepare the student to continue in recreational, fitness or competitive rowing programs. Prereq: Undergraduate degree seeking student.

PHED 14B. Indoor Rowing (Second Half). 0 Units.
This course introduces the student to basic indoor rowing techniques, skills, and equipment. Students will learn conditioning programs to prepare the student to continue in recreational, fitness or competitive rowing programs. Prereq: Undergraduate degree seeking student.

PHED 170. Varsity Baseball. 0 Units.

PHED 171. Varsity Basketball (Men). 0 Units.

PHED 172. Varsity Basketball (Women). 0 Units.

PHED 174. Varsity Cross Country (Men). 0 Units.

PHED 175. Varsity Cross Country (Women). 0 Units.

PHED 178. Varsity Football. 0 Units.

PHED 180. Varsity Soccer (Men). 0 Units.

PHED 181. Varsity Soccer (Women). 0 Units.

PHED 182. Varsity Swimming (Men). 0 Units.

PHED 183. Varsity Swimming (Women). 0 Units.

PHED 184. Varsity Tennis (Men). 0 Units.

PHED 185. Varsity Tennis (Women). 0 Units.

PHED 186. Varsity Track and Field (Men). 0 Units.

PHED 187. Varsity Track and Field (Women). 0 Units.

PHED 188. Varsity Volleyball. 0 Units.

PHED 189. Varsity Wrestling. 0 Units.

PHED 190. Varsity Softball (Women). 0 Units.

PHED 216. Weight Training II. 1 Unit.
This class is for the student with weight training experience and/or the student who has successfully completed the basic weight training program and wishes to continue training in an advanced program. Advanced skill development, program development and safety are emphasized. This class section does not satisfy the Physical Education requirement.

PHED 218. Wellness. 1 Unit.

PHED 21A. Hatha Yoga (First Half). 0 Units.
This course provides an introduction to Hatha Yoga, presenting body awareness, basic philosophy, breathwork, postures and meditation techniques. This class is appropriate for all students. Prereq: Undergraduate degree seeking student.

PHED 21B. Hatha Yoga (Second Half). 0 Units.
This course provides an introduction to Hatha Yoga, presenting body awareness, basic philosophy, breathwork, postures and meditation techniques. This class is appropriate for all students. Prereq: Undergraduate degree seeking student.

PHED 22A. Intermediate Hatha Yoga (First Half). 0 Units.
This course utilizes the basics of Hatha Yoga including body awareness, philosophy, breathwork, and postures with emphasis on increased strengthening, increased aerobic segments, and more challenging postures. This class is appropriate for all students. Prereq: Undergraduate degree seeking student.

PHED 22B. Intermediate Hatha Yoga (Second Half). 0 Units.
This course utilizes the basics of Hatha Yoga including body awareness, philosophy, breathwork, and postures with emphasis on increased strengthening, increased aerobic segments, and more challenging postures. This class is appropriate for all students. Prereq: Undergraduate degree seeking student.

PHED 24A. Jogging (First Half). 0 Units.
Prereq: Undergraduate degree seeking student.

PHED 24B. Jogging (Second Half). 0 Units.
Prereq: Undergraduate degree seeking student.
PHED 25A. Power Volleyball (First Half). 0 Units.
This class introduces volleyball skills, techniques, strategies, rules and scoring. This class is appropriate for most students. Prereq: Undergraduate degree seeking student.

PHED 25B. Power Volleyball (Second Half). 0 Units.
This class introduces volleyball skills, techniques, strategies, rules and scoring. This class is appropriate for most students. Prereq: Undergraduate degree seeking student.

PHED 26A. Racquetball (First Half). 0 Units.
This course teaches racquetball skills and strategies for team and individual play. Course content includes terminology, skill development, scoring, etiquette and safety. This class is appropriate for most students. Prereq: Undergraduate degree seeking student.

PHED 26B. Racquetball (Second Half). 0 Units.
This course teaches racquetball skills and strategies for team and individual play. Course content includes terminology, skill development, scoring, etiquette and safety. This class is appropriate for most students. Prereq: Undergraduate degree seeking student.

PHED 27A. Indoor Group Cycling (First Half). 0 Units.
A stationary cycling program set to motivational music. Students will learn how to use and set up the bike and how to create a challenging workout using sprints, jumps and climbs. This class is appropriate for most students. Prereq: Undergraduate degree seeking student.

PHED 27B. Indoor Group Cycling (Second Half). 0 Units.
A stationary cycling program set to motivational music. Students will learn how to use and set up the bike and how to create a challenging workout using sprints, jumps and climbs. This class is appropriate for most students. Prereq: Undergraduate degree seeking student.

PHED 28A. Squash (First Half). 0 Units.
Students will be introduced to the skills, techniques and strategies necessary to play the sport of squash. This class is appropriate for most students. Prereq: Undergraduate degree seeking student.

PHED 28B. Squash (Second Half). 0 Units.
Students will be introduced to the skills, techniques and strategies necessary to play the sport of squash. This class is appropriate for most students. Prereq: Undergraduate degree seeking student.

PHED 29A. Swimming - Beginning and Intermediate (First Half). 0 Units.
This class focuses on basic swimming skills and safety. This class is appropriate for non-swimmers to those students with mid-range swimming skills. Students with disabilities may be accommodated. Prereq: Undergraduate degree seeking student.

PHED 29B. Swimming - Beginning and Intermediate (Second Half). 0 Units.
This class focuses on basic swimming skills and safety. This class is appropriate for non-swimmers to those students with mid-range swimming skills. Students with disabilities may be accommodated. Prereq: Undergraduate degree seeking student.

PHED 30A. Swimming - Endurance (First Half). 0 Units.
This class is for individuals who have mastered intermediate swimming skills and wish to develop advanced swimming skills and greater swimming endurance. Prereq: Undergraduate degree seeking student.

PHED 30B. Swimming - Endurance (Second Half). 0 Units.
This class is for individuals who have mastered intermediate swimming skills and wish to develop advanced swimming skills and greater swimming endurance. Prereq: Undergraduate degree seeking student.

PHED 31A. Tennis (First Half). 0 Units.
Students will learn the tennis skills and strategies necessary for both singles and doubles play. Emphasis is placed on stroke development, rules, scoring and etiquette. This class is appropriate for all students. Prereq: Undergraduate degree seeking student.

PHED 31B. Tennis (Second Half). 0 Units.
Students will learn the tennis skills and strategies necessary for both singles and doubles play. Emphasis is placed on stroke development, rules, scoring and etiquette. This class is appropriate for all students. Prereq: Undergraduate degree seeking student.

PHED 325. Officiating Basketball. 2 Units.
Administrative procedures, promotion, managerial relationships, scheduling, tournaments, budgeting, scoring systems, and officiating.

PHED 332. Introduction to Sports Medicine. 3 Units.
This class provides a detailed introduction to the foundation of Sports Medicine. Students will understand the complexities of sports medicine and athletic training through classroom lecture, structured laboratory and clinical hours. Topics covered in this class include roles and responsibilities of the sports medicine team, injury pathology, injury prevention, evaluation and management of injury.

PHED 334. Orthopedic Assessment of the Upper Extremity. 3 Units.
This class provides students with hands on experience that prepares them to perform orthopedic assessments within the field of athletic training. Students learn to take medical histories, palpate bony and soft structures, perform range of motion, neurological and circulatory tests. Students will learn to perform orthopedic tests of the upper extremities, head, cervical spine and abdomen. This class involves lectures, laboratory and clinical hours. Prereq: PHED 332 and PHED 342.

PHED 339. Orthopedic Assessment of the Lower Extremity. 3 Units.
This class provides students with hands on experience that prepares them to perform orthopedic assessments within the field of athletic training. Students learn to take medical histories, palpate bony and soft structures, perform range of motion, neurological and circulatory tests; and perform orthopedic special test of the lower extremities, pelvis, and lumbar spine. This class involves lectures, labs, and clinical hours. Prereq: PHED 332 and PHED 342.

PHED 341. Physiology of Exercise. 3 Units.
The classroom and laboratory experiences in this class are intended to provide an understanding of physiological adaptations of the human body to acute and chronic exercise. The classroom portion will focus mainly on the response and adaptation of bodily systems to exercise and the relationship of physiology to sport, health and exercise programs. The laboratory portion will focus on evaluation of the physiological response to exercise. Prereq: PHED 332, PHED 342, PHED 334, PHED 339.
PHED 342. Kinesiology. 3 Units.
The purpose of this course is to present the conceptual ideas and general principles of the science of human movement. It reviews and applies the pertinent aspects of anatomy, physiology and mechanics. Subject matter is drawn from research and clinical findings of widely dispersed kinesiological subdisciplines and professional specializations. Prereq: PHED 332.

PHED 34A. Weight Training (First Half). 0 Units.
This class focuses on muscular strength and endurance training through individualized weight training programs. Emphasis is placed on appropriate use of equipment and safety procedures. This class is appropriate for most students. Prereq: Undergraduate degree seeking student.

PHED 34B. Weight Training (Second Half). 0 Units.
This class focuses on muscular strength and endurance training through individualized weight training programs. Emphasis is placed on appropriate use of equipment and safety procedures. This class is appropriate for most students. Prereq: Undergraduate degree seeking student.

PHED 350. Therapeutic Rehabilitation and Modalities. 3 Units.
Topics covered in this class include concepts and practices associated with the conditioning and reconditioning (rehabilitation) of athletic injuries. Principles and practical skills associated with therapeutic modalities used in the treatment and rehabilitation of athletic injuries are also covered. This class involves lectures, labs and clinical hours. Prereq: PHED 332, PHED 334, PHED 339, and PHED 342.

PHED 40A. Basketball (First Half). 0 Units.
This class introduces basketball skills, techniques, rules and basic offense and defense. This class is appropriate for most students. Prereq: Undergraduate degree seeking student.

PHED 40B. Basketball (Second Half). 0 Units.
This class introduces basketball skills, techniques, rules and basic offense and defense. This class is appropriate for most students.

PHED 42B. Indoor Soccer (Second Half). 0 Units.
Students will learn the skills, techniques and strategies to play the sport of indoor soccer. This class is appropriate for most students. Prereq: Undergraduate degree seeking student.

PHED 44A. Core Yoga (1st Half). 0 Units.
This course combines Hatha Yoga postures, Pilates exercises, body awareness and breathwork while focusing on deep stabilizing abdominal muscles. Students will combine stretching and strengthening to improve posture and flexibility and create balance in the physical body. Students will learn slow, controlled movements to help tone and condition. Prereq: Undergraduate degree seeking student.

PHED 44B. Core Yoga (2nd Half). 0 Units.
This course combines Hatha Yoga postures, Pilates exercises, body awareness and breathwork while focusing on deep stabilizing abdominal muscles. Students will combine stretching and strengthening to improve posture and flexibility and create balance in the physical body. Students will learn slow, controlled movements to help tone and condition. Prereq: Undergraduate degree seeking student.

PHED 45A. Introduction to Speed and Agility Training. 0 Units.
This introductory course is intended for the student with an interest in training of speed and agility specific to their sport interest. The course will focus on the aspects of physical training necessary for the development of speed and agility and improved athletic performance. Prereq: Undergraduate degree seeking student.

PHED 45B. Introduction to Speed and Agility Training. 0 Units.
This introductory course is intended for the student with an interest in training of speed and agility specific to their sport interest. The course will focus on the aspects of physical training necessary for the development of speed and agility and improved athletic performance. Prereq: Undergraduate degree seeking student.

PHED 50A. Personal Safety Awareness (First Half). 0 Units.
This class focuses on safety and preventative techniques. Emphasis is placed on self-protection. This class is appropriate for all students. Prereq: Undergraduate degree seeking student.

PHED 50B. Personal Safety Awareness (Second Half). 0 Units.
This class focuses on safety and preventative techniques. Emphasis is placed on self-protection. This class is appropriate for all students. Prereq: Undergraduate degree seeking student.

PHED 55A. Cardio-Fitness (First Half). 0 Units.
This class presents the components of physical fitness through conditioning activities utilizing equipment such as stairclimbers, treadmills, and elliptical trainers. Students will evaluate their fitness levels and learn how to put together an individualized workout program. This class is appropriate for all students. Prereq: Undergraduate degree seeking student.

PHED 55B. Cardio-Fitness (Second Half). 0 Units.
This class presents the components of physical fitness through conditioning activities utilizing equipment such as stairclimbers, treadmills, and elliptical trainers. Students will evaluate their fitness levels and learn how to put together an individualized workout program. This class is appropriate for all students. Prereq: Undergraduate degree seeking student.

PHED 60A. CPR/First Aid (1st half). 0 Units.
Students will learn the basic first aid and CPR skills necessary to act in an emergency. Automated external defibrillation training is included. This class involves both lecture and hands-on work. Students will have the opportunity to achieve Basic Rescuer certification at the completion of the class.

PHED 60B. CPR/First Aid (2nd half). 0 Units.
Students will learn the basic first aid and CPR skills necessary to act in an emergency. Automated external defibrillation training in included. This class involves both lecture and hands-on work. Students will have the opportunity to achieve Basic Rescuer certification at the completion of this class.
PHED 65B. Team Building, Leadership, and Creative Movement (2nd half). 0 Units.
The primary purpose of this course is to provide an opportunity for Orientation leaders to: work as a team and build transferable skills for collaboration, active listening, communication, and motivation; learn dance movement as a form of communication and stress reduction; create the Orientation Leader Boogie Dance (performed at Welcome Days tradition and football game halftime show); understand the value in personal decision making and awareness (stress reduction, drug/alcohol awareness, sexual assault, etc.); learn campus resources; build Orientation Leader esprit de corps and enhance school spirit. This course will develop more effective and competent university ambassadors. In addition, the course will facilitate the development of leadership skills.
School of Dental Medicine

The Case Western Reserve University School of Dental Medicine (http://dental.case.edu) is a professional school offering a curriculum leading to the Doctor of Dental Medicine degree (DMD). Advanced education programs in the dental specialties are also available.

The School of Dental Medicine was organized June 21, 1892, as the Dental Department of Western Reserve University. For the first 25 years of its existence, the school was located in downtown Cleveland. In 1917, the School of Dental Medicine became an integral part of the university and now occupies a building adjacent to the School of Medicine, the School of Nursing, and University Hospitals of Cleveland. In 2003, the name of the school officially changed from the School of Dental Surgery to the School of Dental Medicine, and the degree offered changed from Doctor of Dental Surgery to Doctor of Dental Medicine. Since its organization, it has conferred degrees on approximately 4,900 graduates.

The Profession of Dentistry

The mission of dentistry is the protection and improvement of the health of individuals and society with a concentration on oral health. Professional activities encompass a wide variety of endeavors including the clinical care of individuals, the prevention of disease, the discovery of new knowledge, and the development of procedures and policies that protect and improve health, especially for those populations at risk for disease.

Because oral health is an important concern of society, the role of the dentist continues to be essential and rewarding. Men and women who are interested in scientific studies directly related to the welfare of people should find a strong appeal in dentistry as a life work. It offers an unusual opportunity for public service, community respect, and the use of originality, compassion, and substantial skill and independent judgment on a daily basis.

Mission Statement

The mission of the Case Western Reserve University School of Dental Medicine is to provide outstanding programs in oral health education, patient care, focused research and scholarship, and service that are of value to our constituents. We will accomplish this in an environment that fosters collegiality and professionalism, and that enables a diverse group of students to become competent practitioners of dentistry and contribute to the health and well-being of individuals and populations.

Dental Education Program

The students who enter the School of Dental Medicine are very carefully selected and have already had many opportunities for intellectual and social development. The years in dental school should permit the continued maturation of the individual and should emphasize the basic knowledge and skills which are common to all dentists. Graduates should continue their dental education during their professional careers and add to the basic concepts taught in dental school by studying the scientific literature and by attending continuing education courses. While in dental school, the student develops an attitude of professionalism and a sense of responsibility toward the patient's welfare, which will provide optimal dental care.

License to Practice Dentistry in Ohio

Specific information about licensure in Ohio and other states should be obtained from the individual state boards of dentistry.

Accreditation

The School of Dental Medicine is an institutional member of the American Dental Education Association and the programs of the School of Dental Medicine are accredited by the Commission of Dental Accreditation.

Student Affairs

The University Office of Student Affairs serves as an ombudsman focusing attention on the rights and responsibilities of students within the university community. In addition, it serves as a central source of information about university policies and procedures that affect student life and extracurricular programs and services. Students may contact the University Office of Student Affairs for resolution of specific problems and for referral to other university offices or campus agencies.

Facilities

The entire Health Sciences Center has been designed so that students can travel from the School of Dental Medicine to the School of Medicine, the School of Nursing, the Health Sciences Library, and any component of University Hospitals without having to go outside.

The dental school building was designed to provide a modern teaching facility. The Multimedia Laboratories are designed and equipped so that the basic sciences (except for anatomy), technique and simulated clinical experience can be carried on by the student in his or her individual area. The 50,000 square foot dental clinic floor consists of two major clinical areas and five specialty clinics. The major clinics are made up of individual cubicles, fully equipped as private operatories. Each student clinician is assigned to one of the individual operatories for the academic year.

Drawing from a local population of more than one million, the clinics provide a broad spectrum of care to the population, affording the student substantial clinical experience. The school cooperates with various organizations of the city in caring for their clients, an arrangement that provides additional clinical experience for students.

Libraries

The Cleveland Health Sciences Library (CHSL) was formed in 1966 by an agreement between the Cleveland Medical Library Association (CMLA) and Western Reserve University. CHSL operates in two locations: the Allen Memorial Medical Library and the Health Center Library (HCL). The total collection currently numbers over 430,000 volumes, including print and electronic journal subscriptions numbering in excess of 60,000.

The Allen collection, strongly clinical, serves private and institutional members of the Cleveland Medical Library Association as well as faculty and students of Case Western Reserve University.

The Health Center Library collection of basic science materials is primarily for faculty and students of the schools of dental medicine, medicine, and nursing and the department of biology.

The Dittrick Museum of Medical History, located on the third floor of the Allen Library, contains nearly 20,000 objects related to the history of medicine, dentistry, and pharmacy, with special emphasis on Cleveland and the Western Reserve. The museum also contains a medical archives collection and a rare book room.

Reference staff in both libraries help and instruct patrons in the use of the library and its bibliographic resources. Items not available on campus may be obtained through inter-library loan. Other services provided are
quick telephone reference, citation verification, computerized or manual bibliographic searches, access to the internet, and online searching of a multitude of databases.

**Hospital Affiliations**

The School of Dental Medicine has working relationships with hospitals and health clinics in the Greater Cleveland community. Students have the opportunity to function as dentists and observe hospital routine and operating room techniques in these hospitals. Many members of the faculty hold staff appointments in these extramural health facilities.

University Hospitals is a 974-bed tertiary care facility located across the street from the School of Dental Medicine. Graduate departments in oral and maxillofacial surgery and pediatric dentistry are based at this facility. A variety of educational and research opportunities exist in relation to this affiliation.

**Community Health Clinics**

Dental students participate in clinical care at several community health clinics in and around the greater Cleveland area. As part of the curriculum, dental students spend two weeks at one of the community clinics and additionally may volunteer their services in their free time. An example of a community health clinic is The Free Medical Clinic of Greater Cleveland, at 12201 Euclid Avenue. It is a nonprofit community service organization that offers medical, dental, podiatric, and legal services, as well as family planning and psychological counseling programs for adults and children; provides a patient advocacy program and speakers for community education and training at other health agencies; and operates a hotline seven evenings a week.

**Administration**

Jerold S. Goldberg, DDS  
(Case Western Reserve University)  
*Dean of the School of Dental Medicine; Professor of Oral and Maxillofacial Surgery*

Ronald L. Occhionero, DDS  
(Case Western Reserve University)  
*Associate Dean for Administration; Professor of Comprehensive Care*

Kristin Z. Victoroff, DDS (Dalhousie University), PhD (Case Western Reserve University)  
*Associate Dean for Education, Associate Professor of Community Dentistry*

Mark G. Hans, DDS, MS  
(Case Western Reserve University)  
*Associate Dean of Graduate Studies; Professor of Orthodontics and Chair*

John W. Smolik, MBA, CPA  
(Baldwin Wallace College)  
*Assistant Dean of Finance, Operations and Information Technology*

Simon P. Bisson, MA, CFRM BA  
(Christ Church University College, Canterbury, England, Ed; Indiana University, MA)  
*Assistant Dean of Development and Alumni Relations*

Emil T. Chuck, PhD  
(BSE, Duke University; PhD, Case Western Reserve University)  
*Director of Admissions*

Philip C. Aftoora, MA  
(University of Dayton, BS; Case Western Reserve University, MA)  
*Director of Student Services*
Advanced Education in General Dentistry (AEGD)

The AEGD program is a one-year experience with a major emphasis in clinical general dentistry designed to provide the resident with training beyond that received in the pre-doctoral curriculum.

Formal courses, seminars and literature review, as well as one week of "on call" per month, enhance the resident's ability to handle dental and medical emergencies encountered in everyday practice.

The AEGD program provides the resident the opportunity to deliver the highest quality of comprehensive dental care to the broadest range of the population with a knowledge, comfort, and ease in treating the high risk patient and under-served segment of the population including: HIV/AIDS, medically compromised, physically handicapped, and geriatric populations with considerable experience in implantology and full mouth rehabilitation.

The AEGD program enables the resident to become proficient in diagnosis and treatment planning for the more challenging and complex cases to identify and treat many medical and/or dental emergencies encountered in every day dental practice. The AEGD program introduces the resident to the basic concepts of hospital dentistry and help them interact with their medical colleagues and other health care providers to integrate medical and dental care.

Goals and Objectives

• To provide the residents with the didactic knowledge and clinical experience to deliver multi disciplinary comprehensive oral health care to a wide range of the population beyond the level of predoctoral education. (This includes providing community services through the management of the medically and/or immunocompromised patient, the physically handicapped patient, as well as the geriatric and the under served segment of the population.)

• Enable the residents to identify and treat the most common medical and/or dental emergencies encountered in every day dental practice.

• To develop in the residents the values of professional ethics, and acceptance of cultural diversity in the practice of dentistry.

• To develop the skills of self evaluation and critical thinking.

• To provide the residents with experience to improve their ability to interact, function and communicate effectively with other health care professionals in the delivery of comprehensive treatment.

• To encourage the resident to continue the process of life long learning through continuing education, professional meetings, and review of literature.

• To provide the residents with training in patient, practice and risk management in order to manage a private dental practice.

Admission

Information about admission to the AEGD Program (http://dental.case.edu/aegd) can be found on the School of Dental Medicine website.

The didactic component of the AEGD program is conducted in both the formal courses as well as the departmental seminars.

Formal Courses

• Management of Medical Emergencies
• Pharmacology
• Orthodontic
• Interdisciplinary Seminars
• Occlusion
• Correlative Medical Sciences

Seminars

• Literature review
• Case Presentation
• Endodontics
• Periodontics
• Oral Surgery
• Implantology
• Oral Diagnosis and Treatment Planning
• Preventive Dentistry
• Pain and Anxiety Control in the Conscious Patient
• Geriatric Dentistry
• Special Care Patients including the Medically Compromised
• Aspesis and Infection Control
• Pediatric Dentistry
• Operative Dentistry
• Fixed and Removable Prosthodontics
• Oral Medicine
• Practice Management

Clinical Component and Rotations

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<td>Clinic - Geriatrics/Pediatrics</td>
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</tbody>
</table>
Service: Pediatric Rotation

- Length of Rotation or Experience (in weeks): 12
- Number of Hours per week: 4

Objectives:
1. To provide residents with both clinical and didactic training in pediatric dentistry beyond that received in the pre-doctoral curriculum.
2. To improve the resident’s ability in diagnosis, treatment planning, oral examination, and physical evaluation of the pediatric patient.
3. To improve the resident’s ability to use non-pharmacologic management techniques to appropriately manage and guide the behavior of the child patient to accept needed treatment and to provide advice or guidance to the parent to enhance the child’s acceptance.
4. To assist the resident in developing a working knowledge of preventive and corrective dental procedures relating to the growth and development of the stomatognathic system.
5. To increase both the confidence and competence of residents in meeting the general oral health needs of the pediatric patient.

Service: Geriatric Dentistry

- Length of Rotation or Experience (in weeks): 16
- Number of Hours per week: 8

Objectives:
1. See the variability of patient disability/ability/cognitive impairment in a diverse patient population.
2. Apply the principles of rational treatment planning to patients with limited access to dental care.
3. Practice behavioral management techniques for patients who are uncooperative.
4. Learn how to manage institutionalized patients and coordinate care with staff of the long-term care facilities.
5. Know how to deal with treatment of patients who cannot give informed consent.
6. Realize how much dental care is needed by older patients; and you will know what a significant positive impact that your work can have on the quality of life of older individuals.
7. Become a patient, empathetic caregiver.

Plan of Study

<table>
<thead>
<tr>
<th>First Year</th>
<th>Units</th>
<th>Fall</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anatomy of the Head and Neck (DENT 513)</td>
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<td>Multidisciplinary Seminar II (DENT 698)</td>
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<td>Epidemiology and Biostatistics (DENT 510)</td>
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<td>Behavioral Considerations in Oral Health Care (DENT 518)</td>
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<tr>
<td>Management of Medical Emergencies (DENT 555)</td>
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<tr>
<td>Advanced Oral Pathology (DENT 512)</td>
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<td>AEGD Residency Training (DENT 699)</td>
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<td>Biological Aspects of the Stomatological System (DENT 501)</td>
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<tr>
<td>Correlative Medical Science (DENT 502)</td>
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</table>
Craniofacial, Surgical, and Special Care Orthodontics Fellowship Program

Fellows accepted into the Craniofacial, Surgical and Special Care Orthodontics Fellowship Program will be provided with advanced clinical, didactic, and research training during the 1 year program of study in the management of children with facial differences. We anticipate most fellows to go through a 1 year program of study. However, individuals who intend to devote the majority of their career in this area may be provided with the opportunity to enroll in a second year of study.

Graduates of the program will be exposed to the diagnoses, treatment planning, and clinical execution of orthodontic and dentofacial orthopedic services to a large clinical volume of pediatric, adolescent, and adult patients who have congenital and acquired craniofacial abnormalities. The goal of the Fellowship Program is to train the fellow to attain a level of competency that enables him or her to recognize, diagnosis and treat patients with craniofacial anomalies and special needs in a hospital-based, team care setting.

Fellows participate in the craniofacial and cleft conferences, review treatment plans and progress notes, and provide clinical care to the patients under direct supervision. All complex treatments are discussed with the attending on a case-by-case basis. New patient exams are done on regular basis and the fellows work up cases (clinical exam, study models analysis, CBCT evaluations) and reviews the treatment plans with the faculty. The fellows will perform all the surgical treatment plans, cephalometric prediction tracings, model surgery, and splint construction. The fellow will also scrub in and participate in the OR activities/surgical procedures.

Rotations with other services will form an integral part of the Fellowship Program. The principal rotations will be with the departments of plastic surgery, oral and maxillofacial surgery, and pediatric dentistry. In addition, the fellow will be exposed to speech pathology, pediatric otolaryngology, genetics, and occupational therapy.

The format of the program allows for constant one-on-one supervision that will allow for subjective assessments of the fellow's understanding of the subject matter, clinical skills, and patient management skills. This will be supplemented by weekly sessions with the faculty, where the fellow’s understanding will be further tested. At the end of each semester, a written examination will form part of the assessment of the fellow’s progress.

Admission

More information about admission to the program can be obtained by contacting the following:

Manish Valiathan (http://bulletin.case.edu/schoolofdentalmedicine/cranio@mailto:manish.valiathan@case.edu), DDS, MSD, Program Director, at 216.368.0673; Stephanie Leasure (http://bulletin.case.edu/schoolofdentalmedicine/cranio@mailto:stephanie.leasure@case.edu), Craniofacial Clinic Assistant, at 216.368.4331; or Colleen Friday (http://bulletin.case.edu/schoolofdentalmedicine/cranio@mailto:colleen.friday@case.edu), Graduate Studies Administrator, at 216.368.1188.
DMD Special Programs for Undergraduates

Pre-Professional Scholars in Dentistry
The Pre-Professional Scholars Program in Dentistry offers exceptionally well qualified high school students two options: the six-year program where students join the CWRU School of Dental Medicine after completing two years of undergraduate course work or the eight-year program that begins after the completion of the bachelor’s degree. For more information about the program, see Pre-Professional Scholars Program (p. 550) in the Office of Undergraduate Studies section of this bulletin. For more information about admission to the Pre-Professional Scholars Program, see the Office of Undergraduate Admission website (http://admission.case.edu/apply/ppsp.aspx).

Senior Year in Professional Studies
The Senior Year in Professional Studies offers Case Western Reserve undergraduate students, who are candidates for the Bachelor of Arts (BA) degree and who are admitted to Case Western Reserve University School of Dental Medicine by the end of the junior year, the opportunity to shorten their entire course of studies by one year. For more information about the program and admission, see Acceleration Toward Professional Degrees (p. 548) in the Office of Undergraduate Studies section of this bulletin.
DMD/MPH DMD and Master of Public Health

Dual-Degree Program

DMD and Master of Public Health

The Case School of Dental Medicine, in collaboration with the School of Medicine, offers a dual-degree program in dental medicine and public health (DMD/MPH). The program is funded by the Health Resources and Services Administration (HRSA), Predoctoral Training in Public Health Dentistry Training Grant.

Purpose

One of the primary goals of the American Dental Association (ADA) is to “Promote the oral health of the public.” Dental public health is one of the nine recognized specialties of the ADA, and is defined as “the art and science of preventing oral diseases and promoting oral health through organized community efforts.” The objective for the five-year dual degree program is to impart knowledge and skills necessary to expand the practice of dentistry into the community in a proactive way that fosters improved oral health, and as a direct result, yields improved overall health of the populations involved.

Curriculum

The DMD curriculum consists of 141.5 credit hours and the MPH curriculum consists of 42 credit hours: 24 credit hours of didactic MPH courses, 9 credit hours for DMD coursework, participation in a seminar series, and 9 credit hours for the required capstone project. A total of 9 credits will be applied from the dental curriculum to the MPH degree. Of the 24 credit hours of didactic curriculum, 18 must be from core MPH courses. Dual degree students may choose to enroll in electives as well. One of the five years of the dual degree program must be dedicated to MPH courses, which can be either before the first DMD year, between the 1st and 2nd DMD years, or between the 2nd and 3rd DMD years. Other possible options for the dedicated MPH year will be considered on a case-by-case basis. Information about the MPH program can be found here. (http://mph.case.edu)

Features

Each dual degree student will be assigned two advisors who will advise and guide them towards completing the MPH program. In addition to didactic courses, the DMD/MPH program requires field experiences/rotations at extramural sites/clinics. The student will also be required to complete a capstone project and present the findings at the Innovations in Population Health conference, the School of Dental Medicine Professional Day, and at a national conference.

Admission

Admission to the DMD program is required for consideration for the dual-degree program. Prospective students are eligible to apply to the MPH program at any time prior to the start of the third DMD year. Applicants must complete an online application form for the MPH program that includes a personal statement about the applicants’ interest in public health and professional goals; three letters of recommendation; GRE or DAT test scores, and TOEFL or IELTS if applicable; and official transcripts for all higher education degrees.

Sample Template for Course Schedule for DMD/MPH (with MPH-dedicated year prior to DMD Year 1)

| Year 1, Fall (12) | MPH 405 Statistical Methods in Public Health * | 3 |
| Year 1, Spring (12) | MPH 411 Introduction to Health Behavior * | 3 |
| Year 2-5 (9) | Capstone Experience * | 9 |

* Indicates core course
DMD/MS Clinical Research Training

Dual-Degree Program
DMD and Master of Science in Clinical Research Training

The Case School of Dental Medicine, in collaboration with the School of Medicine, presents a dual-degree program made possible by the National Institute of Health (NIH) Ruth L. Kirschstein National Research Service (T32) Training Grant.

Purpose

The objective for the five-year joint DMD and Master in Clinical Research Training (DMD-MCRT) at the School of Dental Medicine is to train dental scholars for an academic career and for utilizing scientific advances to solve clinical problems. Part of this goal is training in clinical research so that the dental graduate may promote progress in biomedical research and develop innovative and effective strategies for the oral health needs of the population.

Curriculum

The DMD curriculum consists of 141.5 credit hours and the MCRT curriculum consists of 36 credit hours. The MCRT curriculum consists of 15 graded hours of core curriculum, 6 graded hours of DMD coursework, 3-6 graded hours of elective course(s), participation in a seminar series, and 9-12 graded hours of research work culminating in a thesis project. Components of the dental curriculum are equivalent to clinical research material that is taught at the graduate level. Thus a total of 6 credits will be applied from the dental curriculum to the master’s degree.

A full year of research is a requirement. The student will be required to take one year off (either between the 2nd and 3rd or 3rd and 4th DMD years or immediately after DMD completion) for fulfillment of the master’s program. The one-year research training can also be accomplished in 2-3 month blocks between DMD years. A successful passing of the oral defense of the master’s research thesis is also required.

Features

Key features of this dual-degree program are that it is a five-year program where each student is assigned an advisor, a mentor, and the student will receive “protected time” to complete their master’s requirements. This program will highlight core dental and master’s courses as well as research rotations. The student will be required to complete a master’s thesis research project and make a scientific presentation at the International Association of Dental Research or the American Association of Dental Research conferences.

Admission

Prospective students are eligible to apply to the program anytime after their first year of DMD studies, but prior to the start of the fourth DMD year. Applicants must complete an online application form that includes a personal statement describing the reason for seeking admission along with a summary of career goals and submit a non-refundable application fee, three sealed recommendation letters or online recommendation forms, a recent curriculum vitae including previous research experience, letters of support from training director and research mentor ensuring protected time, and official transcripts for all higher education degrees. Applicants will also be required to submit a photograph and Visa/ Permanent Resident Card/ECFMG (if applicable). Admission to the program is contingent upon good DMD academic standing and recommendation letters from the Associate Dean for Education and the Director of the DMD-MCRT program.

Master of Science in Clinical Research Sample Plan of Study

<table>
<thead>
<tr>
<th>First Year</th>
<th>Units</th>
<th>Fall</th>
<th>Spring</th>
<th>Summer</th>
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<tr>
<td>Study Design and Epidemiologic Methods (CRSP 402)</td>
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<td>Communication in Clinical Research (Part 1) (CRSP 412)</td>
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<td>Statistical Methods I (CRSP 431)</td>
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<td>Communication in Clinical Research (Part 2) (CRSP 413)</td>
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<td>Statistical Methods II (CRSP 432)</td>
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<td>Design and Analysis of Observational Studies (CRSP 500)</td>
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<td>On Being a Professional Scientist: The Responsible Conduct of Research (IBMS 500)</td>
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<tr>
<td>Introduction to Clinical Research Summer Series (CRSP 401)</td>
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<td>Introduction to R Programming (CRSP 406)</td>
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<td><strong>10</strong></td>
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<th>Second Year</th>
<th>Units</th>
<th>Fall</th>
<th>Spring</th>
<th>Summer</th>
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<td>Clinical Research Scholars Thesis (CRSP 651)</td>
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<tr>
<td>Clinical Research Scholars Thesis (CRSP 651)</td>
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<tr>
<td>Clinical Research Scholars Thesis (CRSP 651)</td>
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<td><strong>Year Total:</strong></td>
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<td><strong>1-18</strong></td>
<td><strong>1-18</strong></td>
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<td><strong>Total Units in Sequence:</strong></td>
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</tbody>
</table>
**Doctor of Dental Medicine (DMD)**

**Doctor of Dental Medicine (DMD)**

The program will accomplish its goals through academic work in four themes and two threads, which are woven throughout the four years of the program. The program includes a variety of educational formats to deliver the curricula, including problem-based learning sessions, team-based learning, independent study, seminars, experiential learning opportunities, traditional lectures, virtual reality clinical simulation, laboratories, standardized patient experiences, and patient-based comprehensive care. An important goal of the curriculum is to help students become better prepared in independent learning, critical thinking skills, and the use of evidence. The curriculum is a program of study that includes traditional and newly organized integrated educational modules in the following themes and threads:

**Themes**

**Health and Well-Being**

This theme contains all curricula — both didactic and clinical — that apply to health and the normal structure and functioning of the body and of the oral complex. The traditional content areas of physiology, biochemistry, anatomy, histology, among other dental science classes, are integrated through cases to form a better bridge between the basic sciences and the clinical sciences.

**Disease Processes**

The Disease Processes theme includes content related to general and oral diseases. These topics are often melded with healthy structure and function content to provide students with a global perspective of the implications of disease on usual functioning.

**Restoration of Health**

This theme contains content related to therapies necessary for treatment of medical disease and dental disease. A focus on restoring oral health is accomplished through virtual reality clinical skills training, training on models and progression to comprehensive dental care in conjunction with didactic knowledge.

**Maintenance of Health**

The Maintenance of Health theme focuses on curriculum which explores strategies for preserving health through general and oral health therapies, patient education, disease risk assessment, and disease prevention. This theme provides viewpoint from which students can develop life-long care plans for their patients.

**Threads**

**Inquiry**

This thread that runs throughout the four-year program supports student growth in skills in clinical decision making. Students develop an understanding of what scientific evidence is, how to make clinical decisions, and to value scientific discovery in all aspects of dentistry.

**Leadership**

This thread contains curriculum for the development of students as ethical, sensitive, caring practitioners who are stewards of oral health of the individual patient, the community, and society. An important focus in Leadership curriculum is content that helps students advance in their role as a professional. It also supports the integration of all students into the practice management curriculum centered within their clinical preceptor groups.

**Years**

**Year 1**

This year includes curriculum describing normal healthy functioning and disease processes. Basic science content is taught in the context of clinical cases. Foundational work in understanding human structure and function is paired with learning about disease. Dental clinical sciences study the foundational elements of oral health.

**Year 2**

This year continues with an integrated approach to curricula in health and disease with an emphasis on the development of dental clinical skills. Further development of students as clinicians proceeds with their involvement in the clinical preceptor groups. Students will make a transition to increasing patient-centered clinical care as they demonstrate competency in clinical skills and didactic knowledge.

**Year 3**

This year includes didactic work related to advancing levels of knowledge and clinical experience. Students spend time in didactic classes that are directly related to clinical practice and in rotations to specialty clinical areas while accomplishing comprehensive patient care.

**Year 4**

Students gain clinical experience in the Comprehensive Care Clinics and finish didactic work which may include enrichment courses. They participate in practice management activities of their preceptor group, developing critical skills for general practice dentistry.

**Doctor of Dental Medicine (DMD)**

**First Year Courses**

<table>
<thead>
<tr>
<th>First Term</th>
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<tbody>
<tr>
<td>HEWB 121</td>
<td>Foundations of Life Science</td>
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<tr>
<td>HEWB 130</td>
<td>Oral Histology</td>
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<tr>
<td>HWDP 131</td>
<td>Heart and Lungs in Disease and Health</td>
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<tr>
<td>LDRS 111</td>
<td>Epidemiology for Public Health and Clinical Practice</td>
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<td>MAHE 141</td>
<td>Preventive Periodontics</td>
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<td>MAHE 144</td>
<td>Preventive Periodontics Clinic (graded in the spring)</td>
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<td>MAHE 145</td>
<td>ACE: Outreach Preventive Dentistry</td>
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<td>REHE 151</td>
<td>Dental Anatomy</td>
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<tr>
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<tr>
<td>HEWB 123</td>
<td>Facial Growth</td>
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<tr>
<td>HEWB 124</td>
<td>Masticatory Dynamics</td>
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<tr>
<td>HEWB 126</td>
<td>Masticatory Dynamics Lab</td>
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<tr>
<td>HEWB 128</td>
<td>Body as Host</td>
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<tr>
<td>HEWB 134</td>
<td>Head and Neck Structure and Function</td>
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<td>INQU 102</td>
<td>ACE: Knowing the Patient</td>
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<td>MAHE 144</td>
<td>Preventive Periodontics Clinic (continued from first term)</td>
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<td>REHE 152</td>
<td>Basic Procedures in Fixed Prosthetics</td>
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<td>REHE 154</td>
<td>Basic Procedures in Fixed Prosthetics Lab</td>
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<td>REHE 156</td>
<td>DentSim Laboratory (continued from first term)</td>
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<tr>
<td>REHE 158</td>
<td>Dental Materials I</td>
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**Total Units** 41

**Second Year Courses**

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<tr>
<td>DSPR 239</td>
<td>Neoplasia</td>
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<tr>
<td>HWDP 232</td>
<td>Health and Disease: Renal and Hematologic Systems</td>
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Case Western Reserve University 631
School of Dental Medicine

Third Year Courses

Summer Term

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<td>Management of Medical Emergencies</td>
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<tr>
<td>DSRE 335</td>
<td>Clinical Pharmacology</td>
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<tr>
<td>DSRE 395</td>
<td>Introduction to Oral and Maxillofacial Surgery</td>
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<tr>
<td>LDRS 313</td>
<td>Dental Patient Management/Risk Management</td>
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<td>HEWB 349</td>
<td>Dentofacial Morphology</td>
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<tr>
<td>REHE 358</td>
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First Term

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<tbody>
<tr>
<td>COMP 387</td>
<td>General Practice Dentistry A</td>
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<tr>
<td>COMP 389</td>
<td>General Practice Dentistry B</td>
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<td>DSRE 341</td>
<td>Oral Diagnosis and Radiology</td>
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<tr>
<td>DSRE 393</td>
<td>Principles of Oral and Maxillofacial Surgery I</td>
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<tr>
<td>DSRE 397</td>
<td>Occlusion Seminar</td>
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<td>LDRS 317</td>
<td>Dental Auxiliary Management</td>
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<tr>
<td>REHE 351</td>
<td>Surgical Periodontics</td>
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<tr>
<td>REHE 353</td>
<td>Principles of Treatment Planning II</td>
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<td>REHE 355</td>
<td>Esthetic Dentistry</td>
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<td>REHE 360</td>
<td>Implant Dentistry</td>
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<tr>
<td>DSRE 391</td>
<td>Endodontics</td>
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Second Term

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<th>Course Title</th>
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<tr>
<td>COMP 390</td>
<td>General Practice Dentistry A</td>
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<tr>
<td>COMP 394</td>
<td>General Practice Dentistry B</td>
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<tr>
<td>DSRE 342</td>
<td>Oral Cancer Diagnosis</td>
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<tr>
<td>DSRE 344</td>
<td>Dental Management of Medical Disease</td>
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<tr>
<td>DSRE 370</td>
<td>Principles of Oral and Maxillofacial Surgery II</td>
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<tr>
<td>DSRE 374</td>
<td>Fixed Prosthodontics</td>
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Fourth Year Courses

First Term

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<tr>
<td>COMP 422</td>
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<td>COMP 428</td>
<td>Oral Diagnosis and Radiology (graded in the spring)</td>
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<tr>
<td>COMP 448</td>
<td>Endodontics (graded in the spring)</td>
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<td>COMP 458</td>
<td>Clinical Oral Surgery II (graded in the spring)</td>
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<td>COMP 464</td>
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<td>COMP 468</td>
<td>Removable Prosthodontics (graded in the spring)</td>
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<td>COMP 474</td>
<td>Fixed Prosthodontics (graded in the spring)</td>
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<td>COMP 478</td>
<td>Pediatric Dentistry (graded in the spring)</td>
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<td>COMP 482</td>
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<tr>
<td>COMP 487</td>
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<td>COMP 489</td>
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<td>DSRE 426</td>
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<td>LDRS 416</td>
<td>Practice Management III</td>
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<td>LDRS 420</td>
<td>Jurisprudence and Professional Ethical Responsibility</td>
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<td>REHE 421</td>
<td>Periodontal Medicine and Cases</td>
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<td>REHE 455</td>
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<td>Case Presentations I</td>
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Second Term

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<td>COMP 422</td>
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<tr>
<td>COMP 428</td>
<td>Oral Diagnosis and Radiology</td>
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<td>COMP 448</td>
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<td>COMP 458</td>
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<td>DSRE 426</td>
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<td>LDRS 416</td>
<td>Practice Management III</td>
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<td>REHE 421</td>
<td>Periodontal Medicine and Cases</td>
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Total Units 34
Endodontics

Endodontics

The graduate endodontics program is a continuous 24-month master’s degree (Master of Science in Dentistry) and certificate program commencing the beginning of July each year. It has a full-time director and 5 part-time clinical faculty members. It is concerned with developing competent, skilled clinicians with teaching and research abilities.

To achieve these objectives, the program provides extensive background in both scientific and clinical knowledge. The curriculum is designed to fulfill the requirements of the American Board of Endodontics and promote Diplomates.

The program will prepare specialists in the fields of diagnosis, all phases of treatment and prevention of pulpal and periapical dental disease. It will provide training in research design and methodology as it relates to pulpal, dentinal, periodontal, and related clinical areas, preparing the resident for teaching responsibilities in undergraduate, postgraduate, and graduate levels.

A top of the line surgical microscope with a complete and full documentation package is provided for teaching a variety of microscopic surgery techniques.

The curriculum includes bone grafting and guided tissue regeneration. The IV sedation and general anesthesia training are provided by University Hospitals of Cleveland for the second year resident. Presentation of multiple table clinics is required. The endodontic residents have placed first the last three years at the annual meeting of the Ohio Dental Association.

Admission

Information about admission to the endodontics program (http://dental.case.edu/endodontics/residency/howtoapply) can be found on the School of Dental Medicine website.

<table>
<thead>
<tr>
<th>First Year</th>
<th>Units</th>
<th>Fall</th>
<th>Spring</th>
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<tbody>
<tr>
<td>Anatomy of the Head and Neck (DENT 513)</td>
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<tr>
<td>Multidisciplinary Seminar II (DENT 698)</td>
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<tr>
<td>Epidemiology and Biostatistics (DENT 510)</td>
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<td>Behavioral Considerations in Oral Health Care (DENT 518)</td>
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<td>Management of Medical Emergencies (DENT 555)</td>
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<td>Advanced Oral Pathology (DENT 512)</td>
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<td>Endodontology I (DENT 529)</td>
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<td>Endodontic Literature Review I (DENT 539)</td>
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<td>Clinical Endodontic Specialty I (DENT 551)</td>
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<td>Biological Aspects of the Stomatological System (DENT 501)</td>
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<td>Correlative Medical Science (DENT 502)</td>
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<td>Clinical Pharmacology (DENT 550)</td>
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<td>Research Methods: Preparation (DENT 514)</td>
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<td>Endodontology II (DENT 530)</td>
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<td>Endodontic Literature Review II (DENT 540)</td>
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<td>Clinical Endodontic Specialty II (DENT 552)</td>
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<tr>
<td>Multidisciplinary Seminar II (DENT 698)</td>
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<td>Thesis M.S.D. (DENT 651)</td>
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Total Units in Sequence: 56-72
Expanded Function Dental Auxiliary (EFDA)

Expanded Function Dental Auxiliary Program

The School of Dental Medicine offers a non-degree certificate course in expanded dental functions to dental auxiliaries with requisite training and experience. This continuing education program prepares the student to take an examination administered by the Ohio Commission on Dental Testing for Expanded Function Dental Auxiliaries.

The Expanded Function Dental Auxiliary course is a less than part-time program and includes didactic, pre-clinical laboratory, and clinical training. It is affiliated with several hospitals and health agencies in the Cleveland metropolitan area, where a portion of the clinical training takes place. Students are selected for admission on the basis of their performance on an entrance examination administered by the program faculty.

Upon successful completion of this accredited program, an auxiliary is eligible to sit for the state certifying examination provided by the Commission on Dental Testing in Ohio.

Admission

Information about admission to the EFDA program (http://dental.case.edu/efda) can be found on the School of Dental Medicine website.

Students begin the program learning tooth anatomy, contour and contact using wax. Then students gradually advance through one, two, three, and complex surface restorations of amalgam and composite on the typodont. Rubber dam placement and sealant placement are also learned.

Part of the responsibility for being in the program will be for the employer dentist to allow the EFDA trainee to perform intra-oral procedures (restorations) in the office once the student has successfully passed semester one amalgam, composite, and sealant competencies.

Clinical/patient experience occurs during the second semester at MetroHealth Hospital/clinics, Case School of Dental Medicine Clinic, Rainbow Hospital Tapper Pedodontic Clinic, The Free Clinic of Cleveland, or St. Elizabeth Hospital Dental Clinic in Youngstown, Ohio, and the office in which the student is employed.

Mock board exams are given the second semester, simulating the testing atmosphere of the actual state examination.

After successful completion of the course, the student will be eligible to sit for the state board examination administered by the Commission on Dental Testing in Ohio (http://www.codtohio.org). Examination candidates will be expected to bring their own instruments and materials (not school-owned) to the exam.

According to various sections of the Ohio Law and Regulations for Certification and Licensure Boards, persons convicted of any felony or misdemeanor may not be able to take the licensure or certification examinations; may be refused acceptance of placement by the clinical/practicum sites; or may have restrictions placed on their ability to practice. For more information, contact the Dean of Student Services and the applicable licensure/certification board.

Lecture and labs

- Nomenclature
- Caries classification
- Cavity preparation
- Oral anatomy
- Dental morphology
- Periodontium
- Histology
- Basics of occlusion
- Ergonomics
- Instrumentation
- Pulp protection
- Dental materials
- Matrix and wedge techniques
- Temporization
- Amalgam placement and carving
- Polishing amalgams
- Composite placement
- Composite finishing and polishing
- Posterior composites
- Pit and fissure sealant placement
- Rubber dam placement

First Year

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<th>Course</th>
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<td>Dental Materials for the EFDA (EFDA 113)</td>
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<td>Restorative Dentistry for the EFDA I (EFDA 115)</td>
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<td>Clinical Practicum for the EFDA (EFDA 120)</td>
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Total Units in Sequence: 9.5
Graduate Studies at School of Dental Medicine

Academic Regulations

Registration

Graduate studies programs operate on a twelve-month basis, from July 1 to June 30. The year is divided into two six-month semesters. The fall semester is from July 1 to December 31; and spring semester is from January 1 to June 30. The act of registration includes submission of a course schedule approved by the department, the payment of semester tuition, and the completion of the online registration form. Each semester, registration must be completed as scheduled. Students enrolled in fall and spring semesters may arrange to pay bills for tuition and fees in two installments. At least half of the total bill must be paid at registration; the remainder must be paid in accordance with university policy. Fees may be charged for late registration or late payment. Students who fail to register within 30 days after the published dates will be considered to have withdrawn from the program. In the School of Dental Medicine, students who are not registered are not considered students of record, lose the protections of the university in matters of liability, and therefore, may not treat patients. They can no longer attend class or receive grades and will have to formally reestablish their matriculation. In any circumstance, all lost course and/or clinical time will be added to the end of the program’s original completion date.

Grading

The responsibility for assigning grades rests exclusively with the course director, who must announce the general method of grading at the beginning of the course. Course grades are reported to the registrar of the School of Dental Medicine at the end of the course or when a final grade has been determined, if prior to the scheduled completion time for the course. Incomplete or conditional grades can be changed only by the course director as described in the University Registrar (p. 942) section of this bulletin. Grading in the School of Dental Medicine Graduate Programs is A, B, C, or F.

Transfer Credit

Transfer of credit from another university is limited to six semester hours of graduate-level courses. Such transfer requires approval from the student’s advisor, the department chair, and the Office of Graduate Studies. Courses must have been taken within five years prior or subsequent to matriculation in the graduate program at Case Western Reserve University, and only those with grades of “B” or better are transferable. No credit for a thesis may be transferred from another university.

Graduate credit is not awarded for 100- or 200-level courses or their equivalents.

Thesis Advisory Committee

Each master’s degree candidate is advised to consult with their Program Director as to when and how to form a thesis committee. The Graduate department chair, in consultation with the Program Director, chooses a faculty member to serve as the primary thesis advisor. This advisor also serves as the chair of the thesis committee. The primary thesis advisor will help identify other members of the faculty (at least two) to serve as secondary advisors and as members of the thesis committee. At least two members of the thesis committee must be from the department in which the student is enrolled, and one must be from another department. Additional membership is not restricted and may include persons from outside the university who have qualifications acceptable to the department chair. Members of the thesis committee continue in their capacity until the student graduates or leaves the program of study. The thesis committee will be responsible for guiding the student in the development of a thesis protocol. Once a protocol is acceptable, the thesis committee members advise the student on the conduct of the research and writing of the thesis document. Ultimately, the committee members will evaluate the student’s oral defense and final thesis document.

Research Project

For master’s degree programs, each student must carry out an original and meaningful research project acceptable to the department chair and the advisory committee. A written thesis, similarly acceptable, is to be prepared and must conform to the standard format determined by the Office of Graduate Studies of the School of Dental Medicine. The thesis must be submitted before the prescribed deadline. An oral examination (defense) of the thesis is required. This examination is administered by the student’s advisory committee before a standard date set by the Office of Graduate Studies of the School of Dental Medicine. Unanimous agreement of the committee is required to pass the thesis examination. A student must be registered for thesis credit or continuing graduate work during the semester in which the thesis examination is conducted. The thesis defense is ordinarily open to all members of the university faculty, student body, and guests.

Extra Courses

Individual students enrolled in an advanced education program, whether or not a master’s degree is involved, may be required to take courses beyond the general requirements set forth by the department in order to complete the program. In such instances, the student must be notified in writing by the department chair, with a copy filed in the Office of Graduate Studies of the School of Dental Medicine.

Time Limits

Each student is expected to maintain continuous registration and all requirements must be completed within five consecutive calendar years immediately following matriculation as an advanced education student, including approved periods of leave of absence. A student who fails to complete the requirements within five years must be formally readmitted with full standing in order to continue study, subject to terms of readmission, future time limits, and revised requirements for the award of the degree. Prior status in the program is no guarantee of readmission and should not be assumed.

Leave of Absence

A student may request a leave of absence for personal reasons or reasons of health when anticipated or actual absence is in excess of three weeks. A written request for a leave of absence must include the reason for the request and the length of time requested. A leave of
absence cannot exceed one calendar year. It must be submitted to the
program director and to the associate dean of graduate studies of the
School of Dental Medicine. The program director will forward the request
with his/her response to the Committee on Graduate Studies. In order to
be eligible for such requests, the student must be currently enrolled and
in regular attendance prior to the time or circumstances that necessitated
the request. At the expiration of the leave, the student must resume
registration unless formally granted an extension. A leave of absence
does not extend the maximum time permitted for the completion of
degree requirements. A student who fails to obtain an approved leave, or
who fails to resume registration at the time expected, may be separated
from the program. During the period of leave, it is expected that the
student will not avail himself or herself of the teaching and research
resources of the School of Dental Medicine or the university. At the
end of an approved leave, reentry into the program is reviewed by the
program director in concert with the Committee on Graduate Studies,
and may not be at the same level attained at the time the leave was
granted. Programs with a high patient case component may require that
the clinical portion of the program be repeated in its entirety. Finally, the
committee also reserves the right to place a student on leave of absence
where it has been determined that the circumstances warrant, even in the
absence of a formal request.

Maintenance of Good Standing
A minimum cumulative grade point average of 2.75 is required for good
standing in a graduate program for all courses taken for graduate credit
(excluding those graded Satisfactory/Unsatisfactory or Pass/No Pass).

The associate dean for graduate studies reviews student performance
and may recommend a course of action to the Committee on Graduate
Studies. The committee may require remedial work, place a student
on academic review or probation, set conditions for continuation in
the student’s course of study or program, and may require withdrawal
for failure to meet the academic standards set by the department or
school. A student who receives a grade deemed unsatisfactory in any
course is placed on probation and must remove himself or herself from
probation within a time period specified by the committee. It is expected
that removal from probation will ordinarily require repetition of the course
with an acceptable grade or the successful completion of work deemed
equivalent by the student’s advisory committee and the departmental
chair.

In this regard, a student may be separated from the university for any one
of the following reasons:

1. Failure to correct probationary status within the specified time
   period.
2. Failure to achieve a minimum grade point average of 2.50 or above
   upon completion of 12 semester hours or a grade point average of
   2.75 or higher upon completion of 21 semester hours of graduate
   study.
3. Failure to complete all requirements for the master’s degree within
   five consecutive calendar years from the term of matriculation,
   unless granted an extension of a maximum of one year upon
   recommendation of the advisor and chair and approved by the
   associate dean for graduate studies.

In calculating the grade point average, all courses for which quality
points are given are counted, including courses which may be required
to be repeated. In addition, on the recommendation of the student’s
department, and with due process, the School of Dental Medicine may
suspend or separate a student from the university for failure to maintain
appropriate standards of conduct and integrity in discharging their

Graduation
The minimum requirements for the master’s degree in the School
of Dental Medicine are 36 semester hours of course work, including
six or more semester hours of thesis/equivalent registration, and the
submission of an accepted thesis. Individual departments may require
additional semester hours of specific course work and/or thesis. Not less
than 24 semester hours may be at the 500 level or higher.

A candidate for a Master of Science in Dentistry degree must make
application for the degree to the Office of Graduate Studies of the School
of Dental Medicine no later than three months before the commencement
at which the degree is expected.

The awarding of the degree is dependent upon the satisfactory
completion of all requirements, and the recommendations of department
chair, Committee on Graduate Studies, and faculty of the School of
Dental Medicine. The student must complete all requirements for both the
master’s degree and certificate in order to receive either.

Degrees will not be awarded to candidates with delinquent financial
accounts that include, but are not limited to, tuition payments, fees, and
library fines.

Delayed Graduation
A candidate who has successfully defended his or her thesis, but who
fails to meet the deadline for thesis submission for graduation in one
semester, will be permitted to receive his or her degree at the next
scheduled graduation, without further registration or payment of tuition
if the completed thesis is submitted within fourteen days of the date
originally scheduled for graduation. If all requirements are not met
within this grace period, the candidate must register for the subsequent
semester.
Oral and Facial Maxillofacial Surgery

Oral and Maxillofacial Surgery

The residency program at Case Western Reserve University in Oral and Maxillofacial Surgery is a joint program with the School of Medicine leading to an MD degree and certificate in oral and maxillofacial surgery. Case Western Reserve University is the only program in the country that enables residents to obtain their medical degree and certificate in five years.

Residents rotate through several institutions: the Department of Oral & Maxillofacial Surgery at University Hospitals of Cleveland, Cleveland's Veterans Administration Hospital, the School of Dental Medicine at Case Western Reserve University, the Department of Oral and Maxillofacial Surgery at the Cleveland Clinic, Aultman Hospital in Canton, and the Cleveland Clinic Hospital. This diversity of institutions ensures that residents gain experience in the essential areas of clinical surgery in preparation for all types of practices.

Admission

More information about admission to the oral and maxillofacial surgery (http://dental.case.edu/omfs/residency/howtoapply) program can be found on the School of Dental Medicine website.

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<thead>
<tr>
<th>First Year</th>
<th>Units</th>
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<td>Multidisciplinary Seminar II (DENT 698)</td>
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<tr>
<td>Oral Surgery Residency (DENT 695) (summer/fall)</td>
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<td>Biological Aspects of the Stomatological System (DENT 501)</td>
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Year Total: 1-10 3.5-12.5

Total Units in Sequence: 4.5-22.5

PGY 1

- University Hospitals/OMFS - 7 months
- Veteran's Admin/OMFS - 3 months
- University Hospitals/Anesthesia - 2 months

PGY 2

- Med School - 12 months
- Surgery/Internal Medicine - 4 months
- Pediatrics/Family Medicine/OB GYN - 4 months
- Psychiatry/Neurology - 2 months
- Emergency Medicine/Geriatrics - 2 months

PGY 3

- University Hospitals/OMFS - 5 months (4 months if Foreign Rotation)
- The Cleveland Clinic/OMFS - 1 month
- Veteran's Admin/OMFS - 3 months
- University Hospitals/Anesthesia - 3 months
- Foreign Rotation (optional) - 1 month

PGY 4

General Surgery Internship:

- University Hospitals/OMFS - 2 months
- The Cleveland Clinic/OMFS - 1 month
- University Hospitals and MetroHealth/Surgery Rotations - 9 months
  - Plastic Surgery - 3 months
  - ENT - 2 months
  - Neurosurgery - 1 month
  - SICU/Trauma - 2 months
  - General Surgery/Pediatric Surgery - 1 month

PGY 5

- University Hospitals/OMFS Chief Resident - 6 months
- Aultman Hospital/Private Practice in Akron/Canton - 3 months
- University Hospitals/OMFS - 3 months
Orthodontics

The graduate program in orthodontics is a master’s (Master of Science in Dentistry) and certificate program dedicated to advancing the art and science of orthodontics through research, teaching, and service.

The clinical training of orthodontic residents encompasses all aspects of current orthodontic practice including, full treatment cases with bands and brackets, early treatment, adult treatment, craniofacial anomalies, orthognathic surgery and TMJ/occlusion. The length of the orthodontic program is 30 months. Given this time frame the clinical teaching of orthodontics will be divided according to the importance of the above topics to the private practice of orthodontics. In a program of 30 months it is not possible to produce a seasoned and skilled orthodontist, therefore, our program strives to produce a competent beginner. Accordingly, the clinical load of patients is chosen to match the teaching goals of the department.

There is an option to extend the program to 36 months to satisfy European specialty training standards (ERASMUS).

Admission

More information about admission to the orthodontics program (http://dental.case.edu/orthodontics/residency/howtoapply) can be found on the School of Dental Medicine website.

First Year

<table>
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<tr>
<th>Course</th>
<th>Units</th>
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<th>Spring</th>
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<tbody>
<tr>
<td>Facial Growth and Development (DENT 503)</td>
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<td>Advanced Facial Growth (DENT 504)</td>
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<td>Dentofacial Anomalies (DENT 505)</td>
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<td>Advanced Oral Pathology (DENT 512)</td>
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<td>Anatomy of the Head and Neck (DENT 513)</td>
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Second Year

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Total Units in Sequence: 53.5-69.5
Pediatric Dentistry

The graduate program in pediatric dentistry is a master’s (Master of Science in Dentistry) and certificate program that takes place at Case Western Reserve University School of Dental Medicine and Rainbow Babies and Children's Hospital.

The two-year post doctoral residency program follows closely the principles and policies as outlined in the Guidelines for Advanced Education in Pediatric Dentistry prepared by the American Academy of Pediatric Dentistry and the American Board of Pediatric Dentistry. It is fully accredited by the Commission on Dental Accreditation. Successful completion results in a certificate of specialty education in pediatric dentistry which qualifies the resident for examination by the American Board of Pediatric Dentistry.

Students who elect to complete the master’s program pay full tuition. The MSD program is open to non-US citizens and foreign-trained dentists. Foreign-trained dentists must complete a US GPR or AEGD before applying to the program.

Our purpose is to train the specialist as a qualified practitioner, consultant and advocate for complete dental treatment of healthy and special needs children.

The acquired skills prepare the pediatric dental resident to prevent, diagnose and treat common and unusual oral problems that might arise during the physical, psychological and emotional development of the child and adolescent. In addition to the oral aspects of childcare, the resident becomes cognizant of the general health problems related to children.

Our program offers a balanced clinical and didactic curriculum in advanced infant, child and adolescent dental care.

The pediatric dentistry curriculum is designed to have the resident play an integral role in the health care of children, side by side with his/her medical colleagues, and to prepare the resident for successful entry into the contemporary practice setting while providing the foundation for future growth in the field.

Admission

More information about admission to the pediatric dentistry program (http://dental.case.edu/pediatrics/residency/howtoapply) can be found on the School of Dental Medicine website.

The following courses are required for the postdoctoral student:

- Behavioral Management
- Anatomy
- Epidemiology & Biostatistics
- Microbiology
- Facial Growth and Development
- Craniofacial Anomalies
- Hospital Dentistry
- Conscious Sedation
- Conferences
- Pediatric Dentistry Literature Review
- Preventive and Interceptive Orthodontics
- Genetics
- Pharmacology

- Hospital Rotations in the departments of Anesthesia, Pediatric, and Emergency Medicine

A research requirement must be fulfilled for certification in pediatric dentistry. Students enrolled in the MSD program must complete a formal thesis.

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Total Units in Sequence: 63-99

1 Taught every 2 years, take in either first year fall or first year spring
Periodontics

The graduate program in periodontics is a thirty-six month, continuous course of study, leading to both a certificate in Periodontics and a Master of Science in Dentistry degree. It is a fully accredited program by the American Dental Association, and meets all the clinical and didactic requirements of the American Board of Periodontology.

The general goals of the program are to train expert clinicians in this specialty, and/or to prepare individuals for an academic (research-teaching) career in Periodontics.

This postdoctoral program offers broad clinical experience and research training.

Completion and defense of a research thesis is one of the requirements of this program. Limited teaching experience is offered to the graduate student so that his/her exposure to clinical, research, and teaching facets of periodontics is complete. All of the faculty of the Department of Periodontics involved in teaching graduate students in this program are educationally or board certified periodontists. Additional instruction within this program is by faculty members of the School of Dental Medicine and the School of Medicine. Because of the multiplicity of training programs our professors have completed, the student is exposed to diverse views of diagnosis, prevention, and treatment of periodontal diseases. A brief initial review of basic aspects of periodontology introduces the new graduate student to the specialty training during the summer session. Extensive contact with practicing periodontists, sufficient exposure to hospital periodontal practice, and clinical training in dental implants are additional features of this program.

Admission

More information about admission to the periodontics program (http://bulletin.case.edu/schoolofdentalmedicine/periodontics/%20http://dental.case.edu/periodontics/residency/howtoapply) can be found on the School of Dental Medicine website.

The following courses are required for the postdoctoral student:

- Advanced Periodontal Seminar - ongoing for 3 years
- Literature Review in Periodontology - ongoing for 3 years
- Periodontal Conferences - ongoing for 3 years
- Clinical Periodontics - ongoing for 3 year
- Advanced Principles of Occlusion - 1 semester
- Conscious Sedation - 1 semester (didactic, 2nd year), ongoing for 2 years (clinical)
- Implant Dentistry - 1 semester (didactic, 2nd year), ongoing for 2 years (clinical)
- Research Thesis - ongoing for 2 year
- Periodontal Prosthesis - one semester
- Microbiology, Immunology and the Immune Response - 1 semester
- Management of Medical Emergencies - 1 summer session
- Anatomy of the Head and Neck - 1 summer session
- Limited Tooth Movement - 1 summer session
- Biological Aspects of the Stomatological System - 1 semester
- Correlative Medical Science - 1 semester
- Introduction to Research Methods - one semester
- Advanced Oral Pathology - one semester
- Epidemiology and Biostatistics - 1 semester
- Interdisciplinary Seminar - one semester
- Clinical Pharmacology - one semester
- Creative Thinking in Research Development - 1 semester
- 2-week hospital rotation

### First Year

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School of Dental Medicine Courses

COMP Courses

COMP 322. Surgical Periodontics. 1 Unit.
Companion clinical component to REHE 351. Clinical treatment in conjunction with residents and faculty.

COMP 328. Oral Diagnosis and Treatment Planning. 1 Unit.
Treatment planning based on the correlation of fundamentals taught in diagnosis, preventive dentistry and restorative dentistry. Clinical experience in the application of didactic training consists of four components; assignments in the admitting and radiology service where students carry out examinations of the newly admitted patients and evaluate their problems and needs; radiology seminars where the technique and interpretation of the radiographs taken by the students are discussed; assignments to the emergency service; and clinical conferences with a staff member.

COMP 348. Endodontics. 1 Unit.
Companion clinical component to DSRE 391. Clinical application of endodontic techniques.

COMP 358. Clinical Oral Surgery I. 1 Unit.

COMP 378. Pediatric Dentistry Clinic. 1 Unit.
Companion clinical component of REMA 341

COMP 384. General Dentistry Clinical Qualifying. 1 Unit.
This course consists of the successful completion of the recall clinical qualifying exam and two diagnosis and treatment planning clinical qualifying exams. It is also necessary for the student to successfully fulfill the recall needs of their assigned clinic patients in order to pass this course.

COMP 386. Quality Assurance. 1 Unit.
This course entails quality assurance issues including, but not limited to: providing students with the working knowledge of dental record keeping, as it relates to diagnosis and treatment of pathology; recognition and management of medical illness and disabilities; treatment planning; documentation of pre-existing conditions, current and past treatment; established laboratory protocols; evaluation of reasons for remakes and re-dos; post-treatment evaluation of care. Recommended preparation: LDRS 313.

COMP 387. General Practice Dentistry A. 1.5 Unit.
Comprehensive dental care. Each student is assigned for clinical training to a preceptor group led by a practicing general dentist. The preceptor guides the students in diagnosis, treatment planning, and actual patient treatment with consultation in various specialties as required. Experience in the provision of emergency dental care. The preceptor directs the total dental health care of the patients of each of his students. Biweekly seminars are provided for each preceptor group. Special topics, student cases, techniques, and journal articles are discussed. Recommended preparation: Concurrent enrollment in DENC 387.

COMP 389. General Practice Dentistry B. 1.5 Unit.
Comprehensive dental care. Each student is assigned for clinical training to a preceptor group led by a practicing general dentist. The preceptor guides the students in diagnosis, treatment planning, and actual patient treatment with consultation in various specialties as required. Experience in the provision of emergency dental care. The preceptor directs the total dental health care of the patients of each of his students. Biweekly seminars are provided for each preceptor group. Special topics, student cases, techniques, and journal articles are discussed. Recommended preparation: Concurrent enrollment in DENC 387.

COMP 390. General Practice Dentistry A. 1.5 Unit.
Clinical application of the principles of general practice dentistry. Recommended preparation: Concurrent enrollment in DENC 394.

COMP 394. General Practice Dentistry B. 1.5 Unit.
Clinical applications of the principles of general practice dentistry. Recommended preparation: Concurrent enrollment in DENC 390.

COMP 417. Community Oral Health Capstone Experience. 1.5 Unit.
The goals of this particular course are to provide experience delivering dental care to a population of patients in a community health center while working with and communicating with a dental health care team and to gain experience in cultural sensitivity.

COMP 422. Periodontics. 0.5 Units.
Clinical application of surgical and nonsurgical techniques used in the treatment of moderate periodontal disease. Students exposed to more advanced cases through clinical demonstrations by instructors. Students encouraged to gain additional experience and become more confident in the management of periodontal patients.

COMP 428. Oral Diagnosis and Radiology. 0.5 Units.
Clinical experience in the admitting and radiology service.

COMP 448. Endodontics. 1 Unit.
Clinical application of the principles of endodontics therapy. Diagnosis and treatment planning. Management of endodontic emergencies and prognosis of endodontic treatment.

COMP 458. Clinical Oral Surgery II. 1 Unit.
Clinical application of the principles of oral surgery.

COMP 464. Operative Dentistry. 2.5 Units.
Clinical application of the principles of operative dentistry.

COMP 468. Removable Prosthodontics. 1.5 Unit.
Clinical application of the principles of prosthodontic dentistry.

COMP 474. Fixed Prosthodontics. 2.5 Units.
Treatment of patients requiring simple and advanced fixed prostheses as an integrated part of total patient care.

COMP 478. Pediatric Dentistry. 2 Units.
Emphasizes comprehensive oral health care of the well child to provide experience in examining, diagnosing, treatment planning, and completing treatment of a selected number of children. Preventive aspects of pediatric dentistry emphasized. Additional voluntary experiences in clinical practice of pediatric dentistry available.

COMP 482. Clinical Orthodontics. 1 Unit.
Clinical application of the principles of orthodontics.
COMP 487. General Practice Dentistry A. 2.5 Units.
Comprehensive dental care. Each student is assigned for clinical training to a preceptor group led by a practicing general dentist. The preceptor guides the students in diagnosis, treatment planning, and actual patient treatment with consultation in various specialties as required. Experiences in the provision of emergency dental care. The preceptor directs the total dental health care of the patients of each of his students. Biweekly seminars are provided for each preceptor group. Special topics, students cases, techniques, and journal articles are discussed. Recommended preparation: Concurrent enrollment in COMP 489.

COMP 489. General Practice Dentistry B. 2.5 Units.
Comprehensive dental care. Each student is assigned for clinical training to a preceptor group led by a practicing general dentist. The preceptor guides the students in diagnosis, treatment planning, and actual patient treatment with consultation in various specialties as required. Experiences in the provision of emergency dental care. The preceptor directs the total dental health care of the patients of each of his students. Biweekly seminars are provided for each preceptor group. Special topics, students cases, techniques, and journal articles are discussed. Recommended preparation: Concurrent enrollment in COMP 487.

COMP 490. General Practice Dentistry A. 2.5 Units.
Clinical application of the principles of general practice dentistry. Recommended preparation: Concurrent enrollment in COMP 494.

COMP 492. General Dentistry Clinical Competency. 0.5 Units.
This course consists of the successful completion of the recall, emergency, diagnosis and treatment planning, and patient outcomes clinical competencies. It is also necessary for the student to successfully fulfill the recall needs of their assigned clinic patients in order to pass this course. Recommended preparation: Completion of Basic Core Program.

COMP 494. General Practice Dentistry B. 2.5 Units.
Clinical application of the principles of general practice dentistry. Recommended preparation: Concurrent enrollment in COMP 490.

COMP 495. Directed Clinical Studies. 1 Unit.
This course is intended to provide students with the opportunity to advance their dental clinical patient skills in the comprehensive care clinics of the School while also providing advanced opportunity for students who are so inclined to focus in individual areas of clinical skills development.

COMP 498. Quality Assurance. 1 Unit.
This course reinforces quality assurance skills and knowledge provided in the prerequisite course including, but not limited to: providing students with the working knowledge of dental record keeping, as it relates to diagnosis and treatment of pathology; recognition and management of medical illness and disabilities; treatment planning; documentation of pre-existing conditions, current and past treatment; established laboratory protocols; evaluation of reasons for remakes and re-dos; post-treatment evaluation of care. Recommended preparation: COMP 394.

DENF Courses

DENF 422. Comprehensive Periodontics. 3 Units.
This course is available only to dental school faculty who have earned dental degrees from foreign institutions and who have approval of their Chairperson and the Dean to register. Successful completion of the course is accomplished by fulfilling the unit requirements, competency exams and any other written or practical requirements set forward by the Dental Education Committee and approved by the general faculty of the School of Dental Medicine in order to assure competency in the periodontic procedures associated with general dentistry.

DENF 428. Comprehensive Oral Medicine. 3 Units.
This course is available only to dental school faculty who have earned dental degrees from foreign institutions and who have the approval of their Chairperson and the Dean to register. Successful completion of the course is accomplished by fulfilling the unit requirements, competency exams and any other written or practical requirements set forward by the Dental Education Committee and approved by the general faculty of the School of Dental Medicine in order to assure competency in the radiologic and oral diagnostic procedures associated with general dentistry.

DENF 448. Comprehensive Endodontics. 3 Units.
This course is available only to dental school faculty who have earned dental degrees from foreign institutions and who have the approval of their Chairperson and the Dean to register. Successful completion of the course is accomplished by fulfilling the unit requirements, competency exams and any other written or practical requirements set forward by the Dental Education Committee and approved by the general faculty of the School of Dental Medicine in order to assure competency in the endodontic procedures associated with general dentistry.

DENF 455. Comprehensive Oral Surgery. 3 Units.
This course is available only to dental school faculty who have earned dental degrees from foreign institutions and who have the approval of their Chairperson and the Dean to register. Successful completion of the course is accomplished by fulfilling the unit requirements, competency exams and any other written or practical requirements set forward by the Dental Education Committee and approved by the general faculty of the School of Dental Medicine in order to assure competency in the oral surgery procedures associated with general dentistry.

DENF 464. Comprehensive Operative Dentistry. 3 Units.
This course is available only to dental school faculty who have earned dental degrees from foreign institutions and who have the approval of their Chairperson and the Dean to register. Successful completion of the course is accomplished by fulfilling the unit requirements, competency exams and any other written or practical requirements set forward by the Dental Education Committee and approved by the general faculty of the School of Dental Medicine in order to assure competency in the operative procedures associated with general dentistry.

DENF 468. Comprehensive Removable Prosthodontics. 3 Units.
This course is available only to dental school faculty who have earned dental degrees from foreign institutions and who have the approval of their Chairperson and the Dean to register. Successful completion of the course is accomplished by fulfilling the unit requirements, competency exams and any other written or practical requirements set forward by the Dental Education Committee and approved by the general faculty of the School of Dental Medicine in order to assure competency in the removable prosthodontics procedures associated with general dentistry.
DENF 474. Comprehensive Fixed Prosthodontics. 3 Units.
This course is available only to dental school faculty who have earned dental degrees from foreign institutions and who have the approval of their Chairperson and the Dean to register. Successful completion of the course is accomplished by fulfilling the unit requirements, competency exams and any other written or practical requirements set forward by the Dental Education Committee and approved by the general faculty of the School of Dental Medicine in order to assure competency in the fixed prosthodontic procedures associated with general dentistry.

DENF 478. Comprehensive Pedodontics and Orthodontics. 3 Units.
This course is available only to dental school faculty who have earned dental degrees from foreign institutions and who have the approval of their Chairperson and the Dean to register. Successful completion of the course is accomplished by fulfilling the unit requirements, competency exams and any other written or practical requirements set forward by the Dental Education Committee and approved by the general faculty of the School of Dental Medicine in order to assure competency in the pediatric and orthodontic procedures associated with general dentistry.

DENT Courses

DENT 501. Biological Aspects of the Stomatological System. 2 Units.
This course is a review of biochemistry, molecular and cellular biology, histology, and oral anatomy and an expansion of oral biological topics that underlie the disciplines of endodontics, orthodontics, periodontics, and pediatric dentistry.

DENT 502. Correlative Medical Science. 2 Units.
Case-based discussion of selected systemic disease commonly encountered by the dentist.

DENT 503. Facial Growth and Development. 1 Unit.
Emphasis on the qualitative, quantitative, and integrative changes during postnatal craniofacial growth and development.

DENT 504. Advanced Facial Growth. 1 Unit.
Student participation in seminar evaluation series dealing with problems and controversies apparent in the literature in regard to theories of growth, development, and aging. Emphasis on the craniofacial literature, but not exclusively.

DENT 505. Dentofacial Anomalies. 1 Unit.
This course is designed to provide the student with the practical experience regarding the multidisciplinary aspects of diagnosis and treatment of patients with craniofacial anomalies. Observation of team sessions and active participation in patient examinations, diagnosis, and treatment planning.

DENT 508. Master's Thesis Protocol. 2 Units.
The requirements for the degree of Master of Science in Dentistry include the successful completion of a suitable research experience, demonstration of scholarly attainment, and the ability to conduct directed research.

DENT 509. Research Methods: Preparation. 1 Unit.
A detailed presentation of epidemiological and biostatistical techniques designed to acquaint the student with a broad spectrum of scientific approaches and to prepare for a research project. Topics include design of observational and experimental studies, common biostatistical techniques encountered in the dental literature such as t-test, ANOVA, chi-square, correlation and regression, and assessing the validity of diagnostic tests. Instruction includes lectures, critique of selected literature and computer analysis of data.

DENT 510. Epidemiology and Biostatistics. 3 Units.
Lectures and seminars on the clinical and histopathologic characteristics of many of the common oral diseases. Special emphasis on developing a logical approach to clinical and histopathologic diagnosis. Participation is expected for in-class discussion of the clinical and histopathologic material presented.

DENT 512. Advanced Oral Pathology. 3 Units.
This course deals with the structural, functional, and clinical relationships of the many organs and organ systems which comprise the head, neck, and pharyngeal regions of the human body.

DENT 514. Research Methods: Preparation. 1 Unit.
The goal of this course is to facilitate a formal statement of the student's research idea as preparation for working with a thesis committee or undertaking independent research.

DENT 515. Multidisciplinary Seminar. 0.5 Units.
This seminar meets monthly to discuss multidisciplinary cases to develop treatment recommendations for the patients presented. Each graduate department selects a clinical case that requires the services of at least three dental specialties. Ideally, patients should be in the beginning stage of treatment planning so the input from the various specialties can be used to develop a comprehensive plan to establish a health oral environment. It is expected that several alternative treatments will be discussed and the relative merits of each approach evaluated. To maximize the benefit of this seminar to the student learning process, an attending faculty member should be present from each of the dental specialty programs. In addition, all seminars have a Prosthodontist to provide input on the restorative treatment options.

DENT 516. Microbiology, Immunology, and Immune Systems. 1 Unit.
This course reviews bacterial structure and classification, provides insight into oral bacterial pathogenesis. Principles of antibiotic use and mechanisms of resistance are reviewed. Microbial diagnostic methodologies are discussed. Integration of periodontics, endodontics, and pediatric dentistry is stressed as it relates to the inflammatory process in the human host.

DENT 518. Behavioral Considerations in Oral Health Care. 1 Unit.
This course focuses on the behavioral knowledge and skills the oral health practitioner must possess in order to deliver effective, patient-centered care. Specifically, the course is designed to enhance graduate students’ existing knowledge and skills in relation to dentist-patient communication, management of diverse patient populations, and patient education and facilitation of health behavior change.
DENT 520. Skeletal Anchorage. 0.5 Units.
This course provides 1st year orthodontic residents with the theoretical knowledge and practical skills necessary to successfully treat orthodontic patients in need of absolute anchorage with orthodontic mini-implants. In addition, the most current articles in the orthodontic literature pertaining to this topic are read and discussed. The theory will be supplemented by practical exercises as necessary.

DENT 522. Orthodontic Biomechanics. 1 Unit.
This course provides first year orthodontic residents with the theoretical biomechanical knowledge necessary to successfully treat a wide range of orthodontic malocclusions using the preadjusted straight wire appliance, the segmented arch technique, treatment auxiliaries, and orthodontic mini-implants. In addition, the most current articles in the orthodontic literature pertaining to this topic are read and discussed. The theory will be supplemented by practical exercises as necessary.

DENT 523. Clinical Specialty Seminar I - Orthodontics. 2 Units.
This course is a companion to clinical training in orthodontics and involves faculty and student evaluation of past and present literature. Sessions are used to evaluate current timely literature, and lectures and seminars complement the clinical experiences with topics including patient management, treatment of various aged populations and malocclusions, orthopedic appliances, treatment of patients with special needs, and various aspects of fixed and removable mechanotherapy. First in a series of four courses.

DENT 524. Clinical Specialty Seminar II - Orthodontics. 2 Units.
Second in a series of four courses. (See DENT 523.)

DENT 527. Clinical Specialty Seminar III - Orthodontics. 2 Units.
Third in a series of four courses. (See DENT 523.)

DENT 528. Clinical Specialty Seminar IV - Orthodontics. 2 Units.
Fourth in a series of four courses. (See DENT 523.)

DENT 529. Endodontontology I. 3 Units.
Scientific rationale for endodontic practice. Endodontic anatomy, physiology, pathology, and microbiology. All treatments and techniques studied and substantiated by current and classical research. First in a series of four courses.

DENT 530. Endodontontology II. 3 Units.
Second in a series of four courses. (See DENT 529.)

DENT 531. Endodontontology III. 3 Units.
Third in a series of four courses. (See DENT 529.)

DENT 532. Endodontontology IV. 3 Units.
Fourth in a series of four courses. (See DENT 529.)

DENT 533. Pediatric Dentistry Literature Review I. 2 Units.
Review of the literature in preparation for the specialty board examination in pediatric dentistry. Includes articles on various topics including growth and development, special needs patients, oral pathology and oral medicine, and clinical and hospital practice.

DENT 534. Pediatric Dentistry Literature Review II. 2 Units.
Second in a series of four courses. See DENT 533 Pediatric Literature Review I.

DENT 535. Fundamentals in Pediatric Dentistry I. 3 Units.
Students present selected chapters from major pediatric dentistry review books for critique and discussion. Major strengths and weaknesses are emphasized. The course director then presents the most current information on the subject.

DENT 536. Fundamentals in Pediatric Dentistry II. 3 Units.
Second in a series of two courses. See DENT 535 Fundamentals in Pediatric Dentistry I.

DENT 537. Advanced Clinical Pediatric Dentistry I. 3 Units.
Students develop skills in diagnosis, radiographic technique, treatment planning, preventive and restorative dentistry, space management, trauma management, and nonpharmacologic behavior management. There is an opportunity to attend hospital grand rounds and physician conferences.

DENT 538. Advanced Clinical Pediatric Dentistry II. 3 Units.
Students develop skills in diagnosis, radiographic technique, treatment planning, preventive and restorative dentistry, space management, trauma management, and nonpharmacologic behavior management. There is an opportunity to attend hospital grand rounds and physician conferences.

DENT 539. Endodontic Literature Review I. 3 Units.
Provides scientific basis for present and future treatment. Instructs students in critically evaluating literature. Provides format for lifelong self-education. Specific journal assignments summarized, evaluated, and presented for group discussion weekly. First in a series of four courses.

DENT 540. Endodontic Literature Review II. 3 Units.
Second in a series of four courses. (See DENT 539.)

DENT 541. Endodontic Literature Review III. 3 Units.
Third in a series of four courses. (See DENT 539.)

DENT 542. Endodontic Literature Review IV. 3 Units.
Fourth in a series of four courses. (See DENT 539.)

DENT 550. Clinical Pharmacology. 1 Unit.
This course is designed to enable residents to obtain an understanding of the pharmacology of the most commonly prescribed medications; pharmacotherapeutic concepts in relationship to disease pathophysiology; rational drug therapy in the treatment of disease; drug-drug interactions and drug-disease interactions; adverse drug events. Residents will be expected to apply information on disease pathophysiology and pharmacotherapy to clinical cases. The ultimate goal is to provide relevant information to assist clinicians in practice.

DENT 551. Clinical Endodontic Specialty I. 3 Units.
Students present case histories as they encounter them in clinic. Cases discussed in detail and critically evaluated by colleagues and graduate endodontic faculty. Past endodontic literature discussed in detail as each student presents a topic assigned by faculty. Problems in clinic discussed. Several guest endodontists present various techniques and perform them. First in a series of four courses.

DENT 552. Clinical Endodontic Specialty II. 3 Units.
Second in a series of four courses. (See DENT 551.)

DENT 553. Clinical Endodontic Specialty III. 3 Units.
Third in a series of four courses. (See DENT 551.)
DENT 554. Clinical Endodontic Specialty IV. 3 Units.
Fourth in a series of four courses. (See DENT 551.)

DENT 555. Management of Medical Emergencies. 1 Unit.
This course covers the diagnosis and management of common medical emergencies, with special emphasis on patient evaluation and history taking to prevent such emergencies in the dental office. Venipuncture technique and the use of emergency equipment are demonstrated. Also included is a basic course in cardiopulmonary resuscitation, with practical demonstrations and examinations that lead to certification in basic CPR.

DENT 557. Periodontal Conference I. 1 Unit.
Presentation of treated patients with advanced periodontal disease. Discussion of the clinical findings, etiology, diagnosis, and treatment plan. Critical review of the different surgical procedures used in therapy and evaluation of postoperative results. First in a series of four courses.

DENT 558. Periodontal Conference II. 1 Unit.
Second in a series of four courses. (See DENT 557.)

DENT 559. Periodontal Conference III. 1 Unit.
Third in a series of four courses. (See DENT 557.)

DENT 560. Periodontal Conference IV. 1 Unit.
Fourth in a series of four courses. (See DENT 557.)

DENT 561. Orthodontics for Pediatric Dentists I. 1 Unit.
The course is designed to familiarize the pediatric dentistry residents with (1) the clinical evaluation of patients to determine appropriateness of orthodontic intervention, (2) record taking, (3) diagnosis, (4) treatment planning of cases in the mixed and permanent dentition, (5) treatment administration and (6) retention strategies. The primary focus will be on interceptive orthodontics including growth modification and corrective orthodontics in the permanent dentition. First in a series of four courses.

DENT 562. Orthodontics for Pediatric Dentists II. 1 Unit.
Second in a series of four courses. See DENT 561 Orthodontics for Pediatric Dentists.

DENT 564. Advanced Principles of Occlusion. 1 Unit.
This course is designed to provide in-depth knowledge of the structure and function of all anatomic components involved in occlusion, biomechanics of articulation and mastication; recording of mastication patterns; diagnosis of occlusal dysfunction; relationship to neuromuscular and temporomandibular joint anatomy and pathology; evidence based therapy used in the management of occlusal and temporomandibular disorders and its significance to inflammatory periodontal disease.

DENT 565. Practice Management I (Ortho). 1 Unit.
Seminar and demonstration course designed to prepare the student for all phases of the "business" of orthodontics as well as the responsibility of being a "professional." Management of the department clinic, private practice management, office visitations, and the business community, and ethics through the use of guest speakers on jurisprudence, personal and professional insurance, accounting, estate planning, risk management, informed consent, banking, office design, organized dentistry and investments. First in a series of four courses.

DENT 566. Practice Management II (Ortho). 1 Unit.
Third in a series of four courses. (See DENT 565.)

DENT 567. Practice Management IV (Ortho). 1 Unit.
Fourth in a series of four courses. (See DENT 565.)

DENT 569. Orthodontic Literature Review I. 1 Unit.
The course will focus on contemporary and classic literature selected to cover a wide range of orthodontic topics. The selected literature includes the reading list suggested by the American Board of Orthodontics in preparation for the Part II of the ABO examination. Students will be required to discuss the articles and answer questions pertaining to the reviewed material.

DENT 570. Orthodontic Literature Review II. 1 Unit.
The course will focus on contemporary and classic literature selected to cover a wide range of orthodontic topics. The selected literature includes the reading list suggested by the American Board of Orthodontics in preparation for the Part II of the ABO examination. Students will be required to discuss the articles and answer questions pertaining to the reviewed material.

DENT 572. Pre-Clinical Principles in Orthodontics. 1 Unit.
This course is comprised of a series of seminars presented by orthodontic faculty covering topics that will prepare the first orthodontic resident for the initial phases of clinical training.

DENT 573. Advanced Specialty Principles: Clinical I. 2 Units.
Full fixed orthodontic appliance treatment of patients in an educational setting. First in a series of four courses.

DENT 574. Advanced Specialty Principles: Clinical II. 2 Units.
Second in a series of four courses. (See DENT 573.)

DENT 575. Advanced Specialty Principles: Clinical III. 2 Units.
Third in a series of four courses. (See DENT 573.)

DENT 576. Advanced Specialty Principles: Clinical IV. 1 Unit.
Fourth in a series of four courses. (See DENT 573.)

DENT 577. Clinical Periodontics I. 3 Units.
Clinical practice of periodontics supplemented by case evaluation and treatment planning. A comprehensive study of normal and diseased periodontal tissues including etiology and diagnosis. Current modes of therapy-rationale technique, and prognosis. First in a series of four courses.

DENT 578. Clinical Periodontics II. 3 Units.
Second in a series of four courses. (See DENT 577.)

DENT 580. Orthodontics-Oral Surgery Conference. 0 Units.
A seminar series involving a multidisciplinary approach to the treatment of patients with severe craniofacial deformities. Begins in the fall of each year (continuing for four semesters) with a series of lectures, followed by assignment of patients supervised jointly by the departments of orthodontics and oral surgery. Meetings held bimonthly to review patient progress, plan treatment, and present cases for discussion. Each student involved in all phases of treatment: presurgical orthodontics, the surgical procedure, finishing orthodontics, and retention.

DENT 581. Clinical Periodontics III. 3 Units.
Third in a series of four courses. (See DENT 577.)

DENT 582. Clinical Periodontics IV. 3 Units.
Fourth in a series of four courses. (See DENT 577.)
DENT 583. Orthodontic Diagnostic Seminar I. 1 Unit.
Series of lectures and seminars covering the science of orthodontic
diagnosis. Course consists of lectures on techniques of diagnosis,
treatment planning, and critique of cases from the department or from
faculty private practices. Content also includes long-term follow-up of post
retention cases. First in a series of three courses.

DENT 584. Orthodontic Diagnostic Seminar II. 1 Unit.
Second in a series of three courses. (See DENT 583.)

DENT 585. Orthodontic Diagnostic Seminar III. 1 Unit.
Third in a series of three courses. (See DENT 583.)

DENT 586. Limited Tooth Movement for the Dental Specialist. 1 Unit.
A review of the rationale for orthodontic treatment in periodontally
diseased patients and in pre-restorative dentitions. Lectures, audio-visual
programs, and technique sessions. Diagnosis, treatment planning, and
various methods of tooth movement.

DENT 587. Periodontal Prosthesis. 1 Unit.
This course examines and defines the periodontal prosthetic
interrelationships beginning with treatment planning and continuing
with discussing the utilization of the combined treatment modalities. It
focuses on provisionalization, furcation treatment, occlusion, aesthetics,
removable appliances, and special advanced treatment problems.

DENT 588. Hospital Rotation. 2 Units.
Students are assigned full time to anesthesia service and perform such
duties as directed by anesthesiology staff: preoperative evaluation of
patients, indications and contraindications for specific methods
of anesthesia, relationship of medical problems to anesthesia risks,
assisting in preparation of patients for anesthesia, intubation and
anesthesia management, assisting in the management of complications,
and post-anesthetic recovery management including monitoring of vital
signs, blood gases, EKG, etc., and participation in post-anesthesia
rounds and conferences.

DENT 589. Orthodontic Diagnostic Seminar IV. 1 Unit.
The fourth course in a series which consists of weekly lectures and
seminars covering the science of orthodontic diagnosis. Consists of
lectures on the techniques of diagnosis, various diagnostic aids, and
case planning. Also consists of seminars where the students perform
diagnosis, plan treatment and critique cases from the department. This
course is used for long-term follow-up clinic.

DENT 591. Orthodontics for Pediatric Dentists III. 1 Unit.
Third in a series of four courses. See DENT 561 Orthodontics for
Pediatric Dentists.

DENT 592. Orthodontics for Pediatric Dentists IV. 1 Unit.
Fourth in a series of four courses. See DENT 561 Orthodontics for
Pediatric Dentists.

DENT 595. Advanced Periodontal Seminar I. 1.5 Unit.
Series of seminars covering clinical, histological, and physiological
aspects of the periodontium in health and disease, etiology, diagnosis,
prognosis, prevention, and treatment of periodontal disease, as well as
the relationship of periodontics to other phases of dentistry. First in a
series of four courses.

DENT 596. Advanced Periodontal Seminar II. 1.5 Unit.
Second in a series of four courses. (See DENT 595.)

DENT 597. Advanced Periodontal Seminar III. 1.5 Unit.
Third in a series of four courses. (See DENT 595.)

DENT 598. Advanced Periodontal Seminar IV. 1.5 Unit.
Fourth in a series of four courses. (See DENT 595.)

DENT 631. Pediatric Dentistry Literature Review III. 2 Units.
Third in a series of four courses. See DENT 533 Pediatric Dentistry
Literature Review I.

DENT 632. Pediatric Dentistry Literature Review IV. 2 Units.
Fourth in a series of four courses. See DENT 533 Pediatric Dentistry
Literature Review I.

DENT 637. Advanced Clinical Pediatric Dentistry III. 3 Units.
Third in a series of four courses. See DENT 537 Advanced Clinical
Pediatric Dentistry I. Additionally, residents learn to manage children
with complex special health care needs, including inpatients. Residents
interact and coordinate with other medical departments within the
hospital, and with outside clinics and practitioners.

DENT 638. Advanced Clinical Pediatric Dentistry IV. 3 Units.
Fourth in a series of four courses. See DENT 637 Advanced Clinical
Pediatric Dentistry III.

DENT 639. Advanced Seminar in Pediatric Dentistry I. 3 Units.
Students present patient cases for in-depth discussion of specific clinical
problems.

DENT 640. Advanced Seminar in Pediatric Dentistry II. 3 Units.
Second in a series of two courses. See DENT 637 Pediatric Dental
Seminar I.

DENT 651. Thesis M.S.D.. 1 - 9 Unit.
Subsections for each program area of study: endodontics, orthodontics,
periodontics, or pediatric dentistry.

DENT 661. Conscious IV Sedation I. 2 Units.
Didactic portion covers physical evaluation, physiology, pharmacology,
emergencies, and techniques. Cardiac monitoring, basic life support, and
advanced cardiac life support.

DENT 662. Conscious IV Sedation II. 1 Unit.
(See DENT 661.) Supervised clinical experience in conscious IV
sedation.

DENT 663. Implant Dentistry I Periodontics. 1 Unit.
Designed to enhance the understanding of current concepts and their
role in the multidisciplinary treatment of the patient.

DENT 664. Implant Dentistry II Periodontics. 1 Unit.
(See DENT 663.) Clinical demonstration, participation, and case
presentation in implant dentistry.

DENT 682. Cephalometrics. 1 Unit.
A lecture and laboratory course in cephalometric roentgenography
leading to a thorough understanding of craniofacial radiographic
techniques. Use of x-rays and radiation hygiene, and technical and
interpretive proficiency.

DENT 683. Imaging and IT. 1 Unit.
This course is designed to give some basic computer knowledge and
prepare the resident for the use of computers in the orthodontic office.
DENT 684. Radiology and Cephalometrics. 1 Unit.
Fundamentally related to cephalometric radiography, skeletal morphology, and cephalogram interpretations of historic analyses via the Krogman-Sassouni Syllabus. Also, clinical evaluations of hard and soft tissue relationships of the airway and skeletal maturation are presented. The use of Bolton Standards in craniofacial analysis is stressed.

DENT 685. Literature Review in Periodontics I. 1 Unit.
Comprehensive discussion of selected articles related to clinical periodontology and basic sciences of significance to periodontal research and therapy.

DENT 686. Literature Review in Periodontics II. 1 Unit.
Third in a series of four courses. See DENT 685.

DENT 687. Literature Review in Periodontics III. 1 Unit.
Fourth in a series of four courses. See DENT 685.

DENT 688. Literature Review in Periodontics IV. 1 Unit.
Fourth in a series of four courses. See DENT 685.

DENT 690. Pediatric Dental Residency. 1 - 10 Unit.
Allows registration for non-degree-seeking students in graduate level courses at the direction of the department.

DENT 692. Restorative Fellowship. 6 Units.
Provides for 12 months of clinical and didactic training in all phases of general dentistry beyond the scope of predoctoral dental education. Areas of emphasis include advanced restorative techniques, proper selection of restorative materials, restoration of implants, fixed and removable prosthodontics, and esthetic dentistry. At the discretion of the course director, students may register for an additional 12 months, during which time the student will build on knowledge attained during the first year, continue with advanced didactic instruction, expand their clinical experience through continued patient care, participate in clinical research, and have teaching opportunities.

DENT 694. Fellowship in Dentistry. 6 Units.
The Fellowship in Dentistry provides for advanced clinical, didactic and research training beyond the scope of the pre-doctoral dental education.

DENT 695. Oral Surgery Residency. 1 - 10 Unit.
Allows registration for non-degree-seeking students in graduate level courses at the direction of the department.

DENT 696. Advanced Dental Training. 1 Unit.
This course is a one year advanced training in dental medicine at Case Western Reserve University School of Dental Medicine. Responsibilities may include clinical and didactic responsibilities. The course is designed to give students clinical experience in a defined focus area. Prereq: D.D.S. or equivalent.

DENT 697. Advanced Dental Training II. 1 Unit.
Continuation of Advanced Dental Training I. Prereq: D.D.S. or equivalent.

DENT 698. Multidisciplinary Seminar II. 0 Units.
This seminar meets monthly to discuss multidisciplinary cases to develop treatment recommendations for the patients presented. Each graduate department selects a clinical case that requires the services of at least three dental specialties. Ideally, patients should be in the beginning stage of treatment planning so the input from the various specialties can be used to develop a comprehensive plan to establish a healthy oral environment. It is expected that several alternative treatments will be discussed and the relative merits of each approach evaluated. To maximize the benefit of this seminar to the student learning process, an attending faculty member should be present from each of the dental specialty programs. In addition, all seminars have a Prosthodontist to provide input on the restorative treatment options. Prereq: D.D.S. or equivalent.

DENT 699. AEGD Residency Training. 1 - 8 Unit.
This is a multidisciplinary course that encompasses didactic and clinical training in general dentistry.

DSPR Courses

DSPR 232. Periodontics. 1 Unit.
A comprehensive course in periodontology including etiology, diagnosis, radiographic, interpretations and prognosis.

DSPR 234. Oral Pathology. 3.5 Units.
Diseases and abnormalities of the teeth and adjacent hard and soft tissues. Includes periodontal, pulpal, and periapical diseases as well as cysts, tumors, developmental anomalies, and oral aspects of systematic disease.

DSPR 236. Cariology. 1 Unit.
Etiology, clinical and radiologic features, risk assessment, and prevention of caries.

DSPR 239. Neoplasia. 1 Unit.
Topics covered in this educational module include tumor nomenclature, features of benign versus malignant tumors, cytologic characteristics of cancer cells, pathogenesis and prognosis.

DSPR 333. Management of Medical Emergencies. 1 Unit.
Patient evaluation, diagnosis and treatment of life-threatening emergencies that may arise in the course of dental treatment. Includes instruction in basic life support and cardiopulmonary resuscitation.

DSPR 341. Oral Diagnosis and Radiology. 2 Units.
This course helps the beginning clinician develop and understand the diagnostic process. It is designed to present to the student a method by which the common oral problems facing the dental practitioner can be recognized, diagnosed, evaluated and managed.

DSPR 342. Oral Cancer Diagnosis. 1 Unit.
DSPR 344. Dental Management of Medical Disease. 0.5 Units.
Hospital procedures and protocol and the management of surgical complications and emergencies. General principles of surgery as applied to selected topics.

DSPR 426. Oral Diagnosis Seminar. 1 Unit.
Case-based review of oral diagnosis, radiology, and medicine.

DSRE Courses

DSRE 335. Clinical Pharmacology. 2 Units.
This course is designed to review common pharmacologic agents encountered in the general population. Emphasis is placed on the prescription, action, and interaction of dental pharmacologic agents as well as the implication of medical prescriptions on dental therapy. The course culminates in the evaluation of case studies and problem solving in drug therapy.


DSRE 374. Fixed Prosthodontics. 1.5 Unit.
Diagnosis and treatment planning in fixed prostodontics and construction of simple crowns and bridges. Lecture series concerning the discussions and demonstration of elementary and advanced methods of restoring occlusion, esthetics, and speech using fixed prosthesis.

DSRE 391. Endodontics. 1 Unit.
Recognition of endodontic pulpal health and the changes that occur in the transition from health to disease. The didactic component focuses on scientific basis for recognition of degenerative states of the dental pulp and the philosophy of endodontic therapy. The clinical component focuses on the treatment of diseased, pulpally-involved teeth of actual patients. It provides practical instruction on how to render endodontic therapy under the direct supervision of qualified endodontic personnel.

DSRE 392. Nitrous Oxide and Conscious Sedation. 0.5 Units.
Physiopharmacology of nitrous oxide use. Indications, contraindications, and complications.

DSRE 393. Principles of Oral and Maxillofacial Surgery I. 1 Unit.

DSRE 395. Introduction to Oral and Maxillofacial Surgery. 0.5 Units.
This didactic course is designed to prepare the student for oral surgery clinical rotations and is comprised of the following topics, review of local anesthesia, review of applied anatomy, infection control, patient assessment and case presentation, informed consent, oral surgical armamentarium, and principles of exodontia.

DSRE 397. Occlusion Seminar. 2 Units.
An introduction to gnathological principles: terminology, procedures and instrumentation. Correlation of history and clinical symptoms with treatment modalities emphasized. Use of bite planes, centric relation registration, and diagnostic waxup on mounted casts.

EFDA Courses

EFDA 111. Tooth Morphology for the EFDA. 1 Unit.
Instructional laboratory sessions provide experience with viewing models of teeth as well as reproducing teeth in wax. Mastery of terminology and basic facts of dental anatomy and tooth positions of permanent and primary teeth. Introduction of proper instrumentation begins.

EFDA 113. Dental Materials for the EFDA. 1 Unit.
Instructional laboratory sessions cover the physical and chemical properties and uses and manipulation of materials used in protection of the pulp and intracoronal temporization. Composition, properties and manipulation of dental amalgam, composite and pit and fissure sealant materials are also introduced. Isolation techniques and rubber dam placement lab.

EFDA 115. Restorative Dentistry for the EFDA I. 3 Units.
Skill development in the placement and carving of Class I, II, V and complex amalgam restorations on the typodont. Skill development in the placement and finishing and polishing of Class I, II, III, IV, and V composite restoration and amalgam restoration finishing and polishing on the typodont. Continued skill development in instrumentation, body positioning and ergonomics. Skill development in the use of low and high speed handpieces for rotary instrument use in finishing and polishing restorations. Skill development in self-evaluation using specific criteria. Pit and fissure sealant applications. **Student must show competency of skills acquired to be able to progress in Clinical Practicum for the EFDA**.

EFDA 116. Restorative Dentistry for the EFDA II. 2 Units.
Students begin preparation for the state board examination by demonstrating successful completion of amalgam and composite restorations with increasingly difficult grading evaluation, mastery of self evaluation skills, decreasing restoration placement time and by completing 3 mock board examinations. Students must pass a final clinical and didactic examination to pass the course. Emphasis on understanding Ohio EFDA Registration protocol.

EFDA 120. Clinical Practicum for the EFDA. 2 Units.
Students fulfill the Ohio State Dental Board requirement of having clinical experience on patients in CWRU approved dental clinics. Clinic sessions include a variety of restorative experiences on many patients. One 8 hour session is required for 4 weeks. Students will restore patients' teeth under the supervision of a licensed dentist and a clinical supervisor in clinics affiliated with CWRU. Emphasis is placed on restoring metallic and non-metallic restorations.

EFDA 122. Clinical Board Review. 0.5 Units.
Review of Restorative Expanded Functions for the Dental Auxiliary. This two day course is designed to prepare the Registered Dental Hygienist or Certified Dental Assistant for the EFDA certification examination administered by the Commission on Dental Testing in Ohio. Successful completion of an approved EFDA course is a prerequisite for attendance. This course meets the requirements as remediation for auxiliaries who have not passed the certifying examination after two attempts. The course will involve both laboratory reviews and practice, preparing the participant for the clinical examination.
HEWB Courses

HEWB 121. Foundations of Life Science. 4.5 Units.
This course includes an introduction to basic elements of cell structure and function. This includes the characteristics and role of different types of cells, the cell cycle, mechanisms for cell damage, repair and death, cell signaling, differentiation and gene expression. This course serves as a foundation for the modules in Health and Wellbeing and Disease Processes.

HEWB 123. Facial Growth. 1 Unit.
Introduction to the normal growth and development of the human face from embryology to adult.

HEWB 124. Masticatory Dynamics. 2 Units.
Descriptive anatomy of masticatory structures with emphasis on deciduous and permanent teeth and the temporomandibular-mandibular movements, and the fundamental concepts of the functional relationships between the dentition and the temporomandibular joint. Lectures on comparative anatomy and variations in tooth morphology.

HEWB 126. Masticatory Dynamics Lab. 1.5 Unit.
Companion pre-clinical component to HEWB 124. Laboratory exercises and assignments include drawings, waxups and tooth identification, and use of semi-adjustible articulator.

HEWB 128. Body as Host. 4.5 Units.
This educational module focuses on the role of bacteria, viruses, and fungi in immune function that preserves and maintains health and discusses host changes that occur during oral and systemic disease processes.

HEWB 130. Oral Histology. 1.5 Unit.
Development of teeth and supporting tissues. Histology and ultrastructure cytology of the oral region with emphasis on the calcified tissues.

HEWB 134. Head and Neck Structure and Function. 4.5 Units.
This course explores the developmental, cellular, physiologic, anatomic and biochemical components of the head and neck region. The focus is both healthy functioning and disease of the head and neck area.

HEWB 200. Directed Studies. 1 - 6 Unit.
Directed study under faculty supervision and with special permission of the Associate Dean for Education.

HEWB 349. Dentofacial Morphology. 1 Unit.
This course provides the dental student with an introduction to the assessment of dynamic faces and the relatively static dentition. The course details the etiologies and characteristics of various malocclusions including developmental disharmonies observed during the growth and development of a child. Primary emphasis is laid on empowering the student in the diagnoses of malocclusions employing study casts, intra and extra-oral photographs and, cephalograms.

HWDP Courses

HWDP 131. Heart and Lungs in Disease and Health. 4.5 Units.
This course provides students with the understanding of the structural and functional relationships of the cardiovascular and respiratory systems. This integrated approach serves as a foundation for understanding the health and well-being of these systems. This education module also facilitates student recognition of cardiovascular and respiratory dysfunction that may be present in their patients and help students understand how such conditions may affect their patients’ general and oral health.

HWDP 232. Health and Disease: Renal and Hematologic Systems. 2 Units.
This educational module focuses on the understanding of the structural and functional relationships of the renal and hematologic systems. This integrated approach serves as a foundation for understanding the maintenance of health and well-being as well as disease processes within the body.

HWDP 241. Gastrointestinal System in Health and Disease. 2 Units.
This educational module focuses on the understanding of the structural and functional relationships of the many components of the gastrointestinal system in health and disease.

HWDP 243. Endocrine and Reproductive Systems in Health and Disease. 1.5 Unit.
This educational module focuses on the understanding of the structural and functional relationships of the many components of the endocrine and reproductive systems in health and disease.

HWDP 245. Musculoskeletal System in Health and Disease. 1.5 Unit.
This educational module focuses on the understanding of the structural and functional relationships of the many components of the musculoskeletal system in health and disease.

HWDP 246. Neuroscience in Health and Disease. 2 Units.
An integrated approach to the anatomy and physiology of the human nervous system. Analyzes neuronal phenomena at both cellular and systems levels.

INQU Courses

INQU 102. ACE: Knowing the Patient. 2 Units.
This ACE introduces the student to professional patient interaction and evaluation in a simulated environment. Students will develop interview techniques, learn patient appraisal skills, and techniques for communicating effectively in a health care environment. Students will experience patient interviews and assessment in a simulated environment with live patients.

LDRS Courses

LDRS 111. Epidemiology for Public Health and Clinical Practice. 2.5 Units.
This 3 week intensive sequence provides the first experience with the problem-based learning format and focuses on the content foundation in epidemiology and skills for evidence-based practice in dentistry. Problem-based cases will use oral health topics to present the skills for critical appraisal of health literature. Small-group settings will permit students to gain experience in applying these skills to relevant dental literature.
LDRS 310. Professional Development II. 1 Unit.
Major issues and trends that affect oral health and the mission of dentistry in the United States. Behavioral knowledge and skills essential to the oral health practitioner’s ability to deliver effective patient-centered care.

LDRS 313. Dental Patient Management/Risk Management. 1 Unit.
Principles of patient management and risk management are reviewed. The primary focus is directed toward the skills associated with communication. A variety of examples of malpractice are reviewed and discussed. Other areas of risk are discussed such as infection and occupational hazards related to EPA and OSHA standards.

LDRS 316. Practice Management I. 1 Unit.
This course is designed to develop practical knowledge and skills in dental practice management. It is organized around initial topics that will lay the foundation for adequate planning for practice success after graduation. The subsequent courses build upon this foundation knowledge so that students will have a general perspective of where to begin their strategies for success in the future. This course discusses topics that include analysis of practice configurations, choosing the appropriate consultants, basic tools for fiscal management and evaluation, and identifying opportunities that match the student’s life goals.

LDRS 317. Dental Auxiliary Management. 0.5 Units.
This course introduces students to each type of auxiliary personnel in the dental office and describes their training, testing, duties delegated legally and how their utilization in the office setting can be optimized. Basic management considerations and theories of leadership are presented and various leadership styles are recommended for situations presented. This course provides an understanding of interacting with auxiliary and the process of delegation. The course defines state dental board rules and regulations that guide dentists in the utilization of auxiliary personnel. Such items as overhead costs are explored in relation to each auxiliary category.

LDRS 415. Practice Management II. 1 Unit.
Students deal with entrepreneurship applications and experiences specific to dentistry and are introduced to the process of formulating a business plan. Personal finance and investment strategies are covered in this course, particularly as they pertain to developing a business plan for the students’ careers. Each student constructs a business plan specific to the goals and situation of that student.

LDRS 416. Practice Management III. 1.5 Unit.
This course is designed to develop practical knowledge and skills in dental practice management. As the student prepares for clinical practice, topics surrounding negotiation of working contracts, insurance contract evaluation, policies, compliance, and marketing are among some of the most important issues to be familiar with. Skills acquired in the preceding course are applied to the student’s “practice” (panel of patients) for evaluation of practice productivity and growth.

LDRS 420. Jurisprudence and Professional Ethical Responsibility. 0.5 Units.
Ethical and legal issues, civil and criminal law, contracts, malpractice and current ethical and legal dilemmas encountered in practice.

MAHE Courses

MAHE 141. Preventive Periodontics. 1 Unit.

MAHE 144. Preventive Periodontics Clinic. 1 Unit.
Companion clinical component to MAHE 141. Clinical application of methods for the prevention and maintenance of periodontal health in patients. The importance of patient education, motivation, and cooperation in present methods of prevention and plaque control.

MAHE 145. ACE: Outreach Preventive Dentistry. 1.5 Unit.
This ACE introduces the student to professional patient interaction and evaluation in a simulated environment. Students will develop interview techniques, learn patient appraisal skills, and techniques for communicating effectively in a health care environment. Students will experience patient interviews and assessment in a simulated environment with live patients.

MAHE 214. ACE: Family First. 1 Unit.
The overarching goal of the clinical experience (ACE) is to incorporate the concepts of risk assessment and the importance of the family unit to oral health. The Family First ACE will allow students to explore the interaction between genetic and environmental factors in oral diseases and certain systemic conditions (diabetes, hypertension, and asthma). At the end of the "Family First" rotation the students would have achieved certain didactic and clinical objectives and the experience is linked to the second year didactic courses: Cariology, Periodontology, and Oral Pathology. This experiential learning includes clinical experience, didactic lectures, and small group discussions. Risk assessment for common oral diseases such as caries and periodontal diseases as well as for oral cancer is part of the clinical activities. Students will review the risk assessment and systemic health to delineate genetic and environmental factors through small group discussions.

MAHE 242. Periodontics. 1 Unit.
Companion clinical component for DSPR 232. Students observe and assist at periodontal surgical procedures on moderately advanced periodontal diseases. Treatment includes root planing, curettage, occlusal adjustment, minor tooth movement and case maintenance.

MAHE 340. Nutrition for Dentistry. 1 Unit.
General nutrition concepts are presented in addition to aspects pertinent to the practice of dentistry.

REHE Courses

REHE 151. Dental Anatomy. 3 Units.
Descriptive anatomy of masticatory structures with emphasis on deciduous and permanent teeth and the temporomandibular-mandibular movements, and the fundamental concepts of the functional relationships between the dentition and the temporomandibular joint. Lectures on comparative anatomy and variations in tooth morphology.
REHE 152. Basic Procedures in Fixed Prosthetics. 2 Units.
To introduce and familiarize the dental student to basic principles related to fixed prosthodontics. The introduction will emphasize principles of engineering and preparation designs, full coverage retains for both metal and ceramic restorations.

REHE 153. Dental Anatomy Laboratory. 1 Unit.
Companion preclinical component to REHE 151. Laboratory exercises and assignments include drawings, waxups, tooth identification, and use of semi-adjustable articulator.

REHE 154. Basic Procedures in Fixed Prosthetics Lab. 1.5 Unit.
Laboratory component of REHE 152.

REHE 156. DentSim Laboratory. 1 Unit.
This course covers the criteria, techniques and practice of preparing ‘ideal/standard’ operative preparations. The restorative procedures will be performed on typodont teeth mounted in a computer assisted simulator (DentSim).

REHE 158. Dental Materials I. 0.5 Units.
The primary goal is to introduce basic material science concepts needed to evaluate, compare and select materials for a specific application. Knowledge of properties, indications and limitations of different clinical and laboratory materials will be presented. The effect of manipulation variables on material properties will be emphasized.

REHE 229. Introduction to Radiography. 1.5 Unit.
Initial course consisting of lecture and laboratory covering basic principles of radiography. Included are: instructions on taking intraoral radiographs, radiation physics involved in x-ray generation and the parts and function of the x-ray unit, radiation biology of x-ray interaction with tissue, head and neck anatomy and pathology with regards to radiographic interpretation. Each student will have a clinic rotation.

REHE 252. Pain Control. 1 Unit.
Anatomy pertaining to local anesthesia. Drugs used in local anesthesia and technique of administration. Management of complications. Slides and clinical demonstrations.

REHE 253. Basic Procedures in Esthetics. 1 Unit.

REHE 254. Pharmacology. 4 Units.
This course introduces students to the principles of pharmacology and to the mechanisms of drug action in the context of common disease states.

REHE 256. Radiology. 0.5 Units.
This is a continuation of REHE 229. This course will explore alternative intraoral radiographic techniques, extraoral radiography techniques, their uses and limitation. Included is a discussion of radiation safety in the dental office and film processing. Each student will have an opportunity to gain “hands-on” experience in patient alignment for a panoramic radiograph and alternative tools for taking quality films. Each student will have a clinic rotation.

REHE 257. Prosthodontic Technology. 2 Units.
A lecture-demonstration-laboratory approach to complete denture prosthesis construction. Emphasis on certain fundamental biological considerations of the edentulous patient, such as the oral membranes, muscles, bones, and phonetics and how they relate to the technical aspects of denture constructions.

REHE 258. Principles of Treatment Planning I. 1 Unit.
This course provides lecture presentations to help prepare the student to develop skills in patient diagnosis and treatment planning. The lectures will guide the students through the thought processes necessary in the development of workable treatment plans. The emphasis will be on exposing the students to the approach used in our clinic of providing the patients with options of optimal, alternative and emergency diagnostic or recall treatment plans using decisional analysis.

REHE 259-1. Basic Procedures in Fixed Prosthodontics II. 0 Units.
This course builds upon those core elements covered in REHE 152/154. Emphasis on principles of engineering for fixed partial dentures, preparation and design of fixed partial dentures, considerations for the restoration of endodontically involved teeth, and definitive and provisional fixed partial denture restorations. Introduces dental material topics related to fabrication of a fixed partial denture restoration, including: chemomechanical soft tissue retraction, die spacers, investments, casting and casting alloys, ceramics, soldering, provisional materials, prefabricated and custom post and core systems. Emphasis on principles of engineering for fixed partial dentures, preparation and design of fixed partial dentures, considerations for the restoration of endodontically involved teeth, and definitive and provisional fixed partial denture restorations. Introduces dental material topics related to fabrication of a fixed partial denture restoration, including: chemicomechanical soft tissue retraction, die spacers, investments, casting and casting alloys, ceramics, soldering, provisional materials, prefabricated and custom post and core systems.

REHE 259-2. Basic Procedures in Fixed Prosthodontics II. 2 Units.
This course builds upon those core elements covered in REHE 152/154. Emphasis on principles of engineering for fixed partial dentures, preparation and design of fixed partial dentures, considerations for the restoration of endodontically involved teeth, and definitive and provisional fixed partial denture restorations. Introduces dental material topics related to fabrication of a fixed partial denture restoration, including: chemomechanical soft tissue retraction, die spacers, investments, casting and casting alloys, ceramics, soldering, provisional materials, prefabricated and custom post and core systems. Emphasis on principles of engineering for fixed partial dentures, preparation and design of fixed partial dentures, considerations for the restoration of endodontically involved teeth, and definitive and provisional fixed partial denture restorations. Introduces dental material topics related to fabrication of a fixed partial denture restoration, including: chemomechanical soft tissue retraction, die spacers, investments, casting and casting alloys, ceramics, soldering, provisional materials, prefabricated and custom post and core systems.

REHE 260-1. Basic Procedure Fixed Prosthodontics II Lab. 0 Units.
Laboratory component of REHE 259.

REHE 260-2. Basic Procedure Fixed Prosthodontics II Lab. 2 Units.
Laboratory component of REHE 259-1.

REHE 262. Basic Procedures in Operative Dentistry. 1 Unit.
This course, together with REHE 253, covers the criteria, techniques, and practice of preparing “ideal/standard” operative preparations and placement of operative restorations. The emphasis is on posterior amalgam preparations and restorations, as well as an introduction to cast gold inlay and onlays. Students will be introduced to basic cariology and radiology as it relates to operative dentistry. In addition, the composition and properties of amalgam, liners and bases, investment material, and gold will be reviewed. Students will work on typodont and extracted teeth.
REHE 263. Basic Procedure in Esthetics Lab. 0.5 Units.

REHE 264. Endodontics. 0.5 Units.
Introduction to methods and materials necessary for successful root canal therapy.

REHE 266. Partial Denture Design. 2 Units.
Recognition of clinical situations that require partial denture therapy are developed. Introduction to the terms used in removable partial prosthodontics. Partially edentulous casts diagnosed, designed, surveyed, contoured for path of insertion, prepared for rest seat areas, and finally tripoded for further orientation by each student on his or her own casts. Thus the design, surveying, and clinical applications for removable partial service are presented in order to maintain optimal oral health conditions and to provide a sound basis for the prosthesis.

REHE 267. Prosthodontic Technology Lab. 2 Units.
Companion preclinical component to REHE 257. Each student constructs a complete set of dentures using laboratory manikin as patient. Although REHE 267 was conceived as a technique course, one of its principal objectives is to prepare the student for the clinical aspect of dental education.

REHE 268. Basic Procedures Competency. 1.5 Unit.

REHE 272. B P Operative Dentistry Lab. 1 Unit.
Laboratory component of REHE 262.

REHE 274. Endodontics Lab. 1 Unit.
Companion laboratory component to REHE 264. Complete endodontic treatment performed by each student on extracted teeth using gutta percha.

REHE 276. Partial Denture Design Lab. 1.5 Unit.
Theories of removable partial denture construction which enable the student to perform exercises that are associated with the techniques used to achieve a successful result. Students will be evaluated by various testing methods.

REHE 350. Oral Rehabilitation. 1 Unit.
The didactic curriculum provides a series of lectures that emphasize the importance of evaluation of the entire stomatognathic system for treatment planning. Causal relationships influenced by misdirected forces and hyperfunction are discussed.

REHE 351. Surgical Periodontics. 1 Unit.
Case analysis and treatment planning for various conditions of periodontal disease. Case presentation to patients. Basic surgical technique and advanced types of periodontal surgery demonstrated. Occlusal analysis and occlusal adjustment considered.

REHE 353. Principles of Treatment Planning II. 0.5 Units.
This course provides formal instruction designed to prepare the students for patient management, practice management, and treatment planning. Emphasis on devising optimal, alternative and emergency diagnostic treatment plans.

REHE 355. Esthetic Dentistry. 1 Unit.
Lectures and demonstrations. The indications, contraindications, limitations, and use of modern techniques and materials in esthetic dentistry.

REHE 358. Dental Materials II. 0.5 Units.
This is a didactic course that defines and describes properties, composition, indications and contraindications of uses of different dental materials

REHE 360. Implant Dentistry. 1 Unit.
Didactic and laboratory instruction that introduces the concepts used in implantology. These include the scientific basis of implant tissue reactions, and the surgical and restorative protocols. Emphasis is placed on slide presentation of actual cases. An opportunity is given to students to place an implant in an artificial mandible and to manipulate implant components on a typodont.

REHE 414. Advanced Implant Dentistry Elective. 0.5 Units.
This is a Senior elective course. This elective is designed to expose the student to advance implant therapies for the dentate and edentulous patient. Through lecture, discussions and treatment planning sessions the student will discover the multitude of variations of care available for these patients and the restorative processes necessary to deliver that care. They should also more fully understand the limitations of each of these modalities within the scope of dental implant therapy allowing them to provide for their patients the most appropriate treatment direction.

REHE 416. Basic Principles of Digital Radiology and Cone Beam CT Elective. 0.5 Units.
This is a Senior elective course. This course will be a continuation of REHE 256, Advanced Principles of Radiology. Students will be introduced to digital radiographic techniques, their uses and limitations. Principles of CBCT, anatomy, basic pathology, and working with CBCT volumetric dataset.

REHE 421. Periodontal Medicine and Cases. 1 Unit.
Further application of the knowledge and skills learned in prior periodontal courses. Focus is on how selective periodontal treatment can be integrated into a treatment plan considering the parameters presented by a special situation. Some examples are treatment related to endodontics, prosthodontics, geriatrics, esthetics, orthodontics and implantology.

REHE 455. General Anesthesia, Oral Surgery. 0.5 Units.
REHE 473. Introduction to CEREC Dentistry Elective. 1 Unit.
This is a Senior elective course. The didactic portion of the course will describe the use of CAD/CAM (computer-aided design/computer-aided manufacture) systems. The use of this chairside technology is readily available for the general dentist. An increase in public demand for esthetic procedures has made “all ceramic” restorations a popular treatment choice in restorative dentistry. This elective course will encompass the basic concepts of CAD/CAM dentistry, in particular utilizing the CEREC acquisition and milling machine by Sirona. The course will describe basic concepts of this technology including theoretical and clinical considerations of preparation and design. In the laboratory portion, students will learn the technique of tooth preparation, powdering and capturing an optical impression. In addition, the student will design, mill (manufacturing) and polish the restoration prior to cementation. This course will include both lecture and laboratory sessions. In the laboratory sessions, students will be able to apply the information gained in lecture material through laboratory projects. Following the completion of the lecture and laboratory portions, students will be eligible for clinical experience.

REHE 482. Orthodontics. 1 Unit.
Instruction through lectures and audio-visual programs enabling the student to gain judgment, knowledge, and skills to select and treat uncomplicated tooth irregularities in children and adults. Advanced topics in comprehensive orthodontics, such as surgical orthodontics and cleft-palate treatment.

REHE 488. Case Presentations I. 1 Unit.
First Semester of case presentation is dedicated to the review of comprehensive treatment planning slide material in preparation for National Boards part II and the Northeast Regional Board Dental Simulated Clinical Examination DSCE and the Case Based Examination (CBE) and the Western Regional Board (WREB) treatment planning examinations. Cases treated in the CASE SODM clinics will be reviewed by the preceptor faculty along with clinical specialty faculty and biological science faculty where appropriate. Diagnostic information will be on Blackboard preceding the schedule case review. During the case review questions will be presented for all students to interject through either the PRS format or Blackboard. In addition to the interactive format three disciplined based quizzes will be provided. The semester final will present a case based problem similar to the regional boards in which students identify the components of the diagnosis, treatment plan, treatment modifiers, treatment sequence and prognosis.

REHE 489. Case Presentations II. 1 Unit.
Second Semester. This course provides formal lecture presentations in the discipline of comprehensive dental care to assist students in the development of appropriate and successful diagnoses and treatment plans and the use of techniques and technology to achieve the goals of optimal dentistry. The course provides examples of cases in diagnosis and treatment planning in lecture, and include expertise from other departments in both the clinical and basic biological sciences. This course also provides the methodology for the treatment of moderate to severely mutilated dentitions and information regarding treatment modalities used related to the cases under discussion. The treatment plans are to be evidence based and used in concert with the outcomes of treatment. Techniques and Technology associated with the case shall be described as cases are reviewed. Both didactic lecture presentations and case reviews will utilize the interactive questioning and survey opportunities as needed through either the PRS format or Blackboard. The semester grade will be based on participation in the interactive sessions, a case based examination and each student is to turn in a fully documented senior case that is both diagnostic and treatment demanding. All cases will be approved prior to being considered as an acceptable senior case.

REMA Courses

REMA 261. Preclinical Orthodontics. 1 Unit.
Preclinical orthodontics includes relevant areas of applied growth and development, diagnostic methods and treatment planning. Topics included are: Histology and Physiology of Tooth movement and Laboratory Techniques related to the fabrication and use of suitable orthodontic appliances including material and biologic background necessary for proper clinical management of these appliances.

REMA 270. Introduction to Pediatrics. 1 Unit.
This course will provide instruction in the areas of preventive dentistry, restorative dentistry, pulp therapy, trauma, space maintenance and non-pharmacologic behavior management techniques for the pediatric patient. Particular attention will be paid to those areas that are essential in order to treat a pediatric patient appropriately. It is the hope that this course will communicate expectations and will provide significant preparation that will enhance the dental students' clinical learning experience.

REMA 380. Dental Care for the Aging Population. 1 Unit.
The didactic curriculum provides a general background on the changing demographics of our population as well as knowledge about the medical, social, psychological, and dental problems many older Americans face today. Dental problems common to the elderly, approaches to treatment planning and the provision of care for this unique group in traditional and non-traditional settings are explored.
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James A. Lalumandier, DDS, MPH
(Georgetown University; University of North Carolina)
Professor of Community Dentistry and Chair

Michael A. Landers, DDS, MA
(Case Western Reserve University; The Ohio State University)
Associate Professor of Oral Diagnosis and Radiology

Lisa A. Lang, DDS, MS
(University of Michigan; University of Texas San Antonio)
Associate Professor of Comprehensive Care and Chair

Charles J. Love, DDS
(Case Western Reserve University)
Associate Professor of Comprehensive Care

André K. Mickel, DDS, MSD
(Case Western Reserve University)
Associate Professor of Endodontics and Chair

Thomas A. Montagnese, DDS, MS
(The Ohio State University)
Assistant Professor of Endodontics

Sena Narendran, BDS, MS
(University of Ceylon Sri-Lanka; University of London England)
Associate Professor of Community Dentistry

Suchitra S. Nelson, PhD
(Case Western Reserve University)
Professor of Community Dentistry
Ronald L. Occhionero, DDS
(Case Western Reserve University)
Professor of Comprehensive Care; Associate Dean for Administration

Juan Martin Palomo, DDS, MSD
(Ponta Grossa State University Brazil; Case Western Reserve University)
Associate Professor of Orthodontics

Leena Palomo, DDS, MSD
(Case Western Reserve University)
Assistant Professor of Periodontics

Faisal A. Quereshy, DDS, MD
(State University of New York at Buffalo; Case Western Reserve University)
Assistant Professor of Oral and Maxillofacial Surgery

Danny Sawyer, DDS, PhD
(Medical College of Virginia)
Professor of Oral Diagnosis and Radiology and Chair

Benjamin L. Schechter, DDS
(Case Western Reserve University)
Assistant Professor of Comprehensive Care

Robert C. Skillicorn, DDS, MS
(Ohio State University; University of Michigan)
Associate Professor of Periodontics

Sorin T. Teich, DMD, MBA
(Hebrew University of Jerusalem Israel; Northwestern University-Chicago/Tel Aviv University-Israel)
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Manish Valiathan, MSD, BDS
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India)
Assistant Professor of Orthodontics

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(University of Pittsburgh)
Senior Instructor of Biological Sciences

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Associate Professor of Community Dentistry; Associate Dean for
Education

Russell Wang, DDS, PhD, MSD
(PhD: University of Toronto; MSD: Indiana University)
Associate Professor of Comprehensive Care

Aaron Weinberg, DMD, PhD
(The Hebrew University of Jerusalem, Israel)
Professor of Biological Sciences and Chair

Tim S. Whittingham, PhD, MBA
(University of Wisconsin; Case Western Reserve University)
Associate Professor of Biological Sciences

Kristin A. Williams, DDS, MPH
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Assistant Professor of Community Dentistry
Office of Postdoctoral Affairs

The Office of Postdoctoral Affairs located within the School of Graduate Studies is responsible for the appointment of postdoctoral scholars and fellows, as well as the development, implementation and monitoring of all university policies applicable to these positions. Additional information is available on the Postdoctoral Affairs website (http://postdoc.case.edu).

Administration of the School

Charles E. Rozek, PhD
Wayne State University
Vice Provost and Dean of Graduate Studies

Denise M. Douglas, PhD
University of Minnesota
Senior Associate Dean of Graduate Studies

Faculty Senate Committee on Graduate Studies

General responsibility for overseeing postdoctoral affairs, programs of graduate study and for academic and other general regulations applicable to all graduate students and programs is delegated to the Faculty Senate Committee on Graduate Studies (http://case.edu/gradstudies.case.edu/prospect/admissions/apply.html) through the School of Graduate Studies website (http://gradstudies.case.edu). Each department, school, or interdisciplinary committee is responsible for its particular graduate programs within the framework of the general regulations. The Committee on Graduate Studies consists of the dean of graduate studies, the associate vice president for research, nine faculty members elected by the University Faculty Senate, one appointed postdoc and four graduate students – three elected by the Graduate Student Senate and one appointed from the professional schools.

Graduate Student Senate

Students in the School of Graduate Studies are represented by a Graduate Student Senate (http://gss.case.edu), which consists of one student elected from each department that offers graduate programs. The officers of the senate are elected by the graduate student senators, who also select graduate student representatives to the University Faculty Senate and various campus committees.

Financial Aid

Tuition payments and fees (http://www.case.edu/finadmin/controller/bursar/tuition.htm) are administered through the Bursar’s office. For more information about financial assistance, students should contact the Office of University Financial Aid (http://financialaid.case.edu).

Admission

Applicants with good academic records from fully accredited universities and colleges will be considered for admission to graduate study (http://gradstudies.case.edu/prospect/admissions/admission.html) at Case Western Reserve University. Admission must be recommended by the department or professional school of the university in which the applicant proposes to work and must be approved by the dean of graduate studies. Prospective students apply for admission (http://gradstudies.case.edu/prospect/admissions/apply.html) through the School of Graduate Studies.

Admission of International Students

The admission criteria for international students are the same as U.S. residents except for the following:

1. International students whose first language is not English must be able to speak, read, write and comprehend English. English proficiency must be demonstrated by taking the Test of English as a Foreign Language (http://www.toefl.org) (TOEFL). Please see the School of Graduate Studies website (http://gradstudies.case.edu/prospect/admissions/apply.html) for additional information.

Applicants are exempt from the TOEFL requirements if they:
- speak English as their native language
- have completed a bachelor’s degree or higher at a foreign university where the instruction was in English
- have a earned a bachelor’s degree or higher in a U.S. college or university with instruction in the English language.

2. To obtain a student visa, international students must demonstrate financial sufficiency by submitting bank statements and other financial documents indicating sufficient funds to support the tuition and living expenses for one academic year.

3. For those students who are to receive financial aid from the department, the amount of funds required will depend on the amount of the aid award. In some cases it will be living expenses, and in others more funds will be required.

When a letter of acceptance for an international student has been issued, a copy is sent to the Office of International Student Services (http://www.case.edu/international/resources/internationalservices.html) where the I-20 is processed and sent to the student who must then obtain a student visa in order to begin study in the U.S.
Non-Degree Students

Individuals with earned bachelor’s degrees who want to enroll in classes for personal enrichment or to satisfy prerequisite course requirements for later admission to graduate programs may enroll as non-degree students through the School of Graduate Studies. Prospective non-degree students should apply for admission (http://gradstudies.case.edu/prospect/nondegree.html) through the School of Graduate Studies. Students may enroll in undergraduate and graduate level courses. Continuation in non-degree status is at the discretion of the dean of graduate studies. Non-degree students are not permitted to enroll in more than 21 hours of coursework in one program. In order to continue taking courses in that program, the student must be accepted into the graduate degree program. More information about enrolling as a non-degree student can be found at School of Graduate Studies (http://gradstudies.case.edu/prospect/nondegree.html).

Transferring Non-degree course work

Applicants who are interested in transferring course work into graduate degree programs are encouraged to seek early advice from the departments to which they intend to apply to insure that courses taken as non-degree students will satisfy departmental requirements. Non-degree students cannot assume that they will be admitted to any graduate degree program, or that all course work taken will transfer into the program. Only 400 level and higher course work will be considered for graduate transfer. The term of the earliest approved, transferred course will establish the date of entrance into the degree program. Courses transferred from non-degree status must have been taken within five years of the first term of matriculation as a degree seeking student and passed with a grade of B or better. Students considering transfer into a degree program will need to meet a minimum matriculation requirement of two semesters and six semester hours of course work.

Postgraduate Audit Program

A postgraduate audit program allowing registration for coursework is available to individuals who hold a doctoral degree such as, MD, DNP, DDS, or PhD and are involved in research or clinical programs at Case Western Reserve University. Additional information is available on the Office of Postdoctoral Affairs (http://postdoc.case.edu/current/benefits.html) website.
School of Graduate Studies
Academic Policies

Graduate Academic Policies
Fellowship Tuition Policy for Graduate Students

The purpose of this policy is to allow students pursuing graduate degrees to take courses beyond their degree requirements without additional financial burden to the student and little or no cost to the university. Such courses, referred to as “fellowship” courses, can broaden the educational experience of graduate students by allowing them to pursue studies according to their own intellectual needs.

1. A student pursuing a graduate degree shall be charged tuition at the standard hourly rate for all of the credit hours which are intended to count toward the degree. In any semester for which students are registered for a minimum number (as determined by the school) of credits that will be applied toward the degree, fellowship courses will not incur a tuition charge.

2. In order to enroll in a fellowship course, the student must be in good standing, meet course prerequisites, and obtain consent of instructor. In addition, the student must obtain permission from his/her advisor and the School of Graduate Studies. Up to eight fellowship courses may be permitted in aggregate.

3. Thesis research (651 and 701) and similar courses cannot be taken as fellowship courses and prior rules for 701 and 703 (dissertation fellowship) are not changed by this policy.

4. Fellowship courses can not be audited. The grade that a student receives in the course will count in the cumulative GPA, but will not count towards the degree program GPA.

5. Fellowship courses can not be used toward a degree program at Case Western Reserve University.

6. Notwithstanding any of the foregoing provisions and policies, the rules, regulations, and terms of tuition and credit enrollments for each school shall remain in full force and effect.

Guidelines for Multidisciplinary Graduate and Graduate Professional Studies

Purposes
Multidisciplinary studies have as their goal the education of individuals who can make contributions to academic disciplines or professional endeavors that would be less likely to be accomplished by individuals with a background in a single discipline. Departments or faculty members may design a joint degree program, which will generally result in two degrees, or a multidisciplinary degree, which will generally result in a single degree which has a broader perspective than similar existing degrees. Such programs should meet challenges of new interdisciplinary knowledge and/or developments requiring new combinations of talent. In addition, such programs or degrees should enhance and not duplicate existing programs in the university. Individual students with specific multidisciplinary interests that desire to pursue them at Case Western Reserve University and faculty members who wish to run pilots for joint degree programs or multidisciplinary degrees are encouraged to do so, even if no official joint or multidisciplinary degree program currently exists by organizing an individual joint degree or an individual multidisciplinary degree. Such degrees require faculty and departmental support. Guidance for the design and approval of both such programs and such individual degrees is available from the School of Graduate Studies.

Graduate Student Rights and Responsibilities

It is the responsibility of the student to become familiar with the general rules and regulations of the university, not just those of the School of Graduate Studies. A member of the University community who is accused of violating any of these rules and regulations is subject to university disciplinary action. Due process procedures of adequate notice of all charges and a fair hearing will apply. Case Western Reserve University has established a mechanism whereby students may express a grievance against the actions of other students or members of the faculty and staff. A statement of the policies and procedures to be followed in the case of academic infractions by graduate students may be obtained through the School of Graduate Studies. The policies and procedures governing all other infractions are detailed in the university’s Case Student Handbook (http://studentaffairs.case.edu/handbook). The University Office of Student Affairs (http://studentaffairs.case.edu) should be consulted for non-academic infractions.

It is also the responsibility of the student to become acquainted with the general regulations and administrative procedures governing graduate study, together with the departmental or school regulations which apply to the student’s course of study, and, in consultation with the faculty advisor or advisory committee of the supervising unit, to plan the program and carry out the work in accordance with these regulations and procedures.

Departmental Responsibility for Requirements
Requirements for master’s and doctoral degrees beyond those set forth in these regulations may be established by departments or curricular program committees with the approval of the dean of graduate studies. Individual students may be required to take courses beyond the published requirements in order to successfully complete their degree programs. In such instances the student must be notified in writing upon matriculation by the chair of the department or curricular program, with a copy to be filed in the School of Graduate Studies.

Maintenance of Good Standing
A student maintains good standing in the School of Graduate Studies by registering each fall and spring semester unless on an official leave of absence which has been approved by the School of Graduate Studies. A student is in good standing who meets the standards set by the academic department and the School of Graduate Studies to ensure normal progress toward the fulfillment of the stated requirements at levels of quality without warning or probation or extension of the allowable time limit for degree completion. Students whose quality point averages fall below minimum standards (3.00 for doctoral students; 2.75 for master’s) will automatically be placed on probation until the minimum standards are achieved. In addition, a student will be subject to separation from the university for any of the following reasons:

1. Failure to achieve a quality-point average of 2.50 or higher at the completion of 12 semester hours or 2 semesters of graduate study.

2. Failure to achieve a quality-point average of 2.75 or higher at the completion of 21 semester hours or 4 semesters of graduate study.

3. Failure to receive a grade of S in thesis research 651 or dissertation research 701. A student who receives a grade of U in thesis (Course 651) or dissertation research (Course 701) will be placed on probation and be subject to separation. The probationary status will be recorded on the student’s transcript. The student must be removed from probation by the end of the semester immediately.
following receipt of the grade of U by repeating the course for the same number of credit hours, and achieving a grade of S. Although removal from probation restores the student’s good standing, the grade of U received will not be canceled or substituted by the grade of S subsequently received. Separation will occur if the student placed on probation receives another grade of U in the following semester; or, if the dean of graduate studies, in consultation with the academic unit, determines that the student is unlikely to be successful in working independently and productively toward the completion of the thesis or dissertation research.

4. Failure of a conditionally or provisionally admitted student to satisfy the conditions or provisions stated in the letter of acceptance by the end of the first academic year (2 semesters) or after 18 credits of course work.

5. Failure to make progress towards degree completion. If the student is not making progress towards degree completion, and it has been judged that the student is unlikely to be successful in working independently and productively toward the completion of clinical requirements, thesis or dissertation research the department and/or the dean of graduate studies (in consultation with the department) can recommend academic separation.

6. In addition to disciplinary actions based on academic standards, on recommendation of the student’s department or school, the dean of graduate studies can suspend or separate a student from the university for failure to maintain appropriate standards of conduct and integrity. Such a suspension or separation will be implemented only for serious breaches of conduct that threaten to compromise the standards of a department or create concern for the safety and welfare of others. In the event of such suspension or separation, the student will be entitled to an appeal through the grievance procedure of the Graduate School.

**Maintenance of Quality-Point Average**

In calculating the quality-point average, courses taken as a student in the School of Graduate Studies at the 400 level or above, as well as any courses accepted toward fulfillment of degree requirements for which quality points are given, will be counted, including courses which may need to be repeated. Unless otherwise stated by the department a minimum cumulative quality-point average of 2.75 is required for the award of the master’s degree, and a minimum cumulative quality-point average of 3.00 is required for award of the doctoral degree.

Any department, school, or curricular program committee may choose to establish quality standards higher than those stated above if such additional requirements are made known in writing to the students upon matriculation, and are recorded with the dean of graduate studies. In that case, the departmental standards supersede the minimum standards. Students who do not maintain the minimum quality point average will be placed on academic probation until the minimum standard has been achieved.

**Course Repeat Policy**

Graduate students may petition their department chair to repeat a maximum of two courses during their degree program in order to improve their performance. When a course is repeated the first grade will remain visible on the transcript, but will be removed from the calculation of the cumulative grade point average and the grade point average for the semester in which the course was first taken. The new grade will then be used for calculation of the cumulative grade point average and the grade point average for the semester in which it was earned, regardless of whether the new grade is higher or lower than the first grade. The student’s transcript will show the comment “Repeated: No credit awarded” directly below the original grade. However, if the first attempt of the course resulted in a passing grade, but the second attempt results in a failing grade, then the original grade will remain. Similarly, if a student withdraws from a course that is being repeated, the Course Repeat Option will not be applied and the original grade will stand.

Course repetition may be exercised according to the following conditions:

1. The course repeat option can only be used on course in which a C or lower was earned. Courses with a grading basis of P/NP are not eligible under this policy
2. A student may not use the Pass/No Pass Option on a course that is being repeated
3. A student may only use the repeat option on the same course
4. Research based courses 651, 601 and 701 are exempt from this repeat policy. Thesis research course 651 and dissertation research course 701 grading policies can be found in this bulletin.
5. The course repeat option may not be exercised after a degree has been awarded
6. Approval from advisor and department chair required. Some departments may also require the signature of the Director of Graduate Studies and/or the Graduate Affairs committee
7. The tuition and associated fees for a repeated course may be the responsibility of the student

**Residency Requirement**

The doctoral residency requirement is intended to insure a period of intensive academic interaction with faculty and peers and of sustained independent research. Graduate students are considered to be in residence when they are fully engaged in academic work. As resident students they may teach at the university, take graduate courses, assist in course development, and engage in research or in other scholarly activities at the university. Regardless of the nature of the work, the student’s regular presence at the university is expected during fulfillment of the residency requirement.

The formal fulfillment of residency requires continuous registration in at least six consecutive academic terms (fall, spring and/or summer) from matriculation to a period not exceeding five years after the first credited hour(s) of dissertation research (701). The period while students are on a leave of absence do not count towards fulfilling the residency requirement. Within the context of continuity of registration, departments may enact other restrictions. In such instances, the departmental requirements take precedence and must formally be disclosed to the student at matriculation. This is meant to be a reflection of the appropriate reality that departments and fields have different norms and traditions of graduate study. For example, to fulfill the residency requirement, some departments may require the doctoral student to be registered for 9 or more semester hours of graduate credit in each of two consecutive semesters. Fulfillment of residency by all engineering Ph.D. candidates will be certified by their research advisors and department chairs based on an assessment of active, concentrated involvement for a period of two consecutive semesters during their pursuit of the doctorate.

**Time Limitation**

All the requirements for the master’s degree must be completed within five consecutive calendar years after matriculation as a graduate student, including any leaves of absence. Doctoral students have five consecutive calendar years from the semester of the first credited 701 registration, including leaves of absence, to complete all requirements for the doctorate. Any graduate student who fails to complete the requirements within the five year limit for his or her degree program will be subject to separation from further study unless granted an extension by the dean
of graduate studies with the recommendation of the faculty advisor or advisory committee and approval by the department chair. An extension may be granted if the student and his or her advisor work out a plan of action for degree completion within a specified time frame which must be endorsed by the department chair. Students will be expected to meet all the specified deadlines outlined in the plan of action. The minimum acceptable registration during this extended period for each semester until graduation is three credit hours of 651 or 701, or, for Plan B master’s students, an appropriate course.

Leave of Absence from Graduate Study

Students undertaking graduate work are expected to pursue their studies according to a systematic plan each year whether registered for full or part-time study. Occasionally a student finds it necessary to interrupt his or her studies before completion of the graduate program. A leave of absence is not to be requested unless the circumstances are such that the student cannot continue graduate study. Under such circumstances the student must request in writing a leave of absence for a period not to exceed two consecutive regular academic semesters. Forms (http://gradstudies.case.edu/current/forms.html) can be found at the School of Graduate Studies website. In exceptional circumstances, the leave can be extended for another two semesters. However, the maximum amount of leave permitted per graduate program is four semesters. The reason for the leave must be stated clearly, and the request must be submitted to the dean of graduate studies with the written endorsement of the student’s academic department. During a leave of absence the student must not seek aid from faculty members or use of the facilities of the university. This means that students may not take exams or defend theses and dissertations while on a leave. A leave of absence does not extend the maximum time permitted for the completion of degree requirements, and a leave cannot be taken while students are on extension of the five-year limit. At the expiration of the leave the student must resume registration unless formally granted an extension of the leave. Retroactive leaves are not permitted. A student who fails to obtain a leave of absence, or who fails to register following an official leave, must petition the dean of graduate studies for reinstatement in order to resume work as a student in good standing at the university.

A student who is granted a maternity or paternity leave of absence related to infant care, as well as those who must fulfill military duty obligations, can petition to extend the five-year time limit associated with completion of the degree. The length of the extension may not exceed two years. International students must check with the Office of International Student Services before petitioning for a leave of absence, as such a leave can affect their visa status.

Withdrawal, Resignation, and Reinstatement

Students must maintain continuous registration throughout their degree programs unless granted an official leave of absence. Students who fail to register for any academic term will be automatically withdrawn from their programs. Students who are withdrawn from their programs must petition for reinstatement in order to continue graduate study. The petition must be approved by both the student’s department and the dean of graduate studies before the student may register for further course work as a student in full standing. In each case of readmission with full standing, the official letter will state the terms of readmission, including future time limits for the degree program, and the past course work that will be credited toward the degree. If more than 24 months have elapsed since the last registration, students may have to resubmit file materials if requested by the School of Graduate Studies.

Transfer of Credit

Transfer of credit from another university toward master’s and doctoral degree requirements is awarded for appropriate course work (not applied to another degree program) taken prior to admission. Transfer of credit must be requested in the student’s first academic year, and must be appropriate for the student’s planned program of study. For master’s candidates, transferred credit is limited to six semester hours of graduate-level courses, and no credit for master’s thesis may be transferred from another university. No transfer of credit will be awarded towards the PhD degree except by petition, and no credit for the doctoral dissertation may be transferred from another university. Transfer of credit does not include the transfer of grades and therefore can not be used to fulfill GPA or percentage of graded coursework policies.

Students who wish to receive credit for courses taken outside the university once they are enrolled must petition for approval. All transfer of credit requires approval from the student’s advisor, the departmental chair or graduate committee, and the dean of graduate studies. Such courses must have been taken within five years of first matriculation at Case Western Reserve University and passed with grades of B or better. Forms can be found at the School of Graduate Studies (http://gradstudies.case.edu/current/forms.html).

Internal Transfer of Credit

Students of exceptional ability in the undergraduate programs of Case Western Reserve University who have the approval of the dean of undergraduate studies and the dean of graduate studies may apply to receive credit for graduate courses completed in excess of the undergraduate degree requirements.

Graduate students who internally transfer to another degree program may seek approval to transfer coursework from the original degree program by petition. (http://gradstudies.case.edu/downloads/TransferDept.pdf)

Changes in Registration

To add or withdraw from courses or to change registration from credit to audit or the reverse, a student must obtain the appropriate official form to submit to the University Registrar in accordance with the dates published each academic term for such actions to be taken. Students must make appropriate changes to their schedules by the end of the first week of classes in order to avoid paying full tuition for courses withdrawn after the final drop/add date. Only complete withdrawal for the semester entitles a student to a percentage refund of the withdrawn courses after the first week of classes. (See the “Financial Information” section of this Bulletin under Refunds). Failure to attend class or merely giving notice to the instructor will not be regarded as official notice of withdrawal or change. When making changes in registration, the international student must be aware of maintaining full-time status. Full-time status requires registration for a minimum of 9 semester hours per semester. Students financed by federal loans must remain registered for at least 6 semester hours (defined as half-time) each semester to maintain continued eligibility for that funding or to initiate such a loan.

Graduation

A candidate for a degree awarded by the School of Graduate Studies must make application for the degree to the School of Graduate Studies by the deadline established for that semester, which is approximately twelve weeks before the commencement date for which the degree is expected to be awarded. Students are encouraged to either contact the School of Graduate Studies or visit our website at the beginning of the semester in which they intend to graduate to obtain a packet of graduation materials for either the Master’s (http://
The candidate must meet all the deadlines for completion of degree requirements set forth in the calendar. All candidates must be registered for credit and in good standing during the semester in which the degree is awarded. Payment of tuition, fees, and fines is a prerequisite to the award of a degree.

Delayed Graduation

It is a requirement of the School of Graduate Studies that a student be registered for credit in the semester in which he or she completes all the requirements to graduate in accordance with established deadlines for that semester. For a student engaged in thesis or dissertation research the completion of all requirements to graduate is not easily predicted, making it difficult to adhere to scheduled deadlines. If a student will not be able to meet the degree requirements to graduate in one semester, but will finish before the next semester begins, he or she can petition for a waiver of the requirement to be registered in the semester of graduation. To be granted a waiver of registration students must be registered for the appropriate thesis or dissertation credit hours in the semester (or summer session) immediately preceding the semester of graduation, complete all degree requirements including a current application to graduate, and submit all required materials to the School of Graduate Studies by the last day scheduled for the Drop/Add period of the next semester.

A student who qualifies for the waiver will be awarded the degree at the next graduation without the need to be registered or to pay a special fee. If a student fails to meet the waiver deadline, he or she will be required to register for the appropriate thesis or dissertation credit hours in the next semester, and to reapply for graduation in that semester.

Exceptions to Regulations

Students have the right to petition for exceptions to these regulations. Such a petition should be addressed to the dean of graduate studies. In most cases the student’s department or program committee must endorse the petition.

Graduate Student Grievance Procedure

It is the responsibility of the School of Graduate studies to assure that all students enrolled for graduate credit at Case Western Reserve University have adequate access to faculty and administrative consideration of their grievances concerning academic issues. A three-step procedure has been established for graduate students to present complaints about academic actions they feel are unfair.

1. Students with complaints should first discuss their grievances with the person against whom the complaint is directed.
2. In those instances in which this discussion does not resolve a grievance to the student’s satisfaction, a complaint should be presented in writing to the department chairperson. If the complaint is against the department chair and is not resolved with this individual, the complaint should be presented to the Dean of the School/College.
3. In the event that a decision still appears unfair to the student, the student may bring the matter to the attention of the dean of graduate studies. The dean may ask the student to put the complaint in writing. The dean will then discuss the case with the student and the department chair to evaluate the particulars and to make a ruling on it. As the situation warrants, the dean may appoint a Grievance Committee to recommend what action should be taken. In this event the Committee will be composed of two faculty members selected from the Committee on Graduate Studies of the Faculty Senate and two graduate students selected either from the Executive Committee of the Graduate Student Senate or from the student members of the Committee on Graduate Studies.

The dean of graduate studies has the responsibility for the final decision, and the ruling from the School of Graduate Studies will be considered final and binding on the persons involved in the grievance. Additional information about the grievance procedure can be obtained from the School of Graduate Studies.

It should be understood that this grievance procedure relates solely to graduate student complaints concerning academic issues. The procedure for handling complaints about other matters is detailed in the Graduate Student Handbook (http://gradstudies.case.edu/webfm_send/100).

Procedures and Sanctions for Graduate Student Academic Infractions

Graduate students accused of violating the university’s standards of conduct, which are detailed in this Academic Integrity Policy (http://gradstudies.case.edu/downloads/AcadInteg.pdf), are entitled to adequate notice of all charges and to a fair hearing and may subsequently be subject to disciplinary action. The process that is outlined in the Academic Integrity Policy will apply to academic infractions, e.g., cheating on examinations, plagiarism, and other forms of dishonesty in academic activities. Additional information is available from the School of Graduate Studies.
School of Graduate Studies

Academic Requirements

Master Requirements I Doctoral Requirements I Grading

Academic Requirements for Master Degrees

In recognition that the objectives of master’s degrees differ for various departments and for individual students, especially in the importance given to research, two general plans for master’s degrees may be followed. Plan A is for MA or MS degrees with a thesis based on individual research and a final oral examination. Plan B is for MA, MFA, MPH, or MS degrees without a thesis but requiring a comprehensive examination and/or a major project to be administered by the academic unit.

Within the framework of these general regulations, it is expected that a relevant program of study (http://gradstudies.case.edu/current/ppos.html) will be planned for each candidate for the master’s degree by the student and the faculty advisor or advisory committee. Such a program should include appropriate courses, thesis and/or project hours, and may also include, where relevant, such experiences as field work or practicum.

Master’s Thesis (Plan A)

The minimum requirements for the master’s degree under Plan A are 18 semester hours of course work plus a thesis equivalent to at least 9 semester hours of registration, or 21 semester hours of course work plus a thesis equivalent to at least 6 semester hours of registration. Once registered for thesis credit (Course 651), a student must continue 651 registration each succeeding regular semester until graduation. However, if a student is registered for course work or research toward the doctorate in the semester in which the thesis examination is expected to occur, concurrent registration for 651 is not required. At least 18 semester hours of course work, in addition to thesis hours, must be at the 400-level or higher.

Each student must prepare an individual thesis. Joint theses are not permitted. The written thesis must conform to regulations concerning format, quality, and time of submission as established by the dean of graduate studies. Detailed instructions (http://gradstudies.case.edu/current/graduation/masters.html) can be obtained from the School of Graduate Studies website.

For completion of master’s degrees under Plan A, an oral examination (defense) of the master’s thesis is required. This examination is conducted by a committee of at least three members of the university faculty. The candidate’s thesis advisor customarily serves as the chair of the examining committee. The other members of the committee are appointed by the chair of the department or curricular program faculty supervising the candidate’s course of study. The examining committee must agree unanimously that the candidate has passed the thesis examination. Because theses are made public immediately upon acceptance, they should not contain proprietary or classified material. When the research relates to proprietary material, the student and advisor are responsible for making preliminary disclosures to the sponsor sufficiently in advance to permit timely release of the thesis, and these plans should be disclosed when the thesis is submitted to the School of Graduate Studies.

Master’s Comprehensive (Plan B)

The minimum requirements for the master’s degree under Plan B are 27 semester hours of course work, a comprehensive examination, and in some fields, an approved project. At least 18 semester hours of course work must be at the 400 level or higher.

Each candidate for the master’s degree under Plan B must pass satisfactorily a comprehensive examination to be administered by the department or curricular program committee. The examination may be written or oral or both. A student must be registered during the semester in which any part of the comprehensive examination is taken. If not registered for other courses, the student will be required to register for one semester hour of EXAM 600 Master’s Comprehensive Exam, before taking the examination.

Engineering students are required to complete 3 to 6 semester hours of Special Problems (Project) course work, which must consist of an engineering project approved by the chair of the department offering the degree program, and may be carried out at the student’s place of employment with nominal supervision by a faculty advisor or in the departmental laboratories under direct supervision. The project must culminate in a written report and examination by at least three professors including approval by the chair of the department.

Performance evaluation for Course 601 (Independent study/Research) is limited to P/NP grading.

Theatre students in the MFA program are required to register for six semester hours of Thesis Production (creative project), followed by an oral and written defense.

Academic Requirements for Doctoral Degrees

The degree of Doctor of Philosophy is awarded in recognition of in-depth knowledge in a major field and comprehensive understanding of related subjects together with a demonstration of ability to perform independent investigation and to communicate the results of such investigation in an acceptable dissertation.

Curricular Requirements

Within the framework of these general regulations, it is expected that a relevant program of study (http://gradstudies.case.edu/current/ppos.html) will be planned for each candidate for the doctorate by the student and the faculty advisor or advisory committee. Such a program should include appropriate courses, together with work on the doctoral dissertation, and may also include, where relevant, such experiences as field work or practicum.

Although specific requirements vary among departments, students entering with a bachelor’s degree will satisfactorily complete a minimum of 36 semester hours of courses (which may include independent study/research, course 601), tutorials, and seminars. For students entering with an approved master’s degree, completion of at least 18 semester hours of course work is required. A minimum of 18 semester hours of dissertation research (Course 701) is required for all doctoral students.

Examination Requirements

In order to meet the requirements for the doctorate, a student must pass satisfactorily a general examination (or a series of examinations covering different fields) specified and administered by the student’s department or supervising committee. The examination generally precedes advancement to candidacy. A student must be registered during the semester in which any part of the general or qualifying examination is taken. If not registered for other courses, the student will be required to register for one semester hour of EXAM 700 PhD General/Qualifier Exam, before taking the examination. A student who fails the
examination on the first attempt may be permitted to take the examination a second time within one year at the discretion of the department. Except in unusual circumstances, a student who fails the examination a second time will be separated from further graduate study within the same department or program.

**Advancement to Candidacy**

The formal acceptance of a student as a candidate for the doctoral degree is the responsibility of the student’s department or the committee supervising the doctoral program in accordance with the written procedures of the academic unit. At its discretion the supervising unit may require a student to pass qualifying examinations before candidacy is granted. Generally, advancement to candidacy allows the student to enter the dissertation research phase of the degree program, and occurs after all course work and exam requirements are satisfied. Students are expected to make regular and continuous progress toward the degree. Advancement to candidacy in a PhD program should occur within a maximum of 6 years post-matriculation with a bachelor’s degree (no later than at the completion of 36 semester hours of graduate study) and 4 years post-matriculation with a master’s degree (no later than at the completion of 18 semester hours of graduate study). Students may continue in pre-candidacy status beyond this time by means of a petition to the School of Graduate Studies by a program director, based on evidence of student progress toward the degree. Individual programs can require advancement to candidacy before the time limit set in this policy.

The dean of graduate studies must promptly be notified in writing of the decision concerning a student’s advancement to candidacy, and a copy of the notification must be sent to the student concerned. A student who is refused candidacy status may not undertake further study for credit toward the doctoral degree within the same department or supervising unit. With the approval of both the department concerned and the dean of graduate studies, such a student may:

1. Take additional courses, if required, in order to complete an approved master’s degree in that department.
2. Seek admission to the graduate program of another department.

**Course 701 Requirements**

**Pre- and Post-Candidacy**

**Dissertation Research**

When a student has been advanced to candidacy, he or she may begin dissertation research by formally registering for course 701 credits. At the point at which students begin registering for course 701, the department must identify a university faculty member who will serve as the doctoral student’s principal research advisor, and formally notify the dean of graduate studies. Students who have been advanced to candidacy may register for 1-9 credits of course 701 each fall and spring semester (or up to 6 credits for the summer when needed). In certain cases, students who have not advanced to candidacy may begin registering for up to 6 credit hours of course 701 per semester at the discretion of the department and upon written notification to the dean of graduate studies. Pre-Candidacy 701 hour(s) may be taken concurrently with course work. Once a student begins registration of 701 hours, he or she must register for at least one credit hour of 701 each semester until graduation. Once 701 registration begins doctoral students have five consecutive calendar years from the semester of the first credited 701 registration, including leaves of absence, to complete all requirements for the doctorate.

**Foreign Language Requirements**

Although there is no general foreign language requirement for the doctorate, each department or supervising committee may set such requirements as are appropriate to the student’s program of study. It is the student’s responsibility to ascertain the foreign language requirements approved by the supervising unit. Each department must notify the dean of graduate studies in writing of the specific language(s) required and the date of examination determining the student’s proficiency in the required language(s).

**Dissertation Requirements**

All candidates for the PhD degree must electronically submit a dissertation as evidence of their ability to conduct independent research at an advanced level. The dissertation must represent a significant contribution to existing knowledge in the student’s field, and at least a portion of the content must be suitable for publication in a reputable professional journal or as a book or monograph. Students must prepare their own dissertations. Joint dissertations are not permitted. The dissertation must conform to regulations concerning format, quality, and time of submission as established by the dean of graduate studies. Detailed instructions can be obtained from the School of Graduate Studies (http://gradstudies.case.edu/current/graduation/phd.html). Research work connected with a dissertation is to be carried out under the direct supervision of a member of the university faculty selected by the student in consultation with departmental faculty and approved by the chair of the department.

Approved dissertations are to be uploaded to OhioLink (http://etd.ohiolink.edu) before certification for the doctorate. Because dissertations are made public immediately upon acceptance, they should not contain proprietary or classified material. When the research relates to proprietary material, the student and advisor are responsible for making preliminary disclosures to the sponsor in advance to permit timely release of the dissertation. These arrangements must be disclosed when the dissertation is submitted to the School of Graduate Studies. The required form can be found in the graduation packet. (http://gradstudies.case.edu/current/graduation/phd.html)

**Dissertation Advisory Committee**

Each doctoral student is responsible for become sufficiently familiar with the research interests of the department or program faculty to choose in a timely manner a faculty member who will serve as the student’s research advisor. The research advisor is expected to provide mentorship in research conception, methods, performance, and ethics, as well as focus on development of the student’s professional communication skills, building professional contacts in the field, and fostering the professional behavior standard of the field and research in general. The research advisor also assists with the selection of at least two other faculty to serve as members of the dissertation advisory committee.

The composition of each student’s dissertation defense committee must have formal approval by the Dean or Senior Associate Dean of Graduate Studies on recommendation of the chair of the department, division or curricular program committee. The dissertation committee must consist of a minimum of four members of the University faculty (any tenured or tenure-track Case Western Reserve University faculty member, and any CWRU full-time faculty member whose primary duties include research who is authorized to serve on a PhD dissertation committee by the school or college through which they are affiliated with the university). At least one of these CWRU faculty must hold a primary appointment that is outside of the student’s department, program or school. The chair of the committee must be a CWRU tenured or tenure-track faculty member in
the student’s program. The student’s dissertation/research advisor MUST be a member of the committee and may serve as chair if consistent with departmental policy.

Persons who are not members of the University faculty may serve as additional members of the examining committee, subject to approval by the Graduate Dean. A petition with the rationale for the request must be submitted to the dean along with the proposed member’s curriculum vitae. Under special conditions, a former faculty member whose time of leaving the university has not exceeded 18 months may be approved as a committee member by the dean of graduate studies.

Throughout the development and completion of the dissertation, members of the dissertation defense committee are expected to provide constructive criticism and helpful ideas generated by the research problem from the viewpoint of their particular expertise. Each member will make an assessment of the originality of the dissertation, its value, the contribution it makes, and the clarity, with which concepts are communicated, especially to a person outside the field. The doctoral student is expected to arrange meetings and maintain periodic contact with each committee member. A meeting of the full committee for the purpose of assessing the student’s progress should occur at least once a year until the completion of the dissertation.

Final Oral Examination
(Defense of Dissertation)

Each doctoral candidate is required to pass a final oral examination in defense of the dissertation. The examination may also include an inquiry into the candidate’s competence in the major and related fields.

The defense must be scheduled with the School of Graduate Studies no later than three weeks before the date of the examination. The chair of the examining committee should give approval to schedule the defense when the written dissertation is ready for public scrutiny. The candidate must provide to each member of the committee a copy of the completed dissertation at least ten days before the examination so that the committee members have an opportunity to read and discuss it in advance.

Scheduled defenses are made know through on-campus publication, and any member of the university may be present at that portion of the examination pre-designated as public by the chair of the dissertation defense committee. Others may be present at the formal defense only by invitation of that chair.

It is expected that all members of the dissertation defense committee by present at the defense. Exceptions to this rule: a) must be approved by petition to the dean of graduate studies and only under extraordinary circumstances, b) no more than one voting member can ever be absent, c) the absent member must participate through real-time video conferencing at the department’s expense; however, if such video conferencing is not available, the absent member may participate through telephone conferencing; and d) the student must always be physically present.

The dissertation defense committee is responsible for certifying that the quality and suitability of the material presented in the dissertation meet acceptable scholarly standards. A student will be certified as passing the final oral examination if no more than one of the voting members of the committee dissents.

Institutional Review Board (IRB)
The promotion of scholarship and the discovery of new knowledge through research are among the major functions of Case Western Reserve University. If this research is to be meaningful and beneficial to humanity, involvement of human subjects as experimental participants is necessary. It is imperative that investigators in all disciplines strive to protect human subjects. University policy and federal regulations demand compliance. Per federal regulations (45 CFR 46), all research involving human subjects requires submission of an IRB application (http://ora.ra.cwru.edu/research/orc/Cas%20IRB%20System/CaseIRB.cfm) prior to initiation of research to the Case Western Reserve IRB.

Each IRB application must have a faculty member noted as the Responsible Investigator. Applications that are not fully completed as instructed will not be accepted. See university policy on the involvement of human participants in research for guidelines under which investigations involving human subjects may be pursued.

Course Designations
Courses numbered 100 to 399 are undergraduate-level courses. Courses numbered 400 and higher are graduate-level courses.

Grading System
See the University Registrar (p. 942) section of this Bulletin for a list of valid grades for the School of Graduate Studies and their appropriate use in assigning to graduate students. The only grades that can be changed after they have been assigned by the instructor are Incompletes (I). All others will remain permanently on the student’s academic record. Additional work cannot be done to change an existing grade to a higher grade.

There are some grading schemes in the School of Graduate Studies that have important policy implications. They are:

Incomplete (I)

Grades of I should only be assigned for letter-graded and Pass/No Pass courses for extenuating circumstances, and only when a student fails to complete a small segment of the course. Students may not sit in the same course in a later semester to complete the work required for the original course. All work for the incomplete grade must be made up, and the change of grade recorded in the Office of the University Registrar, by the date specified by the instructor, but no later than the last day of class in the semester following the one in which the I was received. Grade changes received after that date must be accompanied by a petition signed by both the advisor and the chair of the department indicating the reason for the late change and must be approved by the Deputy Provost. Unresolved Incomplete grades will remain permanently on the student’s academic record, if the work is not made up by the designated deadline. A student who has a permanent Incomplete for a required course must retake the course in a later term. When an I grade is assigned by the instructor, he or she must also submit to the School of Graduate Studies the completed “Arrangement to Resolve a Grade of Incomplete” form (http://gradstudies.case.edu/current/forms.html) indicating the date that the I grade will be resolved. If the student cannot complete the work for the Incomplete by the specified deadline, he or she must petition for an extension which must be endorsed by the instructor, and explain the reasons why the work has not been completed, and include a new date for completion. Students will be allowed only one extension of no more than one additional semester to complete the work for an I grade.

Pass/No Pass (P/NP)

Some graduate courses are graded on a pass or no pass basis, and students need to be aware of the regulations governing letter graded and pass/no pass credits. Of the minimum credit hours required beyond the bachelor’s degree to complete course work requirements, at least
12 credits must be letter graded for the master’s degree, and at least 24 credits must be letter graded for the Ph.D. degree. For students with approved master’s degrees who are admitted to Ph.D. programs, at least 12 credits of the required minimum of 18 credits of course work must be letter graded. Letter graded courses should be the courses most central to the student’s plan of study. Additional credit hours of letter graded course work may be specified by departmental policy. Performance evaluation for course 601 (Independent study/Research) is limited to P/NP grading.

**Satisfactory/Unsatisfactory (S/U)**

Grades of Satisfactory (S) and Unsatisfactory (U) are to be used exclusively for two courses: 651 thesis research and 701, dissertation research. “Satisfactory” indicates an acceptable level of progress towards completion of the research required for the degree, and Unsatisfactory indicates an unacceptable level of progress towards completion of the research for the degree. Any student who receives a grade of U will automatically be put on academic probation, and if a second U is received, the student will be separated from further study in his or her degree program.
School of Graduate Studies
Programs of Study

Arts and Sciences

<table>
<thead>
<tr>
<th>Programs</th>
<th>Degrees</th>
<th>Combined Degree Programs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anthropology (p. 146)</td>
<td>MA, PhD</td>
<td>IGS, MA/MSN, PhD/MD, MA/PhD, PhD/MPH</td>
</tr>
<tr>
<td>Art Education (p. 162)</td>
<td>MA</td>
<td></td>
</tr>
<tr>
<td>Art History (p. 162)</td>
<td>MA, PhD</td>
<td>IGS</td>
</tr>
<tr>
<td>Art History and Museum Studies (p. 162)</td>
<td>MA, PhD</td>
<td></td>
</tr>
<tr>
<td>Astronomy (p. 180)</td>
<td>MA, PhD</td>
<td>BS/MS</td>
</tr>
<tr>
<td>Biology (p. 189)</td>
<td>MS, PhD</td>
<td>IGS, BS/MS</td>
</tr>
<tr>
<td>Chemistry (p. 209)</td>
<td>MS, PhD</td>
<td>BS/MS</td>
</tr>
<tr>
<td>Cognitive Linguistics (p. 225)</td>
<td>MA</td>
<td></td>
</tr>
<tr>
<td>Communication Science (p. 363)</td>
<td>MA, PhD</td>
<td>IGS</td>
</tr>
<tr>
<td>Contemporary Dance (p. 234)</td>
<td>MFA, MA</td>
<td></td>
</tr>
<tr>
<td>English (p. 240)</td>
<td>MA, PhD</td>
<td>IGS</td>
</tr>
<tr>
<td>French/Modern Languages (p. 290)</td>
<td>MA</td>
<td>BA/MA, MA/MA</td>
</tr>
<tr>
<td>Geological Studies (<a href="http://futurebulletin.case.edu/collegeofartsandsciences/geologicalsciences/graduatetext">http://futurebulletin.case.edu/collegeofartsandsciences/geologicalsciences/graduatetext</a>)</td>
<td>MS, PhD</td>
<td>BS/MS</td>
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<tr>
<td>History</td>
<td>MA, PhD</td>
<td>MA/JD</td>
</tr>
<tr>
<td>Mathematics</td>
<td>MS, PhD</td>
<td>BS/MS</td>
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<tr>
<td>Mathematics, Applied</td>
<td>MA, PhD</td>
<td></td>
</tr>
<tr>
<td>Music, Early Performance</td>
<td>MA, DMA</td>
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<tr>
<td>Music Education</td>
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<tr>
<td>Musicology</td>
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<tr>
<td>Music History</td>
<td>MA</td>
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<tr>
<td>Physics</td>
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<td>BS/MS</td>
</tr>
<tr>
<td>Political Science</td>
<td>MA, PhD</td>
<td>MA/JD</td>
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<tr>
<td>Psychology</td>
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<td>IGS</td>
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<tr>
<td>Sociology</td>
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<tr>
<td>Statistics</td>
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<td>BS/MS</td>
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<tr>
<td>Theatre Arts</td>
<td>MFA</td>
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<tr>
<td>World Literature</td>
<td>MA</td>
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Biomedical Sciences

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<tr>
<th>Programs</th>
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<tbody>
<tr>
<td>Anesthesiologist Assistant</td>
<td>MS</td>
<td></td>
</tr>
<tr>
<td>Applied Anatomy</td>
<td>MS</td>
<td>MD/MS, MD/PhD</td>
</tr>
<tr>
<td>Biochemical Research</td>
<td>MS</td>
<td></td>
</tr>
<tr>
<td>Biochemistry</td>
<td>MS, PhD</td>
<td>MD/PhD, MS/MD</td>
</tr>
<tr>
<td>Biostatistics</td>
<td>MA, PhD</td>
<td>MA/MSN, MA/MD, MA/PhD, MA/MSA, MA/MPH</td>
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<tr>
<td>Biomedical Sciences Training Program</td>
<td>PhD</td>
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</tr>
<tr>
<td>Cell Biology</td>
<td>PhD</td>
<td>MD/PhD</td>
</tr>
<tr>
<td>Clinical Research Scholars Program</td>
<td>MS</td>
<td>DMD/MS</td>
</tr>
<tr>
<td>Environmental Health Sciences</td>
<td>MS</td>
<td>MS/MD</td>
</tr>
<tr>
<td>Epidemiology and Biostatistics</td>
<td>MS, PhD</td>
<td>MD/PhD</td>
</tr>
<tr>
<td>Genetics</td>
<td>PhD</td>
<td>MD/PhD</td>
</tr>
<tr>
<td>Genetic Counseling Training Program</td>
<td>MS</td>
<td></td>
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<tr>
<td>Medical Physiology</td>
<td>MS</td>
<td></td>
</tr>
<tr>
<td>Medical Scientist Training Program</td>
<td>MD/PhD in biomedical fields</td>
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<tr>
<td>Molecular Biology and Microbiology</td>
<td>PhD</td>
<td></td>
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<tr>
<td>Molecular Medicine</td>
<td>PhD</td>
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</table>

Molecular Virology | PhD | |

Neurosciences | PhD | MD/PhD |

Nutrition | MS, PhD | BS/MS |

Pathology | PhD | MS/MD |

Pharmacology | PhD | MD/PhD |

Physiology and Biophysics | MS, PhD | MD/PhD |

Public Health Nutrition | MS | |

Systems Biology and Bioinformatics | MS, PhD | |

Engineering

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<tr>
<th>Programs</th>
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<tbody>
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<td>Aerospace Engineering</td>
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<tr>
<td>Biomedical Engineering</td>
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<td>BS/MS, MD/MS, MD/PhD</td>
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<td>Chemical Engineering</td>
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<td>BS/MS</td>
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<tr>
<td>Civil Engineering</td>
<td>MS, PhD</td>
<td>BS/MS</td>
</tr>
<tr>
<td>Computer Engineering</td>
<td>MS, PhD</td>
<td>BS/MS</td>
</tr>
<tr>
<td>Computing and Information Sciences</td>
<td>MS, PhD</td>
<td>BS/MS</td>
</tr>
<tr>
<td>Electrical Engineering</td>
<td>MS, PhD</td>
<td>BS/MS</td>
</tr>
<tr>
<td>Macromolecular Science and Engineering</td>
<td>MS, PhD</td>
<td>BS/MS</td>
</tr>
<tr>
<td>Materials Science and Engineering</td>
<td>MS, PhD</td>
<td>BS/MS</td>
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<tr>
<td>Mechanical Engineering</td>
<td>MS, PhD</td>
<td>BS/MS, MD/PhD</td>
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<tr>
<td>Systems and Control Engineering</td>
<td>MS, PhD</td>
<td>BS/MS</td>
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<td>Master of Engineering Program (<a href="http://engineering.case.edu/meng/overview.htm">http://engineering.case.edu/meng/overview.htm</a>)</td>
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<tr>
<td>Master’s in Engineering and Management</td>
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Professional Programs

Weatherhead School of Management

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<tbody>
<tr>
<td>Information Systems</td>
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<tr>
<td>Designing Sustainable Systems</td>
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<tr>
<td>Organizational Behavior</td>
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<td>Accountancy</td>
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Epidemiology

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<th>Programs</th>
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<tr>
<td>Master of Public Health</td>
<td>MPH</td>
<td>DMD, JD, MA, MBA, MD, MSSA, MSN, PhD</td>
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Frances Payne Bolton School of Nursing

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<tr>
<th>Programs</th>
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<tbody>
<tr>
<td>Nursing</td>
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<td>MSN/PhD</td>
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Mandel School of Applied Social Sciences

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<tr>
<td>Social Welfare</td>
<td>PhD</td>
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<tr>
<th>Programs</th>
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<tr>
<td>Biomedical Sciences</td>
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<tr>
<td>Molecular Virology</td>
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<td>Neurosciences</td>
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<td>Nutrition</td>
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<td>Pharmacology</td>
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<td>MD/PhD</td>
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<td>Physiology and Biophysics</td>
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<td>Public Health Nutrition</td>
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<tr>
<td>Systems Biology and Bioinformatics</td>
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School of Law

Founded in 1892, the Case Western Reserve University School of Law (http://bulletin.case.edu/schooloflaw/http://law.case.edu) is a charter member of the Association of American Law Schools and of the national law honorary society, the Order of the Coif. It was among the first law schools accredited by the American Bar Association.

The school has a student body of about 700 and a full-time faculty of about fifty. In the school’s early years, most students came from Ohio and remained in Ohio after graduation. Today, students come from all parts of the country, and there are CWRU law graduates in virtually every state (and in several foreign countries), and certainly in every major U.S. city. An active and aggressive Career Services Office works with students, graduates, and prospective employers from all over the nation to maximize job opportunities.

The Law Library

The law library’s holdings include more than 390,000 books and volume-equivalents, complete collections of federal and state law, law reviews, current law services, an extensive British and Commonwealth collection, and special collections in taxation, labor law, foreign investments, international law, and environmental law. The law library is building strong collections in law and medicine, intellectual property, and law of the European Union. It is a selective depository for both U.S. and Canadian government documents. The law school itself has computer workstations on every floor of the library, providing access to hundreds of electronic services and library catalogs, and a wide range of software services. The university boasts a fast and powerful network and wireless access, and the university network links the law school to the vast resources of the Internet. The law library is a member of OhioLINK, which is a consortium of Ohio’s college and university libraries and the State Library of Ohio. OhioLINK offers access to more than 31 million library items from 79 institutions. These materials include items from law, medical, and special collections.

The law library offers its users access to an ever-expanding list of electronic research databases as well as e-books. Electronic resources are accessible through the library catalog and the Law Library Services page on our website. Web-based databases offered include Lexis/Nexis and Westlaw as well as over 100 OhioLINK databases (including Index to Legal Periodicals and Medline). Many of these OhioLINK databases contain the full text of journal articles. Housed within the law library is a computer laboratory and a computer training classroom.

Special Programs

Litigation Program

Since the mid-1970s, the School of Law has invested heavily in its litigation program. Students practice the basic skills of trial advocacy in such courses as LAWS 6110 Trial Tactics, LAWS 6111 Appellate Practice, and in the co-curricular moot court and mock trial programs.

Student Activities

Publications

The School of Law publishes three scholarly journals, all student-edited. The oldest is the Case Western Reserve Law Review, published quarterly. The Journal of International Law is published two to three times a year; the JIL editorial board also has responsibility for the Canada-U.S. Law Journal (sponsored by the Canada-U.S. Law Institute), published once a year. Health Matrix: Journal of Law-Medicine began as a joint undertaking of all six of the university’s professional schools but since 1990, has been sponsored solely by the law school and its Law-Medicine Center.

Competitions

Moot Court

A student board administers the Dean Dunmore Competition, a year long program in which second-year (and a very few third-year) students participate. It culminates in a round-robin tournament involving 16 finalists. From those finalists, the board selects teams who will compete the following year in the National Moot Court Competition, the Craven Competition in constitutional law, and the Niagara Competition (sponsored by the Canada-U.S. Law Institute). Case Western Reserve also enters the Jessup International Competition; that team is selected by another student group, the Society of International Law Students.

Mock Trial

The Jonathan M. Ault Mock Trial Board sponsors an intramural competition from which emerge the members of interscholastic teams. Currently, the law school sends student representatives to the National Trial Competition, the National Student Trial Competition of the Association of Trial Lawyers of America, and a competition sponsored by the Academy of Trial Lawyers of Allegheny County, Pennsylvania.

Regulations and Rules of Conduct

The Academic Regulations of the School of Law are provided to each student upon matriculation through the law school’s website.

In addition to the university’s rules of conduct, law students are expected to comply with the American Bar Association’s Model Code of Professional Responsibility and Model Rules of Professional Conduct, to the extent that these are applicable, and with the law school’s own Code of Conduct. The Model Code and Model Rules are available in the law library. The school’s Code of Conduct, like the Academic Regulations, is provided to each student upon matriculation through the law school’s Intranet website.

Centers of Academic Excellence

Milton A. Kramer Law Clinic Center

The Supreme Court of Ohio authorizes student practice under attorney supervision in the final year of law school. Through the clinic, students provide legal representation to indigent clients and community groups and receive academic credit. The supervising attorneys are full-time members of the law faculty. The clinical program is the capstone of the skills curriculum and offers specialized practice experiences in Criminal Justice, Community Development, Civil Litigation Practice, focused on consumer matters, predatory lending, social security disability, and other public benefit issues, Immigration, Health Law, and Family Law.

Center for Business Law and Regulation

To better prepare its students and future leaders with a thorough understanding of the business issues facing entrepreneurs, entities, and other clients, the School of Law created the Center for Business Law and Regulation. The center focuses on expanding curricular offerings and programs as well as engaging in opportunities for legal, empirical, and interdisciplinary research, assessing the role and impact of government in the regulation of business. The center will also host special lectures and

Centers of Academic Excellence
The Law-Medicine Center at Case Western Reserve University has been in operation for over 50 years. It began with a focus on forensic medicine, but has broadened to include the whole range of legal, social, economic, scientific, and ethical issues in which law and medicine are interrelated. Besides the regular course offerings, the center frequently presents lectures, symposia, and workshops, and sponsors major conferences. It publishes a student-edited journal, Health Matrix: Journal of Law-Medicine. Participants in the center’s activities include not only university personnel, but also professionals from such institutions as University Hospitals of Cleveland and the Cleveland Clinic.

Center for Social Justice
The School of Law has a proud but little-known history of providing a welcoming atmosphere that attracted African American students in the years before desegregation. Many of those graduates went on to distinguished careers. The purpose of the Center for Social Justice is to honor those graduates and the School of Law’s historic commitment to racial equality, as well as to promote social justice now and in the future for various groups that experience discriminatory treatment today. Its activities include holding conferences and speaker programs, hosting scholars from academia and practice, expanding curricular coverage, and providing financial support to students working in the area of social justice full-time after graduation or during summers while in law school.

Canada-United States Law Institute
The Canada-U.S. Law Institute, established in 1976, is jointly sponsored by the law schools of Case Western Reserve University and the University of Western Ontario. Its primary educational purpose is to give students of both schools a comparative perspective on their own country’s legal system. Each semester, up to six students from each school spend the term in residence at the other school. The school in which the student is a degree candidate gives full credit for the semester’s work. The two schools also exchange faculty, usually for periods of one or a few days, but occasionally to teach one or more courses for a full semester.

A second purpose of the institute is to provide a framework for the exploration of transnational and international legal issues affecting the relationship between Canada and the United States. In addition to the regularly scheduled courses on Canadian-U.S. topics, the institute sponsors workshops and conferences, including annual conferences in Cleveland, which, in recent years, have dealt with Canadian-U.S. economic ties.

The institute also sponsors a regular publication, the Canada-U.S. Law Journal; the annual Niagara Moot Court Competition, in which students from U.S. and Canadian law schools participate; and special research projects, often with funding support.

Administration
Lawrence E. Mitchell, JD
Columbia University
Dean
Alyson Suter Alber, JD
University of Virginia
Associate Dean for Enrollment Planning and Strategic Initiatives
Jonathan L. Entin, JD
Northwestern University
Associate Dean for Academic Affairs
J.T. Garabrant, BA
John Carroll University
Associate Dean for Development and Public Affairs
B. Jessie Hill, JD

Center for Global Security Law and Policy
The School of Law offers opportunities for faculty to study and teach abroad. It also supports the development of international information resources. Through a series of sister law school relationships, it seeks to attract foreign students to the law school and provide opportunities for Case Western Reserve law students to study abroad; it also provides opportunities for faculty to study and teach abroad.

Institute for Global Security Law and Policy
The events and aftermath of 9/11 have made security and counter-terrorism fundamental, if not defining, concerns for the world community, nations, companies, the legal system, and individuals. The Institute for Global Security Law and Policy was established in 2005 to provide a uniquely comprehensive hub for addressing the legal, financial, political, social, religious and cultural ramifications of counterterrorism, using an innovative multifaceted approach that integrates theory with practical application. The Institute develops and integrates the best learning from all sources, including the real world and draws on numerous disciplines and experiences to provide innovative and world class programs, research, teaching, and service on the issues of security and counter-terrorism. The work of the Institute serves as an invaluable resource to governments, businesses, organizations, the legal profession, and the general community.

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Center for the Interdisciplinary Study of Conflict and Dispute Resolution (CISCDR)
During this age of globalization, our world has begun to steadfastly look toward negotiation, mediation, arbitration and other forms of dispute resolution as alternative methods of solving conflict. Since the 1970s, the Alternative Dispute Resolution (ADR) movement has gained momentum in judicial and academic circles and is currently reflected in courses in most law schools, while the number of established mediation and arbitration practices continues to rise. To best prepare students for meeting these societal and legal changes, the School of Law has established the Center for the Interdisciplinary Study of Conflict and Dispute Resolution (CISCDR). CISCDR’s core mission is to encourage greater sensitivity to appropriate dispute resolution and skill development, preparing School of Law students for the multiple roles they will perform as lawyers in a global economy.

Center for Law, Technology and the Arts
The Center for Law, Technology, and the Arts was established as an internationally recognized forum for the interdisciplinary study of law, technology, and the arts. The Center focuses on teaching, research, and programs pertaining to intellectual property, technological innovation and technology transfer, the intersection of science, economics, philosophy, and the law, legal issues concerning biotechnology and computer technologies, and laws and cultural issues relating to the creative arts. Through the Center, the law school is able to offer students opportunities to address important, topical issues relating to law and technology and law and the arts through a variety of courses, lectures, events, and symposia.

Frederick K. Cox International Law Center
The International Law Center serves as the stimulus for enhancing programs in international, comparative, and transnational law at the law school. It supports visiting scholars and visiting faculty at the law school to enrich the curriculum and research capacity of the resident faculty. It also supports the development of international information resources. Through a series of sister school relationships, it seeks to attract foreign students to the law school and provide opportunities for Case Western Reserve law students to study abroad; it also provides opportunities for faculty to study and teach abroad.

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Associate Dean for Development and Public Affairs
B. Jessie Hill, JD
(Harvard University)
*Associate Dean for Faculty Development and Research*

Kenneth R. Margolis, JD
(Case Western Reserve University)
*Associate Dean for Experiential Education*

Sarah McFarlane Polly, JD
(Ohio State University)
*Associate Dean for Student Services*

Michael P. Scharf, JD
(Duke University)
*Associate Dean for Global Legal Studies*

Kelli C. Curtis, JD
(Ohio State University)
*Assistant Dean for Admissions*

Crystal D. Taylor, MBA
(Indiana University)
*Assistant Dean for Finance and Administration*

Kathleen M. Carrick, JD (Cleveland State University), MLS (University of Pittsburgh)
*Director of the Law Library*
Dual Degree Programs

Dual Degree Programs

For students in dual degree programs, 12 hours of elective credits in the JD program are waived in consideration of completion of the dual degree. Students must be separately admitted to both degree programs in order to pursue a dual degree, the qualitative requirements of both degrees must be fully met, and the two degrees must be earned simultaneously. Students must begin coursework in the second degree program prior to beginning the fifth semester of law school work. Also, no coursework completed prior to official matriculation in the law school may be counted towards the law school degree.

JD/MBA (Master of Business Administration)

Students may complete the three-year JD program and the two-year MBA program in four academic years by completing 133 credit hours (including a 7-credit-hour overload which can be taken during the academic year or during the summer semester).

The School of Law allows dual degree students to use 12 credit hours from the MBA to fulfill both JD and MBA requirements. The Weatherhead School of Management allows dual degree students to use 12 credit hours from the School of Law to fulfill both MBA and JD requirements. Students must achieve a grade of C or better to receive double credit for the courses. This reduces the total number of hours required for the two degrees by 24 credit hours.

JD/MBA students may enroll only on a full-time basis, except during summer sessions. Dual degree students must receive both the JD and the MBA degrees simultaneously upon completion of degree requirements at both schools in order to receive the 24 hours of cross-credits described above.

Throughout the dual degree program, JD/MBA students continue to register in the first school they attended. After completion of both degree programs, two separate diplomas are awarded. Course work for both programs must be completed within six years of the date of initial enrollment in either program.

JD/MA or JD/MS (Master of Arts or Master of Science)

Enrolling in both the School of Law and the School of Graduate Studies, a student complete a Juris Doctor (JD) and a Master of Arts (MA) or Master of Science (MS) degree and earn the two degrees in seven semesters or six semesters plus two summers. Current options for this dual degree are:

- MA – Legal History
- MA – Bioethics
- MS – Biochemistry

JD/MSSA (Master of Science in Social Administration)

A dual degree program established by the Mandel School of Applied Social Sciences and the School of Law makes it possible for selected full-time students to pursue an integrated program of studies and receive the MSSA and JD degrees within four years rather than the normal five years that would be required to earn the two degrees separately. Applicants for the dual degree program must apply to and meet the admission requirements of both professional schools and are encouraged to apply for admission to both programs simultaneously.

Dual degree students must receive the MSSA and JD degrees simultaneously to be granted credit for specific courses taken in the other program.

JD/MD (Doctor or Medicine)

The School of Law and the School of Medicine offer a dual degree program that allows a student to complete both degrees in six years. A student who begins at the law school spends two years studying law, then four years studying medicine. Alternatively, a student may spend the first two years and the last two years at the medical school, and the two middle years at the law school.

JD/MPH (Master of Public Health)

The MPH degree will generally add a year of additional course work to the JD degree, creating a four-year program. Law students enrolled in the dual JD/MPH degree program may earn up to 12 credits toward the JD in graduate level MPH courses. The law school offers several health law courses that meet the MPH elective requirements.
Juris Doctor (JD)

Juris Doctor

The School of Law offers the Juris Doctor (JD) degree as well as dual-degree programs. The JD degree requires successful completion of 88 credit hours, of which 38 hours are in required courses and 50 hours are elective courses - at least 2 of the elective credits must be used for the writing of a substantial research paper. The first year program for the JD degree consists mainly of the required basic courses. In addition, in the spring semester students select a 2-credit elective “perspectives” course; the menu of first-year perspectives courses varies from year to year.

Required First Year Courses

<table>
<thead>
<tr>
<th>Course</th>
<th>Required Courses</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>LAWS 1100</td>
<td>Introduction to Lawyering</td>
<td>1</td>
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<tr>
<td>LAWS 1101</td>
<td>Contracts</td>
<td>4</td>
</tr>
<tr>
<td>LAWS 1102</td>
<td>Criminal Law</td>
<td>4</td>
</tr>
<tr>
<td>LAWS 1103</td>
<td>Torts</td>
<td>4</td>
</tr>
<tr>
<td>LAWS 1801</td>
<td>Core 1: Research, Writing, and Skills</td>
<td>2</td>
</tr>
<tr>
<td>LAWS 1201</td>
<td>Civil Procedure</td>
<td>4</td>
</tr>
<tr>
<td>LAWS 1202</td>
<td>Constitutional Law I</td>
<td>4</td>
</tr>
<tr>
<td>LAWS 1203</td>
<td>Property</td>
<td>4</td>
</tr>
<tr>
<td>LAWS 1802</td>
<td>Core 2: Research, Writing, and Skills</td>
<td>2</td>
</tr>
<tr>
<td>LAWS 1100</td>
<td>Choice of Perspectives electives</td>
<td>2</td>
</tr>
</tbody>
</table>

Total Units: 15

Curricular Concentrations

Seven curricular concentrations are offered for the Juris Doctor. These optional concentrations allow students to provide a concentrated focus for some of their elective coursework. The current available curricular concentrations are:

- Business Organizations
- Criminal Law
- Litigation / Alternate Dispute Resolution
- Health Law
- International Law
- Law, Technology, and the Arts
- Public Law – Public and Regulatory Institutions track or Individual Rights and Social Reform track
- National Security Law

Graduate School Option

Students in the School of Law who are not enrolled in a dual-degree program may take up to nine hours of approved courses in the other graduate and professional schools of Case Western Reserve University and have such courses counted for credit toward the JD degree.

JD Curricular Concentrations

JD students have an option to earn a curricular concentration by focusing their course selections within a particularly area of legal study. Requirements for each particular concentration are listed below. In order to receive the concentration, students must earn at least 15-18 credits (varies by the specific concentration) in courses within the concentration, and earn an overall grade point average of 3.000 or higher amongst all courses defined by that concentration. Each concentration has a number of required courses along with a menu of courses that can counted as elective hours. Each concentration also has a writing requirement: a substantial research paper on a topic applicable to the concentration must be completed with a grade of B+ or higher; contact the concentration advisor for more details. Specific courses applicable to each concentration are subject to change by faculty review. Please obtain the most current concentration curriculum sheet from the Law School Academic Services Office. Each concentration has an assigned faculty leader who can assist students with course selection and curriculum planning.

Business Organizations

Required Courses

<table>
<thead>
<tr>
<th>Course</th>
<th>Required Courses</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>LAWS 4401</td>
<td>Business Associations</td>
<td>5</td>
</tr>
<tr>
<td>LAWS 5431</td>
<td>Securities Regulation</td>
<td>3</td>
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<tr>
<td>LAWS 5412</td>
<td>Advanced Securities Regulation</td>
<td>7</td>
</tr>
<tr>
<td>LAWS 5416</td>
<td>Business Planning</td>
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<tr>
<td>LAWS 5417</td>
<td>Capital Markets, Venture Capital, and Mgmt., Principles for Lawyers</td>
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<tr>
<td>LAWS 5403</td>
<td>Federal Taxation of Corporations and Shareholders</td>
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<tr>
<td>LAWS 5404</td>
<td>Federal Taxation of Partnerships and Partners</td>
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<tr>
<td>LAWS 5422</td>
<td>Financial Markets: Law, Theory, and Practice</td>
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<tr>
<td>LAWS 5421</td>
<td>Financial Principles for Lawyers</td>
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<tr>
<td>LAWS 5131</td>
<td>Global Corporate Governance Lab</td>
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<tr>
<td>LAWS 5425</td>
<td>International Business Organizations</td>
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<tr>
<td>LAWS 5120</td>
<td>International Business Transactions</td>
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<tr>
<td>LAWS 5427</td>
<td>Mergers and Acquisitions</td>
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</tr>
<tr>
<td>LAWS 5435</td>
<td>Sales and Secured Financing</td>
<td></td>
</tr>
<tr>
<td>LAWS 5434</td>
<td>Secured Transactions</td>
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</tbody>
</table>

Total Units: 15

Criminal Law

Required Courses

<table>
<thead>
<tr>
<th>Course</th>
<th>Required Courses</th>
<th>Units</th>
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</thead>
<tbody>
<tr>
<td>LAWS 4807</td>
<td>Criminal Procedure I</td>
<td>3</td>
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<tr>
<td>LAWS 5718</td>
<td>Criminal Procedure II</td>
<td>2</td>
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<tr>
<td>LAWS 4808</td>
<td>Evidence</td>
<td>4</td>
</tr>
<tr>
<td>LAWS 5905</td>
<td>Advanced Evidence</td>
<td>7</td>
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<tr>
<td>LAWS 6111</td>
<td>Appellate Practice</td>
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<tr>
<td>LAWS 5113</td>
<td>Counter-Terrorism Law</td>
<td></td>
</tr>
<tr>
<td>LAWS 6022</td>
<td>Criminal Justice Clinic II</td>
<td></td>
</tr>
<tr>
<td>LAWS 5213</td>
<td>Criminal Law and Psychiatry</td>
<td></td>
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<tr>
<td>LAWS 5721</td>
<td>Death Penalty Lab</td>
<td></td>
</tr>
<tr>
<td>LAWS 5722</td>
<td>Death Penalty Lab II</td>
<td></td>
</tr>
<tr>
<td>LAWS 5132</td>
<td>Homeland Security/USCG Lab</td>
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<tr>
<td>LAWS 5121</td>
<td>International Criminal Law and Procedure</td>
<td></td>
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<tr>
<td>LAWS 5116</td>
<td>International Human Rights</td>
<td></td>
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<tr>
<td>LAWS 5736</td>
<td>Juvenile Law</td>
<td></td>
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<tr>
<td>LAWS 6108</td>
<td>Pretrial Practice: Criminal</td>
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<tr>
<td>LAWS 5749</td>
<td>Prisoner Rights &amp; Litigation</td>
<td></td>
</tr>
<tr>
<td>LAWS 5751</td>
<td>Scientific Evidence in Criminal Litigation</td>
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</tbody>
</table>
## Litigation / Alternate Dispute Resolution

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
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</thead>
<tbody>
<tr>
<td>LAWS 5919</td>
<td>Scientific Evidence and Advanced Research</td>
</tr>
<tr>
<td>LAWS 6110</td>
<td>Trial Tactics</td>
</tr>
<tr>
<td>LAWS 5118</td>
<td>International War Crimes Project</td>
</tr>
<tr>
<td>LAWS 5924</td>
<td>White Collar Crime Research Seminar</td>
</tr>
<tr>
<td>LAWS 5925</td>
<td>Wrongful Convictions Seminar</td>
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</table>

### Required Courses

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>LAWS 4808</td>
<td>Evidence</td>
</tr>
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</table>

### Elective Courses

<table>
<thead>
<tr>
<th>Course</th>
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</thead>
<tbody>
<tr>
<td>LAWS 4806</td>
<td>Administrative Law</td>
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<tr>
<td>LAWS 5907</td>
<td>Arbitration Law and Practice Seminar</td>
</tr>
<tr>
<td>LAWS 6103</td>
<td>Basic Mediation Training</td>
</tr>
<tr>
<td>LAWS 5212</td>
<td>Civil Law and Psychiatry</td>
</tr>
<tr>
<td>LAWS 5713</td>
<td>Complex Federal Criminal Investigation and Prosecution</td>
</tr>
<tr>
<td>LAWS 5714</td>
<td>Complex Litigation</td>
</tr>
<tr>
<td>LAWS 5716</td>
<td>Conflict of Laws</td>
</tr>
<tr>
<td>LAWS 5313</td>
<td>Copyright Litigation</td>
</tr>
<tr>
<td>LAWS 5213</td>
<td>Criminal Law and Psychiatry</td>
</tr>
<tr>
<td>LAWS 4807</td>
<td>Criminal Procedure I</td>
</tr>
<tr>
<td>LAWS 5718</td>
<td>Criminal Procedure II</td>
</tr>
<tr>
<td>LAWS 5720</td>
<td>Death Penalty Law and Process</td>
</tr>
<tr>
<td>LAWS 5726</td>
<td>Employment Law</td>
</tr>
<tr>
<td>LAWS 5729</td>
<td>Expert Testimony in Civil Cases</td>
</tr>
<tr>
<td>LAWS 5904</td>
<td>Famous American Trials Seminar</td>
</tr>
<tr>
<td>LAWS 5731</td>
<td>Federal Courts</td>
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<tr>
<td>LAWS 5132</td>
<td>Homeland Security/USCG Lab</td>
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<tr>
<td>LAWS 5734</td>
<td>Immigration Law II</td>
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<tr>
<td>LAWS 5115</td>
<td>International Arbitration</td>
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<td>LAWS 5122</td>
<td>International Litigation Research Seminar</td>
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<td>LAWS 5326</td>
<td>Patent Litigation</td>
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<tr>
<td>LAWS 5428</td>
<td>Products Liability</td>
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<td>LAWS 5914</td>
<td>Professional Responsibility Advanced Research</td>
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<td>LAWS 5751</td>
<td>Scientific Evidence in Criminal Litigation</td>
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<tr>
<td>LAWS 5919</td>
<td>Scientific Evidence and Advanced Research</td>
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<tr>
<td>LAWS 5920</td>
<td>Settlement Law Seminar</td>
</tr>
<tr>
<td>LAWS 5763</td>
<td>White Collar Crime: Prosecution and Defense</td>
</tr>
<tr>
<td>LAWS 5925</td>
<td>Wrongful Convictions Seminar</td>
</tr>
</tbody>
</table>

### Doctrinal electives

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>LAWS 5707</td>
<td>Alternative Dispute Resolution</td>
</tr>
<tr>
<td>LAWS 6111</td>
<td>Appellate Practice</td>
</tr>
<tr>
<td>LAWS 7005</td>
<td>City Law Externship</td>
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<tr>
<td>LAWS 5721</td>
<td>Death Penalty Lab</td>
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<tr>
<td>LAWS 5722</td>
<td>Death Penalty Lab II</td>
</tr>
<tr>
<td>LAWS 7015</td>
<td>Federal Public Defender Externship</td>
</tr>
<tr>
<td>LAWS 7045</td>
<td>Judicial Externship Seminar</td>
</tr>
<tr>
<td>LAWS 6650</td>
<td>Mock Trial</td>
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<tr>
<td>LAWS 6107</td>
<td>Pretrial Practice: Civil</td>
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<tr>
<td>LAWS 7050</td>
<td>Prosecutor's Office Externship</td>
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<tr>
<td>LAWS 5133</td>
<td>Terrorism Prosecution Lab</td>
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<tr>
<td>LAWS 7061</td>
<td>United States Attorney Externship: Criminal</td>
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### Practice electives

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<td>Death Penalty Lab II</td>
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<td>LAWS 7015</td>
<td>Federal Public Defender Externship</td>
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<td>LAWS 7045</td>
<td>Judicial Externship Seminar</td>
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<td>Mock Trial</td>
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<td>Pretrial Practice: Civil</td>
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<td>Prosecutor's Office Externship</td>
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<tr>
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### Total Units

**16**

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### Health Law

#### Required Courses

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<td>LAWS 4201</td>
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<td>Evidence</td>
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<td>LAWS 4806</td>
<td>Administrative Law</td>
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#### Elective Courses

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<td>LAWS 5210</td>
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<tr>
<td>LAWS 5724</td>
<td>Discrimination in Employment</td>
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<tr>
<td>LAWS 5729</td>
<td>Expert Testimony in Civil Cases</td>
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<tr>
<td>LAWS 5203</td>
<td>Food And Drug Law</td>
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<td>LAWS 5204</td>
<td>Genetics and Law</td>
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<tr>
<td>LAWS 5219</td>
<td>Health Care Transactions</td>
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<tr>
<td>LAWS 5221</td>
<td>Hospital and Physician Organization Law</td>
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<tr>
<td>LAWS 6032</td>
<td>Health Law Clinic II</td>
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<tr>
<td>LAWS 6513</td>
<td>Health Matrix ((Editors))</td>
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<tr>
<td>LAWS 6503</td>
<td>Health Matrix Seminar</td>
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<tr>
<td>LAWS 6106</td>
<td>Pretrial Practice: Medical Malpractice</td>
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<td>LAWS 5205</td>
<td>Public Health Law</td>
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<tr>
<td>LAWS 5918</td>
<td>Reproductive Rights Seminar</td>
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<td>LAWS 5225</td>
<td>Research Ethics and Regulation</td>
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<tr>
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### Total Units

**15**

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### International Law

#### Required Courses

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<td>Business Associations</td>
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<td>LAWS 4806</td>
<td>Evidence</td>
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#### Elective Courses

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<tr>
<td>LAWS 5724</td>
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<tr>
<td>LAWS 5751</td>
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### Total Units

**15**

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#### Public International and Comparative Law electives

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<td>Canon Law</td>
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<td>Homeland Security/USCG Lab</td>
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<td>LAWS 5215</td>
<td>Health Care and Human Rights</td>
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<td>LAWS 5733</td>
<td>Immigration Law</td>
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<td>LAWS 5734</td>
<td>Immigration Law II</td>
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<td>LAWS 6101</td>
<td>Immigration Law Practicum I</td>
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<td>LAWS 6102</td>
<td>Immigration Law Practicum II</td>
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<td>International Criminal Law and Procedure</td>
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<td>Intervention Law: Iraq and Vietnam</td>
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<td>Jewish Law</td>
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<td>LAWS 5745</td>
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### International Business Law electives

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<tbody>
<tr>
<td>LAWS 5111</td>
<td>Admiralty Law</td>
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* or any clinic course except Community Development.  
** must take at least one Doctrinal and one Practice course  
+ 4 credits of any clinical course except Community Development may be taken as Practice Courses
Law, Technology, and the Arts

Required Courses (at least 2 of the following) 6
- LAWS 4301 Copyright Law
- LAWS 5314 Cyberlaw
- LAWS 4302 Patent Law
- LAWS 4303 Trademark Law

Elective Courses 12
- LAWS 5211 Biotechnology Law and Policy
- LAWS 5110 Contemporary Issues in International and Comparative Law (IP Topic)
- LAWS 5461 Commercial Information and the Law
- LAWS 5341 Commercialization and Intellectual Property Management
- LAWS 5342 Commercialization and Intellectual Property Management
- LAWS 5311 Computer Law and Policy
- LAWS 5361 Contexts of Invention Seminar
- LAWS 5362 Copyright in the Digital Millennium Seminar
- LAWS 5313 Copyright Litigation
- LAWS 5728 ePayment Systems Seminar
- LAWS 5315 Entertainment Law
- ENGL 525 Intellectual Property and the Construction of Authorship
- LAWS 5322 Intellectual Property & Dealing in
- LAWS 5323 Intellectual Property from a Business and Strategic Planning Perspective
- LAWS 4300 Intellectual Property Survey
- LAWS 5363 Intellectual Property Theory Seminar
- LAWS 5318 Intellectual Property Transactions
- LAWS 5319 International Intellectual Property
- LAWS 5320 Internet Business and Law
- LAWS 6505 Law, Technology and Internet Journal
- LAWS 5739 Law of Archeological Relics
- LAWS 5324 Law of the Music Industry
- LAWS 5325 Law of the Visual Arts
- LAWS 5335 Negotiation Strategies in Sports Management
- LAWS 5326 Patent Litigation
- LAWS 5327 Patent Prosecution
- LAWS 5334 Representing the Musical Artist
- LAWS 5333 Representing the Professional Athlete
- LAWS 5332 Sports Law
- LAWS 5317 The Intersection of Unfair Competition and Intellectual Property

Total Units 17

Public Law – Individual Rights and Social Reform

Required Courses
- LAWS 4806 Administrative Law 3
- LAWS 5717 Constitutional Law II 3
- LAWS 5731 Federal Courts 3

Elective Courses 8
- LAWS 6001 Civil Litigation Clinic
- LAWS 5212 Civil Law and Psychiatry
- LAWS 5711 Civil Rights
- LAWS 5712 Community Development Law
- LAWS 5908 Constitutional Law Research Seminar
- LAWS 5113 Counter-Terrorism Law
- LAWS 6021 Criminal Justice Clinic I
- LAWS 5213 Criminal Law and Psychiatry
- LAWS 4807 Criminal Procedure I
- LAWS 5718 Criminal Procedure II
- LAWS 5720 Death Penalty Law and Process
- LAWS 5721 Death Penalty Lab
- LAWS 5722 Death Penalty Lab II
- LAWS 5724 Discrimination in Employment
- LAWS 5725 Education Law
- LAWS 6031 Health Law Clinic I
- LAWS 5733 Immigration Law
- LAWS 5734 Immigration Law II
- LAWS 6101 Immigration Law Practicum I
- LAWS 5116 International Human Rights
- LAWS 5736 Juvenile Law
- LAWS 5743 Legislation
- LAWS 4402 Nonprofit Organizations
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**National Security**

**Required Courses**

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<td>Criminal Procedure I</td>
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<td>LAWS 5745</td>
<td>National Security Law</td>
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**Elective Courses**

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<td>Financial Integrity in Emerging Markets Lab</td>
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<td>Formation of Government Contracts</td>
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<td>Homeland Security/USCG Lab</td>
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<td>Immigration Law</td>
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Case Abroad at Home courses (National Security topic, with advisor approval)

Summer Institute courses (National Security topic, with advisor approval)

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Master of Laws (LLM)

Master of Laws

Programs for foreign-educated lawyers

Three different Master of Laws (LLM) programs are offered to students who have completed legal training outside of the United States. These programs allow students to spend one year in an intensive study program to gain exposure and immersion into the legal theory and practices of the U.S., and to engage in comparative study of the U.S. and other international legal systems. Building on a base of required courses specific to the International LLM programs, each LLM student will develop an individual plan of study leading to a Master of Laws degree in general United States and Global Legal Studies, or the more focused fields of Intellectual Property Law or International Business Law. Students in general United States and Global Legal Studies have the option to pursue a particular curricular concentration by consulting with the director of Foreign Graduate Studies and choosing a focus area in their elective courses.

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<td>U.S. Contract Law</td>
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<td>LAWS 4904</td>
<td>Doing Business in the United States</td>
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Each student's courses will be determined by the program director in consultation with the student and will be based on the student's prior legal education and interests. After completion of the degree requirements, students may elect to spend a summer internship with a law firm or corporate legal department in the United States. Further information and admission materials may be requested from the Foreign Graduate Studies Program office. (http://www.case.edu/law/llm)

International Criminal Law

The Master of Laws (LLM) program in International Criminal Law is a one-year advanced study program to students who hold the JD degree from a U.S. law school, or equivalent training from a school outside of the USA. It provides students with an in-depth knowledge of international criminal law and procedure, international humanitarian law, and national security law, and will equip them to practice international criminal law before international tribunals or national courts. Students will plan their course of study by working closely with the Program Director. Selected students will also have the opportunity to participate in one of our International Criminal Tribunal Externships during one of their semesters in the program.
School of Law Courses

Courses

LAWS 1100. Introduction to Lawyering. 1 Unit.
This course is the first component of the CaseArc Integrated Lawyering Skills Program. It is an introduction and orientation to the study of law and lawyering skills. The course introduces students to issues of professionalism, interviewing skills, the trial and appellate processes as well as legal analysis, writing and argumentation. It also introduces students to skills for preparation and participation in the law school classroom and to comparative analysis of different legal systems. The course is required for all entering students and is scheduled each day of the week prior to the beginning of regular classes in the fall semester.

LAWS 1101. Contracts. 4 Units.
The formation of a contract; problems of offer and acceptance; consideration; the question of contract breach; damages and remedies for a breach. Required.

LAWS 1102. Criminal Law. 4 Units.
A basic course in substantive criminal law, dealing with the standards to be used in defining and punishing criminal behavior. The course includes discussion of crimes and criminality; culpable mental states; causation; insanity; attempt and complicity; homicide; and rape. Required.

LAWS 1103. Torts. 4 Units.
This course covers compensation of an injured party for harm resulting from intentional or unintentional acts and omissions of others. Consideration is given to the rules, rationale, and policy underlying tort liability. The course includes analysis of assault and battery, false imprisonment, negligence, standard of care, duty, risk, causation, liabilities and rights of landowners and land users, liability relating to dangerous activities and defective products, liabilities arising from special relationships or specially recognized legal interests, and defenses. Required.

LAWS 1201. Civil Procedure. 4 Units.
A broad survey of the procedural development of a lawsuit is undertaken, tracing the various steps from pleading and discovery to trials and judgments. Modern procedural issues involved in jurisdiction of the courts, venue, choice of law, and former adjudications are discussed. Throughout the course principal attention is given to the Federal Rules of Civil Procedure. Required.

LAWS 1202. Constitutional Law I. 4 Units.
The constitutional system of the United States; judicial function in constitutional cases; the division of powers between the nation and the states and within the national government; the powers of the president; national and state citizenship; and constitutional limitations on the powers of the states and nation for the protection of individual liberties. Required.

LAWS 1203. Property. 4 Units.
The nature of property interests; estates in land and future interests; concurrent ownership; landlord-tenant; transfer of property interests; easements, covenants, and equitable servitudes; nuisance; and zoning. Required.

LAWS 1801. Core 1: Research, Writing, and Skills. 0 Units.
This course is the first of a sequence of required courses in the CaseArc Program which trains students in the fundamental skills of practicing law. Students are introduced to the fundamentals of legal analysis and rhetoric beginning with objective written legal analysis. In addition, they receive instruction in manual and, to a limited extent, computerized legal research. Finally, students begin to develop the basic skills of interviewing, fact gathering and client counseling. The course is taught by a combination of classroom instruction, small group discussions and through performance and critique of simulation exercises. The goal is to integrate the learning and application of legal theory, doctrine and practice in an authentic manner. Students are assigned to an instructional team consisting of a doctrinal professor, a research, analysis and writing professor, a clinical professor, a skills professor and a librarian. The team coordinates the assignments and exercises so that students are provided a learning experience that combines lecture, discussion, and hands-on experience. Students must take this course in the fall semester of their first year.

LAWS 1802. Core 2: Research, Writing, and Skills. 4 Units.
This course is the second of the sequence of required courses in the CaseArc Program which trains students in the fundamental skills of practicing law. Students build on their learning in CORE 1 by confronting more complex and challenging problems. The format of the course and teaching methods are similar to CORE 1, but the writing component of the course shifts from the objective mode to the persuasive, and the research component incorporates electronic research in depth. In addition, the students learn more complex fact gathering, document analysis, and counseling. Finally, students are introduced to negotiation theory and technique and to the principles of effective oral presentation in formal and informal settings. Students must take this course in the spring semester of their first year. Recommended preparation: LAWS 801.

LAWS 2001. Professional Responsibility. 3 Units.
This course deals with questions underlying the responsibilities of the lawyer, as a professional, to self, society, client, and the profession. Premises concerning the lawyer’s role or roles within the context of the adversary system are examined in some detail, as is the idea of professionalism. The Model Code of Professional Responsibility and the Model Rules of Professional Conduct are analyzed as generalized statements of the aspirations and obligations of lawyers, and as applied to concrete problems. Required.

LAWS 2803. Core 3: Transaction, Writing, and Skills. 2 Units.
This is the third of the required sequence of four courses in which students are introduced to the fundamental skills of practicing law. Students build on their learning in CORE 1 and CORE 2 by applying the principles of legal research, analysis, writing, interviewing, counseling and negotiation in the transactional setting. Students also learn about the challenges of applying these lawyering skills in the representation of groups and entities. The format of the course and teaching methods are similar to CORE 1 and CORE 2. Students must take this course sometime during the second year of law school, in either the fall or spring semester.
LAWS 2804. Strategic Representation and Communication. 2 Units.
This is the fourth of the required courses in the CaseArc program in which students are introduced to the fundamental skills of practicing law. Students perform the major steps in the process of representing one client from initial interview through a negotiated resolution. As in actual law practice, students will mix independent individual work with collaboration with other student lawyers. Students independently interview and counsel their clients, research, negotiate and communicate with the client and opposing counsel. Students collaborate with their colleagues to share investigation facts, explore legal issues, assess the client’s situation, decide how best to present the client’s position, form legal strategies, and prepare for negotiation. Students perform and receive extensive individual feedback on interviews, client counseling and negotiation, and produce a variety of associated writing assignments. Each class section is organized around a single legal case involving two parties, in one of three subject areas: civil litigation, transactional practice, and criminal practice. Prereq: LAWS 803.

LAWS 4101. International Law. 2 Units.
An introduction to basic comparative, transnational, and international law disciplines. Using areas of substantive and procedural law familiar to first-year students, the course examines issues arising from cross-national activity. Students are exposed to choice of law, comparative law, international law, and international institutions.

LAWS 4200. Bioethics and Law. 2 Units.
This course will explore how the legal and policy systems reconcile competing values and interests in controversies surrounding the practice of medicine. Case law, legislation, administrative law, and institutional policies will be examined, as well as selected commentary from the legal, medical, and philosophical perspectives. Substantive topics will include end-of-life issues, informed consent, use of new reproductive technologies, and other timely subjects in bioethics.

LAWS 4201. Health Law. 3 Units.
The course examines the nature and structure of the health care system; the relationship between patient, provider, and payer; private legal controls on health care delivery such as malpractice and informed consent law; and public controls in the form of government regulatory and payment programs. Offered as HSMC 427 and LAWS 227.

LAWS 4300. Intellectual Property Survey. 2 Units.
This course is designed to provide students with an overview of several areas of law traditionally associated with intellectual property or IP, including copyright law, which pertains to the protection of literary, musical, and artistic creations and has issues replete with First Amendment implications; patent law and trade secret law, which focus on the protection of technological works ranging from chemical formulae, to software, to biotechnology; and trademark law, which relates to the goodwill associated with corporate identity and product recognition. We will also devote time to the study of the philosophy and economics of intellectual property keeping in mind, throughout the course, the need to strike an optimal balance between incentives to create and commercialize intellectual creations on the one hand and public access to these creations on the other hand.

LAWS 4301. Copyright Law. 3 Units.
Copyright law is the in-depth study of the legal doctrine and policy relating to the protection of one’s artistic, literary, musical, and computer-related expression. We will focus primarily on the 1976 Copyright Act and amendments thereto, such as the Digital Millennium Copyright Act of 1998.

LAWS 4302. Patent Law. 2 - 3 Units.
Basic concepts of patent law as property considered primarily in its substantive aspects, including the relationship to other forms of protection and intellectual property, infringement, and statutory requirements for patents.

LAWS 4303. Trademark Law. 3 Units.
Trademark Law is the study of how commercial entities use words and designs to identify the source their products and services in the minds of consumers and competitors. This course focuses on domestic and international trademark acquisition, retention, transfer, registration, and infringement. In addition to the common law of trademarks and unfair competition, much of this course will be devoted to studying the statutory scheme of federal trademark law.

LAWS 4401. Business Associations. 5 Units.
This course is an introduction to the law of business associations, including general and limited partnerships, limited liability companies, and corporations. The functions and relationships of enterprise participants, primarily promoters, equity owners, creditors, and managers are investigated. The course covers pre-organizational problems and then canvasses the roles of ownership and management, with emphasis on the special duties (fiduciary and other) imposed on certain participants in publicly and closely-held entities. The regulation of securities fraud, proxy voting and solicitations, and the issuance of securities under the federal securities laws is explored. Fundamental concepts of business financing, including valuation of the concern and claim structure, are investigated. Organic changes, including dissolutions, mergers, and tender offers, are discussed.

LAWS 4402. Nonprofit Organizations. 3 Units.
Explores the rationales for the existence of the nonprofit sector and the allocation of certain functions to it. The focus is on the legal framework for the structure and operation of nonprofit organizations under state nonprofit corporation statutes and the policy and practice of preferred tax treatment for selected organizations and gifts to them under the Internal Revenue Code.

LAWS 4404. Sales. 3 Units.
One of the basic courses in commercial law. It serves equally as an introduction to the general organization, structure, and appropriate application of the Uniform Commercial Code. Primarily we study the law of Sale of Goods under Article 2 of the U.C.C. Necessarily this includes a study of products liability law, which is explored under both sales warranty and strict tort liability theories. The interrelationship between these competing theories of products liability law are also investigated. Other specific topics studied are the legal rules applicable to 1) the formation of sale contract, including the battle of the forms, statute of frauds, and parol evidence rule, 2) performance of and excuse of performance from the sales contract, 3) title warranties and title transfers, and 4) remedies for breach of the sales contract. Students may not take both LAWS 381 and LAWS 266 (Sales and Secured Financing).

LAWS 4405. Federal Income Tax. 4 Units.
An introductory course in federal income taxation of the individual taxpayer, including a consideration of the nature of income, specific statutory exclusions, business and nonbusiness deductions, the treatment of capital gains and losses, and elementary tax accounting.
LAWS 4701. Dispute Resolution. 2 Units.
This course will examine the characteristic methods by which American courts resolve disputes, and will then compare those methods with those used by alternative institutions of dispute resolution such as administrative agencies, arbitration, and mediation negotiation. In resolving disputed issues of law, American courts are constrained by doctrines of precedent, stare decisis, and the principles of statutory interpretation, all of which will be treated in some depth in the course. Disputed issues of fact in American courts are commonly decided by juries consisting of ordinary citizens, and the course will explore a number of features of the jury as it impacts litigation in courts. The portion of the course devoted to alternative dispute resolution will involve some simulations and role-playing exercises. There will be a single examination at the end of the term which will be the primary basis for grading.

LAWS 4702. Courts, Public Policy, and Social Change. 2 Units.
Examines the social impact of law and use of social research in the legal process, assesses efforts to use law to effect social reform, and empirical studies of legal processes and institutions. Recommended preparation: Graduate standing or consent of department. Offered as LAWS 285 and POSC 429.

LAWS 4703. Executive Compensation: An Introduction to Business Law. 2 Units.
This course introduces students to the broad area known as business law. Among the areas introduced will be the laws of business organizations (including differences in management and corporate governance among different types of entities), securities regulation (both disclosure and registration requirements), drafting of complex contracts, taxation (of entities and individuals), and professional responsibility, and the business lawyer’s interface with other lawyers (specialists in intellectual property, employment, or litigation) and non-lawyers such as board members, accountants and business consultants.

LAWS 4806. Administrative Law. 3 Units.
This course examines the legal and institutional framework within which agencies administer regulatory statutes, with emphasis on procedural and constitutional issues. Major themes include limiting arbitrary action, controlling agency discretion, and promoting governmental accountability. Examples and problems are drawn from a wide range of substantive areas, including business, communications, consumer protection, education, environmental, health and safety, intellectual property, labor and employment law, and real estate law.

LAWS 4807. Criminal Procedure I. 3 Units.
The investigatory stage of the criminal process. Constitutional limitations on searches and seizures, interrogation practices, and pretrial identification procedures are examined. In addition, the exclusionary rule, the principal method for enforcing Fourth, Fifth, and Sixth Amendment rights, is considered.

LAWS 4808. Evidence. 4 Units.
A comprehensive course in the law of evidence as applied in civil and criminal cases. Subjects include relevance, hearsay, judicial notice, privileges, examination of witnesses, expert and lay opinion testimony, and real, demonstrative, and scientific evidence. This course deals with both the practical applications and theoretical underpinnings of the Federal Rules of Evidence and common law precedents. Students may not take both LAWS 207 and LAWS 212.

LAWS 4809. Wills, Trusts, and Future Interests. 4 Units.
A survey of the law of intestate and testate succession, will substitutes, private and charitable trusts, fiduciary administration, and future interests (including the Rule Against Perpetuities).

LAWS 4810. Entering the Profession. 2 Units.
This course provides an introduction to the testing formats and required skills common to bar exams in United States jurisdictions, including the Multistate Bar Exam (MBE, multiple-choice format); the Multistate Performance Test (MPT, task-oriented essay); and essay questions in various substantive areas (which generally incorporate some state-specific content). Substantive content will be presented to provide raw material for practice testing. Students will earn the course credit by attending at least 80% of class sessions and completing 100% of written assignments with at least 65% success rate. Rewrites and retests will be allowed on request. The course does not comprise complete preparation for any bar exam. Rather, it provides familiarity, study strategies, and test-taking instruction along with limited substantive content.

LAWS 4901. Foreign Graduate Seminar. 2 Units.
This seminar is the required introductory course for foreign students enrolled in the Graduate Program in U.S. Legal Studies. It begins with a series of lectures introducing students to American legal education; American government, courts, and culture; various common law subjects; and professional responsibility. Throughout the year seminar sessions are held with legal practitioners from law firms and corporations in the Cleveland area who are involved in an international practice. Limited to the foreign LL.M. students.

LAWS 4902. U.S. Legal Writing for Foreign Law Graduates. 0 Units.
This course is designed to teach English compositional skills and grammar for legal studies. With an English-as-a-second-language focus, this course will seek to teach students the various steps of the writing process, English grammar, and certain aspects of legal composition. The main goal of this course is to enable students to write clearly and correctly within U.S. legal studies and the U.S. legal work place. The course will meet twice a week for one hour. Students will be required to take this course based on a written exam administered at the beginning of the semester. Students must receive a grade of at least a C to pass out of the course.

LAWS 4903. U.S. Contract Law. 3 Units.
The subject matter and coverage of this course is approximately the same as the subject matter and coverage of first-year Contracts (LAWS 123) as abbreviated and modified to reflect that it (a) is limited to foreign students who are candidates for the LL.M. in U.S. Legal Studies and (b) consists of 3 (not 5) credit hours.

LAWS 4904. Doing Business in the United States. 3 Units.
The course is designed to introduce foreign students to many areas of U.S. domestic law through consideration of a transnational business transaction. Examples of areas of law covered: restrictions on foreign investment, regulatory agencies, banking and finance, importing and exporting, business entities, litigation and alternative dispute resolution, labor relations, immigration law, taxation. Limited to candidates for the LL.M. in the U.S. Legal Studies.

LAWS 4905. Business Associations for LL.M. Students. 3 Units.
This course is an introduction to the law of business associations including general and limited partnerships, limited liability companies, and corporations tailored to their specific needs.
LAWS 4906. Evidence. 3 Units.
This is a comprehensive course in the law of evidence as applied in civil and criminal cases. Subjects include relevance, direct and cross-examination, impeachment, character, expert and lay opinion testimony, and hearsay. A problem-oriented approach is used to highlight both the practical applications and theoretical underpinnings of rules of evidence. Students may not take both LAWS 207 and LAWS 212.

LAWS 5110. Contemporary Issues in International and Comparative Law. 1 Unit.
The objectives of the course will revolve around initiating students to the basic concepts and principles of comparative law reasoning and helping students make sense of the increasing dialogue between jurisdictions practicing constitutionalism in a global context with a focus on human rights issues. The coverage of the proposed course will select from the following themes depending on student interest and availability of materials: (a) Freedom of religion, secularism and culture; (b) Freedom of expression and hate propaganda; (c) Freedom of expression and sexual representation; (d) Equality and same sex unions; (e) Assisted suicide; (f) Death penalty; (g) Implementation of human rights in federal or quasi-federal politics; (h) Socio-economic rights; and/or (i) Cultural rights.

LAWS 5111. Admiralty Law. 2 Units.
The general principles of admiralty law including jurisdiction, practice, maritime liens, collisions, salvage, limitation of liability, and the rights of injured maritime workers.

LAWS 5112. Canada-United States Law Institute Seminar. 2 Units.
Canada-US Legal Relations provides students with a broad examination of the issues confronting the Canada-US relationship. Topics discussed include comparative constitutional law, North American trade & investment law, immigration, Canada-US border security, and environmental issues -- including the Great Lakes. The course includes lectures by practitioners and government officials. Students are required to author a paper that may be published in Canada-US Law Institute material and journals.

LAWS 5113. Counter-Terrorism Law. 3 Units.
This course will take an in-depth look at counter-terrorism in the United States, Israel, and other countries. The course will examine the competing conceptions and definitions of terrorism at the national and international level and the institutions and processes designed to execute the "war on terrorism." This will include study of the balance between security and liberty policies in the U.S. Patriot Act, the use of military tribunals or civil courts, the use of assassination or targeted killings, and the emerging law on enemy combatants and their detention, and the arguable need for new self-defense doctrines at the global level. Prereq: LAWS 327.

LAWS 5114. European Union Law. 2 - 3 Units.
After a brief introduction to the institutions and organs of the European Community, the legal aspects of the internal operations of the Community will be discussed. Special emphasis will be placed on the external impact of Community law, for example, its trading rules, company law, and business competition law, as well as its rules governing the free movement of goods, services, capital, and persons. The concept of European citizenship will also be dealt with.

LAWS 5115. International Arbitration. 2 Units.
An advanced course covering the current status of arbitration as a dispute settlement mechanism in international affairs. This course will cover the use of arbitration as a means of resolving international disputes: a) between private parties; b) between private and governmental parties; and c) between governments. It will cover possible forums and rules of arbitral dispute resolution and the problems of the enforcement of foreign arbitral awards. Special aspects of dispute resolution in certain geographical and subject areas will be covered as will be the problem of sovereign immunity. Disputes arising from multinational business transactions will be focused on as will be maritime, environmental, and border disputes.

LAWS 5116. International Human Rights. 3 Units.
This course will cover a variety of issues in the area of international human rights. Issues covered will include the law of treaties and treaty interpretation; international organizations' and non-governmental organizations' roles in protecting human rights; the rights of women and minorities; critiques of the idea of "universal" human rights; and the Alien Tort Claims Act. In addition to covering the procedure and substance of the international system for protection of human rights, we will also discuss human rights under various domestic legal systems from a comparative perspective. Grade is based on the final exam, class participation and possibly a group project.

LAWS 5117. International Organizations. 3 Units.
Deals with legal issues surrounding some common characteristics of intergovernmental organizations having wide membership, with an emphasis on the United Nations systems. Many of the issues are constitutional or procedural; that is, they have to do with the powers of, and restrictions upon, the organizations or their members as set forth in the constituent instruments of the organizations or as developed in practice. Issues such as eligibility for membership and termination thereof, rights and obligations of members, dispute resolution, and legislative procedures will be addressed comparatively. The growth of international law through intergovernmental organizations is also addressed.

LAWS 5118. International War Crimes Project. 3 Units.
Students in this unique course undertake legal research projects for various international criminal tribunals (including the International Criminal Court and the tribunals in Cambodia and Sierra Leone, among others). They prepare memoranda on selected issues related to current tribunal cases. The course sessions explore the development of international criminal law and the establishment of the tribunals, as well as their jurisprudence and their Rules of Procedure and Evidence. Grades are based on the quality of student papers and in-class presentations. Completed research projects along with their accompanying source notebooks become part of the tribunal libraries.

LAWS 5119. Intervention Law: Iraq and Vietnam. 3 Units.
Using the examples of American intervention in Vietnam and Iraq, this course examines some of the international and domestic legal issues raised by war and military intervention. Among the topics covered will be the legal justifications for intervention and the arguments for the illegality of the two wars; constitutional limits on executive war making powers; the justiciability of issues of war and peace under U.S. law; the draft, the volunteer army, and conscientious objection; GI rights and GI dissent; the law of war and international humanitarian law and the recurring problems of massacre, murder, and torture.
LAWS 5120. International Business Transactions. 3 Units.
This course examines various types of international business activities from a transactional perspective. It focuses on international sales, international payments, and international licensing transactions and examines the different legal systems (state, federal, international) that may impact on these transactions. It also considers commercial aspects of the interpretation of cross-border contracts, dispute resolution concerning cross-border contracts, and the role of lawyers. Some basic issues relating to private international law/conflicts of law are also addressed. There is also some introductory coverage of international electronic commerce transactions and related legal issues.

LAWS 5121. International Criminal Law and Procedure. 3 Units.
This course surveys selected issues and current problems involving the criminal aspects of international law and the international aspects of criminal law. The course begins with an introduction to the origins and purposes of international criminal law. We will then explore the contours of the duty to prosecute those who commit international crimes. Next, we will focus on application of domestic and international law to the question of jurisdiction over international criminal activities. This is followed by three units examining substantive international criminal law as contained in multilateral treaties concerning terrorism, war crimes and crimes against humanity. Next, we will explore the procedural aspects of international cooperation in criminal matters, with particular attention to extradition and problems associated with obtaining evidence from abroad. We will also analyze the reach of U.S. constitutional protections to U.S. investigative and law enforcement activities overseas. Finally, we will study the new Yugoslavia and Rwanda War Crimes Tribunals and the permanent International Criminal Court. The class will be seminar-format, with short writing assignments, weekly simulations, and role-play exercises designed to bring the materials to life. There will be no final exam.

LAWS 5122. International Litigation Research Seminar. 2 Units.
This seminar focuses on the litigation of transnational disputes in domestic courts. Topics include jurisdiction, international service of process procedures for obtaining evidence internationally, and the international enforcement of judgments. Students will complete a substantial research paper and will present the results of their research to the class.

LAWS 5123. International Trade and Development. 3 Units.
The public international and United States law regulating international trade. (The private law of international trade and investment is dealt with in International Business Transactions, LAWS 354.) It includes the economic theory of international trade (although no exposure to a course in economics in secondary or undergraduate education is necessary) as well as a legal examination of issues regulating global and regional (e.g., the Canada-U.S. Free Trade Agreement, EEC) international trade. Primary emphasis is on the General Agreement of Tariffs and Trade (GATT) and the World Trade Organization (WTO) as well as such United States legislation implementing the GATT as antidumping and countervailing duties legislation and escape clause relief. The roles of trade and aid are also explored, as well as U.S. legislation affecting the transfer of resources to less developed countries.

LAWS 5124. Islamic Law. 2 Units.
This course will cover major aspects of the Islamic Law. It will provide students with a better understanding of Islam and its adherents. Many topics related to Islam and its basic beliefs, including some contemporary issues, will be covered in this course.

LAWS 5125. Jewish Law. 2 Units.
LAWS 5126. NAFTA and Bilateral Trading Agreements. 1 Unit.
Since the World Trade Organization Doha Negotiations have stalled, countries increasingly look to bilateral and regional trading arrangements as a viable alternative to multilateral negotiations. This course is a four day, one credit course examining the legal and policy considerations with respect to bilateral and regional trading arrangements, using the Canada-U.S. FTA, NAFTA, U.S.-Chile FTA, Canada-Chile FTA, and various United States, Australian and Asian bilateral trading arrangements. The faculty will cover both the legal aspects considered in the negotiations and also the practical considerations of negotiators.

LAWS 5131. Global Corporate Governance Lab. 3 Units.
This Lab will involve students in an integrated experience of academic research and public service. Students will work on research projects on corporate governance law and policy for publicly owned companies in emerging markets such as India, Russia, Turkey, and South Africa. The course will engage students in projects for a variety of organizations involved in improving corporate governance in emerging markets, including the Organization for Economic Cooperation and Development (OECD), the International Fiscal Corporation, the Institute of International Finance (IIF), and locally based governmental and non-governmental organizations. Students will study and research key aspects of corporate governance, including minority shareholder protection, the structure and responsibility of the board of directors, accounting and auditing requirements, transparency of shareholder ownership and control, and enforcement as they apply to emerging markets. Special attention will be paid to the importance of fashioning rules appropriate for the economic, social, and legal environment of each jurisdiction.

LAWS 5132. Homeland Security/USCG Lab. 3 Units.
The DHS/USCG Lab will provide students with the opportunity to conduct research and prepare legal memoranda addressing issues submitted by the US Department of Homeland Security and the United States Coast Guard. Students will meet for lecture sessions that provide a background into the issues presented, including border security, Great Lakes laws, immigration, administrative law, and the environment. The student’s work product will be submitted to, and utilized by, DHS/USCG.

LAWS 5133. Terrorism Prosecution Lab. 3 Units.
This lab will involve students in an integrated experience of academic research and public service. Students will work on research projects in counter-terrorism law in the United States, Israel and other countries. The course will engage students in projects for a variety of organizations that are trying to develop expertise in counter-terrorism law, including U.S. attorney offices, thinktanks, defense attorneys, international governmental and non-governmental organizations. Students will study and research various aspects of counter-terrorism in the U.S., foreign countries, and at the international level, including the balance between security and liberty policies in the U.S. Patriot Act, the use of military tribunals or civil courts, the use of assassination or targeted killings, and the emerging law on enemy combatants and their detention, and the arguable need for new self-defense doctrines at the global level. Prereq or Coreq: LAWS 78.
LAWS 5136. International Humanitarian Law. 1 Unit.
This course is designed to prepare the student members of the Jean Pictet Competition team, but is open to all students with an interest in international humanitarian law. The course will be taught in two all-day Friday-Saturday sessions in January and February by international humanitarian law expert Gregory Noone, who is currently a fellow at the U.S. Institute of Peace and was previously Head of the Foreign Military Rights Affairs Branch of the Office of the Judge Advocate General at the Pentagon. Using case studies as well as simulations and role-playing exercises, the course will address the field of international humanitarian law as a whole, including the law of armed conflict, international criminal law, international human rights law, and the role of international organizations such as the ICRC and U.N. The objective of the course is to convey the reality of international law. Like humanitarian law itself, the course will not deal solely with legal disputes or judicial matters, but with practice and real life situations. The course grade will be based on a paper that will not satisfy the Writing Requirement.

LAWS 5137. Chinese Law. 3 Units.
This seminar will introduce students to the functions, purposes, and ongoing institutionalization of the law in the People’s Republic of China. After briefly examining China’s modern and traditional history, we examine the legal system’s role in the political, social and economic development of China. Over the semester, we will investigate several areas of law--constitutional law, criminal law, economic law, property and intellectual property--and then highlight topics of particular concern to the international community, such as human rights, the WTO and China’s commitment to international law. The goal is for students to understand both internal legal developments within China, the increasingly important role China plays on the global stage, and (ideally) to reflect upon the American legal system.

LAWS 5161. Legal History of European Union Seminar. 3 Units.
The seminar introduces students to the history, development, and present structure of the legal system of the European Union from the ECSC in 1951, through the Treaty of Rome in 1957, to the Treaty of Amsterdam in 1997. The seminar will examine the “constitutional” structures and institutions of the European Union, including the emergence of a binding jurisprudence from the European Court of Justice; will look at general interpretive principles emanating from the European civil law tradition, such as the doctrines of subsidiarity and proportionality; will explore the public law of the European Union, the "four freedoms," human rights, and equal treatment of women and men; and will briefly treat private law rights emergent not only from treaty and parliamentary enactment but from Union jurisprudence. The seminar will concentrate on the historical and economic context, but legal doctrine and practice will also be considered.

LAWS 5202. Bioethics and Law. 3 Units.
Students will be introduced to the basic principles of bioethics and health care law, and to the ways in which these principles apply to specific problems arising in clinical and policy settings. Readings and class discussion will first examine the philosophical framework and the basic moral theories relevant to modern bioethics. After the survey, bioethical issues in the following broad topics may be covered: defining life, including human reproduction, surrogacy and fetal-maternal conflict; euthanasia and the prolonging of life including the right-to-die, medical futility, and advance directives; termination of treatment for children; genetic screening; hospital ethics committees; access to care and the politics of health care in the 90s; and ethics in the business of medicine. Readings will consist of legal cases and documents, statutes, regulations and articles from the academic and the lay press. Grade is primarily based on an exam. Both an oral class presentation and a short paper are optional to supplement the grade, but not to replace the exam. Attendance and class participation are also considered for grading purposes.

LAWS 5203. Food And Drug Law. 2 Units.
This course examines the federal Food, Drug and Cosmetic Act. It will entail a detailed look at the law, policy statements, and literature related to approving new drugs and devices. The course covers such topics as human subjects research; product labeling and testing; OTC vs. prescription status; compassionate use exceptions; control of biotechnology techniques; differences between food, drugs and devices; and FDA enforcement. We will also explore how law and the legal system anticipate and also respond to changes in technology in ways that may enhance or inhibit the development of new technologies and new applications of old technologies. Attendance at classes is mandatory. Grade is based on final exam.

LAWS 5204. Genetics and Law. 3 Units.
The current federal Human Genome Project is attempting to understand the health and behavioral implications of the 50,000 to 100,000 genes in the human body. Genetic tests are being offered to let people know if they are at risk of having a child with a genetic defect or if they will later in life suffer from cancer or other disease. Genetic predispositions are also being investigated for certain behaviors such as gay sexual preference, intelligence, and anti-social behavior. This course will cover the tort law, family law, constitutional law, criminal law, employment law, and insurance implications of developments in genetics.

LAWS 5205. Public Health Law. 2 Units.
This course surveys a range of issues in public health law including contagious diseases, health surveillance and privacy, tobacco, controlled substances, obesity, firearms, emergency preparedness and bioterrorism. It is designed to introduce students studying law or public health to the basic constitutional principles involved in public health law; the scope of local, state and federal authority to regulate; and the variety of ethical issues that arise.

LAWS 5210. Biotechnology Law and Practice. 2 Units.
Through the lenses of being counsel to a fictional start-up biotechnology company, the class will discuss, analyze and address the typical legal issues such a company faces in its first year of existence. In particular, the course will cover: 1. Corporate formation and governance issues; 2. Intellectual property protection and licensing; and 3. Fund-raising. Prereq: LAWS 261 and LAWS 229.
LAWS 5211. Biotechnology Law and Policy. 2 Units.
This course is designed to expose the law student and graduate student in science or business to the legal, business, and policy issues relevant to the biotechnology industry. We will cover issues related to patents, corporate organization and financing (particularly venture capital as it relates to the Start-Up Biotech Company), licensing and other transactions, regulatory issues relevant to the Food and Drug Administration, university technology transfer, and academic conflicts of interest. Prereq: LAWS 229.

LAWS 5212. Civil Law and Psychiatry. 2 Units.
The interaction between law and psychiatry in the rights of persons with mental disabilities in the community and in treatment settings. Topics include involuntary commitment, suicide, guardianship, psychiatric malpractice, psychic damages, special education, confidentiality and child abuse and custody. Students will test the analysis of legal issues against actual experience (videotaped interviews, visit to a state mental hospital). The course is jointly taught by a psychiatrist and an attorney specializing in mental health law.

LAWS 5213. Criminal Law and Psychiatry. 2 Units.
The interaction between criminal law and psychiatry: psychiatric diagnosis and treatment, competence to stand trial, the insanity defense, malingered mental illness, infanticide, stalking, violence, sexual predator laws, and direct and cross-examination of mental health experts. Videotaped examples serve as a basis for discussion. A visit to the Justice Center Court Psychiatric Clinic is included. The course is taught jointly by a psychiatrist and an attorney specializing in mental health law.

LAWS 5214. Current Topics in Health Law. 2 Units.
The course will cover 13 different current topics that students are likely to confront in the practice of health care law. Each topic will be presented by a leading practitioner in the field, who will provide appropriate reading materials. The presentations will be followed by student discussion led by a visiting faculty member. The grade will be based on class participation and an examination.

LAWS 5215. Health Care and Human Rights. 3 Units.
This course combines two areas of law of increasing importance and public attention. In light of emerging medical, research, and genetic technology, courts, legislatures, administrative agencies and ordinary citizens around the world often face issues of health law. At the same time, in a world that is becoming both globalized and plagued by repeated instances of ethnic cleansing and other catastrophic abuses, issues of human rights are at the forefront of public debate. The intersection of health care and human rights, therefore, constitutes a worthy and fascinating area of study. Topics to be covered will be selected from among the following: 1) an overview of relevant human rights doctrines; 2) the concept of public health; 3) the status of the right to health care in different countries; 4) biomedical research involving human subjects; 5) genetic technologies; 6) disability rights; 7) women’s reproductive and health issues; 8) environmental abuses and human rights; 9) infectious disease, bioterrorism, and human rights; and 10) war crimes and other human rights abuses, as they impact public health.

LAWS 5216. Health Care and the Constitution. 3 Units.
Is there a constitutional right to resist all unwanted medical interventions? Is there a constitutional right to access medical interventions at one’s own expense? What, if any, are the constitutional limits on the government’s ability to regulate health care and the practice of medicine? This seminar will focus on the constitutional aspects of health care law. Topics will vary year to year but may include abortion, the “right to die,” compulsory vaccination, medical marijuana, access to unapproved drugs, and minors’ rights to make medical treatment decisions.

LAWS 5217. Health Care Professions. 2 Units.
Class is intended for (and limited to) students interested in health law who do not have training or experience in a health care profession. Instructors and guest speakers will cover the history of medicine, the scientific method, clinical research, medical ethics, techniques for researching medical and scientific questions, medical training, and medical professionalism. Letter grades will be given based on regular attendance and participation, an oral presentation, and a paper. Prereq or Coreq: LAWS 227. The course is not open to bioethics Master’s degree candidates. (BETH)

LAWS 5218. Health Care Regulation. 3 Units.
Course covers the administrative regulation of health law. The course will discuss the intersection of health law and administrative law by first reviewing administrative law concepts, such as delegation, and then discuss how these concepts are applied in health law.

LAWS 5219. Health Care Transactions. 2 Units.
This course will examine a variety of typical transactions among health care providers and payors. Students will have the opportunity to understand the financial motivation behind these transactions and to identify the unique health care law issues presented by them. Students will learn to develop alternative methods for structuring transactions to minimize or avoid such issues. The types of transactions to be examined include: physician recruitment, physician practice acquisitions, physician practice management companies, joint ventures between hospitals and physicians, mergers and acquisitions of health care providers, and formation of integrated delivery networks. Enrollment is limited to 25. Recommended preparation: LAWS 295.

LAWS 5221. Hospital and Physician Organization Law. 2 Units.
This course presents an overview of corporate health care law issues including: public and private reimbursement systems, fraud and abuse, physician self-referrals, corporate practice of medicine/fee splitting, certificate of need, tax-exempt status of health care providers, and antitrust and insurance regulation of health care providers. The course will examine the origins and public behind current corporate health care law and regulations and the issues they present for health care providers. Enrollment is limited to 25. Prereq or Coreq: LAWS 227.

LAWS 5222. Master Classes in Health Law, Policy and Ethics. 2 Units.
Leading experts in the fields of health law, health policy, and bioethics will each teach one master class on a topic of their choice under the coordination of the instructor. The course will be open to graduate and professional students. The grade will be based on class participation and an examination.
LAWS 5225. Research Ethics and Regulation. 2 Units.
This course is designed to introduce students to the ethical, policy, and legal issues raised by research involving human subjects. It is intended for law students, post-doctoral trainees in health-related disciplines and other students in relevant fields. Topics include (among others): regulation and monitoring of research; research in third-world nations; research with special populations; stem cell and genetic research; research to combat bioterrorism; scientific misconduct; conflicts of interest; commercialization and intellectual property; and the use of deception and placebos. Course will meet once per week for 2 hours throughout the semester. Grades will be given based on class participation and a series of group projects and individual short writing assignments. Offered as BETH 503, CRSP 603 and LAWS 603.

LAWS 5311. Computer Law and Policy. 2 Units.
This course will address the ever-evolving issues that relate to intellectual property protection for computer software, with a particular emphasis on patent, copyright, and trade secret protection. The relationship of the Internet to such protection will also be explored. Throughout the semester, the course will consider the nuances of this dynamic area of the law and will also provide pragmatic approaches to common problems faced by intellectual property practitioners. Prereq: LAWS 229 or LAWS 235.

This course will be the first Contemporary Issues in Law and Technology template course. The course will be co-taught by Craig Nard and Declan McCullagh (LTA Fellow in Law and Technology and Washington Bureau Chief for Wired News). The course will cover (1) overview of principles of First Amendment analysis and its relationship to the Internet and the Communications Decency Act; (2) filtering and private restrictions on Internet Speech; (3) threats and the compilation of personal information; and (4) tensions between the First Amendment and the Copyright clause in digital content.

LAWS 5313. Copyright Litigation. 2 Units.
This course will begin with an overview of a copyright litigation case and then proceed to discuss issues relating to pre-litigation strategy, infringement, and defenses to infringement. Thereafter, the course will explore the drafting of a complaint and the answer thereto, including counterclaims; drafting discovery documents; preparing witnesses; and taking and defending a deposition, which will take place in the context of a mock trial, many of the issues that pertain to a trial, including the roles of judge and jury, jury instructions, direct and cross-examination, jury selection, and post-trial motions. Prereq: LAWS 235.

LAWS 5314. Cyberlaw. 3 Units.
This subject deals with how the law regulates and otherwise applies to activities taking place in ‘cyberspace.’ It considers how existing legal principles are being modified and extended in the digital information age to meet the needs of society, particularly in relation to electronic commerce. As the nature of dealings in cyberspace develops and new legal problems emerge over time, the focus of the subject may change to reflect current legal issues. However, topics for discussion will be drawn from the following: the nature of the internet, legal regulation of cyberspace vs. self-regulation, the relevance of international law/ international regulation, e-commerce contracting, ‘property’ in cyberspace with particular reference to intellectual property, trademarks and domain names, defamation on the Internet, online crime (e.g., fraud, pornography, etc.), information privacy and security, online dispute resolution and associated conflicts of law issues.

LAWS 5315. Entertainment Law. 1 - 3 Unit.
This course is designed to introduce students to the basic legal issues relevant to the film and television industries, as well as live performances, theatre, and various other aspects of the entertainment industry.

LAWS 5316. I.T. Principles for Lawyers. 1 Unit.
This course is designed to allow students to achieve an overview of information technology terms and concepts.

LAWS 5317. The Intersection of Unfair Competition and Intellectual Property. 2 Units.
Traces the role of tort, contract, and property in filling the gaps between copyright, trademark, and patent. The trace implicates federal and state systems and a cluster of rights such as trade secrets, ideas, industrial design, common law copyright, and moral rights.

LAWS 5318. Intellectual Property Transactions. 3 Units.
Students will explore how companies develop business and legal strategies to protect their intellectual property assets through agreements with strategic business partners, content providers, vendors, and licensees. As part of the course, students will select a company name and protect it, draft and negotiate agreements, and hold a mock negotiation at the end of the semester. One prior course in patent, trademark, or copyright is required. Grade is based on a final examination.

LAWS 5319. International Intellectual Property. 3 Units.

LAWS 5320. Internet Business and Law. 1 Unit.
This course provides Law students with an understanding of legal issues that need to be addressed in the development of digital business at the level of web site management and transactions. The course also highlights the critical role of technology as a source of new legal requirements, and also as a means to address and enforce legal requirements that are critical in conducting on-line business (e.g., demand for authenticity, or non-repudiation).

LAWS 5321. International Issues in Intellectual Property Seminar. 3 Units.
This seminar will examine selected issues in comparative and international law affecting patents, copyrights, trademarks, and trade secrets. By looking at comparative systems, we will understand the differing philosophies underlying intellectual property in different legal cultures. By examining the movements to harmonize and unify national systems (looking at the process of harmonization, extraterritorial enforcement of rights, conflicts of law, and global protection), we will see how the different cultures are being merged. May satisfy the writing requirement. Recommended preparation: LAWS 370.
LAWS 5322. Intellectual Property & Dealmaking. 2 Units.
This course will provide you the opportunity to engage as an Intellectual Property (IP) specialist in a simulated M&A (merger and acquisition) corporate transaction. You will assume the role of an associate attorney in a law firm and handle certain aspects of the sale of assets of a business, including engaging in due diligence, reviewing and drafting documents, conducting research, analyzing negotiation techniques, learning about the specialist’s role in the transaction, and preparing for the closing of the transaction. Particular emphasis will be upon IP licensing (e.g., patent licenses, trademark licenses, etc.), such as reviewing and drafting IP licensing documents. You will learn skills that an IP lawyer should have by working on and resolving IP issues from actual projects. Accordingly, it is vital to your success in this course that you complete all assignments on time and actively participate in each class. Although this course is set within the context of a company acquisition, most of the IP issues you will be analyzing are generally applicable to many other projects that an IP associate will confront. Prereq: LAWS 261 and (LAWS 229 or LAWS 370).

LAWS 5323. Intellectual Property from a Business and Strategic Planning Perspective. 1 Unit.
Intellectual property rights are legally created business assets used by companies to provide a competitive advantage in the marketplace. Companies use intellectual property differently depending on many factors, such as industry, business strategy, culture and maturity. Intellectual property attorneys are considered valuable members of business teams, contributing to business strategy, business planning and other executive level business decisions. Indeed, IP is a boardroom issue. This class will study the ways intellectual property is used by different companies and how the intellectual property laws impact not only the intellectual property assets, but also the business strategy and business planning. In addition to learning how intellectual property is being used by major corporations, universities, and entrepreneurs/start-ups, the students will pick one company and study how that company manages its intellectual property. Prereq: LAWS 229 and LAWS 261.

LAWS 5324. Law of the Music Industry. 2 Units.
This course will cover the major components of the music industry, including recording agreements (major label and independent labels), record producer deals, songwriting and music publishing concepts, group issues, personal appearances, and music in cyberspace. There will be an extensive discussion of fundamental copyright, trademark, and cyberlaw concepts, as well as advanced copyright concepts specifically related to the recording and publishing industry. Special attention will be paid to the topic of musical copyright infringement litigation. Course materials will include selected cases, forms of the above agreements, and selected handouts. Guest speakers will include a variety of industry professionals, including personal managers, recording artists, record company executives, and concert promoters. Students will be invited to participate in a variety of special events, including attending a music industry seminar at The Rock and Roll Hall of Fame sponsored by Cleveland’s volunteer Lawyers for the Arts and attending the annual Mountain Dew High School Rock-Off held at the Odeon. Prereq: LAWS 235 or LAWS 370.

LAWS 5325. Law of the Visual Arts. 2 - 3 Units.
This seminar is concerned with the relationship between the art world and the law. The art world is comprised of numerous players, such as artists, dealers, museums, auction houses, art critics, forgers, thieves, looters, and the American and various foreign governments. This course focuses on the law’s relationship with each of these entities and how these entities relate to one another in both a cultural and legal sense. In particular, this course will explore at least three of the following issues: theft and plunder of art (especially from 1933-45); the illicit international art trade; artists’ rights such as First Amendment rights, copyright, moral rights, and the resale right; and the role and practice of museums in the art world, including provenance studies, and the museum’s relationship with the artist and community. The first class (and some subsequent classes) will be held at the Cleveland Museum of Art. After a lecture by a museum curator, the students will be given a tour of the museum’s collection that will focus on works of art that have particular relevance to the intersection of law and art. Prereq: LAWS 235.

LAWS 5326. Patent Litigation. 1 Unit.
This course will simulate a patent infringement case. Students will be asked to represent a client, and in that capacity will identify issues, provide legal advice, and prepare papers and pleadings as necessary. In particular, students will be asked to conduct a limited number of the following simulations: draft a complaint and an answer to the complaint, including counterclaims; draft discovery documents; perform a mock Markman hearing; prepare witnesses, including expert witnesses; take and defend a deposition; or prepare pre-trial.

LAWS 5327. Patent Prosecution. 3 Units.
This course will expose students to the issues and concepts of drafting a patent application. Topics include defining an invention, drafting a patent application, responding to Office Actions issued by the USPTO. Patent law is a prerequisite. Grade is based on three short papers and a multiple choice final.

LAWS 5328. Strategic Management of Intellectual Property. 2 Units.
The course will focus on real-world issues encountered by intellectual property attorneys (in-house and outside counsel). Issues and relevant case law relating to due diligence, litigation strategy, procurement, licensing, enforcement, and defense will be discussed. Specific areas will include: (1) How to identify and classify IP as well as develop a corporate framework for fostering creation of IP, extracting it, documenting it, securing internal rights (e.g., forbidding employees to search others patents to mitigate willful infringement liability), or searching in only non-patent literature. There are numerous issues that will be presented and discussed during the course.

LAWS 5330. Business of Baseball. 3 Units.
This course will bring the "business of baseball" to the students, and present them with an interactive "hypothetical" problem-solving dialogue with the instructor, which would deal with the most important issues facing major and minor league baseball today. Prereq: LAWS 261 and LAWS 391.
LAWS 5331. Representing the Athlete. 3 Units.
The emphasis of this course will be placed various aspects involved in
the providing legal services to professional athletes, including negotiation
tactics and letter and contract drafting. The class will include several
negotiation and drafting exercises as well as a simulated representative
relationship between the student and the entertainer/athlete. In the
context of a mock litigation/arbitration, students will also be required to
draft legal briefs in support of the contractual positions taken during the
contract drafting exercises.

LAWS 5332. Sports Law. 3 Units.
Sports and Entertainment Law is the study of legal issues and problems
relating to the music, television, and sports industries. This course
focuses on the applicability of various legal doctrines to these industries,
such as intellectual property law, labor law, and contract law. Also,
emphasis will be placed on negotiation tactics and letter and contract
drafting by conducting several negotiation and drafting exercises as well
as a simulated representative relationship between the student and the
entertainer/athlete. In the context of a mock litigation/arbitration, students
will also be required to draft legal briefs in support of the contractual
positions taken during the contract drafting exercises. Prereq: LAWS 211
and LAWS 261.

LAWS 5333. Representing the Professional Athlete. 2 - 3 Units.
This course will begin with an overview of the sports marketing industry
and then proceed to discuss one of the more important legal doctrines
relating to that industry, involving intellectual property, labor law, and
contract law. In that context, the course will explore the skills necessary
to conduct a series of sports-related contract negotiations. Students will
participate in group-based contract drafting exercises, including drafting
product endorsements and license agreements, with an emphasis on client
representations. Next, in the context of mock litigation, students
will assume a contract breach, and will be required to draft deposition
questions and legal briefs in support of their respective contractual
positions.

LAWS 5334. Representing the Musical Artist. 2 - 3 Units.
This course focuses on practical training in counseling the musical artist
with a particular focus on lawyering skills such as contract drafting,
strategic thinking and negotiation. We follow the artist from the early days
as a "baby band" to when the artist becomes "classic" or "heritage." You
will observe the artist in the recording studio, the interactions among
the band members, the creation of songs/sound recordings. You will
introduced to the cast of characters: the producer; the first manager;
the label's A&R person; the recording engineer, and others. You will-as
music lawyers commonly do- observe the artist creating in the studio
and on a live stage and get a chance to speak with prominent managers,
concert promoters, club owners, and artists.

LAWS 5335. Negotiation Strategies in Sports Management. 2 - 3
Units.
This course covers drafting of sophisticated contractual documents in
the Sports Law world. Document that will be negotiated and drafted
include a lease agreement between a municipality that is constructing a
new stadium/arena and the owner/operator of a team that will play in the
new venue. Also covered will be naming rights, presenting sponsorship
agreements for beverage/food, automobile/rental cars, and financial/
medical services. We will also examine coordination of all sponsorships in
the team's print-multimedia advertising, as well as with the broadcasts of
the team's games.

LAWS 5336. Intellectual Property Theory Seminar. 3 Units.
This course is designed to provide students with an overview of several areas of law traditionally associated with intellectual property
or IP, including copyright law, which pertains to the protection of
literary, musical, and artistic creations and has issues replete with First
Amendment implications; patent law and trade secret law, which focus
on the protection of technological works ranging from chemical formulae,
to software, to biotechnology; and trademark law, which relates to the
goodwill associated with corporate identity and product recognition.
We will also devote time to the study of the philosophy and economics
of intellectual property keeping in mind, throughout the course, the
need to strike an optimal balance between incentives to create and
commercialize intellectual creations on the one hand and public access to
these creations on the other hand. Prereq: LAWS 229 or LAWS 235.

LAWS 5341. Commercialization and Intellectual Property
Management. 3 Units.
This interdisciplinary course covers a variety of topics, including principles
of intellectual property and intellectual property management, business
strategies and modeling relevant to the creation of start-up companies
and exploitation of IP rights as they relate to biomedical-related
inventions. The goal of this two-semester course is to address issues
relating to the commercialization of biomedical-related inventions by
exposing law students, MBA students, and Ph.D. candidates (in genetics
and proteomics) to the challenges and opportunities encountered when
attempting to develop biomedical intellectual property from the point
of early discovery to the clinic and market. Specifically, this course
seeks to provide students with the ability to value a given technological
advance or invention holistically, focusing on issues that extend beyond
scientific efficacy and include patient and practitioner value propositions,
legal and intellectual property protection, business modeling, potential
market impacts, market competition, and ethical, social, and healthcare
practitioner acceptance. The course will meet over two consecutive
semesters--fall and spring--and is six credit hours (three credits each
semester). During these two semesters, law students, MBA students,
and Ph.D. candidates in genomics and proteomics will work in teams of
two (two laws students, two MBA students and one Ph.D. candidate),
focusing on issues of commercialization and IP management of
biomedical-related inventions. The instructors will be drawn from the law
school, business school, and technology-transfer office. To be eligible for
this course, law students must also have a B.S or equivalent in the life
sciences, such as biology, biochemistry, genomics, molecular biology,
etc. Offered as LAWS 367, MGMT 467, GENE 367 and GENE 467.
LAWS 5342. Commercialization and Intellectual Property Management. 3 Units.
This interdisciplinary course covers a variety of topics, including principles of intellectual property and intellectual property management, business strategies and modeling relevant to the creation of start-up companies and exploitation of IP rights as they relate to biomedical-related inventions. The goal of this two-semester course is to address issues relating to the commercialization of biomedical-related inventions by exposing law students, MBA students, and Ph.D. candidates (in genetics and proteomics) to the challenges and opportunities encountered when attempting to develop biomedical intellectual property from the point of early discovery to the clinic and market. Specifically, this course seeks to provide students with the ability to value a given technological advance or invention holistically, focusing on issues that extend beyond scientific efficacy and include patient and practitioner value propositions, legal and intellectual property protection, business modeling, potential market impacts, market competition, and ethical, social, and healthcare practitioner acceptance. The course will meet over two consecutive semesters—fall and spring—and is six credit hours (three credits each semester). During these two semesters, law students, MBA students, and Ph.D. candidates in genomics and proteomics will work in teams of five (two law students, two MBA students, and one Ph.D. candidate), focusing on issues of commercialization and IP management of biomedical-related inventions. The instructors will be drawn from the law school, business school, medical school, and technology-transfer office. To be eligible for this course, law students must also have a B.S. or equivalent in the life sciences, such as biology, biochemistry, genomics, molecular biology etc. Offered as MGMT 467, LAWS 367, GENE 367 and GENE 467. Prereq: LAWS 229 and LAWS 261.

LAWS 5361. Contexts of Invention Seminar. 3 Units.
This seminar will explore the social and cultural construction of invention, the diverse ways in which invention has been conceptualized, from an interdisciplinary perspective—from the perspective, that is, not only of the law but of the arts and sciences in the broadest sense, including literature, the fine arts, entertainment, economics, medicine, engineering, education, and business. Emphasis will be on the cultures, rhetorics, and histories of invention across these fields. As such, this seminar represents an extension of the inquiry initiated at a conference held at Case Law School on "Intellectual Property and the Construction of Authorship." This seminar will help prepare students to participate in a conference to be held in the Spring 2006 entitled (Con)texts of Invention.

LAWS 5362. Copyright in the Digital Millennium Seminar. 3 Units.
Copyright in the Digital Millennium is a seminar that explores the challenges to traditional copyright law presented by the advent of digital technology and the Internet. Beginning with the current litigation involving Internet file-sharing, we explore the legal and doctrinal issues raised by efforts to apply copyright and other legal and technological measures to digital works. In order to evaluate the competing arguments in this debate, students will examine the doctrinal, historical, and theoretical underpinnings of copyright law from multiple perspectives.

LAWS 5363. Intellectual Property Theory Seminar. 3 Units.
We will explore and ask several questions from a philosophical and historical perspective, including: Should one's intellectual product be entitled to protection? What are the reasons for granting or denying protection? What form, if any, should this protection take? What are the costs and benefits to society of protecting one's intellectual product?

LAWS 5401. International Tax. 3 Units.
This course examines the U.S. taxation of transactions undertaken by foreign individuals or entities in the U.S. as well as the U.S. taxation of transactions undertaken by U.S. individuals or entities abroad. Major topics that will be covered include determination of the source of income, the taxation of income derived from a U.S. trade or business, the withholding tax regime, taxation of various entities, controlled foreign corporations, the U.S. anti-deferral rules, the U.S. foreign tax credit, taxation of foreign currency transactions and the role of tax treaties. Prereq: LAWS 72 or LAWS 343

LAWS 5402. Estate Planning and Taxation. 3 Units.
This course covers the federal law of estate and gift taxation. Topics include the computation of the estate tax, the taxation of gifts, the assets included in the gross estate, deductions from the gross estate to compute the taxable estate, credits against the tax, the generation-skipping transfer tax, and estate planning ideas and techniques, such as the use of trusts. The income taxation of estates and trusts is also covered. Grade is based on class participation and a major written paper on a topic chosen by the student and approved in advance by the instructor. Prereq: LAWS 211 and LAWS 232.

LAWS 5403. Federal Taxation of Corporations and Shareholders. 3 Units.
This course provides a comprehensive background in the taxation of corporations and shareholders, including the tax treatment of transfers of property to a corporation; distributions from a corporation to its shareholders; redemptions; liquidations; and the simpler forms of corporate reorganizations.

LAWS 5404. Federal Taxation of Partnerships and Partners. 3 Units.
This course will examine the basics of partnership taxation. The topics will include the tax consequences of capital contributions to and distributions from a partnership, the receipt of a partnership interest in exchange for services, the allocation of profits and losses among the partners, the computation of the adjusted basis of a partner’s interest, the sale or liquidation of a partner’s interest, and the liquidation and termination of the partnership. Prereq: LAWS 211.

LAWS 5405. State Taxation. 3 Units.
This course will mainly explore restraints on the states’ power to tax imposed by the Due Process Clause, Equal Protection Clause, Commerce Clause, and Privileges and Immunities Clause. We will also explore issues of tax policy and politics as well as tax minimization strategies and administration. The course will primarily focus on the sales and use and corporate income taxes. We will focus on the states generally and not the laws of any particular state. Prior tax classes are not required.

LAWS 5406. Tax Law of Charitable Giving. 2 Units.
This course will examine the tax law that relates to charitable giving during life and at death, including the rules of deductibility of charitable gifts of cash and other kinds of property, various vehicles for planned giving (charitable remainder trusts, charitable gift annuities, and others), and the impact of other existing and proposed tax provisions on charitable giving.
LAWS 5408. International Tax Policy Seminar. 3 Units.
This survey seminar will examine the broad policies underlying income
taxation in the international arena with a focus on residence- and source-
based justifications for income taxation, the ways that these bases of
taxation come into conflict, and the various methods that countries use
to mitigate the potential damage from competing tax claims. The
seminar will explore these concepts by focusing on a variety of specific
international tax problems including harmful tax competition, negotiation
of bilateral tax treaties, and the effect of e-commerce on source rules.
Other topics that may be covered include offshore financial centers, or
"tax havens," tax treaties and treaty tax shelters. Limit 12. Recommended
preparation: LAWS 211.

LAWS 5409. Tax Policy Seminar. 3 Units.
This advanced seminar for students interested in fundamental issues
of tax policy and tax reform considers the favorable treatment of capital
gains, the advisability of adopting a comprehensive tax base under a
new definition of gross income, the use of tax incentives to achieve
non-tax policy goals, and the basic system of taxing corporations and
shareholders. May satisfy the writing requirement. Recommended
preparation: LAWS 211.

LAWS 5411. Advanced Real Estate Development: Shopping Centers.
2 Units.
The course takes the point of view of the attorney for a real estate
developer with a strong emphasis on shopping center development,
including apartment complex and office building developments, but
provides insights useful to an attorney for the other side: a tenant,
financial institution, or major department store. The approach is practical
as well as academic; the course may be considered a capstone for
students interested in real estate. Topics include negotiations and
documentation; actual documents are used.

LAWS 5412. Advanced Securities Regulation. 3 Units.
This course will expand on the disclosure and enforcement themes
discussed in the Securities Regulation (LAWS 307) survey course to
engage in an in-depth examination of selected real-world securities
topics. The focus will be to deepen the student’s understanding of the
SEC regulatory regime through consideration of current “hot topics” in
securities law (such as executive compensation, 8-K disclosures, loss
contingencies and Management’s Discussion & Analysis), by reviewing
SEC pronouncements and working with actual or hypothetical disclosure
and counseling situations. In addition to analyzing rules, students will
participate in drafting, analyzing and commenting on sample disclosure
documents and client advice memos. The course is designed to further
the student’s understanding of a corporate/securities law practice as well
as deepen the student’s substantive knowledge in securities regulation

LAWS 5413. Antitrust Law. 3 Units.
A study of the implementation of federal trade regulation statutes with
emphasis on the interrelationship of these laws with the competitive
tensions of the contemporary economy.

LAWS 5414. Banking Law & Regulation. 3 Units.
This course will provide an overview of basic U.S. Federal banking
law in the context of evolving international standards. The course will
begin by examining the roles played by banks in the world economy
and why a specialized set of regulation is justified. The course will then
examine each of the major U.S. Federal laws and international standards
that govern banking activities against the background of the various
regulatory theories discussed. Topics will include entry, expansion/merger,
capital, reserves, investments, lending, interest, insolvency, non-
banking financial activities, money laundering, and international activities.
Close attention will be given to the role of supervision in both domestic
and international contexts. Extensive use will be made of international
and comparative materials

LAWS 5415. Bankruptcy. 3 Units.
An introduction to bankruptcy law, with emphasis on the current Federal
Bankruptcy Code. The course includes Chapter 7 (liquidation bankruptcy
proceedings), Chapter 11 (business reorganizations), and Chapter 13
(simplified reorganizations for individuals and sole proprietorships). Also
considered are various state law debtor-creditor remedies and the impact
of bankruptcy on such remedies. Prior enrollment in the UCC and debtor-
creditor courses may be helpful but is not mandatory.

LAWS 5416. Business Planning. 3 Units.
Major events in the creation and development of a business are
examined in light of partnership, corporate, and tax law problems.
Students are presented with a series of hypothetical client-suggested
transactions. Students seek the most appropriate means of attaining
the business ends desired by the principals. From time to time, brief
written memoranda covering issues raised by the problem scenarios may
be required. Emphasis is placed on the interaction among partnership,
corporate, tax, and securities concepts and doctrine. The significant
business events that may be covered in the course include formation of
a partnership; incorporation of a going concern; corporate distributions,
recapitalizations, and repurchases of shares; sale of the corporate
business; and corporate combination. Prereq: LAWS 211 and LAWS 261.

for Lawyers. 1 Unit.
This course is designed as an introductory course for second- and third-
year law students who want to understand the way in which businesses
are managed and financed, the various roles that capital markets play
in their development, and the methods for measuring business success.
Intensive case studies will be used as a framework for looking at real
world situations. The course will integrate guest lectures from visiting
business leaders. CFOs will explain how they measure the success
of their business and what financial information is required to do their
job. Finally, a part of each class will evaluate real time business issues,
applying the lessons learned from the case studies and modeling the
expected outcomes. James Bildner, CWRU alumnus and CEO of Tier
Technologies, will teach the course. Students will write a paper based on
a case study. This course will count toward the nine-credit limit on non-
law school courses. Prereq: LAWS 261.
LAWS 5418. Corporate Real Estate Transactions. 2 Units.
Real estate is typically the largest single category of capital investment and the second largest category of repeat expense (after total personnel costs) for most businesses. Major industrial and service sector companies are increasingly focused on the opportunities and challenges inherent in the real estate portfolios that support their core operations. This course will highlight the strategic case for effective corporate real estate management and the role of inside and outside legal counsel in the commercial real estate context. The course will consider advanced transactional situations, including purchase and sale of commercial properties, leasing of business properties, and complex industrial facilities. The course’s emphasis on case studies and commercial transaction scenarios are also designed to act as a capstone course that complements and draws upon the students’ prior coursework in contracts, real estate and commercial transactions, ethics and government regulation. Three parallel case studies will run throughout the course, illustrating the application of each topic to different types of client organizations: a Fortune 500 industrial company, a small family-owned retail business, and a medium-sized not-for-profit organization with several sites. Each client organization will have mock client representatives who will have different business and style preferences, which the class will need to accommodate and will come to anticipate in fashioning and recommending solutions for each client. The final exam will build from these same client scenarios, offering the class participants an opportunity to apply their learning to make recommendations to each client with respect to specific situations and goals.

LAWS 5419. Debtor-Creditor Law. 3 Units.
The creditor’s power to enforce its judgments through such judicial processes as attachment, execution, levy, garnishment, and creditors’ bills. The debtor’s power to resist creditors’ claims through statutory exemptions or federal bankruptcy discharge, or because the creditor has acted inappropriately or in bad faith. Also studied is the creditor’s power to set aside and avoid fraudulent transfers made by the debtor, a power which has generated much litigation in recent years. We also study the special rights of the federal government to enforce its claims, through the Federal Debt Collection Act of 1990, the Federal Priority Statute, and the Federal Tax Lien Statute. Finally, we survey collective creditors’ remedies under state law, including assignments for the benefit of creditors, creditors’ arrangements, and receiverships.

LAWS 5420. ERISA. 4 Units.
This class will cover employee benefits law. (ERISA): defined benefit plans, including in-depth consideration of defined benefit plan documents; VEBA’s, their use and regulation; group life, Accidental Death & Dismemberment, and Long Term Disability plans and related insurance documents; insured and non-insured medical benefit plans; reporting and disclosure requirements of ERISA, including summary plan descriptions, summary of material modifications, Form 5500, and "top hat" elections; and requests for favorable determinations of qualified plans, including Form 5300 and Notices to Interested Parties.

LAWS 5421. Financial Principles for Lawyers. 3 Units.
This course provides an introduction to the use of financial economics that are frequently relevant in many areas of law. Topics to be covered include the time value of money, uncertainty, claim structure (including the characteristics of debt, equity, and hybrid securities, and the benefits and detriments of debt and equity financing), behavior of securities markets, and analysis of financial statements. Use of these concepts in specific areas of legal practice will be discussed.

LAWS 5422. Financial Markets: Law, Theory, and Practice. 2 Units.
Explores the interactions of law, principles of finance, and the theoretical underpinnings of financial markets. It introduces students to the roots of evolving financial market liabilities affecting the interests and conduct of people at all levels in those markets by examining (a) the structure and purpose of financial markets, (b) the financial and capital market theories which today shape the contours of the law, (c) intermediation in financial markets, and (d) the challenges of global market regulation.

LAWS 5423. Financial Integrity in Emerging Markets Lab. 3 Units.
In this course, which is offered alternately as either a lab or a seminar, students study and research key aspects of the international financial system integrity rules, with a focus on the anti-money laundering and terrorism financing standards of the Financial Action Task Force (FATF) and the Basel Core Principles on Banking Supervision of the Basel Committee (as well as similar standards promulgated for other financial institutions). When offered as a lab, the course engages students in projects for a variety of organizations involved in improving the integrity of financial institutions, including the FATF (as well as FATF-style regional bodies), the International Monetary Fund, the World Bank, the United Nations Office on Drugs and Crime, and locally based governmental and non-governmental organizations. Students satisfactorily completing this course will be eligible to apply for a fully paid summer internship with a local bank that will involve work in the bank’s legal, anti-money laundering and financial intelligence units. Recommended preparation: LAWS 211 and LAWS 307.

LAWS 5424. Insurance. 3 Units.
A comprehensive introduction to the regulation of the insurance industry and to the legal issues arising from relations between the parties to insurance contracts. The course examines statutory regulation of the industry by state and federal agencies and analyzes cases involving aggressive regulation by the judiciary as well. Insurance decisions on the cutting edge of developments in contract, tort, and agency law are studied. Students are required to study the policy forms most frequently encountered in practice: the automobile policy, the homeowner’s policy, and the life insurance policy. The course also provides exposure to problems relating to other areas of insurance including commercial general liability coverage, fire insurance, professional liability (malpractice) coverage, and health insurance.

LAWS 5425. International Business Organizations. 3 Units.
This course offers a combined classroom and field experience designed to help students understand why U.S. multinational corporations engage in transactions through offshore financial centers or "tax havens." To this end, the course will provide an introduction to and address the tax and other policy implications of various international business structures and strategies including captive insurance arrangements, asset securitizations, hedge funds and offshore banking. The course will consist of four Friday afternoon sessions in the early part of the spring semester, followed by a week-long visit to the Cayman Islands during spring break, when students will meet and hear from academics, private-sector professionals and government officials based in the Cayman.
LAWS 5426. International Real Estate Transactions. 2 Units.
The course will explore selected topics involved in international real estate transactions, from the perspective of an American counsel representing an American entity doing business abroad. Topics may include structuring, transactional goals, due diligence, letters of intent and documentation, deal implementation, title protection, and others. The course will use traditional learning techniques as well as case studies and simulations, with a major focus on letters of intent/documentation. Students will be graded based on class participation and presentations, written assignments, and a final paper/take home exam. Recommended preparation: LAWS 385 (may be taken concurrently).

LAWS 5427. Mergers and Acquisitions. 3 Units.
Topics include the corporate and securities law governing various forms of mergers and acquisitions; business motivations for mergers; concerns of acquiring and acquired companies in friendly mergers; bidders’ techniques and targets’ defenses in hostile tender offers and proxy contests; valuation of businesses and investments, portfolio theory, and capital markets; concerns of companies and investors in negotiating corporate financing. Prereq: LAWS 261.

LAWS 5428. Products Liability. 2 Units.
Explores in depth the liability of manufacturers and sellers for physical injury to persons or property caused by defective products. The relevant law includes UCC warranty provisions, Restatement of Tort (Second) section 402A and other tort law, state "tort reform" statutes, and federal and state statutes regulating product safety, such as the FDA and the Consumer Product Safety Act. The course will also examine proposals to "reform" the law of products liability.

LAWS 5429. Real Estate Transactions and Finance. 2 - 3 Units.
Covers basic real estate transactions as well as issues involved in complex finance and development. Topics include: brokers, land contracts of sale, deeds and title covenants, the recording system, title insurance, mortgages, shopping center development, cooperatives and condominiums, ground lease financing, construction lending, distressed properties, selected federal income tax issues, and the real estate attorney’s professional responsibilities. Whenever possible, issues will be examined in the context of model transactions.

LAWS 5431. Securities Regulation. 3 Units.
This course explores the policies and techniques of state and federal investor protection, with emphasis on the distribution of securities by issuers and their affiliates. After an analysis of express general anti-fraud remedies, the "security" concept, and the diverse philosophies underlying "value judgment" and "disclosure" approaches to regulation of business fund-raising practices, the course proceeds to a full consideration of the impact of the Federal Securities Act of 1933 on primary and secondary distributions. Concurrent as well as independent effects of state blue sky laws, typified by the Uniform Securities Act, are also treated. To round out the total pattern of investor protection in the distributional setting, the course includes limited excursions into the anti-fraud, periodic reporting, public information availability, and broker-dealer aspects of the Securities Exchange Act of 1934. Prereq: LAWS 261.

LAWS 5432. Selected Topics in Business and Law. 1 Unit.
This course will focus on the key principles of business operations and the financial tools necessary to measure business performance and the roles that lawyers play in advising business clients in today's environment, as well as the intersection of law and business in our economy. Coverage and emphasis will vary from year to year. The course will use case studies, real time filings by corporations, and 2-3 books written about well-known business transactions and is co-taught by a visiting practitioner or business leader and a member of the regular faculty.

LAWS 5433. Commercial Paper. 3 Units.
One of the basic courses in commercial law, dealing with the law of negotiable instruments and bank collections and deposits. These topics are considered primarily under the Uniform Commercial Code and, to some extent, recent federal banking and consumer credit legislation.

LAWS 5434. Secured Transactions. 2 Units.
This course deals with Article 9 of the UCC and other legal and equitable rules relating to the use of personal property as security for debts. Topics covered include creation of a security interest (mortgage), rights and obligations of the debtor (mortgagor) and the secured party (mortgagee), priority of interests in the same property, redemption rights of the debtor, and foreclosure of a security interest by the mortgagee. May not be taken by students who have taken or are taking the 4-credit Sales and Secured Transactions course (LAWS 266). Students who have taken or are planning to take the 3-credit Sales (LAWS 381) course may enroll.

LAWS 5435. Sales and Secured Financing. 4 Units.
A concentrated survey of the law relating to the sale and lease of goods and secured financing. (1) Sales. The primary focus will be on the law relating to the sale of goods in commercial setting, i.e., Article 2 of the Uniform Commercial Code. Some attention will be given to the United Nations Convention on the International Sale of Goods. Considerable attention will also be given to consumer sales issues, e.g., the Uniform Consumer Sales Practices Act and similar legislation. There will be some coverage of leasing of goods under Article 2A of the UCC. (2) Secured Financing. Personal property security interests under Article 9 of the UCC will be examined in considerable depth. Real property mortgages will not be covered. Not open to students who are taking or have taken Sales (LAWS 381) or Property Security (LAWS 377). Students taking this course are precluded from subsequently taking either of those courses.

LAWS 5436. Financial Institutions Regulation. 3 Units.

LAWS 5437. Credit Transactions in Global Economy. 1 Unit.
This course offers a comparative and international view of secured credit transactions. Students will examine recent conventions that attempt to harmonize the law of secured credit, including the UN Convention on the Assignment of Receivables, the Unidroit Convention on International Factoring, the EBRD Model Law on Secured Transactions, the Unidroit Convention on the International Interests in Mobile Equipment and the UNCITRAL Legislative Guide on Secured Transactions. Students will consider the policy and theory underlying the law of secured transactions and will examine how much transactions relate to the broader global economy. Coreq: LAWS 289.
LAWS 5438. Business Organizations Research Seminar. 2 Units.
An opportunity to undertake significant research and writing on the law of business organizations. Each student will be expected to complete a major paper in satisfaction of the upper level writing requirement. A satisfactory paper will meet the writing requirement for the concentration in Business Organizations. Limited to 12. Prereq: LAWS 261.

LAWS 5460. Advanced Nonprofit Organizations Seminar. 3 Units.
In this seminar, students will explore selected topics related to structure, governance, tax exemption, and government oversight of nonprofit organizations. Class readings and discussions for the first several weeks will build on the basic understanding developed in LAWS 234, Law of Nonprofit Organizations. Topics will be selected to consider framework in context, using recent real-life case studies. Students will write a significant paper on a chosen topic and present it to the class. The course grade will be based on the paper, the presentation, and class participation. Paper may satisfy writing requirement. Prereq: LAWS 234.

LAWS 5461. Commercial Information and the Law. 3 Units.
This seminar focuses on defining 'commercial information' from a lawyer's perspective and analyzing ways in which laws in different jurisdictions are developing to protect owners and developers of such information from unauthorized access, interference, disclosure and/or use of their information products and services. The subject will be taught from a comparative/international perspective because of the increasingly global nature of many of the issues for discussion. Class discussion topics will include: the nature of commercial information and its relationship to the legal concept of property; the relationship between commercial information and intellectual property law (specifically copyright, patent, and trade secret law); case studies involving Internet business methods, computer software and electronic databases and the way in which intellectual property laws have developed in relation to these information products; the use of contract law and technological protection measures to protect the value of information stored and accessed electronically; and problems of financing businesses, and generally valuing business assets, where the main valuable assets are commercial information products.

LAWS 5470. Alternative Dispute Resolution. 2 Units.
Students will examine the processes of alternative dispute resolution (ADR) through reading materials, videotapes, guest lectures, and simulation exercises. Particular emphasis will be given to the interaction of lawyers and clients in business negotiations and in litigation. Negotiation, arbitration, mediation, the summary jury trial, and the mini-trial will be examined. The class will also cover impediments to ADR, such as lack of understanding or hostility on the part of clients or lawyers. Offered as LAWS 351 and LHRP 451.

LAWS 5508. American Indian Law. 2 Units.
An introduction to the body of law governing the relationship among Indian tribes and state and federal governments. Major themes include tribal sovereignty; the federal-tribal relationship; criminal, tax, and regulatory jurisdiction on reservations; and the rights of individual Indians. Does not fulfill writing requirement.

LAWS 5704. Adoption Law. 2 Units.
This course surveys adoption law in the United States, including public and private adoptions, international adoptions, and the legal issues involving reproductive law and surrogacy.

LAWS 5705. Advanced Family Law. 2 Units.
This is a simulation course in advanced family law. Students will conduct the preparation, strategy, and execution of a civil family law hearing in selected areas, e.g., domestic violence. The student will study a major statute (e.g., Domestic Violence Statute, Ohio Code Section 3113.31), and simultaneously master the techniques of hearing, including opening statement, direct examination, cross examination, closing argument, and learn the use of evidentiary objections and the handling of documents at trial. The choice of topic may change from year to year. Prereq: LAWS 63 or LAWS 210.

LAWS 5706. Advanced Legal Research. 3 Units.
This course provides in-depth exposure to the sources of law and legal commentary generated in American and other legal systems, and provides hand-on exposure to sophisticated methodologies for effective legal research in all media. Upon completion of the course, students will be equipped to plan and execute effective research on familiar or unfamiliar legal topics.
LAWS 5713. Complex Federal Criminal Investigation and Prosecution. 3 Units.
The course will explore some of the practical, substantive, and ethical issues that arise in complex federal investigations and prosecutions. Students will read cases and articles concerning topics such as the use of electronic surveillance, plea bargaining, and contacts with persons represented by counsel. They will also discuss how the law limits or enhances the powers of federal prosecutors conducting criminal investigations and prosecutions. Grade will be based on class participation and a take-home examination. Prereq: LAWS 131 and LAWS 327.

LAWS 5714. Complex Litigation. 2 Units.
Analysis of key issues typically encountered in complex civil litigation including substantive implications of seemingly procedural choices. Class actions, multidistrict litigation, joinder and consolidation. Exploration of practical and ethical issues encountered in complex civil litigation.

LAWS 5715. Computers and Crime. 1 Unit.
The course will cover both the new kinds of criminal activity made possible by computer technology and the use of computer technology to commit traditional crimes like embezzlement and terrorism. The class will examine Internet gambling and the distribution of child pornography on the Internet to illustrate issues that arise in connection with the use of computer technology in criminal activity. The class will also focus on procedural issues like jurisdiction and venue that become problematic in the context of computer crime. Limited to 20. Prereq: LAWS 131.

LAWS 5716. Conflict of Laws. 2 Units.
Competing approaches to choice of law in cases having multi-state and/or multi-national contacts. The course also covers personal jurisdiction, constitutional and international limitations on choice of law, and enforcement of judgments. Comparative and international perspectives are integrated throughout. Students develop their own choice of law theory in a simulated restatement conference.

LAWS 5717. Constitutional Law II. 3 Units.
This course explores the individual freedoms protected by the First Amendment. Primary attention is devoted to the freedoms of speech, assembly, and association. The course analyzes what is protected, why it is protected, and to what degree it is protected. Topics covered include prior restraint, advocacy of unlawful conduct, the hostile audience, defamation, commercial speech, obscenity, offensive speech, expression on public property, and symbolic speech.

LAWS 5718. Criminal Procedure II. 2 Units.
The adjudicatory stage of the criminal process. Pretrial release, preliminary hearings, grand jury practice, speedy and public trial, discovery, right to jury trial, guilty pleas, right to counsel, and double jeopardy are examined. Prereq: LAWS 327.

LAWS 5719. Cross-cultural Dispute Resolution. 2 Units.
Students will explore a wide range of domestic, foreign, and international dispute resolution processes, with emphasis on dispute resolutions amongst parties of different cultural and legal traditions.

LAWS 5720. Death Penalty Law and Process. 2 Units.
The course offers a review of the death penalty process, theory, and law from trial through execution, including examination of state laws and federal habeas corpus law. The course focuses on the legal principles implicated by the death penalty and also examines the social issues it raises including the social/legal arguments against the death penalty, race and gender issues, and the influence of political and other factors on the process. Recommended preparation: LAWS 327.

LAWS 5721. Death Penalty Lab. 3 Units.
This Lab will involve students in an integrated experience of academic research and public service. Students will work on semester-long research projects arising from actual death penalty cases that will be of assistance to practitioners in death penalty cases or research projects for governmental and non-governmental organizations engaged in support for, opposition to, or reform of the death penalty at a local state, national, or global level. Issues may include: victim’s rights; jury selection (race/gender discrimination); proportionality (disparities in geographic application or application to different fact patterns); economic impact on the system; clemency; and transnational problems with foreign accused; systemic review (e.g., Illinois commission); and other specific recurring issues arising from innocence, assistance of counsel, experts, jury instructions, or misconduct (judge, attorney, jury). The students will have no direct representation responsibilities.

LAWS 5722. Death Penalty Lab II. 2 Units.
This lab will involve students in an integrated experience of academic research and public service. As enrollment is limited to students who have successfully completed Lab I, these students will assume a supervisory role working with Lab I students. Students will work on research projects arising from actual death penalty cases that will be of assistance to practitioners in death penalty cases or research projects for governmental and non-governmental organizations engaged in support for, opposition to, or reform of the death penalty at a local state, national, or global level. Issues may include: jury selection issues; proportionality issues; economic impact of the application of the death penalty; examination of issues surrounding a specific state’s ability to provide a viable clemency; issues of international law; research, investigation, and litigation of case specific issues ranging from actual innocence, ineffective assistance of counsel, ineffective assistance of experts, prosecutorial misconduct, judicial misconduct, juror misconduct, etc. Prereq: LAWS 407.

LAWS 5723. Disability Law. 3 Units.
Disability Law provides a comprehensive overview of the federal laws relating to individuals with disabilities. The course focuses on issues of nondiscrimination and affirmative rights in the areas of employment, government programs and services, places of public accommodation and education. Beyond analyzing the legal framework that shapes disability rights, the course will also discuss issues related to disability rights from a social policy perspective.

LAWS 5724. Discrimination in Employment. 3 Units.
This course will examine the federal laws concerning discrimination in the workplace. These include Title VII of the 1964 Civil Rights Act, the Equal Pay Act, the Age Discrimination in Employment Act, the Americans with Disabilities Act, the Genetic Information Nondiscrimination Act. We will study the regulation of discrimination based on race, sex, religion, national origin, age, disability, and genetic status, including policy and ethical question and strategic considerations in prosecuting and defending employment-based civil rights actions.
This course surveys the legal and social policy challenges related to public education settings. Students will study relevant constitutional issues, legislative mandates, school vouchers to supplement tuitions in private schools, charter schools, and more recent attempts under state constitutions to provide a quality education for all children. Beyond analyzing the legal frameworks that shape public education, the course will also cover the difficulties confronting public education from a sociological perspective.

This course examines employer-employee relations in non-union settings. Topics include wrongful discharge, occupational safety and health regulation, minimum wage, and workplace privacy issues. The course emphasizes written work, including advanced legal research training. Minimal overlap with Labor Law (LAWS 359) and Discrimination in Employment (LAWS 328).

The course is designed to provide an overview of both the breadth and depth of environmental regulation in the United States and to consider ways our environmental regulatory system might be improved. Although all of the major environmental laws will be surveyed, several statutes will be examined in greater detail. Students will be expected to navigate select provisions of statutes and regulations through in-class problem sets. Guest speakers will also be invited to speak on topics of current interest.

This seminar builds on the foundation established during the first-year curriculum and focuses on the law and technology of payment systems. Such topics will include the contractual relationship amongst and between the various organizations transacting to enable a b2c payment; the various elements of such agreements; the various impacts of a payment system (criminal, civil, and administrative); the implications for legal structure and policy; and the ethical considerations of a lawyer advising clients within this domain. Grade is based on a paper, a presentation, and class attendance and participation.

This course addresses the use of expert witnesses in civil trials, focusing on evidentiary issues. We will first examine several theoretical and conceptual issues concerning the role of experts as well as the pertinent standards of admissibility. We will give careful attention to what it means to make an argument from expert opinion. Then we will examine the use of expertise in a variety of contexts, including the proof of identity, proof of causation, proof of breach of duty, and proof of damages. Prereq: LAWS 104 and LAWS 207 or LAWS 212.

This survey course covers law relating to the creation, functioning, and dissolution of the family as a legal unit. Topics include legitimacy, adoption, procreative rights, cohabitation, marriage, family obligations, division of marital property, divorce and annulment, and child custody. Particular attention is given to the social forces that affect the development of rules and policies.

This course explores the relationships between the federal courts, Congress, and state courts and governments. Topics include congressional control of federal jurisdiction, justiciability, federal court abstention, suits against state and federal governments and officials, habeas corpus, and federal injunctions on state proceedings.

Government procurement law continues to interest policymakers, corporations, and legal employers. The federal government’s annual acquisition of services, supplies, and construction accounts for more than $500 billion. This is a survey course of the many issues involved in federal contract and procurement law. Subjects covered include the bidding process and bid protests, acquisition planning, negotiation procedures, contract pricing, collateral policies, contract award controversies, and lawsuits against the government and government employees.

The general principles of immigration law and procedure, including federal authority to regulate immigration, removal of aliens (deportation and exclusion), administrative and judicial review, fleeing persecution (refugees, asylees, and others), immigrant and nonimmigrant visas, and consular practice. The course will emphasize practical application of current immigration law.

The course is dedicated to the study of visas for visitors and aliens of extraordinary ability in the sciences, arts, or entertainment. Course materials will be drawn from Legomsky’s Immigration and Refugee Law and Policy, the Immigration and Nationality Act, and Title 8 (CFR). Students will be required to write a paper or prepare a visa petition. The course will likely be offered every other year. Prereq: LAWS 277.

This course examines selected issues and current problems in international environmental law, with a particular focus on transboundary environmental problems, global “commons,” and the development, implementation and enforcement of international environmental agreements. Requirements for the class will include several short writing assignments and weekly simulations and role-play exercises. There will be no final exam. Limited enrollment of 20 students.

The role of the juvenile court in society: Its jurisdiction, procedures, and dispositional alternatives. Students study both the quasi-criminal aspects of the juvenile court (jurisdiction over juvenile delinquents and status offenders) and the civil-protective aspects of the court (termination of parental rights and the handling of neglected, dependent, and abused children). In addition, the rights afforded juveniles are compared with the rights afforded adults in comparable circumstances. Many related juvenile justice issues, such as the right of a minor female to have an abortion without parental notice and the constitutionality of capital punishment for juvenile offenders, are also examined.
LAWS 5737. Labor Law. 3 Units.
The basic course in the area of union-management relations, designed both for students desiring to pursue the field further and for those whose interest lies in an introduction to legal principles in this area. The course begins with a brief historical study of the evolution of the labor movement and prestatutory law. It then considers federal regulation under the National Labor Relations Act of union organizational efforts, management-union interaction, and the representational process, then proceeds to the collective bargaining process. The collective bargaining process is examined in some depth with special emphasis on the scope and substance of the duty to bargain in good faith, the enforcement of collective bargaining agreements in courts and by arbitrators, and the legal regulation of industrial warfare, the strike and lockout.

LAWS 5738. Land Use Control. 3 Units.
This course analyzes the public control of land use, primarily at the local and state levels. Both legal and policy perspectives are considered. Attention is given to constitutional limitations such as the takings doctrine, equal protection, and due process. Topics considered include zoning, subdivision controls, exclusionary regulations, and historic preservation.

LAWS 5739. Law of Archeological Relics. 2 Units.
This course addresses the private and public law relating to the ownership, sale, use, and repatriation of archeological artifacts other than human remains. The readings include excerpts from articles and books regarding the international trade (legal and illegal) in such artifacts. Significant attention is given to international law, such as the UNESCO Convention on Cultural Property.

LAWS 5740. Leadership and Communication Skills for Lawyers. 2 Units.
This 13-week interactive course will provide students with the tools and techniques needed to be more capable speakers and communicators. While the course will include some training for persuasive public speaking in a courtroom, most of the focus will be on developing effective communication skills so that students will have the requisite confidence, focus, and control to speak in a variety of settings. A section of the class will also concentrate on handling the media including how to control a message and advice for clients who may be in the public spotlight. The program will be interactive so that students have numerous opportunities to participate and speak. Role-playing exercises will be utilized as well as video-taped playback. Grading is based on participation and improvement and there will not be a final exam.

LAWS 5741. Legal History of the Corporation. 3 Units.
This course will examine the history of the modern corporate form, beginning with the revolutionary changes of the late nineteenth and early twentieth centuries. The goal is to explore the contingent nature of the corporation through a focus on its history as well as to examine the social, ecological and political consequences of what has become the most powerful economic institution in world history.

LAWS 5742. Legal Theory, Selected Topics. 2 Units.
This two-semester sequence examines selected issues in legal theory. The subject matter varies from year to year and will be announced at the time of registration for the first of the two semesters. The first semester (Selected Topics in Legal Theory I), will entail a close reading of one or more selected scholarly works that have advanced our understanding of the deep structures of the law. Students will be required to write one or more short, non-research papers during the term that engage the readings, and a separate grade will be assigned for the term based on these papers and class participation. At the end of the term, students wishing to continue during the second semester of the sequence and complete their writing requirement for graduation will select their topics; the topic must be the examination and critique of some argument or thesis presented in or arising from the readings for the fall semester. Prereq or coreq: LAWS 207 or LAWS 212.

LAWS 5743. Legislation. 2 - 3 Units.
This course is a study of the legislative process and product. The class will examine theories of the legislative function; campaign and election regulation; the processes through which the legislature acts; and the drafting and interpreting of statutes.

LAWS 5744. Mediation Representation: Theory, Principle and Practice. 2 Units.
An advanced course exploring the fundamentals of conflict, mediation theory, doctrine and practice, its historical evolution and increasing use as a centerpiece of modern legal dispute resolution. The course will cover the theory, doctrine, history and practice of mediation; the mediation process; the mediator’s, client’s, and advocate’s role in mediation; the underlying principles of bargaining, risk and value and how to adapt these negotiation skills for a mediation setting. Students will also learn how to use mediation as a problem-solver for the client. Format is lecture, discussion and student presentation and simulation. The course includes the writing of mediation memoranda, as well as mediation role playing, with critique from the teachers and invited guest mediation practitioners.

LAWS 5745. National Security Law. 3 Units.
Provides a study of the separation of powers in national security matters, presidential war powers, congressional and presidential emergency powers, the domestic effect of international law, the use of military force in international relations, investigating national security threats, the Freedom of Information and Privacy Acts, access to national security information in the federal courts, and restraints on disclosing and publishing national security information. The course builds upon a strong foundation of constitutional law and addresses the fundamental tension that exists in our foreign and domestic affairs by virtue of the constitutional separation of powers between the respective branches of government. Several classroom hours will be spent dealing with constitutional war powers and how the executive and legislative branches have tried to define their respective measures of expressed and implied power with regard to the Vietnam War, the War Powers Resolution of 1973, and more recent US incursions such as the first Persian Gulf War and the most recent invasion of Iraq.
LAWS 5746. Ohio Constitutional History. 3 Units.
This course will focus on the constitutional history of Ohio and the economic, social, and political forces that influenced the development of the Ohio Constitution. The approach will be both chronological and thematic. The course will place Ohio constitutional history in its larger historical context—the Founding Era, the Northwest Ordinance and the Path to Statehood, the Age of Jackson, the Progressive Movement, the New Federalism, and Modern Constitutional Revision. The course will also examine the following topics: the treatment of African-Americans, the rights of women, judicial review, separation of powers, the temperance movement, municipal home rule, tort reform, judicial selection, and the bill of rights. Students will be expected to work with primary source documents; there will be a required paper but no final exam. Students papers will not be limited to Ohio topics.

LAWS 5747. Philosophy of Law. 3 Units.
This is an examination of the general nature of law, the broad concerns of jurisprudence, the study of comparative law, and many of the issues raised in the literature of legal philosophy. Students will examine the principles of legal positivism, mitigated natural law, and rights theory. Selected readings and cases will illustrate these theories, which will also be examined in the context of rule selection by new governments in developing or revolutionary societies. The course also looks at the general nature of legal systems: how politics, morality, and individual views of justice and rights affect particular court cases and the course and development of law generally. Topics will include abortion, obscenity and sin, civil disobedience, affirmative action, surrogatehood, and the death penalty. This is unlike any other of the legal theory or jurisprudence courses, and those who have sampled legal theory elsewhere in a different form are welcome and encouraged to enroll. Recommended preparation: PHIL 101. Offered as LAWS 353, PHIL 335, and PHIL 435.

LAWS 5748. Poverty, Social Inequality, and the Law. 3 Units.
An overview of the way the law impacts on disadvantaged people, and the law that supports advocacy on their behalf. Students will learn about legal problems that are common to poor people and identify potential solutions. The course will analyze the effectiveness of various legal interventions such as administrative advocacy, and litigation (including individual and class representation) in various contexts. Past and current means of using and changing the law on behalf of low-income people will be studied. Students will analyze the responsibilities of lawyers to represent low-income clients. Many of the concepts will be taught through the use of case studies; a client interview will be conducted, and court observation is required. Grade is based on oral case study presentation, written assignments, and class participation.

LAWS 5749. Prisoner Rights & Litigation. 3 Units.
This course explores the complex areas of habeas corpus and prisoner § 1983 litigation. The course explores the legal, procedural, social, economic and other issues surrounding federal court review of state court criminal convictions, conditions of confinement for prisoners, and prisoner rights. Topics will include standards of review, substantive rights, federal jurisdiction, and Constitutional reaches and limits.

LAWS 5750. Religion, Ethics, and the Law. 3 Units.
This is a paper seminar, limited to 12 students. The course will explore the interrelationship between religion, ethics, and the law in the American legal system. We will begin with a series of general questions. To what extent do we have true separation of church and state in American jurisprudence? Why should religious beliefs be given more deference than political opinions or other personal expressions? Does the law set the standard for public morality or reflect it? In order to establish a successful legal system, does society need to reach a consensus as to its moral and ethical values? When is the government ethically justified in punishing individuals for their misconduct, and what theories justify punishment within the criminal justice systems? In the second part of the course we will focus on a variety of issues that raise legal, ethical, and religious questions. Topics may include capital punishment, euthanasia, genetic testing, war crimes, and others.

LAWS 5751. Scientific Evidence in Criminal Litigation. 2 Units.
The legal issues associated with the use of scientific evidence at trial. It examines the admissibility of scientific evidence, expert testimony, and related issues. In addition, it considers specific techniques such as forensic pathology, fingerprint comparison, firearms identification, bite mark comparisons, questioned document examinations, and polygraph and DNA evidence testing. Outside experts are used to present many of the topics.

LAWS 5752. Selected Topics on American Legal Professions. 3 Units.
This seminar will consider the history, structure and demographics of the American legal profession. We will focus primarily on recent changes in the organization and operation of law practice and the effect of those trends on the delivery of legal services and the working lives of lawyers. Students will be required to write and present a substantial paper, which may satisfy the writing requirement. Grade is based on class participation, a presentation, and a paper.

LAWS 5753. Selected Topics in Family Law. 3 Units.
This course explores in depth the theory, doctrine and practical application of various topics within family law. The topics explored may include marriage, divorce, property division, spousal support, parent-child relations, child custody, visitation, child support, domestic violence, rights of unmarried partners, etc.

LAWS 5755. Sexual Orientation & the Law. 3 Units.
The course will address the development of legislation and case law dealing with LBGT rights in different practice areas including family law, estate planning, and employment law. Further, the course will deal with possible scenarios for future legislative and judicial activity.

LAWS 5759. Topics in Advanced Labor Law. 2 Units.
Covers relations between employers, employees, and unions not covered in the basic Labor Law Course (LAWS 359). Among topics included are hot cargo agreements, obligations of successor employers, duty to fair representation, union security, federal preemption of state labor legislation, internal union affairs, and labor law reform. Prereq: LAWS 359.
LAWS 5761. Control of Toxins in Products and Workplaces. 3 Units.
This seminar will explore the regulation of potentially dangerous levels of toxic substances in products and workplaces. Particular attention will be devoted to considering the structure of the current legal framework for ensuring that the public is adequately represented in these highly complicated regulatory programs that impose substantial costs on manufacturers. After studying key aspects of the major federal programs that oversee the manufacture and marketing of toxins in products and workplaces, seminar participants will consider the role that the market and tort law play in supplementing regulation. Students will be expected to write a substantial research paper related to one to the themes of the course.

LAWS 5762. Urban Development Lab. 2 Units.
This course will involve students in an integrated experience of academic research and public service to the Greater Cleveland area. Students will work on semester-long research projects arising from issues raised by local nonprofit development organizations and the development arms of other local nonprofit groups and government agencies. Specific topics will vary from semester to semester, but will generally fall within (i) barriers to development of urban properties, (ii) the role of local government and communities in encouraging or discouraging development projects and (iii) solutions for making urban areas, in general, and Cleveland, in particular, more livable and sustainable. When possible, students will present their findings directly to the organization(s) raising the issue. Students can expect direct or indirect exposure to aspects of real estate, finance, land use, tax and other regulatory law. Note: LL.M. courses have been inactivated.

LAWS 5763. White Collar Crime: Prosecution and Defense. 2 Units.
This course will engage students in a study of issues relating to the prosecution and defense of white collar crime in America, e.g., defining/ understanding "white collar crime," the role of the federal government in investigating and prosecuting white collar crime, corporate vs. individual responsibility, analyzing various white collar offenses: mail fraud and wire fraud, RICO, perjury/false statements/obstruction, securities fraud, and analysis of current white collar criminal prosecutions in the news (US v. Martha Stewart, the Adelphia prosecution, the Tyco prosecution, the Worldcom prosecution, the Traficant prosecution here in Cleveland), and exercises in prosecuting and defending white collar crime: investigations, charging decisions, and strategies in structuring a trial presentation and crafting jury addresses in complex white collar cases. As part of their final exam, students will be required to prepare and deliver a live jury summation (either for the government or the defense) in a mock white collar criminal case. Students will also sit for a short essay exam dealing with the various topics covered in class.

LAWS 5764. Workers’ Compensation. 2 Units.
Workers’ Compensation law and theory continue to evolve through statutory change and judicial decisions. The statutes deal with benefits for work-connected injury and disability. Course material is national in scope with an emphasis on corresponding Ohio cases. The course also touches on related areas of law, such as torts.

LAWS 5765. State and Local Government. 3 Units.
Examines the power of state and local governments. Among the topics considered are the purpose and role of local governments; the source and scope of local governmental power; state and federal constitutional restraints on local governmental activity; the distribution of powers between state government and local governments; and the various options by which state and local governments finance their activities.

LAWS 5766. Non-Capital Habeas Lab. 2 - 3 Units.
Students will be assigned to research, write, and litigate issues on live cases of both state and federal prisoners. As part of the course, students will learn how to properly and effectively represent clients in criminal cases through lecture, written assignments, oral advocacy and other skills-related activities. Prereq: LAWS 207 or LAWS 212. Prereq or Coreq: LAWS 327

LAWS 5901. Advanced Civil Procedure. 4 Units.
This course will pick up where the 1L Civil Procedure course leaves off, exploring in greater depth topics raised by the Federal Rules of Civil Procedure. Among the planned topics are the following: discovery (ranging from the practical, Pretrial Practice-type approach to a more conceptual, casebook-style approach); sanctions; multi-district litigation; finality (starting off from collateral estoppel/res judicata, through Rule 60, and including issues pertaining to the legislative revival of time-barred claims); appealability; class actions; injunctions.

LAWS 5902. Advanced Contracts. 3 Units.
We will examine the methodology of law and economics and of deontological approaches to contracts, legal realism, the methodology of default rules, gap filling and incomplete contracts, adjustment of long-terms contracts, employment contracts and the employment at will doctrine, promissory estoppel, relational contracts, incorporation strategies in the U.C.C. and the new formalism in Contracts.

LAWS 5903. Advanced Criminal Law Seminar. 3 Units.
This seminar focuses on substantive criminal law rather than criminal procedure. It uses the first-year criminal law course as a foundation and examines a number of issues not typically covered in that course. Student interests will influence the topics chosen for examination, which will include: theft offenses, conspiracy, fetal abuse, decriminalization of drug use and commercial sex, and the roles of the executive, judicial, and legislative branches in making criminal law. Grade is based on class participation, a presentation, and a research paper.

LAWS 5904. Famous American Trials Seminar. 3 Units.
This seminar is in part a course of American legal history and in part advanced evidence course. We will consider in some detail several (probably five) famous trials in American history, starting with the Salem witchcraft trials and ending (probably) with the trial of Charles Manson. For each trial considered, except the first, students will be expected to read an assigned book that concerns the trial and to address various issues for class discussion. Each student will also write a paper about a famous trial not covered in the assigned readings and make a presentation to the class regarding that case at the end of the semester. This seminar will be limited to 12 students and may be used to satisfy the writing requirement.

LAWS 5905. Advanced Evidence. 3 Units.
This seminar is designed to cover specific issues in evidence, e.g., privilege, toxic torts, computer-generated evidence, expert testimony, syndrome evidence, and profile evidence. A paper and presentation are required. The paper may satisfy the writing requirement.
LAWS 5906. African-American Lawyers Seminar. 3 Units.
This seminar takes an interdisciplinary approach to the study of African-American lawyers. It examines aspects of the history of black lawyers in America, as well as topics relating to black lawyers in contemporary America. The course will situate these experiences in the context of both the history of the legal profession and the history of race relations and the struggle for civil rights in the United States. Students will prepare a substantial research paper and make an oral presentation of their research to the class. Limited to 12.

LAWS 5907. Arbitration Law and Practice Seminar. 2 Units.
This seminar will cover arbitration as a form of adjudication focusing on the law, processes, uses, and practice of arbitration. The seminar begins with a conceptual exploration of adjudication and arbitration and proceeds with discussions of the uses of arbitration to resolve commercial, international, labor, and consumer disputes. The seminar will next explore the relationship between arbitration and the courts examining the Federal Arbitration Act and State Law which includes preemption and choice of law issues, the agreement to arbitrate focusing on contract formation and arbitrability issues, and judicial supervision and review. Finally, the seminar will cover the arbitration proceeding itself with detailed looks at the selection and impartiality of the arbitrator as well as the role of lawyers, evidence, discovery, and interim measures in the conduct of the proceeding. Both trial and appellate simulations will be a feature of this seminar experience.

LAWS 5908. Constitutional Law Research Seminar. 2 Units.
This seminar permits students to write an in-depth paper, exploring an area of Constitutional Law most interesting to them. There are no explicit rules governing subject matter except that the paper must have, as its central focus, constitutional doctrine, policy, and/or analysis. Several classes will be held during the semester. The focus of these classes will be the process of writing a paper and the research tools available. A thesis statement, an outline, and at least one draft before the final paper are required. The grade will be based solely on the quality of the paper. The paper may be used to satisfy the writing requirement.

LAWS 5909. Current Controversies in Environmental Law. 3 Units.
This seminar will explore current legal and policy controversies in environmental law. Special attention will be paid to recent Supreme Court decisions and forthcoming environmental protection, federal courts, including current constitutional challenges to environmental programs and regulations. Issues likely to be discussed include the impact of recent federalism decisions on environmental protection, federal preemption of state regulation, environmental standing, the non-delegation doctrine, and cost-benefit analysis, among other topics. Students will read recent Supreme Court and Circuit court opinions, appellate briefs, academic commentary and supporting materials. Grade is based on class participation, final presentation, and a paper. Limited to 12.

LAWS 5910. Environmental Law Research Seminar. 2 Units.
This course is for those students who wish to fulfill the writing requirement by writing on a contemporary environmental law subject.
LAWS 5916. Religion Clauses of First Amendment Seminar. 3 Units.
This seminar will explore the constitutional doctrines relating to the Free Exercise Clause and the Establishment Clause of the First Amendment. The readings will include key Supreme Court cases demonstrating the evolution of free exercise and Establishment Clause doctrines, as well as some historical materials, but we will also maintain a focus on current First Amendment controversies, such as school vouchers, faith-based government funding initiatives, and religious symbols on public property. Grade is based on class participation, final presentation, and a paper. Limited to 12.

LAWS 5917. Remedies Seminar. 3 Units.
This seminar provides students with both a broad survey of the law of civil remedies and a chance to focus individual research on a particular area of interest within that broad survey. The law of remedies focuses on what happens after the merit of a case has been decided; how does the court provide redress to the successful litigant? This seminar examines concepts of corrective justice, the institutional incentives created by different types of remedies, and related policy issues. Topics include "private" remedies (tort, contract, etc.), "public remedies," such as civil rights actions in which plaintiffs seek broad injunctive relief, and specialized areas of public-policy concern such as punitive damages and remedies in class-action suits.

LAWS 5918. Reproductive Rights Seminar. 3 Units.
This seminar will cover the basics of the Supreme Court's reproductive rights jurisprudence and will look at a series of topics relating to the reproductive rights law and policy, including "partial-birth" abortion and the health exception; minors' access to abortion, contraception, and sex education; reproductive rights and religion; and assisted reproductive technologies. In addition to various interim writing assignments, you will be required to submit a substantial paper by the end of the semester. Prereq: LAWS 202.

LAWS 5919. Scientific Evidence and Advanced Research. 2 Units.
Students must be concurrently enrolled in LAWS 214 (no exceptions). Enrollment limited to six students.

LAWS 5920. Settlement Law Seminar. 2 - 3 Units.
This seminar will examine the theory and practice of settlement of disputes. Matters to be considered include: the practical issues of how one negotiates the settlement and drafts settlement documents; the theoretical issues of why some cases settle and why some do not; the appropriate role of judges and mediators in facilitating settlements, and the procedural and substantive law affecting the settlement of law suits. Grade is based on a presentation and a paper. Enrollment is limited to 12.

LAWS 5921. Social History of Crime Seminar. 3 Units.
This course is designed to offer students a somewhat different optic on the way that law operates in society, different, that is, from the sense one might get from reading case books. Here our concern is with the meaning of law in the largest sense, not so much from the standpoint of legal doctrine, but in the sense of how it works as a system of power to advance certain interests in society at the expense of less powerful groups. By "social history" I refer to the study of ordinary people, as opposed to political leaders and rulers. Thus the course explores how the law played out in the lives of ordinary men and women during the period from the eighteenth century to the present. What is a crime? How have certain customary rights been criminalized and why? What are the ideological underpinnings of the law? These are some of the questions we will take up as we examine crime in Britain and the U.S. from a thematic perspective.

LAWS 5922. Supreme Court Seminar. 3 Units.
Students will examine the judicial process in the U.S. Supreme Court, including the nature of decision-making in a multi-member tribunal, procedural and jurisdictional issues, and the development of a justice's jurisprudential philosophy. Students follow and analyze a particular justice or an aspect of the Court's operation. May satisfy the writing requirement.

LAWS 5923. Torts Theory Seminar. 3 Units.
This seminar will allow students to examine theories of justice in the context of tort law. In the seminar, we will be reading and discussing a series of articles that seek to provide a basis for understanding and evaluating tort doctrine. This will include readings concerning the economic approach, the corrective justice approach, and approaches based on distributive justice. The doctrine that we study will be that which is familiar from the first year course: strict liability, the requirements of the reasonable person, proximate cause, duty and product liability. Students will pick an area of tort doctrine and write a paper that will apply one or more theories to that area. A student might, for example, examine a manufacturer's duty to warn customers about possible harm in the use of the product, and write a paper helping us to understand that duty in light of economic and corrective justice theories.

LAWS 5924. White Collar Crime Research Seminar. 2 Units.
This seminar focuses on white collar crime. Topics include insider trading, extortion, loansharking, bribery, embezzlement, corporate fraud, blackmail and internet-related criminal activity. Students will complete a substantial research paper and will present the results of their research to the class.

LAWS 5925. Wrongful Convictions Seminar. 3 Units.
This course focuses on the causes of wrongful convictions, including eyewitness misidentifications, false confessions, jailhouse informants, scientific fraud, prosecutorial misconduct, and ineffective assistance of defense counsel. Remedies to prevent the conviction of the innocent are also discussed. A paper and presentation are required. Prereq: LAWS 212 or LAWS 327. Coreq: LAWS 212 or LAWS 327.

LAWS 5926. 14th Amendment Seminar. 3 Units.
This seminar focuses on the Fourteenth Amendment through Supreme Court cases and the social implications of these holdings. We will discuss the definition of equality under the law and approaches to reaching equity goals. Students should gain a frame work for comparing equity arguments asserted in a variety of settings for different groups, e.g., gender in employment settings, wealth discrimination, and race in education.
LAWS 6001. Civil Litigation Clinic. 3 Units.
In this course, students handle various kinds of civil disputes on behalf of consumers who need legal assistance but cannot afford to pay for a private lawyer. Students are responsible for all phases of litigation, including the initial client interview and case assessment, preparation of pleadings and motions, conducting discovery, settlement negotiations, and, if necessary, trying the case before a judge or jury. A weekly two-hour seminar session provides a regular forum for learning the substantive law that applies to the students’ caseloads, as well as discussion of the various legal, professional, and ethical issues that arise in the cases. In addition, after completing required basic mediation training, students act as mediators in small claims and/or landlord-tenant cases in municipal court. Students must be enrolled in and complete both semesters to receive credit. Prereq: LAWS 207 or LAWS 212 and LAWS 432.

LAWS 6002. Civil Litigation Clinic. 3 Units.
Continuation of LAWS 6001. Both semesters must be completed before credit is given.

LAWS 6011. Community Development Clinic I. 3 Units.
This is a year-long course; students must complete both semesters of work to receive credit. Students represent business and non-profit entities in formation of their businesses and to obtain tax exemption for non-profit corporations. They act as general counsel helping their clients plan for future projects and activities and operate in compliance with law that regulates their activities. Students may also help to structure tax, real estate and corporate transactions for entities. Students may have the opportunity to work on simple intellectual property matters including trademark, tradename and copyright registrations, as well as website issues and nondisclosure agreements. This clinic is primarily transactional in nature and is designed to expose students to the special problems encountered in representing entities and in structuring transactions. Seminar sessions will be devoted to discussions of applicable law pertaining to specific cases students are working on and development of the skills necessary to represent individuals and entities in transactional matters. Students also will be exposed to the ethical problems associated with entity representation. Prereq or Coreq: LAWS 261.

LAWS 6012. Community Development Clinic II. 3 Units.
(See LAWS 6011.)

LAWS 6021. Criminal Justice Clinic I. 3 Units.
Students handle a limited number of misdemeanor cases in municipal courts throughout Cuyahoga County. The seminar sessions are devoted to discussions of cases being handled by the students and to ethical and strategic considerations of criminal law practice, trial tactics, and plea bargaining. Hypothetical case studies are also used to increase the breadth of the students’ exposure to the criminal justice system. Each student also handles some prosecution in local court. Prereq: LAWS 327.

LAWS 6022. Criminal Justice Clinic II. 3 Units.
Continuation of LAWS 413. Both semesters must be completed before credit is given.

LAWS 6031. Health Law Clinic I. 3 Units.
Students represent clients in social security disability claims, adult guardianships, health insurance claims and disputes, access to health care, special education for disabled children, nursing home transfers and discharges, and other health and disability law-related issues. They investigate complaints in nursing home and represent clients in administrative and court proceedings. A major part of the student’s responsibilities is to analyze the problems and determine the best way of resolving them. Seminar sessions are primarily devoted to specific skills and to discussions of matters being handled by the students. The ethical and practical problems encountered in health law practice are emphasized, as well as legal theory. This is a year-long course; students must be enrolled in and complete both semesters of work to receive credit. Prereq: LAWS 207 or LAWS 212 and LAWS 227 or LAWS 373.

LAWS 6032. Health Law Clinic II. 3 Units.
Continuation of LAWS 6031. Both semesters must be completed before credit is given.

LAWS 6041. Intellectual Property Entrepreneurship Clinic. 3 Units.
This clinic will provide students with the opportunity to represent start-up companies as they develop their plans to commercialize their technology. The clinic will be based out of the Shaker LaunchHouse or other local incubator sites. In particular, students will focus on intellectual property issues that arise in the cases. Students will work on pending matters that may include preparation of legal memoranda or briefs, applications for relief (such as asylum, cancellation of removal, protection under the Violence Against Women, protections of non-citizen victims of domestic violence), and evidentiary submissions for pending cases. Students are required to attend master (preliminary) and individual hearings, and a pro bono refugee clinic offered with the Catholic Charities or Legal Aid Society. This is a year-long course. Prereq: LAWS 229.

LAWS 6042. Criminal Justice Clinic II. 3 Units.
The immigration Practicum provides an opportunity for students of achieve practical immigration experience by working with real-life situations before the immigration Court and the USCIS. Students will work on pending matters that may include preparation of legal memoranda or briefs, applications for relief (such as asylum, cancellation of removal, protection under the Violence Against Women, protections of non-citizen victims of domestic violence), and evidentiary submissions for pending cases. Students are required to attend master (preliminary) and individual hearings, and a pro bono refugee clinic offered with the Catholic Charities or Legal Aid Society. This is a year-long course. Prereq: LAWS 277.

LAWS 6010. Basic Mediation Training. 1 Unit.
This course provides students with basic mediation training. After successful completion, students will be certified, allowing them to serve as volunteer mediators in forums where basic training is required.
LAWS 6104. Eminent Domain Law: Litigation Techniques and Trial Practice. 2 Units.
This course will provide students with a study of the law of eminent domain as it has evolved under the US Constitution and State of Ohio laws, with a special focus on the emerging law that has developed on the last decade. Will provide a special opportunity for students to understand the techniques and strategy of the litigation of modern eminent domain actions, both from the perspective of the acquiring agency as well as the private property owner. Also, provides exposure to the trial of an eminent domain action, both from the perspective of the acquiring agency as well as the private property owner. Also, provides exposure to the trial of an eminent domain action and special techniques, strategies, and practice pointers related to the successful trial of right to take proceedings before a judge and the trial of jury actions on issues of compensation.

LAWS 6106. Pretrial Practice: Medical Malpractice. 2 Units.
This advanced skills course is a specialized version of the Pretrial Practice (Civil) course. The focus is on the work of counsel for plaintiffs and defense counsel in medical malpractice cases including pleading, discovery, motion practice, and settlement negotiation. The course will emphasize the special problems confronted in medical malpractice cases such as obtaining and interpreting medical records and dealing with expert medical witnesses.

LAWS 6107. Pretrial Practice: Civil. 2 Units.
This course picks up where most first-year legal research and writing courses leave off. We will examine intensively, among other things, the various discovery devices (including depositions, interrogatories, document requests, and requests to admit), pretrial motion practice, litigation as a means of achieving the best possible negotiated result, and alternative dispute resolution mechanisms (including mediation and arbitration). In other words, we will study the things that litigators spend most of their time doing and thinking about: how lawyers go about gathering and preserving evidence, the everyday interactions they have with courts, and the reasons they do all these things even though they rarely expect to get all the way to trial. The course will include simulations and extensive drafting assignments.

LAWS 6108. Pretrial Practice: Criminal. 2 Units.
This course introduces students to the key activities lawyers undertake in a criminal case in advance of trial. This course examines the various steps leading up to trial, such as the preparation of an indictment, the drafting of discovery requests, motion practice related to discovery and the suppression of evidence, preparation and negotiation of plea agreements, and other motion practice related to the pre-trial phase. This course is designed to expose students to the pretrial phase in a criminal case from the perspective of both the prosecution and defense. Anticipated topics for discussion will include case investigation, the gathering of evidence, pretrial problems typically encountered in a criminal case, and the role sentencing guidelines can have in shaping plea negotiations and other pretrial negotiations. The course will include simulations, drafting assignments, opportunities for mock oral argument, and negotiating exercises. Limited to 12 students.

LAWS 6109. Trial Tactics. 4 Units.
An intensive course in trial tactics, techniques, and advocacy. The emphasis during the first half of the semester is on practice in the separate components of a trial: direct examination, objections, cross-examination, use of rehabilitative devices, examination of expert witnesses, jury selection, opening statements, closing argument, and pretrial preparation. During the second half of the semester each student acts as co-counsel in a full trial. Videotape recording is used for critiquing student performance throughout the semester. Students may not take both LAWS 397 and LAWS 395 (Trial Practice). Prereq: LAWS 207 or LAWS 212.

LAWS 6111. Appellate Practice. 3 Units.
This course is designed to teach students the rules and formalities of appellate practice and help students develop the skills necessary to write an effective appellate brief and present a persuasive oral argument. During the first semester students research and write an appellate brief and engage in short in-class oral arguments. During the second semester students receive instruction on the organization and presentation of longer oral arguments, engage in a practice oral round and receive an individualized critique of their performance. They complete the course by competing in the Dunmore Moot Court Tournament, which culminates in a final round oral argument before sitting judges in the spring. Prereq: LAWS 801 and LAWS 802.

LAWS 6501. Canada - United States Law Journal. 0 Units.
Students enrolled in this non-credit course will serve as writers and editors for the annually published Canada - U.S. Law Journal.

LAWS 6503. Health Matrix Seminar. 2 Units.
Students write their Health Matrix notes throughout the year long Health Matrix Seminar. Students work closely with the instructor to develop their topics, outlines, several drafts, and final notes. The course will include multiple individual meetings with the professor, extensive feedback, and oral presentations of the papers. Students will develop their writing and oral presentation skills and will receive training concerning advanced legal research, plagiarism, and statutory interpretation. 2L associates also will have responsibilities for journal production work, such as verifying footnotes.

LAWS 6504. Law Review Seminar. 2 Units.
The seminar will provide training in writing, editorial skills, and advanced legal research for students writing notes for the Case Western Reserve Law Review. Topics to be covered include plagiarism, selecting a topic, web-based research, advanced Lexis and Westlaw research, advanced research training in selected substantive areas, and writing techniques. Satisfactory completion of the note will satisfy the upper-level writing requirement. Grade based on the quality of the note and class participation.
LAWS 6505. Law, Technology and Internet Journal. 0 - 3 Units.
The Journal of Law, Technology and the Internet Seminar offers students interested in technology and intellectual property the opportunity to write their notes through a year-long seminar. Students work closely with the instructor to develop their topics, thesis, outlines, and final note. Students will have numerous individual meetings with the professor and extensive feedback of the papers. Students will develop their writing skills, learn about plagiarizing, and will receive training concerning advanced legal research. 2L associates will be trained for journal production work such as verifying citations. The course will also include 3-4 whole group meetings through the quarter. Second year students will also be responsible for performing an in-depth evaluation of the article accepted through the peer-review process. 2L editors will ensure that submitted articles have not been preempted by any article already in print. Once an article has been approved by the Faculty Peer-Reviewers, 2L editors will be given portions of the article for which they are responsible for verifying all citations, and performing textual edits required to bring the article into compliance with Journal policies.

LAWS 6512. Int’l Law Journal Board. 2 Units.
LAWS 6513. Health Matrix. 2 Units.
LAWS 6514. Law Review Editorial Board. 2 Units.
LAWS 6550. Mock Trial. 2 Units.
LAWS 6560. Moot Court Team. 2 Units.
LAWS 6570. Transactional Lawyering Team Competition. 2 Units.
Participants take part in national competition of drafting and negotiating sophisticated contracts and are judged on their drafting and negotiating skills. Course obligations include a competitive round internally to determine the team composition, research and drafting a sophisticated transactional agreement including classroom sessions on relevant topics, participation in practice sessions, and travel to and participation in a regional competitive meet and, if successful there, a national competitive meet.

LAWS 6600. Supervised Research Seminar. 1 - 2 Unit.
Second- and third-year students may earn graded credit for an individual research project of scholarly depth and scope, under the close supervision of a faculty member. Approval of the faculty supervisor is required before registration. No student may undertake more than two Supervised Research projects or earn more than a total of four hours of Supervised Research credit. No student may work on more than one Supervised Research project in one semester. May satisfy the writing requirement.

LAWS 6701. Access to Justice Externship. 3 Units.
This is an externship program in which students work at the Legal Aid Society of Cleveland for 12 hours per week with and under the direct supervision of Legal Aid attorneys. (For the summer program, students will work full time for 10 weeks during the summer months.) Students will research substantive and procedural legal issues, draft memoranda, and assist with preparation of cases. Students will work on a variety of issues, depending on student interest and agency need. In the past students have worked on substantive matters in the areas of family law, bankruptcy, housing, worker’s compensation, government benefits, special education and immigration. Students will interact with the law school faculty liaison through journals and periodic meetings to discuss and further reflect upon the externship experience. For more information about the Legal Aid Society of Cleveland, students are encouraged to visit http://www.lasclev.org/.

LAWS 6705. Curricular Training: Law Field Research. 0 Units.
This course is intended exclusively for the foreign national J.D. or LL.M. law student who wishes to gain applied legal experience based on their intended career path with an organization that offers course credit for internship experience. These internships may be either paid or unpaid. This course will provide a means for the student to build required skills and bridge the gap between the classroom and real world application. The student is encouraged to explore and discover additional avenues to assist in the management and advancement of his/her career. Does not count toward J.D. credit.

LAWS 7001. Access to Justice Externship. 3 Units.
This is an externship program in which students work at the Legal Aid Society of Cleveland for 12 hours per week with and under the direct supervision of Legal Aid attorneys. (For the summer program, students will work full time for 10 weeks during the summer months.) Students will research substantive and procedural legal issues, draft memoranda, and assist with preparation of cases. Students will work on a variety of issues, depending on student interest and agency need. In the past students have worked on substantive matters in the areas of family law, bankruptcy, housing, worker’s compensation, government benefits, special education and immigration. Students will interact with the law school faculty liaison through journals and periodic meetings to discuss and further reflect upon the externship experience. For more information about the Legal Aid Society of Cleveland, students are encouraged to visit http://www.lasclev.org/.
LAWS 7009. Equal Employment Opportunity Commission Externship. 3 - 4 Units.
This is an externship program in which students approved by the EEOC Chief Administrative Judge will work at the EEOC’s local office for 12 hours per week during the academic semester, or 40 hours per week for nine weeks during the summer, with and under the direct supervision of Administrative Judges primarily on litigation matters. Students will gain legal and practical experience in administrative law and employment discrimination issues, including those that fall under the statutes that the EEOC enforces: Title VII, the Americans with Disabilities Act, the Age Discrimination in Employment Act, and the Equal Pay Act. The students will work with EEOC’s local Administrative Judges who adjudicate cases brought by federal employees against various federal agencies under these statutes. Students will also attend periodic meetings in which they will review and reflect upon the work engaged in on the matters assigned, learn about other EEOC matters, and discuss various topics relating to the EEOC’s mission and jurisdiction. Topics in these discussions may include substantive law dealt with the various cases before the EEOC and various lawyering skills, including drafting opinions, as well as topics like negotiation, settlement, and professionalism. Students will interact with the law school faculty liaison through journals and periodic meetings to discuss and further reflect upon the externship experience.

LAWS 7015. Federal Public Defender Externship. 3 Units.
This externship program will give students an opportunity to observe and participate in many facets of federal criminal procedure and practice. Under the supervision of the Federal Public Defender and his staff, students will research and draft legal memoranda, pre-trial motions, sentencing motions, and appellate briefs. Students will also observe court proceedings and assist in trial and hearing preparation. Students will work on a variety of cases, including drug, firearm, fraud, and white collar crime. Given the pace and work demands of the Office of the Federal Defender, this externship program will have students assisting with substantive legal work.

LAWS 7019. Federal Trade Commission Externship. 3 Units.
This externship program will expose students to federal civil practice involving the Federal Trade Commission in a range of civil matters primarily focused on the FTC’s consumer protection mission. The externship includes seminar-style discussions with both junior and senior FTC litigators in the East Central Region office. Students will assist FTC attorneys and staff in the preparation and presentation of their cases.

LAWS 7022. General Counsel Externship. 3 - 4 Units.
This is an externship program in which students selected by the law school will work at the Office of the General Counsel of John Carroll University, for approximately 12 hours per week during the fall or spring semester. During the summer, students will work full time for approximately 9 weeks. Students will work under the direct supervision of the General Counsel or her staff on pending matters. They will engage in a variety of activities including legal research, fact investigation, preserving testimony of witnesses via affidavits, client interviews, reviewing and drafting of memoranda and policies, contracts and other corporate documents. Students will focus on legal issues involving corporate law and governance, contracts, employment law, as well as other legal issues unique to higher education. Students will also attend regularly scheduled discussions in which they will review the work they have completed, and various topics relating to the practice of the Office of General Counsel. Students will interact with a law school faculty liaison through journals and periodic meetings to discuss and further reflect upon the externship experience. Students must be approved by the Office of General Counsel.

LAWS 7028. Hospital Law Externship. 3 Units.
This is an externship program in which students will work in the general counsel’s office of a large hospital center. Participating hospitals are the MetroHealth System, Summa Health System, University Hospitals of Cleveland, and the Cleveland Clinic Foundation. Students will be selected by the law school and, in some cases, with the participation of the supervising hospital attorney. Students will work in the office of the general counsel for approximately 12 hours per week during the spring semester. Students will work under the direct supervision of a supervising attorney. They will engage in a variety of activities including conducting legal research, drafting memoranda, letters, and other documents, and preparing presentations to hospital attorneys. Students also will shadow their supervising attorney and participate in day-to-day activities of the office. Additionally, students will work with client departments and departmental staff to gather information and to gain insight into and understanding of the clinical, business, and health care operations of a large health system.

LAWS 7035. International Tribunal Externship. 12 Units.
This program provides opportunity for students to participate in a semester long program with a tribunal program arranged through the Cox International Law Center.

LAWS 7040. Internal Revenue Service Externship. 3 Units.
This externship program will expose students to federal civil tax practice involving the IRS and Office of IRS Chief Counsel, including a broad range of issues involving the assessment and collection of federal taxes. The externship includes seminar discussions and placement in the local office of IRS Chief Counsel. Students will assist the attorneys in providing legal assistance to IRS personnel, in federal tax litigation in the U.S. Tax Court, and providing legal assistance to the U.S. Attorney’s Office in federal tax litigation.

LAWS 7045. Judicial Externship Seminar. 4 Units.
Students in the spring of their first year are selected for summer externships with specific federal district and circuit judges. Classes in the spring of the first year, during the externship summer, and in the fall of the second year complement the eight weeks of externing in the judge’s chamber. Recommended preparation: Permission of the instructors.
LAWS 7048. Ohio Appeals Court Externship. 3 - 4 Units.
This is an externship program in which students approved by the judges involved will work at an Ohio appellate court for 12 hours per week during the academic semester, or 40 hours per week for 9 weeks during the summer, with and under the direct supervision of the judges and their staff. The externship will involve research and writing support for one or more of the appellate judges. It will expose the student to the inner workings of the appellate courts, including the process of preparing for oral argument, review of briefing, and drafting of opinions. The extern will also have direct and regular contact with the assigned judge(s) and other court personnel and will have several opportunities to observe oral arguments. Students will also attend periodic meetings in which they will review and reflect upon their work on the matters assigned, learn about other pending matters, and discuss various topics relating to the work of the courts. Topics in these discussions may include substantive or procedural issues dealt with in the various cases before the courts and various lawyering skills, including drafting opinions, as well as topics including ethics and professionalism is appellate practice. The faculty supervisor will meet weekly with the extern to discuss the experience, provide feedback on the extern’s weekly journal, and to amplify the extern’s understanding of the substantive legal issues involved in the extern’s work.

LAWS 7050. Prosecutor’s Office Externship. 3 - 4 Units.
This externship program will expose students to many facets of state criminal practice through their placement in a particular division of the Prosecutor’s office including, for example, the Grand Jury Division, Children and Family Services Division, Juvenile Division, Felony Trial Division, and the Appellate Division.

LAWS 7061. United States Attorney Externship: Criminal. 3 Units.
This is an externship program in which students selected by the law school will work at the United States Attorney’s Office in Cleveland for 12 hours per week, with and under the direct supervision of Assistant U.S. Attorneys on cases under investigation or being prosecuted by that office. Most cases will involve general crimes (robbery, theft, immigration, etc.), or offenses involving drugs or firearms. Students will observe and, in some cases, participate (as assistants to the AUSA on the case) in pretrial and court proceedings, and will work on projects to assist in the prosecution of the cases to which they are assigned. Students will research significant legal issues, draft briefs and pleadings and assist with witness and exhibit preparation. Students will also attend a 1-hour weekly seminar in which they will review and reflect upon the court proceedings observed and the work engaged in on the cases assigned, and discuss various topics relating to federal civil litigation involving the government. Topics in the seminar may include authority and responsibility of the U.S. Attorney, ethics, litigation with the government, discovery and pre-trial practice, expert witnesses, damages, compromise and settlement, sanctions and civility. Students must be approved by the United States Attorney following completion, review and approval of a security clearance application.

LAWS 7062. U.S. Attorney Externship: Civil. 3 Units.
This is an externship program in which students selected by the law school will work at the United States Attorney’s Office in Cleveland for 12 hours per week, with and under the direct supervision of Assistant US Attorneys on civil cases being handled by that office. Most cases will involve torts, employment discrimination, immigration and prisoner habeas, administrative appeals, environmental enforcement, bankruptcy, debt collection and civil fraud. Students will observe and, in some cases, participate (as assistants to the AUSA on the case) in pretrial and court proceedings, and will work on projects to assist in the prosecution of the cases to which they are assigned. Students will research significant legal issues, draft briefs and pleadings and assist with witness and exhibit preparation. Students will also attend a 1-hour weekly seminar in which they will review and reflect upon the court proceedings observed and the work engaged in on the cases assigned, and discuss various topics relating to federal civil litigation involving the government. Topics in the seminar may include authority and responsibility of the U.S. Attorney, ethics, litigation with the government, discovery and pre-trial practice, expert witnesses, damages, compromise and settlement, sanctions and civility. Students must be approved by the United States Attorney following completion, review and approval of a security clearance application.

LAWS 7071. Cuyahoga County Law Department Externship. 3 - 4 Units.
This is an externship program in which students approved by the Department attorneys will work at the Cuyahoga County Law Department for 12 hours per week during the academic semester, or 40 hours per week for nine weeks during the summer, with an under the direct supervision of Law Department attorneys primarily on transactional and legislative matters. Students will gain legal and practical experience in economic development issues, the legislative process, government contracting, including competitive - bidding requirements, negotiating and drafting contracts. Students will also attend periodic meetings in which they will review and reflect upon the work engaged in on the matters assigned, learn about other law department matters, and discuss various topics relating to the law department’s mission and jurisdiction. Topics in these discussions may include substantive law dealt with in the various sections of the law department, various lawyering skills including drafting, negotiation and settlement and professionalism. Students will interact with the law school faculty liaison through journals and periodic meetings to discuss and further reflect upon the externship experience. Students must be approved following a security clearance application.

LAWS 7080. Sports/Entertainment Law Externship. 3 Units.
This externship is offered to selected students who participate in the summer Great Lakes Sports and Entertainment Law Academy. This externship offers academic credit for placement with various high-profile sports and entertainment law institutions.
School of Law Faculty

School of Law Faculty

Jonathan H. Adler, JD
(George Mason University)
Johan Verheij Memorial Professor of Law; Director of the Center for Business Law and Regulation

Michael J. Benza, JD
(Case Western Reserve University)
Senior Instructor in Law

Jessica Wilen Berg, JD, MPH
(Cornell University; Case Western Reserve University)
Professor of Law, Bioethics & Public Health; Associate Director of the Law-Medicine Center

Jaime Bouvier, JD
(Case Western Reserve University)
Senior Instructor in Law

David J. Carney, JD
(University of Michigan)
Professor of Law

Kathleen M. Carrick, MLS, JD
(University of Pittsburgh; Cleveland State University)
Associate Professor of Law; Director of the Judge Ben C. Green Law Library

Juscelino Colares, JD, PhD
(Cornell University; University of Tennessee)
Professor of Law; Associate Director of the Frederick K Cox International Law Center

Avidan Y. Cover, JD
(Cornell University)
Assistant Professor of Law; Associate Director of the Institute for Global Security Law & Policy

Jennifer I. Cupar, JD
(Case Western Reserve University)
Professor of Law

Carol T. Fox, JD, PhD
(Case Western Reserve University)
Senior Instructor in Law

George W. Dent Jr., JD, LLM
(Columbia University; New York University)
Professor of Law

Jonathan L. Entin, JD
(Northwestern University)
David L. Brennan Professor of Law; Professor of Political Science

Leon Gabinet, JD
(University of Chicago)
Coleman P. Burke Professor of Law

Peter M. Gerhart, JD
(Columbia University)
Professor of Law

Paul C. Giannelli, JD & LLM, MSFS
(University of Virginia; George Washington University)
Albert J. Weatherhead III and Richard W. Weatherhead Professor of Law; Distinguished University Professor

Jonathan C. Gordon, JD
(Columbia University)
Professor of Law

Richard K. Gordon, JD
(Harvard University)
Professor of Law; Director of the Institute for Global Security Law and Policy

B. Jessie Hill, JD
(Harvard University)
Professor of Law

Sharona Hoffman, JD, LLM
(Harvard University; University of Houston)
Edgar A. Hahn Professor of Law and Bioethics; Co-Director of the Law-Medicine Center

Daniel A. Jaffe, JD
(Columbia University)
Associate Professor of Law

Erik M. Jensen, JD
(Cornell University)
Schott - van den Eynden Professor of Law

Lewis R. Katz, JD
(Indiana University)
John C. Hutchins Professor of Law, Director of Foreign Graduate Legal Studies

Maureen Sheridan Kenny, JD
(Cleveland State University)
Professor of Law

Charles R. Korshom, JD
(Yale University)
Assistant Professor of Law

Juliet P. Kostritsky, JD
(University of Wisconsin)
Everett D. and Eugenia S. McCurdy Professor of Contract Law

Raymond Shih Ray Ku, JD
(New York University)
Professor of Law; Co-Director of the Center for Law, Technology, and the Arts

Yuri R. Linetsky, JD
(Case Western Reserve University)
Senior Instructor in Law

Judith P. Lipton, JD
(University of Connecticut)
Professor of Law; Co-Director of the Milton A. Kramer Law Clinic Center

Kenneth R. Margolis, JD
(Case Western Reserve University)
Professor of Law

Kevin C. McMenigal, JD
(University of California, Berkeley)
Judge Ben C. Green Professor of Law

Laura E. McNally, JD
(Syracuse University)
Professor of Law

Maxwell J. Mehlman, JD
(Yale University)
Arthur E. Petersilge Professor of Law; Professor of Bioethics; Director of the Law-Medicine Center

Kathryn Sords Mercer, MSSW, JD (Case Western Reserve University)

Professor of Law

Lawrence E. Mitchell, JD (Columbia University)

Dean and Joseph C. Hostetler-Baker & Hostetler Professor of Law

Dale A. Nance, JD (Stanford University)

John Homer Kapp Professor of Law

Craig Allen Nard, JD, JSD & LLM (Capital University; Columbia University)

Tom J.E. and Bette Lou Walker Professor of Law; Director of the Center for Law, Technology and the Arts

Andrew Pollis, JD (Harvard University)

Assistant Professor of Law

Cassandra Burke Robertson, JD (University of Texas)

Associate Professor of Law

Matthew Rosman, JD (New York University)

Professor of Law; Co-Director of the Milton A. Kramer Law Clinic Center

Michael P. Scharf, JD (Duke University)

John Deaver Drinko-Baker & Hostetler Professor of Law; Director of the Frederick K. Cox International Law Center

Carolyn K. Seymour, JD (University of Michigan)

Professor of Law

Calvin William Sharpe, JD (Northwestern University)

Galen J. Roush Professor of Law

Ted Steinberg, PhD (Brandeis University)

Adeline Barry Davee Distinguished Professor of History and Professor of Law

Barbara R. Snyder, JD (University of Chicago)

University President and Professor of Law

Robert N. Strassfeld, JD (University of Virginia)

Professor of Law

Timothy Webster, JD, LLM (Cornell University)

Assistant Professor of Law

Ruqaiijah Yearby, JD, MPH (Georgetown University; Johns Hopkins University)

Professor of Law

Professor for the Practice of Banking & Finance and Law

Shannon E. French, PhD (Brown University)

Inamori Professor of Ethics; Professor of Law; Director of the Inamori International Center for Ethics and Excellence

Brian K. Gran, JD, PhD (Indiana University; Northwestern University)

Associate Professor of Sociology and Law

Kenneth F. Ledford, JD (University of North Carolina), PhD (Johns Hopkins University)

Associate Professor of History and Law

Martha A. Woodmansee, PhD (Stanford University)

Professor of English and Law

Secondary Faculty

Scott Fine, MBA (Stanford University)
School of Medicine

The mission of the Case Western Reserve University School of Medicine (http://casemed.case.edu) is to advance the health of humankind through the four interrelated components of Education, Research, Clinical Care and Public Service.

The School of Medicine provides two tracks leading to the MD degree: the longstanding School of Medicine program, also called the University track, and the Cleveland Clinic Lerner College of Medicine at Case Western Reserve University, also known as the College track, which first admitted students in 2004. The School boasts a longstanding Medical Scientist Training Program, or MSTP, and, through the School of Graduate Studies, programs resulting in PhD and MS degrees, as well as certificates in disciplines led by faculty in the School of Medicine.

As a research institution, the School of Medicine has a tradition of national leadership. The School of Medicine consistently ranks in the top tier of the nation’s medical schools for federal research funding from the National Institutes of Health, and is proud of its Clinical Translational Service Award in partnership with its affiliates. In fiscal year 2010, the School earned more than $340 million in grants from the NIH including grants through the affiliated Cleveland Clinic Lerner College of Medicine. Faculty and trainee research is routinely reported in the nation’s top journals, leading to biomedical discoveries and improved health.

The School of Medicine engages the community in public service in many ways. The School of Medicine’s commitment links researchers and medical students to the community. The school’s faculty provide 90 percent of the indigent health care in Cuyahoga County and a majority of the care for indigent patients in Ohio. A major economic influence on the northern Ohio area, the School of Medicine and its affiliated hospitals are among the largest employers of personnel in the area and further stimulate the economy by providing concepts for technology transfer to the business sector. On the international level, the School of Medicine has a global health and diseases program focusing on AIDS, tuberculosis, malaria and other diseases that directly threaten world health.

The school is very proud of the contributions made by its educators and graduates but doesn’t rest on its laurels. The curriculum constantly responds to the latest findings in education and medicine and sets the pace for other schools with input from gifted and committed scholars.

At least eleven Nobel Prize holders have ties to the School of Medicine:

• John J.R. Macleod, MB, ChB, DPH, physiology professor at Case from 1903 to 1918, shared the 1923 Nobel Prize in Physiology or Medicine for the discovery of insulin. Dr. Macleod completed much of his groundwork on diabetes in Cleveland.

• Corneille J.F. Heymans, MD, who was a visiting scientist in the Department of Physiology in 1927 and 1928, received the Nobel Prize in Physiology or Medicine in 1938 for work on carotid sinus reflexes.

• Frederick C. Robbins, MD, shared the 1954 Nobel Prize in Physiology or Medicine for his work on the polio virus, which led to the development of polio vaccines. He received the award two years after joining the medical school. Dr. Robbins was active at the school until his death in 2003, at which time he held the titles of medical school dean emeritus, University Professor emeritus, and emeritus director of the Center for Adolescent Health.

• Earl W. Sutherland Jr., MD, who had been professor and director of pharmacology from 1953 to 1963, won the 1971 Nobel Prize in Physiology or Medicine for establishing the identity and importance of cyclic adenosine monophosphate (AMP) in the regulation of cell metabolism.

• Paul Berg, PhD, who earned his biochemistry degree at the university in 1952, received the 1980 Nobel Prize in Chemistry for pioneering research in recombinant DNA technology.

• H. Jack Geiger, MD, a 1958 alumnus of the medical school, is a founding member and past president of Physicians for Social Responsibility, which shared the 1985 Nobel Peace Prize as part of International Physicians for the Prevention of Nuclear War, and Physicians for Human Rights (PHR), which shared the 1997 Nobel Peace Prize as part of the International Campaign to Ban Landmines.

• George H. Hitchings, PhD, who had been a biochemistry instructor from 1939 to 1942, shared the 1988 Nobel Prize in Physiology or Medicine for research leading to the development of drugs to treat leukemia, organ transplant rejection, gout, the herpes virus and AIDS-related bacterial and pulmonary infections.

• Alfred G. Gilman, MD, PhD, a 1969 graduate of the medical school, shared the 1994 Nobel Prize for Physiology or Medicine for identifying the role of G proteins in cell communication.

• Ferid Murad, MD, PhD, a 1965 graduate of the medical school, shared the 1998 Nobel Prize in Physiology or Medicine for discoveries concerning nitric oxide as a signaling molecule in the cardiovascular system.

• Paul C. Lauterbur, PhD, a 1951 graduate of the engineering school and a visiting professor of radiology at Case in 1993, shared the 2003 Nobel Prize in Physiology or Medicine for pioneering work in the development of magnetic resonance imaging.

• Peter C. Agre, MD, who completed a fellowship in hematology at Case while a medical student at Johns Hopkins, shared the 2003 Nobel Prize in Chemistry for discoveries that have clarified how salts and water are transported out of and into the cells of the body, leading to a better understanding of many diseases of the kidneys, heart, muscles and nervous system.

Two other distinguished alumni have served as U.S. surgeon general: Jesse Steinfeld, MD, a 1949 graduate, was surgeon general from 1969 to 1973, and David Satcher, MD, PhD, who graduated in 1970 and was surgeon general from 1998 to 2002.

Dr. Satcher also served as director of the Centers for Disease Control and Prevention from 1993 to 1998, and another medical school graduate, Julie Gerberding, MD, MPH, followed in his footsteps, in 2002 becoming the first woman to be named CDC director.

History

Since its founding in 1843, the Case Western Reserve University School of Medicine has been an innovator in medical education and a leader in pioneering research. Beginning as the Medical Department of Western Reserve College (and popularly known then as the Cleveland Medical College), the school moved into its first permanent home, in downtown Cleveland, in 1846. In 1915, a 20-acre site was secured for a medical center in University Circle, the current home of Case Western Reserve University, its School of Medicine, and two of the school’s affiliated hospitals, University Hospitals of Cleveland and the Louis Stokes Cleveland Department of Veterans Affairs Medical Center. University
Circle also is home to many of the country’s outstanding cultural and educational institutions.

The school was one of the first medical schools in the country to employ instructors devoted to full-time teaching and research. Six of the first seven women to receive medical degrees from accredited American medical schools graduated from Western Reserve College (as it was called then) between 1850 and 1856.

Already a leading educational institution for more than a century, in 1952 the School of Medicine initiated the most advanced medical curriculum in the country, pioneering integrated education, a focus on organ systems and team teaching in the preclinical curriculum. This curriculum instituted a pass/fail grading system for the first two years of medical school to promote cooperation among students instead of competitiveness, introduced students to clinical work and patients almost as soon as they arrived on campus, and provided free, unscheduled time in an era when doing so seemed unthinkable. Many other medical schools followed suit, and these components remain at the core of the medical school’s curriculum today.

In 1924, the School of Medicine moved into the most modern and best-equipped preclinical science building in the country at that time. That building, donated by Cleveland industrialist Samuel Mather, remains an integral part of the medical school complex. It was named the Harland Goff Wood Building in 1993 in honor of the late chair and professor of biochemistry and former provost of the university.

In 1971, the Health Sciences Center was completed to house the university’s medical, dental and nursing schools, as well as the Health Center Library. In 1994, the health sciences complex was named for now-retired U.S. Congressman Louis Stokes. The proximity of these excellent research and educational centers to other prestigious university departments, including science, engineering and social sciences, stimulates uniquely creative interaction among researchers and educators.

Another giant leap in research capabilities came in the early 1990s, when the Richard F. Celeste Biomedical Research Building, named for the former Ohio governor, was opened. The $70 million building, attached to the Wood Building, added 154,000 square feet of research space and includes conference spaces, a lecture hall, public spaces and a cafeteria.

The School of Medicine was the first medical school to provide laptop computers to all its students. Today, students use their laptops to access the entire syllabus as well as numerous electronic resources deemed essential by faculty. Students have access to the WiFi network at the medical school and across campus. Technology is used to enhance, not replace, the faculty-student interaction that occurs in the classroom, the laboratory and small group discussions.

In 2002, the School of Medicine became only the third institution in history to receive the best review possible from the body that grants accreditation to U.S. and Canadian medical degree programs, the Liaison Committee on Medical Education. Also in 2002, the school built on its tradition of innovation in education when the university and the Cleveland Clinic entered into an agreement to form the Cleveland Clinic Lerner College of Medicine of Case Western Reserve University, with the first students matriculating in 2004. The “College Track” is a program within the Case Western Reserve University School of Medicine. The Cleveland Clinic serves as an outstanding teaching site for all medical students in the School of Medicine, in addition to being the site for pre-clerkship education in the College Track.

In 2002, the university and Cleveland Clinic entered into a landmark agreement to form the Cleveland Clinic Lerner College of Medicine of Case Western Reserve University, with the first students matriculating in 2004. The “College Track” is a program within the Case Western Reserve University School of Medicine. The Cleveland Clinic serves as an outstanding teaching site for all medical students in the School of Medicine, in addition to being the site for pre-clerkship education in the College Track.

Cleveland Clinic was founded in 1921 by four Case Western Reserve faculty members, three of whom are counted among the alumni of the Case School of Medicine. Cleveland Clinic’s main campus, where much of the activity associated with the program will occur, is located on 180 acres adjacent to the Case Western Reserve campus.

Occupying 50 buildings, the main campus includes a hospital, an outpatient clinic, a children’s hospital, heart and vascular institute, cancer institute, eye institute, research institute and supporting labs and facilities. To better serve the Cleveland suburbs with primary care services, Cleveland Clinic operates 16 family health centers, eight regional hospitals and medical offices throughout Northeast Ohio, staffed with Cleveland Clinic primary care physicians, as well as many medical and surgical specialists. State-of-the-art imaging services are available, and several locations contain pharmacies and outpatient surgery centers that provide same-day surgical services close to home. In 2011, the clinic recorded more than 4.2 million outpatient visits throughout the health system and 155,000 hospital admissions. Among them were patients from all 50 states and more than 100 countries. More than 2,800 full-time physicians and scientists and 11,000 nurses represent 120 medical specialties and subspecialties. Cleveland Clinic is consistently named as one of the nation’s top hospitals by U.S. News & World Report, and our heart and heart surgery program has been ranked No. 1 by U.S. News since 1995. Go here (http://my.clevelandclinic.org/default.aspx) for more information.
The MetroHealth System (http://metrohealth.org)

The MetroHealth System is one of the largest, most comprehensive health care providers in Northeast Ohio, caring for people in and around Greater Cleveland for more than 170 years. This academic health care system is committed to the communities it serves by saving lives, restoring health, promoting wellness, and providing outstanding, lifelong care that is accessible to all.

Affiliated with Case Western Reserve University School of Medicine since 1914, MetroHealth is a center for medical research and education, with all active staff physicians holding CWRU faculty appointments. More than 400 primary care and specialty care physicians practice within The MetroHealth System. At the core of the MetroHealth system, is the MetroHealth Medical Center. The system’s main health care provider, research facility and teaching hospital is also home to the region’s only Level 1 trauma and burn center. However, The MetroHealth System also serves Greater Cleveland with more than a dozen urban and suburban primary and specialty healthcare centers in Cleveland, Strongsville, Westlake, Lakewood, Pepper Pike and Beachwood.

MetroHealth has received many accolades for its high level of care and the innovation of its physicians. Surgeons at MetroHealth are pioneering new techniques in minimally-invasive surgery for faster recoveries, while its primary care physicians are developing cutting-edge ways to manage common and chronic diseases through the use of electronic medical records and a patient-centered medical home model called Partners in Care. Its maternal-fetal medicine specialists are successfully managing the riskiest of pregnancies and saving the tiniest of lives. In addition, MetroHealth is nationally recognized by the American Heart Association for cardiac and stroke care and the cancer center has earned outstanding achievement awards for the treatment of cancer patients. Every year, MetroHealth provides care to more than 28,000 inpatients and delivers approximately 3,000 newborns. More than 790,000 visits are recorded each year in the medical center’s outpatient centers, and patient visits to the emergency department exceed 99,000. To learn more about MetroHealth and its locations and services, go here (http://metrohealth.org).

The Louis Stokes Cleveland Department of Veterans Affairs Medical Center (http://www.cleveland.va.gov)

The Louis Stokes Cleveland Department of Veterans Affairs Medical Center (VAMC) is a major teaching hospital of the School of Medicine and is an important site for the education of medical students. The Cleveland VAMC also supports more than 100 residency and fellowship training positions in medicine, surgery, and psychiatry and their subspecialties. Most VAMC physicians hold faculty appointments within the School of Medicine. The affiliation is overseen by the Deans Committee, consisting of the dean, department chairpersons from the School of Medicine, and key VAMC officials.

The Cleveland VAMC is a part of the VA Healthcare System of Ohio, linking VA health care facilities in Ohio in an integrated service network. Inpatient care is provided at the Wade Park location and includes medicine, surgery, psychiatry, spinal cord injury, neurology and rehabilitation medicine as well as a nursing home and a domiciliary. Outpatient care is delivered in primary and specialty care clinics located at Wade Park, Akron, Canton, Cleveland, East Liverpool, Lorain, Mansfield, New Philadelphia, Painesville, Ravenna, Sandusky, Warren and Youngstown. The medical center serves more than 100,000 individual veterans annually through approximately 11,600 hospital admissions and 1,884,000 outpatient visits.

An active research program includes activities funded through the Department of Veterans Affairs and other governmental and private funding sources. Total funding of approximately $21.5 million annually (from all sources) supports more than 50 principal investigators in a broad range of research endeavors. For more information, go here (http://www.cleveland.va.gov).
Institutes and Centers

Advanced Platform Technology Research Center of Excellence
216.791.3800 x6003
Ronald J. Triolo, PhD, Executive Director
Gilles Pinault, MD, Medical Director

The Advanced Platform Technology (APT) Research Center of Excellence (http://www.aptcenter.research.va.gov) is a multi-institutional center composed of investigators from Case Western Reserve University and the Louis Stokes Cleveland Department of Veterans Affairs. Building on the 25+ year history of rehabilitation research in northeast Ohio, the Center was created in 2005 with a $5.0 million award from the Veterans Health Administration [VHA] Rehabilitation Research and Development Service as a national VA Research Center of Excellence. This commitment was subsequently renewed in 2010 for a second 5-year term with an additional award of $5.0 million. An additional $6 million award in 2010 from the State of Ohio’s Department of Development further validated the Center’s ability to achieve its primary mission to serve the clinical needs of veterans with motor, sensory and cognitive deficits and limb loss. The total value of the APT-related research portfolio is presently $45 million.

The APT Center is providing leadership to create and deliver innovative devices based on cutting-edge microelectronics, materials and MEMS fabrication and is a catalyst for the discovery and development of new technologies and techniques that can be employed in the rehabilitation process to provide independence for veterans and other individuals with disabilities. These techniques include basic and clinical research programs and the development and administration of new device-based therapies to patients within the emphasis areas of neural interfaces, prosthetics and orthotics, health monitoring & maintenance and enabling technologies. The Center provides affiliated investigators seed funding, administrative support (grants preparation and management, regulatory and statistical support), professional engineering & prototyping and an established quality system for the documentation and control of device design and production. Leveraging its investigators’ exceptional track records in a variety of disciplines, the Center is promoting the translation of its research into clinical and commercial applications. Current clinical applications being investigated include intelligent braces, respiratory support, sensation and control of a prosthetic hand, urinary incontinence, behavioral recovery after traumatic brain injury and, monitoring brain activity.

Case Cardiovascular Center

216.368.3391
Mukesh K. Jain, MD, Director, Case Cardiovascular Research Institute
Daniel I. Simon, MD, Director, University Hospitals Harrington-McLaughlin Heart & Vascular Institute
Director, Case Cardiovascular Center

The Case Cardiovascular Center (CCC) (http://casemed.case.edu/casecardiovascularcenter) was established in 2006 with the central mission to develop premier clinical, research, and education programs in heart and vascular disease. The structure of the Center includes clinical (University Hospitals Harrington-McLaughlin Heart & Vascular Institute—UH-HMHVI) and research (Case Cardiovascular Research Institute—CVRI) arms.

The UH-HMHVI (http://www.uhhospitals.org/tabid/2210/default.aspx) is a multi-disciplinary team of nearly 60 full-time faculty members dedicated to (a) the prevention, diagnosis, and treatment of heart and vascular disease to both local and regional patient populations in Northeast Ohio, (b) the education and training of medical students, residents and fellows,
and (c) the development of breakthrough medical advancements and practices to deliver superior clinical outcomes. These clinical services range from primary to quaternary levels of expertise and are provided at all health care facilities within the University Hospitals healthcare system. The clinical programs are organized into 11 program centers that comprise the Institute.

The research activities of the CCC are focused on the development of premier research programs that span the full spectrum of activities from basic bench-side research to translational research (“first-in-man”) and clinical trials. The CVRI is focused on basic and translational studies. The Research & Innovation Center (RIC) of the UH-HMHVI is dedicated to innovative clinical trials and applied technology. The major areas of research focus in the CVRI include cardiovascular biology, mechanisms of gene regulation, innate immunity & inflammation, and stem cell & regenerative medicine. Investigators in the CVRI have full access to two laboratories for in vivo research in small and large animals. The RIC oversees all clinical research activities within cardiovascular medicine and surgery and is supported by a lead administrator along with nurse coordinators and staff to facilitate patient enrollment as well as regulatory/grant activities. Active areas of clinical research include interventional cardiology, vascular medicine, heart failure, electrophysiology, preventive cardiology & rehabilitative medicine, and cardiovascular imaging.

Case Center For Imaging Research
216.844.8076
Jeffrey L. Duerk, PhD, Director
Chris Flask, PhD, Scientific Director
The CCIR (http://ccir.case.edu) is a joint venture between Case Western Reserve University School of Medicine and University Hospitals of Cleveland. The CCIR through its ~40 faculty and state-of-the-art clinical and preclinical imaging capabilities promotes interdisciplinary and translational imaging research. The CCIR also serves as a shared resource for CWRU’s Cystic Fibrosis Center, the Case Comprehensive Cancer Center, the Center for Stem Cell and Regenerative Medicine, and the Clinical and Translational Science Collaborative (CTSC). As the imaging research program at CWRU continues to grow, we strive to make the CCIR imaging capabilities available to the broader research community. This overriding goal has led to a strong collaborative relationship between the CCIR imaging faculty and basic researchers in many disciplines.

Preclinical imaging facilities includes four high resolution MRI scanners, a microPET/CT scanner, a microSPECT/CT imaging system, and three bioluminescence/fluorescence systems. In addition, magnetic relaxometry scanners for high throughput screening of developmental MRI contrast agents, and recent addition of a cryofluorescence imaging system to obtain high resolution, 3D optical imaging capabilities enhance our technologies. CCIR staff provides quantitative image analysis as needed for specific applications. The CCIR clinical imaging research facilities offer a full range of imaging support. The facility includes 4 MRI scanners and one human PET/CT for clinical research studies. The CCIR has also recently completed a $1.2M construction project to create a new radiopharmaceutical facility. Together with our existing cyclotron and radioisotope delivery system, our imaging center now has the capacity to conduct a variety of molecular PET imaging studies from preclinical animal studies all the way to routine clinical studies.

The Center for AIDS Research
216.368.0271
Jonathan Karn, PhD, Director
Michael Lederman, MD, Co-Director
Since its founding in 1994, the Case Western Reserve University/University Hospitals Center for Aids Research (Case CFAR (http://cfar.case.edu)) has been a center of excellence for both clinical and basic science AIDS research. Investigators participating in the Case CFAR draw on resources from the Case Western Reserve University School of Medicine, University Hospitals Case Medical Center, MetroHealth Medical Center and the Cleveland Clinic Foundation and the Joint Clinical Research Center in Kampala Uganda. As the only NIH-funded CFAR in the Midwestern United States, the CFAR plays an important role in ensuring that cutting-edge AIDS research and well received community outreach is supported in our region of the country. Major strengths in the Case CFAR include international research, especially with respect to research in tuberculosis and HIV malignancy, microbicides, pathogenesis, virology, clinical trials, and training, at the national and international levels. As the first CFAR to make a major investment in international research, we have been able to expand a highly productive and long-standing scientific relationship with Makerere University, Kampa.

The Case CFAR shares and supports the mission of the National CFAR program to support a multi-disciplinary environment that promotes basic, clinical, epidemiologic, behavioral, and translational research in the prevention, detection, and treatment of HIV infection and AIDS. The Case CFAR provides: Leadership and strategic planning that promotes and supports outstanding HIV/AIDS research at our participating institutions, laboratory cores with expertise, state-of-the-art instrumentation and technologies; pilot grant awards and mentoring to develop junior faculty interested in HIV; educational and training efforts which encompass the whole range of contemporary HIV/AIDS research; community outreach programs, and the promotion of and participation in collaborative research efforts within the national CFAR network and in Uganda.

### The Center for Child Health and Policy at Rainbow Babies & Children’s Hospital

216.844.6253
Leona Cuttler, MD, Director
Ann Nevar, MPA, Supervisor

Established in 2007, the Center for Child Health and Policy at Rainbow (http://bulletin.case.edu/schoolofmedicine/www.rainbowbabies.org/healthpolicy) focuses on major health policy issues that are central to the well-being of children and youth. The Center recognizes that health policy forms a framework for all health care delivery, and that health policy is therefore essential to improving children’s health. In this way, the Center focuses on the nexus between policy and practice of pediatric medicine.

The Center fills the need to amalgamate expertise in pediatric medicine and research with expertise in health policy. Operating as a think tank, the Center brings together experts in child health, health finance, law and policy to perform policy analyses, consultations, research, educational programming, and community outreach to advance child health through policy. Work is focused on several areas including: Maternal/Fetal/Newborn Health; Chronic Illness; Quality; and Care Delivery Systems. The Center is the only program devoted to child health policy in Cleveland and one of few nationwide.

To date, the Center has accrued many products and achievements including: Ohio Health Policy Researcher of the Year in 2006; Ohio Health Policy Researcher of the Year for Independent Research in 2009; programs designated Centers of Excellence; multiple white papers, reports, and peer-reviewed publications; grants and awards from the National Institutes of Health, The Centers for Disease Control and Prevention, the Ohio Department of Health, the Ohio Department
of Job and Family Services, and numerous foundations; and invited/ elected memberships in state and national policy committees.

**Center For Health Care Research And Policy**

216.778.3902

Randall D. Cebul, MD, Director

The mission of the Center for Health Care Research & Policy (http://casemed.case.edu/mims) is to: 1) improve the health of the public by conducting research that improves access to health care, increases the quality and value of health care services, and informs health policy and practice; and 2) lead education and training programs that promote these goals. Formally established in 1994, the Center’s mission is carried out by a cross-disciplinary faculty who both lead and collaborate with other scholars in Northeast Ohio and beyond. A core faculty of 17 is extended by affiliated Senior Scholars throughout the university, assisted by an able staff and over 30 grant-supported research associates. The Center’s home at MetroHealth’s Rammelkamp Research and Education Building is an outstanding venue for collaborative research, mentoring of students and junior faculty, and cross-disciplinary seminars. The Center’s research and training focuses in programmatic areas that reflect national health care priorities as well as high impact problems in adults. Center Programs pertain to chronic conditions, especially stroke, obesity and diabetes, and kidney disease. Programs are supported by methods units, including biostatistics and evaluation, health care decision making, and health economics and health policy. Research using clinical informatics capitalizes on growing institutional capacities in electronic medical records (EMR) and clinical decision support. Center faculty view Northeast Ohio as a laboratory for research, recognizing the national relevance of regional challenges and opportunities. For over four years, the Center has served as the administrative home for Better Health Greater Cleveland, an EMR-catalyzed initiative to measure, publicly report, and improve health outcomes for the region’s residents with chronic medical problems. Center faculty also assume leadership roles in federally-supported degree programs in Health Services Research and Clinical Investigation and teach in the core curriculum of the School of Medicine.

**Center for Modeling Integrated Metabolic Systems**

216.368.4066

Gerald M. Saidel, PhD, Director

The Center for Modeling Integrated Metabolic Systems (MIMS) (http://casemed.case.edu/mims) combines mathematical modeling, computersimulation, and in vivo experimentation to quantify relationships between cellular metabolism and physiological responses of tissue-organ systems and the whole body. The MIMS Center was inspired by Dr. Marco E. Cabrera (deceased), who together with Prof. Gerald M. Saidel, co-directed this Center. It was established in 2002 with a $11.8 million grant (P50-GM066309) from NIGMS of the National Institutes of Health as a Center of Excellence in Complex Biomedical Systems (later Systems Biology). The MIMS Center involves multi-disciplinary research teams from Case Western Reserve University, Case Medical Center of University Hospitals of Cleveland, and Cleveland Clinic.

The primary aim of the MIMS Center is to develop mechanistic, mathematical models to simulate cellular metabolism in various tissues and organs (i.e., skeletal muscle, heart, brain, and adipose tissue) and to integrate these components in whole-body models. These biologically and physiologically based computational models incorporate cellular metabolic reactions and transport processes of a large number of chemical species. Model parameters quantitatively characterize metabolic pathways and regulatory mechanisms under normal and abnormal conditions including obesity and hypoxia as well as in disease states including type-2 diabetes, cystic fibrosis, and chronic kidney disease. The large-scale, complex mathematical models are solved numerically using sophisticated computational algorithms to simulate and analyze experimental responses to physiological and metabolic changes. Model parameters are optimally estimated by minimizing differences between model simulated outputs and experimental data using large-scale, nonlinear optimization algorithms. Experimentally validated models are used to predict the effects of altering metabolic processes with disease states, pharmacological agents, diet, and physical training.

**The Center for Translational Neuroscience**

216.368.5473

Robert M. Miller, PhD, Director

The goals of the Center for Translational Neuroscience (http://www.case.edu/med/CTN) are to develop scientific interactions that promote understanding of the pathology of neurological diseases and to develop novel therapeutic strategies for the treatment of those diseases. The Center pursues these goals through Translational Interest Group meetings and events, and through the Neurological Institute, in the University Hospitals Case Medical Center, where clinicians and investigators have a direct conduit between research and developing treatments.

**Cleveland Functional Electrical Stimulation (FES) Center**

216.231.3257

Robert F. Kirsch, PhD, Executive Director

Robert Ruff, MD, PhD, Medical Director

The Cleveland Functional Electrical Stimulation (FES) Center (http://fescenter.org) is a consortium of three nationally recognized institutions: Department of Veterans Affairs, MetroHealth Medical Center and Case Western Reserve University. Through the support of these partners, the Cleveland FES Center is able to provide a continuum of advancement. Created in 1991 with a grant from the Department of Veterans Affairs, the FES Center currently has research funding at the federal, state and local levels and additional industry and foundation funding in excess of $17M in order to achieve its mission.

The Center focuses on the application of electrical currents to either generate or suppress activity in the nervous system. This technique is known as functional electrical stimulation (FES). FES can produce and control the movement of otherwise paralyzed limbs for standing and hand grasp, activate visceral bodily functions such as bladder control or respiration, create perceptions such as skin sensibility, arrest undesired activity such as pain or spasm, and facilitate natural recovery and accelerate motor relearning. Founded to introduce FES into clinical practice, the Center provides innovative options for restoring neurological health and function by developing advanced technologies and integrating them into clinical care.

**Institute for Transformative Molecular Medicine**

216.368.5725

Jonathan S. Stamler, MD, Director

The Institute for Transformative Molecular Medicine (ITMM), which operates under the combined aegis of Case Western Reserve University and University Hospitals, is composed of physician-scientists and basic discovery researchers who work to acquire fundamental scientific knowledge within the field of molecular medicine. Founded in 2010, the ITMM provides physician-scientists with the opportunity for professional advancement based on their contributions to life sciences, protected from demanding clinical schedules or administrative responsibilities. The mission of the ITMM is to foster the unrestricted pursuit of new knowledge that can be cultivated as the basis for therapeutic innovation, and to join new generations of physician-scientists.
Endowed Lectures

Publications
Publications describing the School of Medicine are produced by the Office of Development, Alumni Relations, and Communications. Many articles and news reports are accessible via the Web under news and publications. (http://casemed.case.edu) The medical school produces an annual report highlighting accomplishments in research, education, and service.

For example, AlumniNews, produced by the Office of Alumni Relations, features updates to keep alumni connected to past colleagues, current students, and happenings at the School of Medicine. This biannual newsletter publishes in the spring and fall, and all alumni who spent the majority of their time within the School of Medicine (MD and PhD alumni) should receive a printed issue in the mail. Copies are also delivered to locations around the medical school to reach MD and PhD students, and a link to a PDF version is emailed to all students. This university-wide publication is distributed electronically to all CWRU alumni once a month. Each school within the university submits one news bulletin for publication and can be viewed online (http://www.cwru.edu/alumni/news). The Reunion Newsletter is distributed to all alumni who are celebrating milestone reunion years from the School of Medicine. This newsletter is published three times during the year for celebratory years. The third issue each year serves as a follow-up on the celebration. This last publication is also sent to the next year’s reunion classes to create momentum and get alumni involved in upcoming reunions.

Endowed Lectures

The Nikaan B. Anderson Lecture
Established in 1974 by friends of the late professor of anesthesiology (from 1969 until his death in 1974), this annual lecture is presented by teachers of the science of anesthesia.

The Claude S. Beck Scholarship Visiting Lectureship
This lecture, about cardiovascular surgery, was established in 1989. At what is now known as the Case Western Reserve University School of Medicine, Claude S. Beck, MD, was demonstrator of surgery in 1924 to 1925; professor of neurosurgery in 1940; and the first professor of cardiovascular surgery in the United States from 1952 until 1965.

The Richard E. Behrman, MD, Lecture In Child Development
Established in 2001 with contributions from friends of colleagues of this former School of Medicine dean (1980 to 1989), this annual lecture is delivered by distinguished scholars in child development.

The Jack H. Berman, MD, Lecture
Established in 1999 by family, friends and colleagues of this alumnus and associate clinical professor, guest lecturers discuss the basic science behind disease and its application to patient care through this program.

The Louis A. Bloomfield Memorial Lecture
Established in 1955 in memory of the Cleveland attorney Theodore R. Bloomfield by his widow and his son, this lecture brings outstanding members of the medical profession from around this country and abroad to discuss new concepts and developments in medicine with the medical community and allied professions.

The William E. Bruner, MD, DSc, Lecture in Ophthalmology
This lecture was established in 2002 in memory of the father of Clark E. Bruner and grandfather of William E. Bruner II, MD, a 1975 medical school alumnus, with gifts coming from them as well as Susan F. Bruner.

The Courtney Burton Frontiers of Medicine Lecture
This annual lecture is presented by an outstanding individual who has achieved or helped achieve a significant advance in medicine or a closely related field and whose presentation would be of great interest to members of the medical profession. It is supported by a fund established in 1993. Courtney Burton Jr., was chair of the board of Oglebay Norton Co. from 1957 until shortly before his death in 1992.

The Alfred Cahen Memorial Lecture
This lecture series in gastroenterology has been supported by a fund established in 1965 by Lottie Cahen, widow of the founder and former president of World Publishing Co., in memory of her late husband.

The Frohring Presidential Lectureship in Medicine and Engineering
Lecturers in medicine and engineering deliver this lectureship at the discretion of the University president thanks to a fund begun in 1993 by Paul R. Frohring.

Nathan S. Greenfield Family Visiting Lecturers in Pharmacology
Through an endowment, Rosalee Greenfield Weiss, PhD, and Raymond A. Weiss, PhD, established this annual lecture in 1997 to honor her father, Nathan S. Greenfield, a pharmacist who owned Wade Park Pharmacy in Cleveland from 1914 to 1956; her mother, Corinne Sternheimer Greenfield; and Lynn Stuart Weiss, daughter of the benefactors, who died of cancer in her mid-20s in 1971.

The Zella Hall Lecture
This annual lecture or series of lectures is presented by one or more distinguished visiting researchers selected by the dean of the School of Medicine or his or her designee. It/they are made possible because of support received in 1998 by the estate of Zella Hall.

The Hanna Lectures
Founded in 1913 by G. W. Crile, 1864-1943, in honor of H. Melville Hanna, philanthropist and founder of the MA Hanna Co., the Hanna Lectures are delivered by distinguished basic scientists from this country and abroad.

The William D. Holden Lectureship in Surgery
Established in 1985 by the members of the Department of Surgery of MetroHealth Medical Center in honor of their former chair and Payne Professor of Surgery, this series of lectures in surgery is delivered by distinguished leaders in American surgery.

The Lorand V. Johnson Lecture
This lecture, for residents and visiting staff members in ophthalmology, was established in 1967 by the Wright Foundation.
The Kaiser Permanente Endowed Lectureship in Bioethics
This lecture is presented by a distinguished visiting lecturer with the goal of advancing the study of bioethics. It was established in 1994.

The Rita Ann Kicher Lecture
In this annual lecture, established in 1996, a distinguished visiting lecturer promotes quality health care by emphasizing new developments in the identification and treatment of life-threatening cardiac arrhythmia. Rita Ann Kicher was the daughter of Thomas Kicher, PhD, a triple alumnus, long-time faculty member, and dean (1992-1997) of the Case School of Engineering. At the time of her death, she was a systems analyst at University Hospitals of Cleveland’s Center for Quality Assessment and Utilization Management.

The Clifford L. Kiehn, MD, and John Desprez, MD, Visiting Lecturers in Plastic and Reconstructive Surgery
These lecturers are distinguished visitors whose presentations advance the study of plastic and reconstructive surgery. The lectureship was established in 1994. Dr. Kiehn is the former head of plastic and reconstructive surgery, and Dr. Desprez followed him in that role.

The Jerome I. Kleinerman, MD, Lectureship in Pulmonary Pathobiology
This lectureship is named for an internationally respected lung specialist and professor emeritus of pathology at the School of Medicine. Established in 2000 by the late Dr. Kleinerman’s daughters, friends and colleagues, the lectureship each year supports a distinguished visiting lecturer whose presentation advances the study of pulmonary pathobiology. The lecturer is selected by a faculty committee that includes members having appointments at MetroHealth Medical Center. The members of the committee are chosen by the dean of the School of Medicine.

The Robert R. Kohn Lecture
The lecture honors an alumnus of the Class of 1957 and was established in his memory in 1989 by family, friends and colleagues to advance the study of pathology.

The Lester Krampitz Lecture and Education Fund
The fund was established in 1982 by family, friends and colleagues of former faculty member Lester Krampitz, MD, to honor him with a lecture fund in microbiology. It is intended to facilitate the interchange of ideas, a process Dr. Krampitz, who joined the faculty in 1946 and retired in 1978, believes is vital to scientific research.

The Carl H. Lenhart Surgical Lecture
Established in 1955 by friends of this alumnus of the Class of 1904, in his memory, this lecture presents outstanding speakers on clinical developments in surgery.

The Alan Moritz, MD, Endowment Fund
This fund was established in 1991 by friends and colleagues of the late forensic pathologist, medical school faculty members, and university provost.

The Olof H. Pearson, MD, Lecture
Established in 1999 by family and friends of the late endocrinologist, oncologist and faculty member, this lecture features a cancer-related topic at the School of Medicine.

The Robert S. Post, MD, Visiting Lectureship
Established in 1995 by Dr. Post’s friends and colleagues in the Community Dialysis Center, in memory of the former faculty member and head of nephrology, this lecture features a distinguished visiting expert in the field of nephrology.

The Edward W. Purnell Lectureship in Ophthalmology
Established in 1991 and named for the late physician, surgeon, researcher, and medical school head of ophthalmology, this lecture features a visiting expert in the Department of Ophthalmology.

The Frederick C. Robbins Lecture in the Department of Medicine Visiting Lecturer
Established in 1995 by the Department of Medicine in honor of Frederick C. Robbins, MD, dean emeritus of the School of Medicine, university professor emeritus, and Nobel Prize winner, this lecture features a distinguished visiting expert each year in the Department of Medicine.

The Henry Z. Sable, MD, PhD, Endowment Fund
Established in 1997 by Mrs. Florence M. Sable in honor of her late husband, who was professor emeritus of biochemistry, this lecture advances the study of biochemistry via a visiting expert selected by the chairperson of the Department of Biochemistry.

The Roy Scott Lecture
Established by colleagues, students, family and friends in memory of the former head of the Department of Medicine of MetroHealth Medical Center, this lecture involves an annual two-day visit of a leading cardiologist, who presents the lecture and grand rounds to house officers and students of the School of Medicine.

The Robert Sternlicht Visiting Lecturers in Pharmacology and Cancer Biology
Originally established in 1990 by friends and family and named the Robert Sternlicht Memorial Fund, these lectures feature distinguished experts whose presentations will advance the study of oncology at the School of Medicine. Lecturers are chosen by the chair of the Department of Pharmacology and the director of the comprehensive cancer center. Robert Sternlicht was the son of Himan Sternlicht, PhD, associate professor emeritus of pharmacology.

The Merton F. Utter Memorial Lecture
Established in 1981 in memory of the former professor of biochemistry and chair of the Department of Biochemistry, this lecture is delivered by a scientist of the highest caliber in a field related to those in which Dr. Utter was interested. Lecturers are chosen by the chair of the Department of Biochemistry.

The Austin S. Weisberger Lecture
Established in 1972 in the Department of Medicine, this lecture honors the memory of the man who, at the time of his death in 1970, was the John Huntington Hord Professor and chair of the Department of Medicine of the School of Medicine and University Hospitals.
The Harland G. Wood Endowment Fund in the Department of Biochemistry

Established in 1994 in memory of the late chair and professor of biochemistry and former provost of the university, this fund supports an annual Page-Wood symposium, co-sponsored by the School of Medicine and the Cleveland Clinic Foundation, featuring a leader in the field of biochemistry, an annual guest lecturer in biochemistry, and an annual guest lecturer selected by faculty with the rank of assistant professor in the Department of Biochemistry.

Administration

Pamela B. Davis, MD, PhD
Dean, School of Medicine and Vice President for Medical Affairs

Achilles A. Demetriou, MD, PhD
Vice Dean for Clinical Affairs for the Case Medical Center

George E. Kikano, MD
Vice Dean for Community Health

Clint W. Snyder, PhD
Interim Vice Dean for Education and Academic Affairs

Carol L. Moss, MS
Vice Dean for External Affairs and VP for Medical Development

Christopher Masotti, CPA, MBA
Vice Dean for Finance and Administration

Mark Chance, PhD
Vice Dean for Research

Lisa M. Mencini, CPA, MBA
Senior Associate Dean and Chief of Staff

Murray D. Altose, MD
Associate Dean for Louis Stokes Veterans Affairs Medical Center

Alfred Connors, Jr. MD
Senior Associate Dean for the MetroHealth System

C. Kent Smith, MD
Senior Associate Dean for Students

James Young MD
Executive Dean for Cleveland Clinic Lerner College of Medicine

Alan Hull, MD, PhD
Associate Dean for Curricular Affairs, Cleveland Clinic Lerner College of Medicine

Lina Mehta, MD
Associate Dean for Admissions

Terry M. Wolpaw, MD
Associate Dean for Curricular Affairs

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Associate Dean for Development

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Associate Dean for Graduate Education

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Associate Dean and Director of Graduate Medical Education

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Associate Dean for Space and Facilities Planning

Kathleen N. Franco, MD
Associate Dean for Admissions and Student Affairs, Cleveland Clinic Lerner College of Medicine

Robert L. Haynie, MD, PhD
Associate Dean for Student Affairs

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Assistant Dean for Basic Science Education

J. Harry Isaacson, MD
Assistant Dean for Clinical Education for Cleveland Clinic Lerner College of Medicine

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Assistant Dean for Finance and Planning

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Associate Dean for Medical Student Research

Linda M. Graham, MD
Assistant Dean for Research Education, Cleveland Clinic Lerner College of Medicine

Elizabeth McKinley, MD
Assistant Dean for Student Societies

Steven Ricanati, MD
Assistant Dean for Student Societies

Daniel Wolpaw, MD
Director of Clinical Programs

Siu Yan Scott
Interim Registrar
Anesthesiology and Perioperative Medicine

Laura Bishop (http://bulletin.case.edu/schoolofmedicine/anesthesiologyandperioperativemedicine/mailto:laura.bishop@case.edu), Coordinator

The Department of Anesthesiology and Perioperative Medicine medical division of the University Hospitals Case Medical Center includes more than four dozen Attending Anesthesiologists on staff supervising Resident Anesthesiologists and Anesthetists to provide the best patient care.

The Anesthesiologist Assistant Program at Case Western Reserve University began in 1969 and originally awarded a baccalaureate degree, evolving into a professional postgraduate curriculum in 1987 and granting the Master of Science degree. In general, admission to an AA program requires a bachelor’s degree with prescribed prerequisites typical of premedical course work, and successful completion of the MCAT.

Application Deadline: October 1 of each year for admission into June class. The 24-month AA program is accredited by the Commission on Accreditation of Allied Health Education Programs (CAAHEP) and is based on the Standards for Anesthesiologist Assistant Program.

Graduates must complete a curriculum which includes 63 credit hours (six semesters) of classroom and clinical instruction. The first three semesters integrate basic science and clinical instruction.

The program is led by Joseph M. Rifici, MEd, (http://bulletin.case.edu/schoolofmedicine/anesthesiologyandperioperativemedicine/mailto:Joseph.Rifici@uhhospitals.org) and Matthew Norcia, MD (http://bulletin.case.edu/schoolofmedicine/anesthesiologyandperioperativemedicine/mailto:Matthew.Norcia@UHhospitals.org). More information can also be obtained from Laura Bishop (http://bulletin.case.edu/schoolofmedicine/anesthesiologyandperioperativemedicine/mailto:Laura.Bishop@uhhospitals.org), Education Coordinator, Cleveland.

CWRU also oversees the Master of Science in Anesthesia Program - Houston, Texas Campus (http://casemed.case.edu/anesthesiaprogram/program/houston.cfm) and Washington, D.C. Campus (http://casemed.case.edu/anesthesiaprogram/program/dc.cfm).

Master of Science in Anesthesia Degree

The Master of Science in Anesthesia (MSA) Program mission is to graduate skilled and compassionate anesthesiologist assistants. The admission policy reflects this goal. Applicants are considered on a variety of parameters which measure academic ability, communication skills, clinical aptitude, and personality traits.

Admission to the MSA program requires that the following criteria are met:

A. Bachelor’s degree from an accredited college or university

Documentation of each of the prerequisites listed below having been completed with a grade of B or higher within five (5) years prior to the application deadline at an accredited American or Canadian institution of higher learning. For those courses that have been repeated, the highest grade will be used in the calculation.

- one semester of biochemistry
- one year of biology with laboratory*
- one year of anatomy with laboratory (human preferred)

B. Medical College Admission Test

- minimum composite score of 20
- test must have been completed within 3 years of application deadline
- when the MCAT has been taken more than once, component scores from different exams may not be combined

Applicants with international undergraduate, graduate or advanced degrees must meet the standard admission requirements listed above. International application requirements also include the TOEFL (Test of English as a Foreign Language) OR the IELTS (International English Language Testing System) and Education Credential Evaluation Reports for foreign transcripts.

All information must be received by the deadline, October 1st. Candidates participate in interviews with members of the Admission Committee, which is comprised of faculty and staff members of the MSA program. All academic requirements must be completed satisfactorily before matriculation. Prospective candidates are permitted and encouraged to shadow an anesthetist in the OR. Prior approval for this visitation is required.

The 24-month program includes 66 credit hours (six semesters) of classroom and clinical instruction. The first three semesters integrate basic science and clinical instruction. During the remaining 3 semesters, students complete month-long rotations in all subspecialties of anesthesiology: ambulatory surgery, burns and trauma, cardiothoracic surgery, general surgery, neurosurgery, obstetrics, pediatrics, surgical intensive care unit. Clinical training focuses on all types of anesthesia including general, epidural, spinal and peripheral nerve blockade.

Instruction is also provided in advanced patient care monitoring techniques and pre-testing, calibration and operation of anesthesia delivery systems and monitors. At Case our personal approach and rigorous educational standards produce compassionate and highly skilled anesthesiologist assistants.

The MSA Program is accredited by the Commission on Accreditation of Allied Health Education Programs (CAAHEP) and is based on the Standards for Anesthesiologist Assistant Programs. Graduates sit for the Certification Examination administered by the National Commission for Certification of Anesthesiologist Assistants (NCCAA) and co-sponsored by the National Board of Medical Examiners (NBME).

Additional information may be found on the Master of Science in Anesthesia Program Web site (http://casemed.case.edu/anesthesiaprogram).
## MS Anesthesiology Assistant, Plan of Study

### Basic Science Year

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<th>Course</th>
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**Year Total:**

- Total Units 66

### Clinical Year

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**Year Total:**

- Total Units 66

## Courses

### ANES 403. Cardiac Electrophysiology. 2 Units.
In this course students will learn basic and advanced Electrocardiogram interpretation using simulators and electrocardiograms to understand an overview of heart anatomy, function, and neurophysiology.

### ANES 440. Patient Monitoring and Instrumentation I. 2 Units.
Students are taught the proper balance between circuits and engineering concepts and the clinical application of anesthesia instrumentation. Monitors and devices used in the operating room are studied with respect to principles of operation, calibration, and interpretation of data. A hands-on laboratory is utilized to maximize direct contact to the instrumentation of the profession.

### ANES 441. Patient Monitoring and Instrumentation II. 2 Units.
Continuation of ANES 440. Recommended preparation: ANES 440.

### ANES 456. Applied Physiology for Anesthesiologist Assistants I. 3 Units.
Basic and applied human systems physiology with emphasis on topics and areas of special concern to the anesthetist.

### ANES 458. Applied Physiology for Anesthesiologist Assistants II. 3 Units.
Continuation of ANES 456. Recommended preparation: ANES 403 and ANES 456.

### ANES 460. Introduction to Anesthesia. 2 Units.
Introduction to basic concepts dealing with clinical anesthesia. Medical terminology, human anatomy, medical chart interpretation and drug dosage calculations.

### ANES 461. Orientation to Clinical Experience. 3 Units.
Introduction to experience in the operating room with emphasis on the fundamental procedures and techniques used in administering an anesthetic. Preoperative assessment, IV placement techniques, airway management, intraoperative patient care and postoperative management are all emphasized in this course. BLS (basic life support) certification is required for course completion. Recommended preparation: Acceptance in the M.S.A. program.

### ANES 462. Anesthesia Clinical Correlation I. 1 Unit.
A series of conferences presented by students that applies to anesthetic theory as it relates to the clinical experience. Specific anesthetic situations are emphasized. Recommended preparation: ANES 460.

### ANES 463. Anesthesia Clinical Experience I. 3 Units.
A continuation of the preparation, observation, and hands-on learning format initiated in ANES 461. Patient management and technical skills are refined with close attention to the didactic course work. A comprehensive clinical examination is administered at the end of the semester. ACLS (Advanced Cardiac Life Support) certification is required for course completion. Recommended preparation: ANES 461.
ANES 464. Anesthesia Clinical Correlation II. 1 Unit.
A spectrum of case presentation conferences presented by the students dealing with basic and major problems in anesthesia management. Medical and surgical history of individual patients and the outcomes of anesthesia and surgery are emphasized. Journal Club and Mortality and Morbidity conferences are included. Recommended preparation: ANES 462.

ANES 465. Anesthesia Clinical Experience II. 4 Units.
A continuation of ANES 463. A comprehensive clinical examination is administered at the end of the semester. PALS (Pediatric Advanced Life Support) and ACLS (Advanced Cardiac Life Support) certification is required for course completion. Recommended preparation: ANES 463, BLS Certification, ACLS Certification.

ANES 467. Anesthesia Clinical Experience III. 4 Units.
Extended exposure to all of the clinical subspecialties of anesthesiology (obstetrics, pediatrics, neurosurgery, cardiovascular, etc.). Students alternate through rotations at several area hospitals. Recommended preparation: ANES 465, ACLS certification and PALS.

ANES 468. Anesthesia Clinical Correlation III. 1 Unit.

ANES 469. Anesthesia Clinical Experience IV. 8 Units.
A continuation of ANES 467. A comprehensive clinical examination is administered at the end of the semester. Recommended preparation: ANES 467.

ANES 470. Anesthesia Clinical Correlation IV. 1 Unit.

ANES 471. Anesthesia Clinical Experience V. 8 Units.
A continuation of ANES 469. A comprehensive clinical examination is administered at the end of the semester. Recommended preparation: ANES 469.

ANES 475. Pharmacology for Anesthesiologist Assistants I. 2 Units.
Pharmacodynamics, pharmacokinetics, uptake, distribution and action of the volatile and intravenous anesthetics, muscle relaxants, narcotics, hypnotics and other pharmaceuticals used in the administration of an anesthetic. Prereq: Consent of Department.

ANES 476. Pharmacology for Anesthesiologist Assistants II. 2 Units.
Continuation of ANES 475. Prereq: ANES 475.

ANES 477. Clinical Decision Making in Anesthesia. 2 Units.
An introduction to thinking about clinical situations and problems and coming to safe and effective solutions to these problems. This course focuses on common clinical situations where appropriate decision making is important to the outcome of the case. Numerous areas of medicine and anesthesiology will be covered to provide the student with a wide sampling of decisions made each day with patient care. This course supplements the other courses offered during the spring semester by integrating and applying basic science knowledge to the care of patients. Prereq: Consent of department.

ANES 480. Fundamentals of Anesthetic Sciences I. 1 Unit.
A continuum of courses over the fall and spring semesters that covers a series of topics in basic medical science with special emphasis on the effect of anesthetics on normal physiology. An examination is administered at the end of each semester.

ANES 481. Fundamentals of Anesthetic Sciences II. 1 Unit.
A series of topics in basic medical science with special emphasis on the effect of anesthetics on normal physiology. An examination is administered at the end of the semester. Prereq: ANES 480.

ANES 485. Introduction to Physiological Model-Based Simulation. 1 Unit.
Introduction to physiological model-based simulation using on-screen computer simulation and mannequins. Emphasis is placed on improving appropriate anesthesia-related basic science knowledge, manual skills in anesthesia machine checkout, drug and equipment setup, safety inspections, and performing anesthesia for uncomplicated surgical cases.

ANES 486. Physiological Model-Based Simulation I. 1 Unit.
An extension of ANES 485 with emphasis on improving or exercising knowledge of anesthesia-appropriate basic science, the use of more advanced equipment and techniques for uncomplicated surgical cases with an introduction to crisis management. Recommended preparation: ANES 485.

ANES 487. Physiological Model-Based Simulation II. 1 Unit.
An extension of ANES 486 emphasizing the physical techniques aspects of crisis management, team work and rescue in anesthesia, including support for and review of training in Basic Life Support and Advanced Cardiac Life Support. Recommended preparation: ANES 486.

ANES 488. Anesthesia Non-Technical Skills Lab. 1 Unit.
In this course the student will learn anesthesia non-technical skills, which are used integrally with medical knowledge and clinical techniques. They encompass both interpersonal skills (e.g. communication, team working, leadership) and cognitive skills (e.g. situation awareness, decision making). This course uses modified Crew Resource Management techniques taught in the aviation industry and considers the limitations of human performance and the nature of human error. The goals are to train individuals to avoid, capture and mitigate against the consequences of error. During the course, behaviors shown to minimize errors and maximize patient safety are highlighted and then practiced, with feedback being given to students on their performance.

ANES 490. Ethics, Law and Diversity for Anesthesiologist Assistants. 2 Units.
This course will focus on three topics. First, a discussion of legal practice as it applies to health care including basics of medical jurisprudence, negligence, and how to avoid a lawsuit. Second, a discussion of ethical theory including the principles of medical ethics, do not resuscitate, truth telling, and assessment of competence. Last, a discussion on diversity that will focus on the differences and similarities among people and how these factors influence patient care. The final grade will be based on an essay and a multiple choice exam.

ANES 499. Clinical Remediation. 1 - 10 Unit.
(Credit as arranged.) Course offered to the student one time during the program of study which remediates “C” or below work in a clinical course.
ANES 580. Fundamentals of Anesthetic Sciences III. 1 Unit.
The second-year equivalent of ANES 480 and 481. An examination is administered at the end of the semester. Recommended preparation: ANES 480 and 481.

ANES 581. Fundamentals of Anesthetic Sciences IV. 1 Unit.
The second year equivalent of ANES 481. An examination is administered at the end of the semester. Prereq: ANES 580.

ANES 584. Physiological Model-Based Simulation III. 1 Unit.
An extension of ANES 487 emphasizing the physical techniques and aspects of crisis management, team work, and rescue in anesthesia. Prereq: ANES 487.

ANES 585. Physiological Model-Based Simulation IV. 1 Unit.
Extension of ANES 584 emphasizing the physical techniques and aspects of crisis management, team work, and rescue in anesthesia. Prereq: ANES 584.

ANES 599. Clinical Remediation. 1 - 10 Unit.
(Credit as arranged.) Course offered to the student one time during the program of study which remediates "C" or below work in a clinical course.
Department of Anatomy

Ms. Christine Marshall (http://bulletin.case.edu/schoolofmedicine/anatomy/mailto:christine.marshall@case.edu), Department Administrator

The goal of the Department of Anatomy is to provide individuals with the skills and experiences that will allow them to develop and maintain successful careers as researchers and teachers. The strengths of both the faculty and students of the department help lead to the achievement of this goal. Graduate studies in the Department of Anatomy can lead to the master of science degree in applied anatomy. The master’s degree may be obtained as part of a joint degree program for qualified individuals participating in other programs at the university, such as the joint MD/MS degree. Every MS graduate student in the Department of Anatomy must successfully complete 21 credits in the core curriculum of anatomical sciences, human gross anatomy, histology, neuroanatomy and embryology. An additional two credits offered by the department in seminar and research presentations also are required. Elective course work and, for the thesis MS students, laboratory rotations and research, complete the graduate students’ program of study. Research areas of particular strength among faculty in the Department of Anatomy include biological anthropology, cell injury, control of respiration, and non-molecular developmental neurobiology. The department has existing collaborative research efforts with basic scientists in several clinical departments, including medicine, orthopedics, pediatrics, neurology and neurosurgery.

MS Applied Anatomy

The Applied Anatomy program is designed for students who seek a comprehensive education in the anatomical sciences, particularly those individuals pursuing careers as medical health professionals and teachers who desire an advanced degree to enhance their skills and credentials. The Anatomical Sciences Core Curriculum (ASCC) courses emphasize the traditional aspects of anatomical structure, function, and nomenclature with critical aspects of cell and developmental biology, biochemistry, and physiology of cells, tissues, and organs integrated into their content. The elective courses allow curriculum flexibility for students to emphasize their diverse individual interests. The Master of Science in Applied Anatomy serves as an excellent preparation for students to emphasize their diverse individual interests. The Master of Science in Applied Anatomy is an advanced degree that provides comprehensive education in the anatomical sciences, human gross anatomy, histology, neuroanatomy and embryology. The research experience may be obtained as elective coursework ANAT 499: Independent Study with individual faculty members.

Comprehensive written and oral exams covering the basic scientific principles presented in the core curriculum must be passed after successful completion of the core coursework comprising the Anatomical Sciences Core Curriculum. All degree requirements must be completed within five years; most students complete the program in 11/2-21/2 years. Tuition or stipends will not be provided for the master of science program (no additional tuition is required for enrolled medical students).

These specific sequences of classes, while common, are not exclusive and are meant only to exemplify the typical program of study leading to the Master of Science in Applied Anatomy degree. The required courses (21 credits) comprising the Anatomical Sciences Core Curriculum are specifically delineated, whereas the elective courses (9 credits minimum) are not identified since they vary significantly between individual students. Students become eligible to take the MS Comprehensive Examination upon successful completion of the ASCC courses.

Degree Requirements

The Master of Science in Applied Anatomy degree requires a minimum of 30 graduate course credits. Required courses include 21 credits of the Anatomical Sciences Core Curriculum; the remaining credits are elective courses selected to fulfill individual student interests and goals. Medical students are required to take at least one of the Surgical Anatomy courses. As a type B “comprehensive” program, a research thesis is not required for the MS Applied Anatomy, although research experience may be obtained as elective coursework ANAT 499: Independent Study with individual faculty members.

Admission

Acceptance into the Master of Science in Applied Anatomy program requires a baccalaureate degree from an accredited institution and is based on undergraduate and/or graduate GPAs, results of admission examinations (GRE, MCAT, DAT), plus letters of recommendation; an Educational Credential Evaluation and Authentication Report is required for foreign transcripts plus documentation (TOEFL) of English language skills for foreign applicants. Acceptance into the joint MD/MS program requires that the medical student be in good academic standing in the CWRU medical curriculum at the time of matriculation into the program, and a letter of approval from their respective Associate (‘Society’) Dean of Student Affairs. Each student in the Applied Anatomy program has a faculty advisor from the Department of Anatomy Graduate Executive Committee which coordinates the program and reviews the graduate Planned Program of Study for individual students. Contact the Department of Anatomy for additional program and application information.

**MS Applied Anatomy, Plan of Study**

<table>
<thead>
<tr>
<th>First Year</th>
<th>Units</th>
<th>Fall</th>
<th>Spring</th>
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<tbody>
<tr>
<td>Histology and Ultrastructure (ANAT 412)</td>
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<tr>
<td>General Histology Laboratory (ANAT 413)</td>
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<tr>
<td>Master of Science ASCC Comprehensive Examination (May/June)</td>
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*Note: The Master of Science in Applied Anatomy degree requires a minimum of 30 graduate course credits. Required courses include 21 credits of the Anatomical Sciences Core Curriculum; the remaining credits are elective courses selected to fulfill individual student interests and goals. Medical students are required to take at least one of the Surgical Anatomy courses. As a type B “comprehensive” program, a research thesis is not required for the MS Applied Anatomy, although research experience may be obtained as elective coursework ANAT 499: Independent Study with individual faculty members. Students become eligible to take the MS Comprehensive Examination upon successful completion of the ASCC courses.*
Joint MD/MS Applied Anatomy, Plan of Study

First Year

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<thead>
<tr>
<th>Units</th>
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Second Year

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<tr>
<td>MD/MS - Comp Exam (Jan/Feb)</td>
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<td>MD/MS - Step I exam</td>
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<td>MD/MS - Begin clinical/research rotations</td>
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Third Year

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<td>Independent Study (ANAT 499)</td>
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<tr>
<td>Surgical Anatomy courses (1 clinical block each)</td>
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<tr>
<td>Surgical Anatomy I</td>
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<tr>
<td>Surgical Anatomy II</td>
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Fourth Year

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Total Units in Sequence: 31-39

1 Surgical Anatomy I, worth 4 credit hours, to be taken in the fall; Surgical Anatomy II, worth 4 credit hours, to be taken in the spring.

Courses

ANAT 312. Basic Histology. 3 Units.
Fundamental histology course covering microscopic structure, nomenclature, and function of normal cells, tissues, and organs (human emphasis) to provide a sound foundation for bioengineering, pre-medical and pre-dental students.

ANAT 353. Anatomy for the Artist. 3 Units.
Reflecting the interdisciplinary nature of medical illustration, the course will have two complementary components. Morning sessions will involve instruction in human anatomy followed by direct observation and drawing of that anatomy from the cadaver. The entire body will be covered, including both the internal structures as well as those that directly impact the surface anatomy, to provide the student with a comprehensive understanding of the human form in its totality. Afternoon sessions will have students study the perceptual problems of drawing from the live model, focusing on the anatomical structure and functionality of the skeletal and muscular system. Muscle action and involvement in human movement and form will be analyzed and applied.

ANAT 375. Human Evolution: The Fossil Evidence. 3 Units.
This course will survey the behavioral and developmental changes that occurred in the hominid lineage during the past five million years. In addition to a thorough review of the fossil evidence for human evolution, students will develop the theoretical framework in evolutionary biology. Recommended preparation: ANTH 377, BIOL 225. Offered as ANAT 375, ANTH 375, ANAT 475 and ANTH 475. Prereq: ANTH 103.

ANAT 377. Human Osteology. 4 Units.
This course for upper division undergraduates and graduate students will review the following topics: human skeletal development and identification; and forensic identification (skeletal aging, sex identification and population affiliation). Offered as ANAT 377, ANTH 377, ANAT 477 and ANTH 477.

ANAT 391. Embryology. 3 Units.
A detailed description of development will be presented, focusing mainly on the developing human. Discussions and presentations will also include several developing systems that have served as useful models in experimental embryology for deciphering mechanisms responsible for producing adult metazoan organisms. Offered as ANAT 391 and ANAT 491.

ANAT 399. Independent Study. 1 - 4 Unit.
Laboratory research project. Student must obtain approval of a supervising Anatomy department professor before registration and list the professor’s name on the schedule card.

ANAT 411. Gross Anatomy. 6 Units.
This in-depth, cadaver dissection-based, course covers all aspects of human gross anatomy. The course is modeled after a traditional medical school gross anatomy curriculum and taught by the CWRU School of Medicine, Department of Anatomy faculty. It is divided into three sections: thorax and abdomen; pelvis/periene and limbs/back; and head and neck. One hour of lecture will precede 3 hours of dissection laboratory Monday, Wednesday, and Friday. Lectures and dissection labs will cover all human anatomy, and students should be prepared to devote more time that the scheduled hours of 1:00 to 5:00pm. Dissection labs are open 24 hours 7 days a week. Recommended preparation: B.A./B.S., or fourth year undergraduate science major.

ANAT 412. Histology and Ultrastructure. 4 Units.
Comprehensive functional histology course integrating microscopic identification (‘structure plus nomenclature’) of normal cells, tissues, and organs with aspects of their cell biology, biochemistry, and physiology (‘function’). Topical coverage includes complete (‘head-to-toe’) tissue and organ survey with human emphasis.
ANAT 413. General Histology Laboratory. 2 Units.
Microscopic structure of tissues and organs. Laboratory course associated with ANAT 412 (see ANAT 412 description). Recommended preparation: ANAT 312 or ANAT 412 or concurrent enrollment.

ANAT 414. Neurological Anatomy, 4 Units.
This course employs a variety of teaching-learning methods—among them lectures, small-group discussions, hands-on "construction" of pathways, and brain dissection. Regional morphology will be studied via examination of the preserved brain and of sections through the CNS; functional systems will be "followed" through the spinal cord, brain stem and/or forebrain.

ANAT 415. Neurological Anatomy Laboratory, 1 Unit.
This laboratory course provides an adjunct to ANAT 414, Neurological Anatomy. It affords the student the opportunity to learn the complex three-dimensional anatomy of the human central nervous system from photographs of brain slices and sections, from glass slides of human brain sections, from actual brain slices, and from dissection of the brain. The material will be approached not only through traditional methods of studying regional morphology but also by "following" the components of functional systems through the spinal cord, brain stem, and/or forebrain. Animated, three-dimensional, and color imagery will also be employed. Recommended preparation: ANAT 414 or concurrent enrollment.

ANAT 420. Forensic Pathology. 3 Units.
Forensic Pathology is that discipline where medicine and the law meet. Forensic pathologists strive to determine the cause, manner, and mechanism of death, and how to prevent unnatural death from occurring. This course reviews the field of forensic pathology, from sudden natural death, to homicide, to child abuse. Students will be exposed to an autopsy, and tour a crime laboratory. These tours are mandatory. Grading is based on performance on an examination and review and presentation of a forensic paper. Actual case material will be used. Students are therefore expected to maintain the highest professional and ethical standards.

ANAT 424. Neural Integrative and Regulatory Mechanisms. 3 Units.
This course is designed as a sequence to ANAT 414, Neurological Anatomy, or any other "introductory" course in neuroanatomy. Topics to be addressed include central regulation of pain, the regulation of somatic and visceral motor activity, neurotransmitter substances, the basal forebrain, the blood-brain barrier, levels of consciousness, sleep-wake mechanisms, cognitive behaviors and memory. Appreciation of the three-dimensional anatomy and vasculature of the spinal cord and brain will be gained through brain dissection and study of stained and unstained sections. Recommended preparation: ANAT 414 or permission.

ANAT 431. Statistical Methods I. 3 Units.
Application of statistical techniques with particular emphasis on problems in the biomedical sciences. Basic probability theory, random variables, and distribution functions. Point and interval estimation, regression, and correlation. Problems whose solution involves using packaged statistical programs. First part of year-long sequence. Offered as ANAT 431, BIOL 431, CRSP 431, EPBI 431, and MPH 431.

ANAT 445. Mammal Diversity and Evolution. 3 Units.
This course focuses on the morphologic and taxonomic diversity of mammals in a phylogenetic context. By the end of the course, students will be able to (1) describe the key morphological and physiological features of mammals; (2) identify the main anatomical characteristics of all orders and most families of extant, non-volent mammals; (3) interpret a phylogenetic tree and the data used to generate it; (4) appreciate major historical patterns in mammal diversity and biogeography. Two lectures and one lab each week; most labs will be specimen-based and will take place at the Cleveland Museum of Natural History. One weekend field trip to Cleveland Metroparks Zoo. This course satisfies a laboratory requirement for the biology major. Offered as ANAT 445, BIOL 345, and BIOL 445. Prereq: BIOL 214.

ANAT 452. Writing a Scientific Paper. 2 Units.
For graduate and post-doctoral students. Participants must have experimental data (not necessarily complete) with which they will write a full scientific paper. Course is limited to two participants.

ANAT 462. Advanced Principles of Developmental Biology. 3 Units.
Same as BIOL 362 except the required term paper is an NIH-format research proposal. Recommended preparation: BIOL 216. Offered as ANAT 462 and BIOL 462.

ANAT 467. Topics in Evolutionary Biology. 3 Units.
The focus for this course on a special topic of interest in evolutionary biology will vary from one offering to the next. Examples of possible topics include theories of speciation, the evolution of language, the evolution of sex, evolution and biodiversity, molecular evolution. ANAT/ANTH/EEPS/PHIL/PHOL 467/BIOL 468 will require a longer, more sophisticated term paper, and additional class presentation. Offered as ANTH 367, BIOL 368, EEPS 367, PHIL 367, ANAT 467, ANTH 467, BIOL 468, EEPS 467, PHIL 467 and PHOL 467.

ANAT 475. Human Evolution: The Fossil Evidence. 3 Units.
This course will survey the biological and behavioral changes that occurred in the hominin lineage during the past five million years. In addition to a thorough review of the fossil evidence for human evolution, students will develop the theoretical framework in evolutionary biology. Recommended preparation: ANTH 377, BIOL 225. Offered as ANAT 375, ANTH 375, ANAT 475 and ANTH 475. Prereq: ANTH 103.

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A detailed description of development will be presented, focusing mainly on the developing human. Discussions and presentations will also include several developing systems that have served as useful models in experimental embryology for deciphering mechanisms responsible for producing adult metazoan organisms. Offered as ANAT 391 and ANAT 491.
ANAT 497. Scientific Presentations. 1 Unit.
These courses provide a foundation and experience for making scientific presentations. Scheduled simultaneously with ANAT 498 and students from both courses are present, but the requirements for passing differ. Students in ANAT 497 prepare PowerPoint and poster presentations. Oral presentations by students taking ANAT 498 will occur during the class periods for the remainder of the semester. Students taking 497 and 498 must participate in these discussions. Students must take ANAT 497: Scientific Presentations before ANAT 498: Applied Anatomy Seminar.

ANAT 498. Applied Anatomy Seminar. 1 Unit.
These courses provide a foundation and experience for making scientific presentations. Scheduled simultaneously with ANAT 497 and students from both courses are present, but the requirements for passing differ. Students in ANAT 497 prepare PowerPoint and poster presentations. Oral presentations by students taking ANAT 498 will occur during the class periods for the remainder of the semester. Students taking 497 and 498 must participate in these discussions. Students must take ANAT 497: Scientific Presentations before ANAT 498: Applied Anatomy Seminar.

ANAT 499. Independent Study. 1 - 4 Unit.
Laboratory research project. Student must obtain approval of a supervising Anatomy department professor before registration and list the professor's name on the schedule card.

ANAT 503. Readings and Discussions. 1 - 3 Unit.
In-depth consideration of special selected topics through critical evaluation of the literature. Student must obtain approval of supervising Anatomy department professor before registration.

ANAT 513. Surgical Anatomy of the Thorax and Abdomen. 4 Units.
This course is intended for graduate and fourth-year medical students interested in surgery and surgical subspecialties. This integrated course will review basic gross anatomy, provide advanced training in gross and surgical anatomy, introduce common clinical problems and their anatomical consequences, and basic surgical approaches. Recommended preparation: ANAT 411 and permission of instructor.

ANAT 515. Surgical Anatomy: Orthopaedic Musculoskeletal. 4 Units.
This orthopaedic musculoskeletal anatomy course is offered to M.S. in Applied Anatomy students and fourth-year medical students. The course will familiarize participants with surgical approaches used to treat musculoskeletal disease. Students will learn to correlate normal and abnormal anatomical findings with radiographical studies. Recommended preparation: ANAT 411.

ANAT 516. Surgical Anatomy: Head and Neck. 4 Units.
This cadaver-based advanced anatomy course is offered to M.S. in Applied Anatomy students and fourth-year medical students. Students will build on their understanding of basic gross, histological, pathologic, and embryonic anatomy of the head and neck. The course will familiarize participants with surgical approaches used to treat pathological conditions of the head and neck including cranial cavity, cranial base, orbit, maxillofacial, oral, otic, pharyngeal, and airway. Students are required to attend and participate in lectures, surgical labs, and discussions in order to successfully complete the course. Instructor consent is required. Recommended preparation: ANAT 411.

ANAT 523. Histopathology of Organ Systems. 3 Units.
Comprehensive course covering the underlying basic mechanisms of injury and cell death, inflammation, immunity, infection, and neoplasia followed by pathology of specific organ systems. Material will include histological (structure) and physiological (function) aspects related to pathology (human emphasis). Recommended preparation: ANAT 412 or permission of instructor. Offered as ANAT 523 and PATH 523.

ANAT 530. Medical Sculpture: Basic Facial Reconstruction. 2 Units.
This introductory course takes a step-by-step approach to forensic facial reconstruction. Students will study the placement and function of head and neck muscles and learn about average tissue depths. An oil-based clay will be used to add muscles and contours to a human skull cast at the depth indicated by tissue markers to successfully recreate facial features.

ANAT 531. Medical Sculpture: Advanced Facial Reconstruction. 2 Units.
Students must be able to interpret soft tissue data with a minimal amount of help. Students will be provided a cast human skull on which to complete a facial reconstruction using an oil-based clay using tissue depth data information from that skull. Once completed, a photograph of that individual is available to compare the achieved likeness. A final exercise will have students advance the age of the individual using age rendering techniques (adaptable to work with fugitives and missing persons). Recommended preparation: ANAT 530.

ANAT 610. Oxygen and Physiological Function. 3 Units.
Lecture/discussion course which explores the significance and consequences of oxygen and oxygen metabolism in living organisms. Topics to be covered include oxygen transport by blood tissues, oxygen toxicity, and mitochondrial metabolism. Emphasis will be placed on mammalian physiology with special reference to brain oxidative metabolism and blood flow as well as whole body energy expenditure and oxidative stress related to disease. Offered as ANAT 610 and PHOL 610.

ANAT 611. Practicum in Human Gross Anatomy. 1 - 3 Unit.
A course of study designed especially for the preparation of teachers that involves the supervised practical application of previously studied theory. Students accepted into ANAT 611 must participate in one of three sections of the course (as described below). Participation is defined as preparing a prospection prior to each dissection laboratory and being present to teach in each dissection laboratory. The opportunity exists, at the discretion of the course director, to present classroom lectures. Presentation of classroom lectures is not required. The teaching experience obtained will be obtained in ANAT 411 - Human Gross Anatomy. Teaching will be guided, supervised, and evaluated by the appropriate faculty from the department of anatomy. The three sections of ANAT 611 and the subjects covered are: Trunk Gross Anatomy (6 weeks), Musculoskeletal Gross Anatomy (3 weeks), Head & Neck Gross Anatomy (4 weeks). Recommended preparation: ANAT 411 and permission of instructor.
ANAT 612. Practicum in Histology and Ultrastructure. 2 Units.
A course of study designed especially for the preparation of teachers that involves the supervised practical application of previously studied theory. The prerequisite knowledge required for ANAT 612 must have been obtained previously in ANAT 412: Histology and Ultrastructure and the associated laboratory ANAT 413: Histology Laboratory. Required participation in ANAT 612 is defined as: 1. Meet weekly with course instructor to (pre)review course material; 2. Attend all ANAT 412 lectures; 3. Participate/assist in all ANAT 413 laboratory sessions. Teaching will be guided, supervised, and evaluated by the course instructor with reference to the graduate student's overall progress and performance as a teacher. Required prerequisites: ‘A’ grades on ANAT 412 and ANAT 413; permission of instructor required.

ANAT 614. Practicum in Neurological Anatomy. 1 Unit.
A course of study designed especially for the preparation of teachers that involves the supervised practical application of previously studied theory. The graduate student will administer all laboratory sessions, assisting students with identification of structures and with understanding the functional aspects of neuroanatomical pathways. The graduate student will meet with the course director once per week to discuss the student’s performance and progress and to plan for upcoming class sessions. The course director will assist the student in developing the organizational skills necessary to be a course director as the student learns to anticipate questions, define problematic areas, and recognize varying learning styles. The graduate student will be evaluated by the course director with reference to the graduate student's overall progress and performance as a teacher. Recommended preparation: ANAT 414.

ANAT 651. Thesis M.S.. 1 - 9 Unit.
Master’s Thesis Plan A.

(Credit as arranged.) Prereq: Predoctoral research consent or advanced to Ph.D. candidacy milestone.
Department of Biochemistry

Sakeenah Bari-Harold (http://bulletin.case.edu/schoolofmedicine/biochemistry/mailto:sakeenah.bari-harold@case.edu), Coordinator

Biochemistry is the study of the molecular basis of cellular function, making it a central discipline in the biological sciences. Biochemists ask the question, "How do life processes work at the molecular level?" The Department of Biochemistry offers undergraduate programs leading to the bachelor of arts degree and bachelor of science degree in biochemistry and graduate programs leading to the master of science, doctor of philosophy, and dual-degree programs as follows: doctor of medicine/doctor of philosophy degree; doctor of medicine/masters of science in biomedical investigation; juris doctor/masters of science in biochemistry.

The department also participates in several interdisciplinary and interdepartmental programs in the School of Medicine and at Case Western Reserve University that provide additional avenues of study. Research interests within the department include a spectrum of modern biochemical topics in six broad areas: enzymology, protein chemistry, structural biology, gene expression, cell biology, and molecular medicine/gene therapy. The department has state-of-the-art equipment and facilities for research in modern biochemistry. More complete information about the undergraduate and graduate programs may be obtained by contacting the departmental office or by using the URL above.

Research Areas

Research of Department of Biochemistry faculty members covers a broad spectrum of topics from events at the level of electron movement in biochemical reactions to the intracellular trafficking of proteins. Research in the department is broadened by collaborations with faculty in other university departments and with scientists at other Cleveland research institutions. The specific areas of active research within the department are outlined below.

Proteins and Enzymes

Proteins are components of all living tissue, and their function is critical for life processes. Understanding the chemical mechanisms of enzymatic catalysis is essential for determining the role of individual proteins in human disease. Biochemistry faculty study a variety of proteins and enzymes ranging from growth factors to oncogenes.

Structural Biology

The function of a protein is determined by its three-dimensional structure and interactions. Faculty apply many modern techniques to the determination of macromolecular structure, including X-ray crystallography, and multidimensional heteronuclear NMR, fluorescence, Raman, and circular dichroism spectroscopy. Macromolecules under investigation include, transcarboxylase, ribosomes, DNA-protein complexes, and neurochemical enzymes.

Regulation of Gene Expression

The elucidation of mechanisms regulating gene expression is a major goal of modern biology. Biochemistry faculty study the control of transcription by hormones and other regulatory molecules, the interaction between proteins and DNA, the function of oncogenes, the basal and hormone mediated transcriptional machinery, and the processing and translation of RNA.

Cell Biology

The control of the metabolism, differentiation and cell signaling within and between cells is an area of active investigation.

Metabolic Regulation

Biochemistry faculty investigate the control of metabolism in animals, such as dietary and hormonal regulation of gene expression. Transgenic murine technology allows the study of the impact of gene ablation on metabolic processes.

BA Biochemistry I BS Biochemistry I Minor

Undergraduate Programs

Major

The two undergraduate major programs in Biochemistry, BA and BS, are based on the Arts & Sciences General Education Requirements, but differ in amount and intensity of the mathematics and physical sciences required. Either degree is excellent for students planning to undertake graduate work in biochemistry or in related areas of the biomedical sciences. Both the BA and the BS programs permit students to follow many options after graduation. Graduates are well prepared to pursue further studies in the biological sciences, for a career in medicine, for Doctor of Pharmacy programs, for employment in the chemical, pharmaceutical, and biotechnology industries, or as research assistants in research laboratories. The BA has a reduced emphasis on the quantitative aspects of science and makes available a considerable amount of elective time that permits a student to either concentrate on biochemistry even more intensively than the curriculum requires, or pursue other subjects in science or liberal arts. The BS degree is for the student who has a particularly strong interest in the quantitative physical sciences.

In both programs, undergraduate research is strongly encouraged. As many as nine hours of Research in Biochemistry (BIOC 391 Research Project) may be credited toward the requirements for graduation. The capstone in Biochemistry (BIOC 393 Senior Capstone Experience) is a thesis and presentation of a student’s undergraduate research studies.

Bachelor of Arts in Biochemistry

Required Courses:

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<tr>
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<th>Hours</th>
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<td>Molecular Biology: Genes and Genetic Engineering</td>
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<td>BIOC 312</td>
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<td>BIOC 334</td>
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Two approved technical electives in biochemistry: 6

BIOC 393 | Senior Capstone Experience                 | 3     |

Additional Required Courses:

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BA Biochemistry, Sample Plan of Study

**Freshman**

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**Sophomore**

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**Senior**

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**Total Units**: 118-151

Note: At least the 3 credits of undergraduate research, BIOC 391 Research Project, is minimally recommended for the Capstone. An additional 3 credits of BIOC 391 is highly recommended. Students should consult their academic advisers about the elective parts of the curriculum.

a Selected students may be invited to take CHEM 323 Organic Chemistry I, CHEM 324 Organic Chemistry II.

b One of the approved electives in Biochemistry taken must be either BIOC 312 Proteins and Enzymes or BIOC 334 Structural Biology.

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**Bachelor of Science in Biochemistry**

**Required Courses**

- BIOC 307 General Biochemistry
- BIOC 308 Molecular Biology: Genes and Genetic Engineering
- BIOC 312 Proteins and Enzymes
- BIOC 334 Structural Biology
- BIOC 373 Biochemistry SAGES Seminar
- Approved Technical Elective in Biochemistry
- BIOC 393 Senior Capstone Experience
- BIOL 214 Genes, Evolution and Ecology
- CHEM 104 Principles of Chemistry I
- CHEM 105 Principles of Chemistry II
- CHEM 111 Principles of Chemistry for Engineers
- CHEM 113 Principles of Chemistry Laboratory
- CHEM 223 Introductory Organic Chemistry I
- CHEM 232 Organic Chemistry I
- CHEM 224 Introductory Organic Chemistry II
- CHEM 234 Organic Chemistry II
- CHEM 301 Introductory Physical Chemistry I
- CHEM 302 Introductory Physical Chemistry II
- CHEM 303 Introductory Physical Chemistry III
- CHEM 335 Physical Chemistry I
- CHEM 336 Physical Chemistry II
- CHEM 233 Introductory Organic Chemistry Laboratory I
- CHEM 234 Introductory Organic Chemistry Laboratory II
- CHEM 121 Calculus for Science and Engineering I
- CHEM 122 Calculus for Science and Engineering II
- CHEM 124 Calculus III
- MATH 223 Calculus for Science and Engineering III
- MATH 224 Elementary Differential Equations
- MATH 225 Differential Equations
- PHYS 121 General Physics I - Mechanics
- PHYS 123 General Physics II - Electricity and Magnetism
BS Biochemistry, Sample Plan of Study

### Freshman

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### Total Units in Sequence: 121-151

Note: At least the 3 credits of undergraduate research, BIOC 391 Research Project, is a prerequisite to the Capstone. An additional 3 credits of BIOC 391 is highly recommended. Students should consult their academic advisers about the elective parts of the curriculum.

### Honors Program

Biochemistry majors who have excellent academic records may be admitted to the department's Undergraduate Honors Program. To graduate with departmental honors in biochemistry, a student must satisfy the following requirements:

1. A combined grade point average of at least 3.6
2. A minimum of 6 credit hours of undergraduate research BIOC 391 in one laboratory
3. A BIOC 393 report approved by the Undergraduate Education Committee of the department on the basis of the quality of the research, the written report, and an oral presentation. An acceptable report:
   A. Should follow a standard journal format
   B. Should demonstrate the student's understanding of the research area, experimental techniques, goals and implications of the project
   C. Should show that the student has advanced his/her knowledge of the applicable techniques and the underlying scientific concepts
4. The research mentor must write a letter recommending the student for honors on the basis of the student's contribution to the overall efforts of the laboratory.

### Minor

**Required Courses:**
- BIOC 307 General Biochemistry 4
- BIOC 308 Molecular Biology: Genes and Genetic Engineering 4

**One of the following:**
- BIOC 312 Proteins and Enzymes 3
Students may obtain credit for a minor in biochemistry by completing one year of freshman chemistry (including laboratory), one year of organic chemistry (including laboratory), two semesters of approved biology courses, and three semesters of didactic courses in biochemistry.

Masters Degrees

The Biochemistry Department offers four Masters degrees. The three-year Masters of Science in Biochemical Research provides training in laboratory research. The two-year Masters of Science in Biochemistry provides students with advanced study in biochemistry and related fields. Two other programs provide advanced study in biochemistry in conjunction with degrees in medicine (MD/MS) and law (JD/MS).

Prerequisites for admission into any of the Biochemistry Graduate Programs are one year each of chemistry, organic chemistry, calculus, biology and physics. Applicants must also have a BA, BS or equivalent undergraduate degree. As part of the application process, students are required to take the Graduate Record Examination (verbal, quantitative and an advanced area test, usually biology, biochemistry or chemistry). Some students with otherwise excellent qualifications, but lacking some of the prerequisites may be conditionally admitted with the understanding that specified deficiencies will be made up within a stipulated time span. Students with advanced training (coursework, laboratory research, MS degree, etc.) may be given advanced standing. Please visit the Department’s web page (http://www.cwru.edu/med/biochemistry) for details about the application process.

MS Biochemical Research Plan of Study

The program leading to the MS degree in biochemical research is uniquely designed to provide interested students with sufficient background and laboratory experience to enable them to function as senior research assistants and eventually as laboratory supervisors in university departments, research institutes, or industrial laboratories. Students in this three-year program receive a stipend, and tuition costs are covered by the department. The students pursue flexible and individually designed schedules, which prepare them for independent research projects in the second and third years of the program. The program simultaneously develops background knowledge and technical skills in modern biochemistry, which can be applied to several career paths. A more complete description of the program, admission policies, and financial aid is available from the departmental office.

The duration of the MSBR program is 33 months. Applicants who have been working as full time laboratory technicians may be granted 1 semester credit for one full year of work, and up to 2 semesters credit for two or more years of work. Credit for acceptable didactic coursework may be awarded up to a total of 14 hours. All decisions concerning advanced standing or transfer of credit will be made by the Graduate Education Committee following acceptance into the program and in consultation with the advisor. Courses taken to satisfy other degree requirements (i.e. BA or BS) may not be transferred for credit. A maximum of 6 hours can be transferred toward the course requirements, as set by the Graduate School. The program shall not be extended on the basis of work that needs to be completed in order to achieve a publishable result.

The degree follows Plan A for the Master’s degree. The program requires 36 hours of academic credit (including both research and didactic courses) as well as the writing and defense of a thesis. All courses must be at the 400 level or higher. The course credits include didactic courses (minimum of 12 hours of graded coursework), research (BIOC 610 Biochemical Research) and (BIOC 651 Thesis M.S.). BIOC 651 Thesis M.S. is taken only in the second and third years and requires an examination by the student’s pre-thesis committee and a written thesis. The student’s transcript will be annotated M.S. in Biochemical Research, including the title of the student’s independent project.

Prior to the student’s matriculation, she/he chooses an academic advisor. In general the selection process involves communication with those faculty members who have announced their interest in taking a Master’s student. In some cases the student may be invited to spend up to a week in the prospective advisor’s laboratory to facilitate the decision making process. In the early spring of the first year, pre-thesis committee of three faculty members (at least two of whom must be members of the Biochemistry faculty) is chosen by the student, in consultation with the advisor. In yearly meetings, this committee provides additional scientific expertise, offers support in overcoming research difficulties and evaluates the student’s progress in research and course work.

MS Biochemistry

The program leading to the MS degree in biochemistry is designed to provide students with knowledge of the latest advancements in biochemistry and related fields. It is intended for students who desire to pursue a career not directly involved with research, such as teaching, or various administrative positions in the pharmaceutical industry. Students typically enroll in three courses for each of four semesters. The duration of the MSB program is 21 months; it follows the Plan B for the Master’s degree (p. 662). The default advisor for this program is the Graduate Advisor, but another advisor may be selected. The student’s progress is monitored by the Biochemistry Graduate Advisor and by the Graduate Education Committee. The program requires 36 hours of academic credit of which 18 hours must be graded coursework.
Although a “coursework Masters degree”, students in the program often take 6 to 12 hours of BIOC 601 (Biochemical Research) as part of their requirements. All courses must be at the 400 level; they must be on the list of approved electives, or be approved by the advisor.

**MS Biochemistry Plan of Study**

### First Year

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<tr>
<th>Units</th>
<th>Fall</th>
<th>Spring</th>
<th>Summer</th>
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<tbody>
<tr>
<td>General Biochemistry (BIOC 407)</td>
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<td>BIOC Elective</td>
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<td>Molecular Biology: Genes and Genetic Engineering (BIOC 408)</td>
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<td>BIOC Elective</td>
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<td>On Being a Professional Scientist: The Responsible Conduct of Research (IBMS 500)</td>
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<td>9-10</td>
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### Second Year

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<th>Summer</th>
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<td>Proteins and Enzymes (BIOC 412)</td>
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<tr>
<td>BIOC Elective</td>
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<td>Structural Biology (BIOC 434)</td>
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**Total Units in Sequence:** 36-38

### MD/MS Biomedical Investigation-Biochemistry Track

The tracks proposed in the joint MD/MS program are derived from existing type B MS programs (p. 662) at the School of Medicine into a joint program with the MD, using a common template. The core activities for this degree include limited credit from the medical core curriculum, 3-6 graduate courses in specific tracks, participation in a common seminar series, scientific integrity training, and a requirement for a special problems project that reflects a full year of research (18 hours of 601 non-graded credits) culminating in a written report and examination. This program will require 5 years overall to complete the requirements for both degrees. Students who wish to join the MD/MS program may apply to the Program after arriving at the University any time prior to Fall of their second year of medical school. For more information, please see MD Dual Degrees (p. 792).

The Biochemistry track is designed to provide students with knowledge of the latest advances in biochemistry and related fields. It is also appreciated that a number of courses offered by other departments may be considered “biochemistry” in the broader sense. Depending on the research project, it may be appropriate for the student to substitute one of the courses below in lieu of one of the biochemistry electives. Should this be the case, the student must receive permission from the Graduate Program Advisor for this substitution prior to registering for the course.

**Students in the Biochemistry track must complete:**

<table>
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<tr>
<th>Elective</th>
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<tbody>
<tr>
<td>IBIS 401</td>
<td>Integrated Biological Sciences I</td>
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<tr>
<td>IBIS 402</td>
<td>Integrated Biological Sciences II</td>
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<tr>
<td>BIOC 412</td>
<td>Proteins and Enzymes</td>
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<td>or BIOC 434</td>
<td>Structural Biology</td>
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</tr>
<tr>
<td>BIOC 601</td>
<td>Biochemical Research</td>
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<td>IBMS 500</td>
<td>On Being a Professional Scientist: The Responsible Conduct of Research</td>
</tr>
<tr>
<td>IBIS 600</td>
<td>Exam in Biomedical Investigation</td>
</tr>
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</table>

### JD/MS in Biochemistry

This program allows students admitted to the School of Law an opportunity to pursue a master of science degree in Biochemistry as part of an additional year of study. Such training adds expertise to students who anticipate careers in patent law or in areas related to biotechnology or pharmaceutical research. Please see the separate listing in the publication materials provided by the School of Law on this program.

Entrance into this program is achieved first by acceptance into the CWRU School of Law. Upon acceptance, students can then apply to the Biochemistry program for admission into the JD/MS program. As a result of participating in the dual degree program, students complete 12 fewer hours of law school coursework than they would if they were in the JD program alone. The Department of Biochemistry accepts 9 hours of law school classwork in courses dealing with science issues, in place of 9 credits of other elective work. Thus, the student will take a total of 27 hours of Biochemistry coursework of which at least 12 hours must be letter graded.

Dual degree students are advised concerning matters related to the JD degree by the Associate Dean for Academic Affairs at the School of Law. In addition, dual degree students are granted priority registration for upper level courses, ensuring that they will be able to accommodate their scheduling needs in obtaining required classes. Dual degree students are advised concerning matters related to the MS in Biochemistry by a JD/MS Advisor as designated by the Graduate Education Committee of the Department of Biochemistry.

**JD/MS in Biochemistry (plan B (p. 662))**

**Research Oriented MS*”**
PhD Biochemistry

The aim of the PhD in biochemistry program is to prepare students for careers in teaching and research in biochemistry. The emphasis of the doctoral program is on research culminating in the completion of an original independent research project under the guidance of a faculty member in the biochemistry program. The research areas in the department are described later in this section. In addition to the research activities, graduate students participate in formal courses both within and outside the department, formal and informal seminars, and discussions of current literature. Although students choose from the various tracks within the department, all are broadly trained in modern aspects of biochemistry and become familiar with techniques and literature in a variety of areas. Many collaborative projects with other departments also are available to broaden the spectrum of training offered. Most students begin with an integrated curriculum in cellular and molecular biology in addition to specialized courses in biochemistry. Admissions to the Biochemistry program may be obtained through the Biomedical Sciences Training Program, by direct admission to the department or via the MSTP program.

Prerequisites for admission into the Biochemistry PhD Program include one year each of chemistry, organic chemistry, calculus, biology and physics. Applicants must also have a BA, BS or equivalent undergraduate degree. Students must submit scores from the Graduate Record Examination and may submit scores from an advanced area test, usually in biology, biochemistry or chemistry. Some students with otherwise excellent qualifications, but lacking some of the prerequisites may be conditionally admitted with the understanding that specified deficiencies will be made up within a stipulated time span. Please visit the Department’s web page (http://www.cwru.edu/med/biochemistry) for details about the application process.

To earn a PhD in Biochemistry, a student must complete rotations in at least three laboratories followed by selection of a research advisor, and complete Core and Elective coursework including responsible conduct of research as described in the Course of Study, below. Students who previously completed relevant coursework, (for example, with a MS) may petition to complete alternative courses.

In addition, each PhD student must successfully complete a qualifier examination for advancement to candidacy in the form of a short grant proposal with oral defense. The qualifier is generally completed in the summer after year two. During the dissertation period, students are expected to meet twice a year with the thesis committee, present seminars in the department, and fulfill journal publication requirements. Throughout the doctoral training, students are expected to be enthusiastic participants in seminars, journal clubs, and research meetings in the lab and program. Completion of the PhD degree will require 36 hours of coursework (24 hours of which are graded) and 18 hours of BIOC 701 Dissertation Ph.D..

PhD Biochemistry Plan of Study

§ Please also see Graduate Studies Academic Requirements for Doctoral Degrees (p. 662)

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<tr>
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<tr>
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Total Units in Sequence: 58-90

Courses

BIOC 307. General Biochemistry. 4 Units.

Overview of the macromolecules and small molecules key to all living systems. Topics include: protein structure and function; enzyme mechanisms, kinetics and regulation; membrane structure and function; bioenergetics; hormone action; intermediary metabolism, including pathways and regulation of carbohydrate, lipid, amino acid, and nucleotide biosynthesis and breakdown. One semester of biology is recommended. Offered as BIOC 307, BIOC 407, and BIOL 407. Prereq: CHEM 223 and CHEM 224.
BIOC 308. Molecular Biology: Genes and Genetic Engineering. 4 Units.
An examination of the flow of genetic information from DNA to RNA to protein. Topics include: nucleic acid structure; mechanisms and control of DNA, RNA, and protein biosynthesis; recombinant DNA; and mRNA processing and modification. Where possible, eukaryotic and prokaryotic systems are compared. Special topics include yeast as a model organism, molecular biology of cancer, and molecular biology of the cell cycle. Current literature is discussed briefly as an introduction to techniques of genetic engineering. Recommended preparation for BIOC 408 and BIOL 408: BIOC 307 or BIOL 214. Offered as BIOC 308, BIOL 308, BIOC 408, and BIOL 408. Prereq: BIOC 307 or BIOL 215.

BIOC 312. Proteins and Enzymes. 3 Units.
Aspects of protein and nucleic acid function and interactions are discussed, including binding properties, protein-nucleic acid interactions, kinetics and mechanism of proteins and enzymes, and macromolecular machines. Recommended Preparation: CHEM 301. Offered as BIOC 312 and BIOC 412. Prereq: BIOC 307.

BIOC 315. Nuclear Receptors in Health and Disease. 3 Units.
This course focuses on hormone-gene interactions mediated by the ligand-inducible transcription factors termed nuclear hormone receptors. The class will address the mechanisms of action, regulatory features, and biological activities of several nuclear receptors. The usage of nuclear receptors as therapeutic targets in disease states such as cancer, inflammation, and diabetes will also be discussed. The course aims to teach students to critically evaluate primary literature relevant to nuclear hormone receptors biology, and to reinforce presentation/discussion skills. Grades for undergraduates will be based on midterm, final exam; grades for graduates will be based on midterm, final exam, and presentation of a recently published research article related to the role of nuclear receptors in health and disease. Offered as PHRM 315, BIOC 315, PHRM 415 and BIOC 415.

BIOC 334. Structural Biology. 3 Units.
Introduces basic chemical properties of proteins and discusses the physical forces that determine protein structure. Topics include: the elucidation of protein structure by NMR and by X-ray crystallographic methods; the acquisition of protein structures from databases; and simple modeling experiments based on protein structures. Offered as BIOC 334, BIOL 334, BIOC 434, and BIOL 434. Prereq: BIOC 307.

BIOC 373. Biochemistry SAGES Seminar. 3 Units.
Discussion of current topics in biochemical research using readings from the scientific literature. The goals are for the student: 1) to discuss and critically analyze selections from the biochemical literature; 2) to gain a broader understanding of important topics not formally covered in the didactic courses; and 3) to learn to write in the style of journals in the field of biochemistry. Prereq: BIOC 307 and BIOC 308. Restricted to majors in Biochemistry.

BIOC 391. Research Project. 1 - 9 Unit.
(Credit as arranged.) Offered on a pass/fail basis only. Maximum 9 hours total credit.

BIOC 393. Senior Capstone Experience. 3 Units.
Students will complete their Capstone Projects, begun in BIOC 391. Pertinent research activities will depend on the nature of the student’s project. The student will meet regularly with their Capstone adviser, at least twice monthly, to provide progress reports, discuss the project, and for critique and guidance. By the end of this course, the student will have completed their SAGES Senior Capstone research project, written a project report in the form of a manuscript, and presented their project reports orally in the department and at the Senior Capstone Fair, or its equivalent. Prereq: BIOC 307 and BIOC 308.

BIOC 401. Impacts of Intellectual Property on Biomedical Research. 1 Unit.
This course will expose students to the challenges and opportunities related to intellectual property when developing biomedical technologies within the context of nonprofit research institutions. The course will examine the effects that patent law has on research strategy, funding availability and follow-on funding availability. Special attention will be paid to the dynamics between the potential for profit, the need for translational research and institutional and individual conflicts of interest.

BIOC 407. General Biochemistry. 4 Units.
Overview of the macromolecules and small molecules key to all living systems. Topics include: protein structure and function; enzyme mechanisms, kinetics and regulation; membrane structure and function; bioenergetics; hormone action; intermediary metabolism, including pathways and regulation of carbohydrate, lipid, amino acid, and nucleotide biosynthesis and breakdown. One semester of biology is recommended. Offered as BIOC 307, BIOC 407, and BIOL 407. Prereq: CHEM 223 or CHEM 224.

BIOC 408. Molecular Biology: Genes and Genetic Engineering. 4 Units.
An examination of the flow of genetic information from DNA to RNA to protein. Topics include: nucleic acid structure; mechanisms and control of DNA, RNA, and protein biosynthesis; recombinant DNA; and mRNA processing and modification. Where possible, eukaryotic and prokaryotic systems are compared. Special topics include yeast as a model organism, molecular biology of cancer, and molecular biology of the cell cycle. Current literature is discussed briefly as an introduction to techniques of genetic engineering. Recommended preparation for BIOC 408 and BIOL 408: BIOC 307 or BIOL 214. Offered as BIOC 308, BIOL 308, BIOC 408, and BIOL 408.

BIOC 412. Proteins and Enzymes. 3 Units.
Aspects of protein and nucleic acid function and interactions are discussed, including binding properties, protein-nucleic acid interactions, kinetics and mechanism of proteins and enzymes, and macromolecular machines. Recommended Preparation: CHEM 301. Offered as BIOC 312 and BIOC 412.

BIOC 413. Advanced Topics in Molecular and Biochemical Research Ethics. 0 Units.
This course offers continuing education in responsible conduct of research for advanced graduate students. The course will cover the nine federally defined responsible conduct of research (RCR) areas through a combination of lectures, on-line course material and small group discussions. Six 2-hour meetings per semester are planned. Maximum enrollment of 15 students with preference to graduate students in the Department of Molecular Biology and Microbiology, the Department of Biochemistry, and trainees of the Cell and Molecular Biology Training Grant. Offered as: BIOC 413, MBIO 413.
BIOC 415. Nuclear Receptors in Health and Disease. 3 Units.
This course focuses on hormone-gene interactions mediated by the ligand-inducible transcription factors termed nuclear hormone receptors. The class will address the mechanisms of action, regulatory features, and biological activities of several nuclear receptors. The usage of nuclear receptors as therapeutic targets in disease states such as cancer, inflammation, and diabetes will also be discussed. The course aims to teach students to critically evaluate primary literature relevant to nuclear hormone receptors biology, and to reinforce presentation/discussion skills. Grades for undergraduates will be based on midterm, final exam; grades for graduates will be based on midterm, final exam, and presentation of a recently published research article related to the role of nuclear receptors in health and disease. Offered as PHRM 315, BIOC 315, PHRM 415 and BIOC 415.

BIOC 420. Molecular Genetics of Cancer. 3 Units.
Cancer is a genetic disease, not only in the Mendelian sense of inheritance, but also in the sense that it is caused by somatic mutation. The targets of mutation are a set of proto-oncogenes and tumor suppressor genes whose products govern cellular proliferation, death and differentiation. The objectives of this course are to examine the types of genes that are the targets of mutational activation or inactivation and the mechanistic outcome of mutational changes that lead to oncogenesis. The course will also probe viral mechanisms of oncogenesis related to the products of cellular proto-oncogenes or tumor suppressor genes. In the course of these examinations we will explore the genetic and molecular genetic approaches used to identify and study oncogenes and tumor suppressor genes. Students should be prepared to present and discuss experimental design, data and conclusions from assigned publications. There will be no exams or papers but the course will end with a full-day, student-run symposium on topics to be decided jointly by students and instructors. Grades will be based on class participation and symposium presentation. Offered as BIOC 420, MBIO 420, MVIR 420, PATH 422, and PHRM 420. Prereq: CBIO 453 and CBIO 455.

BIOC 430. Advanced Methods in Structural Biology. 1 - 6 Unit.
The course is designed for graduate students who will be focusing on one or more methods of structural biology in their thesis project. This course is divided into 3-6 sections (depending on demand). The topics offered will include X-ray crystallography, nuclear magnetic resonance spectroscopy, optical spectroscopy, mass spectrometry, cryo-electron microscopy, and computational and design methods. Students can select one or more modules. Modules will be scheduled so that students can take all the offered modules in one semester. Each section is given in 5 weeks and is worth 1 credit. Each section covers one area of structural biology at an advanced level such that the student is prepared for graduate level research in that topic. Offered as BIOC 430, CHEM 430, PHOL 430, and PHRM 430.

BIOC 432. Current Topics in Vision Research. 3 Units.
Vision research is an exciting and multidisciplinary area that draws on the disciplines of biochemistry, genetics, molecular biology, structural biology, neuroscience, and pathology. This graduate level course will provide the student with broad exposure to the most recent and relevant research currently being conducted in the field. Topics will cover a variety of diseases and fundamental biological processes occurring in the eye. Regions of the eye that will be discussed include the cornea, lens, and retina. Vision disorders discussed include age-related macular degeneration, retinal ciliopathies, and diabetic retinopathy. Instructors in the course are experts in their field and are members of the multidisciplinary visual sciences research community here at Case Western Reserve University. Students will be exposed to the experimental approaches and instrumentation currently being used in the laboratory and in clinical settings. Topics will be covered by traditional lectures, demonstrations in the laboratory and the clinic, and journal club presentations. Students will be graded on their performance in journal club presentations (40%), research proposal (40%), and class participation (20%). Offered as NEUR 432, PATH 432, PHRM 432 and BIOC 432.

BIOC 434. Structural Biology. 3 Units.
Introduces basic chemical properties of proteins and discusses the physical forces that determine protein structure. Topics include: the elucidation of protein structure by NMR and by X-ray crystallographic methods; the acquisition of protein structures from data bases; and simple modeling experiments based on protein structures. Offered as BIOC 334, BIOL 334, BIOC 434, and BIOL 434.

BIOC 452. Nutritional Biochemistry and Metabolism. 3 Units.
Mechanisms of regulation of pathways of intermediary metabolism; amplification of biochemical signals; substrate cycling and use of radioactive and stable isotopes to measure metabolic rates. Recommended preparation: BIOC 307 or equivalent. Offered as BIOC 452 and NTRN 452.

BIOC 460. Introduction to Microarrays. 3 Units.
Microarray technology is an exciting new technique that is used to analyze gene expression in a wide variety of organisms. The goal of this course is to give participants a hands-on introduction to this technology. The course is intended for individuals who are preparing to use this technique, including students, fellows, and other investigators. This is a hands-on computer-based course, which will enable participants to conduct meaningful analyses of microarray data. Participants will gain an understanding of the principles underlying microarray technologies, including: theory of sample preparation, sample processing on microarrays, familiarity with the use of Affymetrix Microarray Suite software and generation of data sets. Transferring data among software packages to manipulate data will also be discussed. Importation of data into other software (GeneSpring and DecisionSite) will enable participants to mine the data for higher-order patterns. Participants will learn about the rationale behind the choice of normalization and data filtering strategies, distance metrics, use of appropriate clustering choices such as K-means, Hierarchical, and Self Organizing Maps. Course Offered as BIOC 460, PATH 460, CNCR 460. Prereq: CBIO 455.
BIOC 475. Protein Biophysics. 3 Units.
This course focuses on in-depth understanding of the molecular biophysics of proteins. Structural, thermodynamic and kinetic aspects of protein function and structure-function relationships will be considered at the advanced conceptual level. The application of these theoretical frameworks will be illustrated with examples from the literature and integration of biophysical knowledge with description at the cellular and systems level. The format consists of lectures, problem sets, and student presentations. A special emphasis will be placed on discussion of original publications. Offered as BIOC 475, CHEM 475, PHOL 475, PHRM 475, and NEUR 475.

BIOC 476. Cellular Biophysics. 4 Units.
This course focuses on a quantitative understanding of cellular processes. It is designed for students who feel comfortable with and are interested in analytical and quantitative approaches to cell biology and cell physiology. Selected topics in cellular biophysics will be covered in depth. Topics include theory of electrical and optical signal processing used in cell physiology, thermodynamics and kinetics of enzyme and transport reactions, single ion channel kinetics and excitability, mechanotransduction, and transport across polarized cell layers. The format consists of lectures, problem sets, computer simulations, and discussion of original publications. The relevant biological background of topics will be provided appropriate for non-biology science majors. Offered as BIOC 476, NEUR 477, PHOL 476, PHRM 476.

BIOC 519. Molecular Biology of RNA. 3 Units.
Selected topics regarding editing, enzymatic function, splicing, and structure of RNA. Offered as BIOC 519, CLBY 519, and MBIO 519.

BIOC 521. Chromatin, Epigenetics, and Disease. 3 Units.
The Departments of Genetics and Biochemistry are pleased to announce "Chromatin, Epigenetics, and Disease advanced graduate students. This course will review the history of chromatin and cover the relationships between chromatin structure and the processes of transcription, gene silencing, cell fate determination, DNA methylation, and RNA interference and other biological processes. The course will also cover epigenetic mechanisms and their effects on human disease. The course will emphasize critical reading of articles from the primary literature, presentations by students, and be predominantly discussion based. Limit: 12 students. Offered as BIOC 521 and GENE 521.

BIOC 599. RNA Structure and Function. 3 Units.
This course will cover fundamental aspects of modern RNA biology with emphasis on the interplay of three dimensional structure of nucleic acids and their function. The main focus of the course is on the recent discoveries that indicate a prominent role of RNA as a major regulator of cellular function. Topics discussed will include an introduction to RNA structure, folding and dynamics, RNA/RNA and RNA-protein interactions, and role of RNA in catalysis of biological reactions in ribosome and the role of other catalytic RNAs in rRNA biogenesis, pre-mRNA splicing, and viral replication. The course also covers the recently discovered RNA regulatory switches, large noncoding regulatory RNAs, and the role of RNA in human diseases and novel, RNA-based therapeutics. Offered as BIOC 599, CLBY 599, and MBIO 599.

BIOC 601. Biochemical Research. 1 - 18 Unit.
Credit as arranged.

BIOC 605. Independent Project in Biochemical Research. 1 - 18 Unit.
Credit as arranged. Limited to students in the M.S. program in biochemical research. Prereq: BIOC 407 and BIOC 601.

BIOC 611. Biochemistry Seminar I. 1 Unit.
Student presentations of topics from the current scientific literature unrelated to the student’s research project. Participants are required to present a seminar.

BIOC 612. Biochemistry Seminar II. 1 Unit.
Discussion of current research.

BIOC 617. Special Topics in Biochemistry. 3 Units.
Special topics courses on areas of current interest in biochemistry.

BIOC 618. Special Topics in Biochemistry. 3 Units.
Special topics courses on areas of current interest in biochemistry.

BIOC 620. Transcription and Gene Regulation. 3 Units.
This course covers mechanisms of transcription that play critical roles in biological processes. It is designed to develop scientific thinking in designing experiments and evaluating the merits of research papers. Students will be able to present two to three 30-minute talks. Topics include: 1) structure and function of RNA polymerases; 2) accessory factors involved in initiation, elongation, and termination; 3) regulation transcription; 4) transcriptional coactivators and corepressors; 5) regulation of transcription factor activity. A take-home exam will be conducted at the final week. Grades will be based on presentations and take-home exam. Offered as BIOC 620 and MBIO 620.

BIOC 641. Proposition I. 2 Units.
Design of research proposal.

BIOC 643. Proposition II. 2 Units.
Design of research proposal.

BIOC 651. Thesis M.S.. 1 - 6 Unit.
(Credit as arranged.)

BIOC 701. Dissertation Ph.D.. 1 - 18 Unit.
(Credit as arranged.) Prereq: Predoctoral research consent or advanced to Ph.D. candidacy milestone.
Department of Bioethics

Marie Norris (http://bulletin.case.edu/schoolofmedicine/bioethics/mailto:marie.norris@case.edu), Program Assistant

The mission of the Department of Bioethics is to improve public and professional understanding of the ethical issues involved in health sciences research, health care delivery, and health policy development through teaching, research and community dialogue.

The department has offices at the Case’s School of Medicine and at MetroHealth Medical Center and has faculty from multiple disciplines, including philosophy, religion, law, political science, anthropology, history, sociology, nursing and medicine.

Department faculty teach in both core and elective components of the medical school curriculum, undergraduate courses in ethics, and an intensive course in responsible conduct of research for PhD students in the School of Medicine. The department also has a highly successful master’s degree program in bioethics.

Department faculty have gained international prominence for research in many areas of biomedical ethics that collectively address the concerns of the School of Medicine’s spectrum of biomedical disciplines.

The Department of Bioethics publishes a newsletter, Bioethics Update. Bioethics Update contains information and articles on a variety of ethical issues of interest to both professional and lay communities. It is published three times a year and features faculty research and activities, department events, and master’s degree alumni information.

Please visit the department website (http://www.case.edu/med/bioethics/bioethics.html), where visitors can read Bioethics Update online, obtain information about the master’s degree and PhD programs, and learn about department and faculty activities.

Master of Arts in Bioethics Degree

The Department of Bioethics offers a program leading to the Master of Arts degree in bioethics, emphasizing the interdisciplinary and interprofessional nature of the field. This graduate program is designed to provide advance training in bioethics for students and professionals who anticipate encountering ethical issues in the course of their primary careers.

The 27 credit-hour degree can be earned full-time in one year or part-time in up to three years. Core courses are taught by department faculty and are scheduled so that part-time students can continue their professional responsibilities while completing the degree.

The Master of Arts program provides students with a firm understanding of the intellectual content of the study of bioethics, of bioethical literature, and of the underlying philosophical arguments and empirical assumptions that inform it. Students are taught to understand the institutions and structures of health care and the ethical issues that arise in medical practice. They are trained to identify and analyze a range of clinical ethics issues.

All students pursuing a Master of Arts degree in bioethics are required to complete the interdisciplinary core of 12 credit hours (the equivalent of four courses) in the first two semesters of their first year of study.

The courses, BETH 401 Foundations in Bioethics I, and BETH 402 Foundations in Bioethics II, each six credits, examine 10 basic topic areas in bioethics: death and dying, the therapeutic relationship, method and theory in bioethics, organ transplantation, health care justice, defining health care needs, reproduction and fertility, families, babies and children, research ethics and genetics. Classes meet two evenings per week for seminar sessions (two hours per session).

Another required course is BETH 405 Clinical Ethics Rotation. This course requires a minimum of 8 hours of clinical experience per week during two 10-week rotations. Students spend most of their time observing rounds in relevant services (intensive care units, pediatrics, geriatrics, etc.) with leading clinicians at several area hospital sites. Students must complete rotations at two sites. At the conclusion of each rotation, students are familiar with the clinical, psychological, social, professional, and institutional contexts in which ethical problems arise. Also, they are able to identify, analyze and understand ethical issues as they develop.

In addition, all students must complete 12 credit hours of electives. Electives are selected in consultation with a faculty advisor. Electives must enhance the student’s understanding of bioethical issues and must be relevant to the student’s academic goals.

The department currently offers dual-degree programs with the School of Medicine (MD/MA), the School of Medicine’s Department of Genetics (PhD/MA), the School of Law (JD/MA), the Frances Payne Bolton School of Nursing (MSN/MA) the School of Medicine’s Public Health program (MPH/MA) and Mandel School of Applied Social Sciences (MSSA/MA) at CWRU. Students must apply and be accepted to each program to qualify.

Commencing in the fall semester of 2007, the department will offer a new research ethics track within the MA program, designed to prepare specialists who will pursue research ethics-related work as a primary career (IRB coordinators, research administration, etc.) or who will use this specialized training to enhance their primary careers (investigators, regulators, etc.). In addition to the core seminars BETH 401 Foundations in Bioethics I and BETH 402 Foundations in Bioethics II, discussed above, the research ethics track will feature a modified clinical ethics rotation, focused on IRB work and research ethics activities, and four research ethics electives.

Admission policies conform to those of Case Western Reserve University School of Graduate Studies. In general, an applicant for admission and concurrent financial consideration must have completed application forms on file by March 1 for the fall semester.

MA Bioethics Plan of Study

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<th>First Year</th>
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<tr>
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<td>Elective I</td>
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<tr>
<td>Elective II</td>
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PhD in Bioethics

The increasing complexity of the health care system has resulted in a growing need for investigators who can conduct research to address pressing social problems in bioethics. The objective of the bioethics doctoral program is to train scholars who will have specific expertise
in the conceptualization, design and conduct of empirical research concerning bioethics questions. Graduates will:

- obtain grounding in the philosophical basis of bioethics to conceptualize and analyze moral problems
- develop a theoretical perspective to guide their research
- be proficient in empirical methodologies (both qualitative and quantitative) so that they can conduct research in bioethics problems
- become researchers who can develop and conceptualize timely and meaningful research questions in bioethics

Graduates of the program have a wide range of opportunities, including careers as independent investigators, serving as a bridge between colleagues in the traditional medical humanities and those in clinical and basic-science departments, and employment in academic bioethics centers, clinical and basic science departments in medical schools and schools of public health, government agencies, and public policy institutes.

PhD students receive a full tuition scholarship, health insurance support and a $20,000-per-year graduate assistantship.

**Course of Study**

Completion of the PhD requires

- Minimum of 51 credit hours of course work for candidates with bachelor’s degrees; minimum of 42 credit hours for candidates with master’s degrees
- 18 credit hours of dissertation course work
- 125 research hours (supervised research experiences with Department faculty)
- Training in research ethics
- Comprehensive examination preceding advancement to candidacy
- Defense of dissertation proposal
- Completion of dissertation
- Defense of dissertation

**Core Coursework**

- Foundations in Bioethics I & II
- Clinical Ethics Rotation
- Advanced Seminar on Methods in Normative Bioethics I & II
- Empirical Research Methods and Design in Bioethics I & II
- Statistical Methods and Data Management in Bioethics I & II
- Grant Writing
- Critical Readings in Bioethics
- Research hours

Additional course work: three credit hours each in advanced statistics, methods and study design, and theory from the social sciences, and six credit hours of elective courses

**Enrollment in the Doctoral Program**

The doctoral program is highly selective. Candidates should have a strong theoretical background in the social sciences or philosophy, preferably in the form of a master’s degree in a relevant discipline or a clinical degree. Candidates also must demonstrate an ability to work with quantitative data and demonstrate promise of integrating theory and empirical application.

**Applicants must complete an interview and submit:**

- CWRU Graduate School Application
- Transcripts (undergraduate and graduate if applicable)
- GRE scores — verbal, analytic and quantitative sections. Scores will be considered in relation to the applicant’s other credentials. Applicants may submit scores of other standardized tests in addition to the GRE.
- Three letters of recommendation
- A letter to the admission committee detailing the applicant’s general interests in bioethics and the candidate’s past training and current research interests

**PhD Bioethics, Plan of Study**

§ Please also see Graduate Studies Academic Requirements for Doctoral Degrees (p. 662)

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**Total Units in Sequence:** 85.5
Courses
BETH 271. Bioethics: Dilemmas. 3 Units.
We have the genetic technology to change nature and human nature, but should we? We have the medical technology to extend almost any human life, but is this always good? Should we clone humans? Should we allow doctor-assisted suicide for the terminally ill? This course invites students from all academic disciplines and fields to examine current and future issues in bioethics—e.g., theory and methods in bioethics; death and dying; organ transplantation; genetics; aging and dementia; fertility and reproduction; distributive justice in health care access. The course will include guest lecturers from nationally-known Bioethics faculty. Offered as BETH 271, PHIL 271.

BETH 314. Global Health: India. 3 Units.
Bioethics is the study of ethical controversies arising at the intersection of biology, medicine, technology, politics, law, philosophy, religion and culture. This course will discuss and analyze the issue of health in India; recognizing that health is more than the diagnosis and treatment of a disease. Using three diseases (HIV/AIDS, leprosy and tuberculosis) students will explore the relationship between culture and health care outcomes. Relevant issues addressed in the course include the history of British rule in India, Hinduism, the Caste system, poverty, access to education and public policy. Faculty will introduce readings on the history of India, medical anthropology, religion and the law. Students will then be given the opportunity to focus on a particular topic, research the existing literature, present their findings to the class and create a plan to observe the chosen topic while in India during the Summer semester. Course instructors include Nicole Deming, JD, MA Assistant Professor of Bioethics; Deepak Sarma, PhD. Associate Professor of South Asian Religions; and Gopal Yadavalli, MD Assistant Professor of Medicine and Chief of the Infectious Diseases Clinic at the Cleveland VA Medical Center. The course will also invite guest lectures from many different departments and schools to share their expertise and experience in the areas of Global Justice, Anthropology, and Human Rights.

BETH 315. International Bioethics: Policy and Practice. 3 Units.
Taught by Case and international faculty, this course will include 7-10 days of intensive didactic and experiential learning in one of several "host" countries. Examples of sites include: Free University of Amsterdam and University of Utrecht in the Netherlands; University of Paris in France; and Ben Gurion University in Israel. It will afford a unique opportunity to gain perspective on important bioethics issues in different societies, i.e., euthanasia, public health policies, access to healthcare, and stem cell research. At the international site, students will spend 6 hours per day (5 days) in seminar (involving didactics, discussion, and guided-observation clinical experience). There will be two 3-hour preparatory sessions, required reading, and two 3-hour post trip sessions. Requirements: preparation, attendance, and class participation, a 12-15 page paper (undergraduate credit) and a 15-20 page paper (graduate credit). Graduate credit will also require students to prepare a presentation for a post-intensive session. Enrollment will be capped at 25. This course has an additional fee to cover costs of travel and lodging. Limited scholarships are available. Offered as BETH 315 and BETH 415.

BETH 315A. International Bioethics Policy and Practice: Women’s Health in the Netherlands. 3 Units.
This 3-credit course allows students to familiarize themselves with social policies and practices related to women’s health in the United States and the Netherlands. Issues covered in the course include birth control and family planning, abortion, prenatal testing, childbirth, health care disparities, cosmetic surgery, prostitution and trafficking in women. This course also addresses the US and Dutch national policies regarding the public provision of health care for women. The course places an emphasis on the ways in which social norms shape policies over time, which political actors are involved in shaping women’s health policy, and the balance between women’s health as a matter of the public good or individual responsibility. This course substantively explores gender-specific cultural values and practices in relation to women’s health in the United States and the Netherlands and will help students develop the analytical skills necessary for evaluating social policy and ethical issues related to women’s health. Offered as BETH 315A and BETH 415A.

BETH 315B. International Bioethics Policy and Practice: Public Health in the Netherlands. 3 Units.
This one week 3-credit intensive course will be held in Amsterdam, The Netherlands. Taught by faculty from Case and Utrecht University, this course offers students a cross-cultural perspective on ethical dilemmas raised by the practice of public health in the United States and Northern Europe. Additionally, this course examines policies related to prostitution, drug use, sex education, infectious disease prevention, and access to health care and how they differ in the cultural and political settings of U.S. and the Netherlands. We will examine both the rationales and outcomes of Dutch and American policies, stimulating course participants to consider their own views on these often controversial issues. Prior to the trip, students will attend lectures at Case, which will acquaint them with the theoretical approaches to public health ethics and major issues raised in the practice of public health. In these pre-trip sessions, students will also analyze and report on a case study designed to stimulate critical thinking on comparative public health ethics. In Amsterdam, students will attend lectures that will be supplemented by site visits and discussion sessions aimed at exploring the ethics of public health policy and practice in the Netherlands. Following the intensive week in Amsterdam, students will meet with instructors at Case for two hours to discuss their experiences and compare policies and practices in the United States and the Netherlands. Offered as BETH 315B and BETH 415B.

BETH 315C. International Bioethics Policy and Practice: Health Care Costa Rica. 3 Units.
This 3-credit course gives students the unique opportunity to observe patients and practitioners encounter in a radically different health care system. Costa Rica has one of the most comprehensive health care systems in the Western hemisphere, featuring the innovative use of mid-level health care workers organized in basic comprehensive health care teams. This has resulted in a longer life expectancy than the United States, despite a per capita GDP of only $10,000 per person. Students will gain first-hand experience of Costa Rican health care through field experiences at sites including a national hospital in the capital city, San Jose; a peripheral treatment clinic in a smaller town; and observation of the work of an integrated basic health care team in an indigenous reserve. Following each visit, students will discuss the practical and ethical dilemmas that practitioners face in the context of the Costa Rican health care system. Specific topics include: health inequalities within and between nations; the ethics of transplantation, medical research, and end-of-life care; and health care in rural environments and with indigenous populations. Offered as BETH 315C and BETH 415C.
BETH 315D. International Bioethics Policy and Practice: Issues at the Beginning and End of Life in France. 3 Units.
This 3-credit course gives students the unique opportunity to observe patients and practitioners in a radically different health care system. France has one of the most comprehensive and successful health care systems in the world which covers all citizen and non-citizen residents of France. Instruction is by Case and French faculty and includes 3 classes of intensive didactic learning in the US and 5 days of intensive didactic and experiential learning in Paris, France. Students will gain first-hand experience of the French health care through lectures and readings with French bioethicists and physicians who, generally, are one and the same. Field experiences at sites include the principal medical school in Paris, as well as hospitals, clinics, assisted reproduction facilities and hospices in order to explore the ethical issues related to life and death. Specific topics include: of lectures at home and in Paris include medical education in France, the ethics of a national health care system, reduction/elimination of health care inequalities, gender issues in medical education and medical practice, genetic research, abortion, assisted reproductive technologies, end of life decision making in adult and pediatric medicine, transplantation technologies and immigrant health. Offered as BETH 315D and BETH 415D.

BETH 315E. International Bioethics: Policy and Practice-US and Spanish Perspectives, Salamanca Spain. 3 Units.
This 3-credit hour course will introduce advanced undergraduate and graduate students to theoretical and practical aspects of bioethics in a European context. Continental health professionals and bioethicists work in an environment that differs from the American context in at least three important dimensions: the political structure of their health care systems, the cultural influence of their religious histories, and the theoretical perspective of continental moral philosophy. The University of Salamanca in Spain, one of the oldest universities in Europe (known as the "Oxford of Spain"), will be used in this course as a focal point for examining the interplay of these three dimensions in shaping institutional and professional approaches to specific problems in bioethics, including end of life decisions, organ procurement and allocation, reproductive ethics, health care justice, and environmental bioethics ("eco-ethics"). This course will help advanced students who are already grounded in American bioethics develop the analytical skills necessary for evaluating European bioethical scholarship and policy-making, while helping less advanced students develop a familiarity with fundamental similarities and differences between bioethics in Spain and the U.S. The course will include a one week trip to Salamanca, Spain where students will be taught by instructors and faculty from the University of Salamanca. Teaching will include some guided field experiences and regular discussion sessions with the course faculty. Prior to the trip, students will attend 4 hours of class at Case to become familiar with elements of political theory and moral philosophy relevant to the in-country discussions. Following the trip, students will meet with instructors for an additional 2 hours. Offered as BETH 315E and BETH 415E.

BETH 315F. Looking at Bioethics through the Lens of Both American and Spanish Films. 3 Units.
This one week 3-credit intensive course will be held in San Sebastian, Spain. Taught by faculty from CWRU and University of the Basque Country, this course offers students a cross-cultural perspective on bioethics in the United States and Spain. This course uses the medium of film, complemented by readings in bioethics, film criticism, and medical research, to introduce students to a number of compelling bioethics problems facing physician-scientists today, including: when life begins, the nature and limits of informed consent, use of randomization without equipoise, medical imperialism (or the appearance thereof), the treatment of so-called "orphan" diseases, use of deception in research, and financial conflicts of interests caused by among other things, the involvement of the pharmaceutical industry in the drug invention process. Offered as BETH 315F and BETH 415F.

BETH 401. Foundations in Bioethics I. 6 Units.
The first of the two required seminar courses, this course covers five basic topic areas in bioethics: death and dying; health professional-patient relationship; method and theory in bioethics; organ transplantation; and ethics and children. The course meets twice weekly and is taught in seminar format by Center faculty members who are experts on specific topics. Preentry.

BETH 402. Foundations in Bioethics II. 6 Units.
This course completes the required seminar core and covers the basic bioethics topic areas: health care justice; defining 'health care needs;' reproduction and fertility ethics; research ethics; and ethics in genetics. The course meets twice weekly and is taught in seminar format by Center faculty members who are experts on specific topics. Recommended preparation: BETH 401.

BETH 405. Clinical Ethics Rotation. 1.5 - 3 Unit.
In this course students will become familiar with the clinical, psychological, social, professional, and institutional context in which ethical problems arise. This course exposes students to clinical cases, to hospital ethics committees and ethics consultation programs, to institutional review boards (IRB), and to hospital policies covering the "do not resuscitate" orders (DNR), advance directives, withdrawal of artificial feeding, organ procurement and transplantation, and medical futility. Requires minimum of 8 total hours of rotation experience per week during two semester 10-week rotations. Locations for this course include: MetroHealth Medical Center, University Hospitals of Cleveland, and the Hospice of the Western Reserve. Recommended preparation: BETH 401 or concurrent enrollment.

BETH 408. Ethics, Law and Health Research. 3 Units.
This course focuses on an examination of issues arising at the juncture of law, ethics, and health research, such as informed consent, the assessment of risks and benefits, conflict of interest, and scientific misconduct. Particular attention is placed on issues arising in the context of study design and community based research. To the extent possible, the class will utilize a case-focused approach.
BETH 409. Global Justice and Bioethics. 3 Units.
This course aims to introduce students to the problem of global distributive justice, with an emphasis on both theoretical accounts of justice, and the practical implications of those accounts for important topics in global bioethics. The first half of this course will be devoted to important contemporary works which bring out core philosophical ideas about justice and how we address concerns of justice globally. The second half of this course will focus on current global bioethics topics, such as inequality and poverty, global intellectual property rights, the allocation of healthcare resources, the setting of research priorities, exploitation & the distribution of the benefits of research, and medical tourism. In addition to familiarizing students with the contemporary literature regarding global justice and related topics in bioethics, this course also seeks to help students strengthen their skills in reading, analyzing, interpreting, and engaging with philosophy and bioethics texts. This course is a seminar and will therefore emphasize in-class discussion rather than lecture. Students are expected to prepare by reading all assigned readings before class.

BETH 410. Reproductive Ethics. 3 Units.
Reproductive ethics is a sub-discipline of bioethics that deals with moral issues related to pregnancy, reproduction, and reproductive health care. Relevant issues include procreative liberty and reproductive rights, sterilization, contraception, abortion, conscientious refusals by health care professionals to participate in abortions or in other reproductive practices, reproductive genetic testing, prenatal healthcare, birthing practices, in vitro fertilization, surrogacy, gamete and embryos donation, and research involving reproductive materials. Particular attention will be paid to why each of these issues is controversial.

BETH 412. Ethical Issues in Genetics/Genomics. 3 Units.
This course is designed to familiarize graduate students with the major controversies over the generation and use of new human genetic information. Topics will include the spread of predictive genetic testing, prenatal diagnosis, genetic discrimination, human genetic variation research, eugenics, genetic counseling, and the limits of human gene therapy. The course will be conducted as a seminar, involving discussions of readings, guest speakers, and student presentations.

BETH 414. International Health Research Ethics. 3 Units.
This course will introduce students in the health and social sciences to key ethical issues that arise in international health research. The course will include intensive reading and case-based discussion of current ethical and moral quandaries posed by research conducted in the international arena. Five full-day sessions are planned. Each day will be divided into a series of formal presentations and active, group-based discussions around topics that include: the historical context of international health research; current international ethics principles, standards, and declarations; key tools and concepts for unpacking ethical issues in international health research; issues in informed consent and conflict of interest; “reasonable availability” and the conduct of clinical trials; cutting-edge international genetics research; and, the responsibility of researchers to the international health community. Course evaluation is based on class participation, a written exercise, and a case analysis.

BETH 415. International Bioethics: Policy and Practice. 3 Units.
Taught by Case and international faculty, this course will include 7-10 days of intensive didactic and experiential learning in one of several “host” countries. Examples of sites include: Free University of Amsterdam and University of Utrecht in the Netherlands; University of Paris in France; and Ben Gurion University in Israel. It will afford a unique opportunity to gain perspective on important bioethics issues in different societies, i.e., euthanasia, public health policies, access to healthcare, and stem cell research. At the international site, students will spend 6 hours per day (5 days) in seminar (involving didactics, discussion, and guided-observation clinical experience). There will be two 3-hour preparatory sessions, required reading, and two 3-hour post trip sessions. Requirements: preparation, attendance, and class participation, a 12-15 page paper (undergraduate credit) and a 15-20 page paper (graduate credit). Graduate credit will also require students to prepare a presentation for a post-intensive session. Enrollment will be capped at 25. This course has an additional fee to cover costs of travel and lodging. Limited scholarships are available. Offered as BETH 315 and BETH 415.

BETH 415A. International Bioethics Policy and Practice: Women’s Health in the Netherlands. 3 Units.
This 3-credit course allows students to familiarize themselves with social policies and practices related to women’s health in the United States and the Netherlands. Issues covered in the course include birth control and family planning, abortion, prenatal testing, childbirth, health care disparities, cosmetic surgery, prostitution and trafficking in women. This course also addresses the US and Dutch national policies regarding the public provision of health care for women. The course places an emphasis on the ways in which social norms shape policies over time, which political actors are involved in shaping women’s health policy, and the balance between women’s health as a matter of the public good or individual responsibility. This course substantively explores gender-specific cultural values and practices in relation to women’s health in the United States and the Netherlands and will help students develop the analytical skills necessary for evaluating social policy and ethical issues related to women’s health. Offered as BETH 315A and BETH 415A.

BETH 415B. International Bioethics Policy and Practice: Public health in the Netherlands. 3 Units.
This one week 3-credit intensive course will be held in Amsterdam, The Netherlands. Taught by faculty from Case and Utrecht University, this course offers students a cross-cultural perspective on ethical dilemmas raised by the practice of public health in the United States and Northern Europe. Additionally, this course examines policies related to prostitution, drug use, sex education, infectious disease prevention, and access to health care and how they differ in the cultural and political settings of U.S. and the Netherlands. We will examine both the rationales and outcomes of Dutch and American policies, stimulating course participants to consider their own views on these often controversial issues. Prior to the trip, students will attend lectures at Case, which will acquaint them with the theoretical approaches to public health ethics and major issues raised in the practice of public health. In these pre-trip sessions, students will also analyze and report on a case study designed to stimulate critical thinking on comparative public health ethics. In Amsterdam, students will attend lectures that will be supplemented by site visits and discussion sessions aimed at exploring the ethics of public health policy and practice in the Netherlands. Following the intensive week in Amsterdam, students will meet with instructors at Case for two hours to discuss their experiences and compare policies and practices in the U.S. and the Netherlands. Offered as BETH 315B and BETH 415B.
BETH 415C. International Bioethics Policy and Practice: Health Care Costa Rica. 3 Units.
This 3-credit course gives students the unique opportunity to observe patients and practitioners encounter in a radically different health care system. Costa Rica has one of the most comprehensive health care systems in the Western hemisphere, featuring the innovative use of mid-level health care workers organized in basic comprehensive health care teams. This has resulted in a longer life expectancy than the United States, despite a per capita GDP of only $10,000 per person. Students will gain first-hand experience of Costa Rican health care through field experiences at sites including a national hospital in the capital city, San Jose; a peripheral treatment clinic in a smaller town; and observation of the work of an integrated basic health care team in an indigenous reserve. Following each visit, students will discuss the practical and ethical dilemmas that practitioners face in the context of the Costa Rican health care system. Specific topics include: health inequalities within and between nations; the ethics of transplantation, medical research, and end-of-life care; and health care in rural environments and with indigenous populations. Offered as BETH 315C and BETH 415C.

BETH 415D. International Bioethics Policy and Practice: Issues at the Beginning and End of Life in France. 3 Units.
This 3-credit course gives students the unique opportunity to observe patients and practitioners encounter in a radically different health care system. France has one of the most comprehensive and successful health care systems in the world which covers all citizen and non-citizen residents of France. Instruction is by Case and French faculty and includes 3 classes of intensive didactic learning in the US and 5 days of intensive didactic and experiential learning in Paris, France. Students will gain first-hand experience of the French health care through lectures and readings with French bioethicists and physicians who, generally, are one and the same. Field experiences at sites include the principal medical school in Paris, as well as hospitals, clinics, assisted reproduction facilities and hospices in order to explore the ethical issues related to life and death. Specific topics include: of lectures at home and in Paris include medical education in France, the ethics of a national health care system, reduction/elimination of health care inequalities, gender issues in medical education and medical practice, genetic research, abortion, assisted reproductive technologies, end of life decision making in adult and pediatric medicine, transplantation technologies and immigrant health. Offered as BETH 315D and BETH 415D.

BETH 415E. International Bioethics: Policy and Practice-US and Spanish Perspectives, Salamanca Spain. 3 Units.
This 3-credit hour course will introduce advanced undergraduate and graduate students to theoretical and practical aspects of bioethics in a European context. Continental health professionals and bioethicists work in an environment that differs from the American context in at least three important dimensions: the political structure of their health care systems, the cultural influence of their religious histories, and the theoretical perspective of continental moral philosophy. The University of Salamanca in Spain, one of the oldest universities in Europe (known as the “Oxford of Spain”), will be used in this course as a focal point for examining the interplay of these three dimensions in shaping institutional and professional approaches to specific problems in bioethics, including end of life decisions, organ procurement and allocation, reproductive ethics, health care justice, and environmental bioethics (“eco-ethics”). This course will help advanced students who are already grounded in American bioethics develop the analytical skills necessary for evaluating European bioethical scholarship and policy-making, while helping less advanced students develop a familiarity with fundamental similarities and differences between bioethics in Spain and the U.S. The course will include a one week trip to Salamanca, Spain where students will be taught by instructors and faculty from the University of Salamanca. Teaching will include some guided field experiences and regular discussion sessions with the course faculty. Prior to the trip, students will attend 4 hours of class at Case to become familiar with elements of political theory and moral philosophy relevant to the in-country discussions. Following the trip, students will meet with instructors for an additional 2 hours. Offered as BETH 315E and BETH 415E.

BETH 415F. Looking at Bioethics through the Lens of Both American and Spanish Films. 3 Units.
This one week 3-credit intensive course will be held in San Sebastian, Spain. Taught by faculty from CWRU and University of the Basque Country, this course offers students a cross-cultural perspective on bioethics in the United States and Spain. This course uses the medium of film, complemented by readings in bioethics, film criticism, and medical research, to introduce students to a number of compelling bioethics problems facing physician-scientists today, including: where life begins, the nature and limits of informed consent, use of randomization without equipoise, medical imperialism (or the appearance thereof), the treatment of so-called “orphan” diseases, use of deception in research, and financial conflicts of interests caused by among other things, the involvement of the pharmaceutical industry in the drug invention process. Offered as BETH 315F and BETH 415F.

BETH 417. Introduction to Public Health Ethics. 3 Units.
The course will introduce students to theoretical and practical aspects of ethics and public health. This course will help students develop the analytical skills necessary for evaluating ethical issues in public health policy and public health prevention, treatment, and research. Will include intensive reading and case-based discussions. Evaluation based on class participation, a written exercise and a case analysis. Open to graduate students with permission from instructors.
BETH 419. Ethics and the Business of Biomedicine. 3 Units.
Central to current national discourse are concerns about ethics, costs, and profits in relation to health care. These concerns are primarily driven by major shifts in health care during the 20th century. These shifts include: the transformation of professional medical practice from a service orientation to a market orientation; the emergence of powerful pharmaceutical and health care corporations; the development of new, innovative, and expensive biomedical technologies by for-profit enterprises. This course will focus on questions about values (e.g., distributive justice, rights, human dignity, community welfare in relation to the business of medicine. Topics covered include: 1) commodification in relation to health care; 2) the just distribution of health care goods and services in market economies; 3) pharmaceutical research, development, and marketing; and 4) ethical issues in the sale of human body parts and ethically contentious services (like contract surrogacy). While course topics will be addressed primarily in reference to the United States, students will have some opportunity to analyze specific issues regarding these topics from an international perspective.

BETH 420. Critical Issues in Research Ethics. 3 Units.
This course is open to graduate students with an interest in health-related research ethics. Enrollment preference will be given to Masters-level bioethics students in the Research Ethics Track (RET). The course provides students with a comprehensive study of critical issues in research ethics, including the modern history of research ethics in science and medicine, the ethics of clinical trial design and conduct, advanced issues in informed consent, the ethics of animal experimentation, and key issues in genetics research. Coursework will include case studies and in-depth readings to highlight topic areas. Discussions of ethical and regulatory frameworks that influence decision-making, policy development, and the conduct of biomedical and social-behavioral science research will allow students to explore the nuances, gaps, challenges, and concerns present in research, particularly research involving human subjects. Topics will be addressed within the framework of integrating research ethics into the scientific process. Students are expected to lead class discussions and write a course-relevant paper. Enrollment will be limited to 15 students. Class will meet weekly for 3 hours.

BETH 421. Research Ethics Practicum. 1.5 Unit.
The Research Ethics Practicum (80 hours, 1.5 CREDITS) is designed to complement the theoretical and conceptual training received in the course, Critical Issues in Research Ethics. By way of a series of campus-wide rotations, students learn about the practical, everyday side of research administration, compliance, and scientific review. Students will work with key staff in research ethics centers, and observe their day-to-day operations, as well as attend institutional review board (IRB) and Institutional Animal Care and Use Committee (IACUC) meetings. They will become familiar with human subjects, animal, and tissue research regulations and policies as these are applied in an institutional/academic research context. Students will also spend time in a clinical trials unit and tour animal care facilities. The practicum has the following overall objectives: (1) students will be able to identify, analyze, and understand research ethics issues as they develop in the context of actual institutional research governance (2) students will gain an understanding of methods of ethical research design and implementation.

BETH 422. Clinical Ethics: Theory & Practice. 3 Units.
This course will focus on both theoretical and practical issues in clinical ethics. Clinical ethics will be distinguished from other areas of bioethics by highlighting distinctive features of the clinical context which must be taken into account in clinical ethics policy and practice. Fundamental moral and political foundations of clinical ethics will be examined, as will the role of bioethical theory and method in the clinical context. Topical issues to be considered may include informed consent; decision capacity; end of life decision making; confidentiality and privacy; the role and function of ethics committees; ethics consultation; the role of the clinical ethicist; decision making in various pediatric settings (from neonatal through adolescent); the role of personal values in professional life (e.g., rights of conscience issues, self disclosure and boundary issues); dealing with the chronically non-adherent patient; ethical issues in organ donation and transplant; health professional-patient communication; medical mistakes; and other ethical issues that emerge in clinical settings.

BETH 425. Stem Cells: Ethics and Policy. 3 Units.
This graduate-level course addresses major issues in the science, ethics, and politics of stem cell research. Over the past decade, embryonic stem cell research has emerged as one of the world’s most controversial areas of biomedical research. While new forms of stem cell research have emerged recently which appear to sidestep the debate over the use of human embryos, these new forms of stem cell research raise a host of problems in their own right. Furthermore, as stem cell research marches toward clinical applications for patients, the scientific and ethical issues will continue to evolve in evermore complex directions. In order to fully appreciate the ethical and policy issues at the cutting edge of stem cell science, one needs a sound grasp of the science of stem cell research. Thus this course is designed to take a science-based approach to the ethics of stem cell research. (No prior knowledge of stem cell biology is presupposed.)

BETH 430. Bioethics in Literature. 1 Unit.
This course complements the Foundation course in the MA bioethics program by introducing students to narrative literature (fiction, nonfiction and poetry) that addresses ethical issues in medicine. The material is frequently the work of physicians and patients who narrate their respective experiences. As such, narrative provides direct insights into the practice of modern medicine tested against both accepted and controversial moral norms and serves as a vehicle for discussion and analysis of ethical issues. These issues involve topics such as death and dying, reproduction, pediatrics, women as patients and clinicians, public health and medicine as a profession and its practice as a privilege. Students will sample the work, among others, of William Carlos Williams, Lewis Thomas, Toni Morrison, Margaret Atwood, John Donne, Dylan Thomas and Abraham Verghese.
BETH 440. Science and Society Through Literature. 3 Units.
This course will examine the interaction of scientific investigation and discovery with the society it occurred in. What is the effect of science on society and, as importantly, what is the effect of society on science? An introduction will consider the heliocentric controversy with focus on Galileo. Two broad areas, tuberculosis and the Frankenstein myth, will then be discussed covering the period 1800-present. With tuberculosis, fiction, art and music will be examined to understand the changing views of society towards the disease, how society's perception of tuberculosis victims changed, and how this influenced their treatments and research. With Frankenstein, the original novel in its historical context will be examined. Using fiction and film, the transformation of the original story into myth with different connotations and implications will be discussed. Most classes will be extensive discussions coupled with student presentations of assigned materials. Offered as PHRM 340, BETH 440, PHRM 440, and HSTY 440.

BETH 466. Promoting Health Across Boundaries. 3 Units.
This course examines the concepts of health and boundary spanning and how the synergy of the two can produce new, effective approaches to promoting health. Students will explore and analyze examples of individuals and organizations boundary spanning for health to identify practice features affecting health, compare and contrast practices and approaches, and evaluate features and context that promote or inhibit boundary spanning and promoting health. Offered as MHPH 466, EPBI 466, and BETH 466. Prereq: Graduate student status or instructor consent.

BETH 496. Public Policy and Aging. 3 Units.
Overview of aging and the aged. Concepts in the study of public policy. Policies on aging and conditions that they address. The politics of policies on aging. Emergent trends and issues. Offered as ANTH 498, BETH 496, EPBI 408, GERO 496, HSTY 480, MHPH 408, NURS 479, NURS 579, POSC 480, and SOCI 496.

BETH 503. Research Ethics and Regulation. 2 Units.
This course is designed to introduce students to the ethical, policy, and legal issues raised by research involving human subjects. It is intended for law students, post-doctoral trainees in health-related disciplines and other students in relevant fields. Topics include (among others): regulation and monitoring of research; research in third-world nations; research with special populations; stem cell and genetic research; research to combat bioterrorism; scientific misconduct; conflicts of interest; commercialization and intellectual property; and the use of deception and placebos. Course will meet once per week for 2 hours throughout the semester. Grades will be given based on class participation and a series of group projects and individual short writing assignments. Offered as BETH 503, CRSP 603 and LAWS 603.

BETH 504. Critical Readings in Bioethics. 3 Units.
This course will focus on both normative (traditional) and descriptive (empirical) approaches to bioethics. It will be co-directed by two faculty members, one with a specialization in normative bioethics and one with a specialization in descriptive bioethics.

BETH 505. Methods in Normative Bioethics I. 3 Units.
The first of the two required Methods seminars is designed to give graduate students an intensive introduction to the modes of moral reasoning that have been adopted and adapted by contemporary Bioethics, and the major critical perspectives that have been brought to bear upon them.

BETH 506. Methods in Normative Bioethics II. 3 Units.
The second of the two required Methods seminars is designed to give graduate students an intensive introduction to the modes of moral reasoning that have been adopted and adapted by contemporary Bioethics, and the major critical perspectives that have been brought to bear upon them.

BETH 507. Research Design in Bioethics I. 3 Units.
The first of two empirical research courses will introduce students to theoretical and methodological approaches in the design and implementation of empirical research on topics in biomedical ethics. Students will be provided with a comprehensive and robust exploration of empirical models for the development of bioethics research and the skills for critically assessing the optimal methods for designing studies relevant to ethical issues in biomedicine.

BETH 508. Research Design in Bioethics II. 3 Units.
The second of two empirical research courses will introduce students to theoretical and methodological approaches in the design and implementation of empirical research on topics in biomedical ethics. Students will be provided with a comprehensive and robust exploration of empirical models for the development of bioethics research and the skills for critically assessing the optimal methods for designing studies relevant to ethical issues in biomedicine. Prereq: BETH 507.

BETH 511. Grant Writing. 3 Units.
This course will teach students the fundamentals of writing a grant proposal. We will concentrate on NIH-style applications, although the principals of grant writing can be applied to any venue. In the process of working through devising a research question and study design, students will be encouraged to use this as an opportunity to think about their dissertation topic. In addition to applying theoretical and research design knowledge gained through their other core course work, the course will also teach students about how to complete application forms and to create a budget. We will also familiarize students with the peer review process. Each student will produce a draft grant application. The students will form a mock peer review section and will critique the grants.

BETH 512. Clinical Ethics Rotation - Ph.D.. 1.5 Unit.
In this course students will become familiar with the clinical, psychological, social, professional, and institutional context in which ethical problems arise. This course exposes students to clinical cases, hospital ethics committees and ethics consultation programs, to institutional review boards (IRB), and to hospital policies covering the “do not resuscitate” orders (DNR), advance directives, withdrawal of artificial feeding, organ procurement and transplantation, and medical futility. Requires minimum of 10 total hours of rotation experience per week during two semester 10-week rotations. Locations for this course include: MetroHealth Medical Center, University Hospitals of Cleveland, and the Hospice of the Western Reserve. Recommended preparation: BETH 520/521 or concurrent enrollment.

BETH 520. Foundations in Bioethics I - Ph.D.. 3 Units.
The first of the two required seminar courses, this course covers five basic topic areas in bioethics: death and dying; health professional-patient relationship; method and theory in bioethics; organ transplantation; and ethics and children. The course meets twice weekly and is taught in seminar format by Center faculty members who are experts on specific topics.
BETH 521. Foundations in Bioethics II - Ph.D. 3 Units.
The second of the two required seminar courses, this course covers five basic topic areas in bioethics: death and dying; health professional-patient relationship; method and theory in bioethics; organ transplantation; and ethics and children. The course meets twice weekly and is taught in seminar format by Center faculty members who are experts on specific topics.

BETH 602. Special Topics in Bioethics. 1 - 3 Unit.
Students will explore particular issues and themes in biomedical ethics in depth through independent study and research under the direction of a faculty member.

BETH 603. Bioethics Research. 6 Units.
Research leading toward the MD/MA degree is Bioethics.

BETH 604. Advanced Research Ethics Seminar. 0 Units.
This course meets for two hours each month and is focused on the following topics and the development of the stated competencies:
September Introduction; How to critically analyze the literature; Facilitator critique of assigned manuscript; Designing re-entry projects Critical analysis of literature. October Trainee #1 critique of assigned manuscript; Methodological and ethical issues in designing and reviewing research; Trainee presentation of concept papers for re-entry projects Critical review of research protocols and manuscripts; Issues in designing research. November Trainee #2 critique of assigned manuscript; How to prepare and present professional presentations Critical analysis of literature; Oral presentation skills December Trainee #3 critique of assigned manuscript; Principles of adult education Critical analysis of literature; Oral presentation skills; Development of teaching skills. January Trainee #1 critique of assigned manuscript; Principles of adult education Critical analysis of literature; Oral presentation skills. February Trainee #2 critique of assigned manuscript; Developing submissions for IRB review Critical analysis of literature; Oral presentation skills; Identifying and addressing ethical issues in research; Preparation of IRB submissions. March Trainee #3 critique of assigned manuscript; Update on development of re-entry projects; Logistical issues related to re-entry projects; Manuscript preparation Critical analysis of literature; Oral presentation skills; Implementing research; Preparing work for publication; Negotiation skills. April Re-entry issued Implementing research; Readjustment. This course is only open to trainees in the Fogarty-funded Training Program in International Research Ethics.

BETH 605. Special Study: IRB Administration. 1.5 Unit.
This course is limited to Fogarty-sponsored trainees in the Training Program in International Research Ethics. The course, which meets 1.5 hours per week, focuses on issues relevant to the management and administrations of the various functions of research ethics review committees. Topics to be covered include identification and selection of appropriate community representatives for membership and/or consultation, utilization of independent experts/consultants, recordkeeping, approaches to communication with investigators, and others. Regular guest lectures will be provided by members of the various local IRBs, staff members of local IRBs, and senior investigators. The course will utilize a case-based approach.

(Credit as arranged.) Prereq: Predoctoral research consent or advanced to Ph.D. candidacy milestone.
Department of Genetics and Genome Sciences

Clarice Young (http://bulletin.case.edu/schoolofmedicine/genetics/mailto:clarice.young@case.edu), Coordinator

The Department of Genetics & Genome Sciences embraces a unified program devoted to outstanding research and teaching in all areas of genetics, with particular emphasis on genomics, human genetics and animal models, development, and chromosome structure and function. Faculty conduct internationally recognized research programs in each of these areas. The also are committed to training the next generations of leading genetics researchers. The department has three special programs: the Center for Human Genetics, the Center for Computational Genomics, and the Genomic Medicine Institute (descriptions appear later in this narrative).

Programs offered lead to the PhD, combined MD/PhD degree, or MS with a special emphasis in genetic counseling. In addition to required and elective coursework, students participate in ongoing journal clubs, research seminars and grand rounds. A program of departmental and interdepartmental seminars by outstanding visiting scientists provides regular exposure to a broad range of current research in genetics.

The department accepts direct on-line applications (http://genetics.case.edu/page.php?page_id=126) to the doctoral program by those who have significant prior research experience in genetics and are committed to careers in genetics research. The PhD program also participates in the integrated Biomedical Sciences Training Program (BSTP, please see separate listing in this publication and/or BSTP Web site). Students interested in pursuing the combined MD/PhD program are admitted through the Medical Scientist Training Program (MSTP, please see separate listing in this publication). Those interested in careers in genetic counseling apply directly to the Genetic Counseling Training Program, via the common Graduate Studies application (http://gradstudies.case.edu).

The Center for Human Genetics is an integral part of the Department of Genetics and consists of both research and clinical laboratories involved in human and clinical genetics. This center supports research and clinical programs focusing on the molecular basis of inherited disease, human genetic disease mapping, and the genetic dissection of complex disease, as well as providing clinical care and training for postdoctoral fellows and genetic counseling students.

The Center for Computational Genomics is an interdisciplinary research and training program involving faculty in the Department of Epidemiology and Biostatistics in the School of Medicine and in the Department of Electrical Engineering and Computer Science in the School of Engineering. The center provides opportunities to combine research in genetics, genomics, epidemiology, biostatistics, computer science, and systems biology.

The Genomic Medicine Institute is a joint program involving the Cleveland Clinic Foundation and Case. Its emphasis involves translating discoveries in basic and clinical research to clinical practice. The mission is to exploit the discoveries in genomics, epidemiology, ethics, pharmacology, genetics and physiology to revolutionize the practice of medicine.

MS Genetic Counseling

The Genetic Counseling Training Program is a 40 credit hour program that spans four academic semesters and an intervening summer. Acquisition and mastery of clinical competencies are reflected in the Program’s didactic coursework, clinical rotations, thesis process and supplementary experiences. The sequence of medical genetics courses and genetic counseling courses are designed to introduce concepts regarding medical genetics, general medical practice, counseling theory and clinical skills such that they build from beginning skills to a more advanced skill set in the order needed for clinical experiences. The goal of the program is to provide students with the knowledge and clinical skills to function as competent and caring genetic counselors in a wide range of settings and roles. All of these activities enable successful graduates to meet the clinical competencies as outlined by the American Board of Genetic Counseling (ABGC).

Experiential professional training occurs concurrently with formal coursework and over the summer between years one and two. Clinical settings include a variety of clinics and inpatient services at the Center for Human Genetics at University Hospitals Case Medical Center, the Genomic Medicine Institute at the Cleveland Clinic, Genetic Services at MetroHealth Medical Center and Medical Genetics at Akron Children’s Hospital. Students also rotate through the Center for Human Genetics Diagnostic Laboratory which includes experiences in cytogenetics, molecular genetics, cancer cytogenetics and maternal serum screening. Student participation in these and other departmental professional and educational activities such as lectures, seminars, journal club, grand rounds, genetics conferences, and various research, counseling and patient management conferences is expected throughout the program. Coursework and clinical experiences are designed to develop the competencies expected by the ABGC.

The First Year

The major activities during the first year consist of course work (in plan of study below), clinical observations and defining a research question and preparing a research proposal. Observational clinical rotations begin early in October with students observing in prenatal genetics, cancer genetics, and general genetics clinics at the program’s three affiliated institutions. Additionally, students meet several times over the fall semester to discuss the thesis process, potential topics and are introduced to the faculty’s research areas of interest.

In addition to continuing clinical observational rotations and thesis work, students continue with course work including an introduction to research methods and more in-depth theory and practice in the psychosocial aspects of counseling during spring semester.

During the intervening summer of years 1 and 2, students begin clinical rotations at the Medical Genetics Division at Akron Children’s Hospital to gain exposure in various clinical settings including prenatal, general genetics, pediatrics, specialty clinics and cancer genetics clinic. They also rotate through the Center for Human Genetics Laboratory to become familiarized with the clinical aspects of a diagnostic cytogenetics and molecular genetics laboratory.

The Second Year

The major focus of the second year is continued clinical experiences, research and taking the comprehensive written and oral examination. Students also complete their coursework, taking one course each semester.

At the beginning of spring semester in January, the students sit for the written comprehensive examination (covering the didactic and clinical genetic counseling material covered to date in the program) and the oral section of the examination, which is given shortly after the written portion. Both examinations are intended to allow students to expand on their knowledge base of human and medical genetics and genetic counseling. Students are expected to pass both sections of the examination in order
to meet graduation requirements by the Program. The written portion of the examination is patterned after the certification examination given by the American Board of Genetic Counseling.

Students continue to work on data collection and analyses for their theses projects, which should result in a publishable document. They meet with the PD periodically to review their progress as well as with their thesis committee and of course, are meeting with their mentor on a more frequent basis. During the fall semester of second year the student also attend the National Society of Genetic Counselors annual education meeting. This provides an opportunity for students to meet genetic counselors from across the country, to attend scientific sessions to continue adding to their knowledge base and to meet and discuss job opportunities with prospective employers. Successful completion of the program fulfills the curricular and clinical training requirements for eligibility to sit for the certification examination given by the ABGC.

The sequence of courses for students graduating in 2012 is as follows:

**MS Plan of Study**

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<th>First Year</th>
<th>Units</th>
<th>Fall</th>
<th>Spring</th>
<th>Summer</th>
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<tr>
<td>Intensive: Medical Terminology and SOM Block 2 lectures</td>
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<tr>
<td>Advanced Medical Genetics: Clinical Genetics (GENE 525)</td>
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<td>Embryology (online course)</td>
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<td>Principles and Practices of Genetic Counseling (GENE 528)</td>
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<td>Advanced Medical Genetics: Cytogenetics (GENE 524)</td>
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<td>Advanced Medical Genetics: Molecular and Quantitative Genetics (GENE 526)</td>
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<td>Intensive: Human Development (1 week)</td>
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<td>Psychosocial Issues in Genetic Counseling (GENE 529)</td>
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<td>Family System Interventions (SASS 517)</td>
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<td>Thesis M.S. (GENE 651)</td>
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<td>Cancer Genetics (GENE 531)</td>
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<td>Clinical Practicum in Genetic Counseling (GENE 532)</td>
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**Year Total:**

| | Units |
| | Fall | Spring | Summer |
| | 9 | 10 | 3 |

<table>
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<tr>
<th>Second Year</th>
<th>Units</th>
<th>Fall</th>
<th>Spring</th>
<th>Summer</th>
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<td>or Advanced Medical Genetics: Molecular and Quantitative Genetics (GENE 526)</td>
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<td>Thesis M.S. (GENE 651)</td>
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<tr>
<td>Ethical and Professional Issues in Genetic Counseling (GENE 530)</td>
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</table>

| Year Total: | | | |
| | 9 | 9 | |

**Total Units in Sequence:** 40

**PhD Genetics**

Admissions to the Genetics program may be obtained through the integrated Biomedical Sciences Training Program, by direct admission to the department or via the MSTP program. The following summary pertains to most incoming PhD students, regardless of the route through which they enter the program. Exceptions are occasionally made to reflect previous educational experiences (e.g., a prior MS degree).

**The First Year**

Course work, rotations in at least three laboratories, and participation in seminars, journal clubs, and research meetings are the major activities of first year students. During the Fall term, most students take core courses in Cell and Molecular Biology (CBIO 453 Cell Biology I/CBIO 455 Molecular Biology I) that are offered for Biomedical Sciences Training Program departments. Laboratory rotations begin in early July and the choice of a thesis advisor is usually made at the end of December (see below for more details on Choosing an Advisor).

During the Spring term, PhD students take the core Advanced Eukaryotic Genetics course sequence (GENE 500 Advanced Eukaryotic Genetics I/GENE 504 Advanced Eukaryotic Genetics II), which is followed by a written comprehensive examination in late May or early June. This core course is designed to acquaint students with fundamental principles and methodologies used in modern genetic research. The focus is on similarities and differences between different model organisms used in genetics research. Also during the Spring term and continuing into the Summer, students begin formulating a doctoral research proposal.

**The Second Year and Beyond**

During the second year, students participate in a Proposal Writing Workshop (GENE 511 Grant Writing and Reviewing Skills Workshop) and take other advanced elective courses based on the academic background and interest of the student. The remaining elective credits can be satisfied by choosing from the courses offered by departmental faculty or participating training faculty from other departments (see List of Courses below). At the end of the second academic year, students must pass an oral proposal defense in order to advance to candidacy for the PhD degree. An outline of the typical course of study is shown below.

**PhD Genetics, Plan of Study Sample**

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<thead>
<tr>
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<th>Units</th>
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<th>Spring</th>
<th>Summer</th>
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<td>Molecular Biology I (CBIO 455)</td>
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<tr>
<td>Complete 3 lab rotations (July 1 to Dec 15)</td>
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<td>Choose Ph.D. mentor (end December)</td>
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<td>Research in Genetics (GENE 601)</td>
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</table>

Program Directors meet with students to discuss status, mentor, Students begin assembling Ph.D. thesis committee

| Year Total: | | | |
| 9 | 9 | | |
Courses

GENE 367-1. Commercialization and Intellectual Property Management. 3 Units.
This interdisciplinary course covers a variety of topics, including principles of intellectual property and intellectual property management, business strategies and modeling relevant to the creation of start-up companies and exploitation of IP rights as they relate to biomedical-related inventions. The goal of this two-semester course is to address issues relating to the commercialization of biomedical-related inventions by exposing law students, MBA students, and Ph.D. candidates (in genetics and proteomics) to the challenges and opportunities encountered when attempting to develop biomedical intellectual property from the point of early discovery to the clinic and market. Specifically, this course seeks to provide students with the ability to value a given technological advance or invention holistically, focusing on issues that extend beyond scientific efficacy and include patient and practitioner value propositions, legal and intellectual property protection, business modeling, potential market impacts, market competition, and ethical, social, and healthcare practitioner acceptance. The course will meet over two consecutive semesters--fall and spring--and is six credit hours (three credits each semester). During these two semesters, law students, MBA students, and Ph.D. candidates in genomics and proteomics will work in teams of five (two law students, two MBA students and one Ph.D. candidate), focusing on issues of commercialization and IP management of biomedical-related inventions. The instructors will be drawn from the law school, business school, and technology-transfer office. To be eligible for this course, law students must also have a B.S or equivalent in the life sciences, such as biology, biochemistry, genomics, molecular biology, etc. Offered as LAWS 367, MGMT 467, GENE 367 and GENE 467.

GENE 367-2. Commercialization and Intellectual Property Management. 3 Units.
This interdisciplinary course covers a variety of topics, including principles of intellectual property and intellectual property management, business strategies and modeling relevant to the creation of start-up companies and exploitation of IP rights as they relate to biomedical-related inventions. The goal of this two-semester course is to address issues relating to the commercialization of biomedical-related inventions by exposing law students, MBA students, and Ph.D. candidates (in genetics and proteomics) to the challenges and opportunities encountered when attempting to develop biomedical intellectual property from the point of early discovery to the clinic and market. Specifically, this course seeks to provide students with the ability to value a given technological advance or invention holistically, focusing on issues that extend beyond scientific efficacy and include patient and practitioner value propositions, legal and intellectual property protection, business modeling, potential market impacts, market competition, and ethical, social, and healthcare practitioner acceptance. The course will meet over two consecutive semesters--fall and spring--and is six credit hours (three credits each semester). During these two semesters, law students, MBA students, and Ph.D. candidates in genomics and proteomics will work in teams of five (two law students, two MBA students and one Ph.D. candidate), focusing on issues of commercialization and IP management of biomedical-related inventions. The instructors will be drawn from the law school, business school, and technology-transfer office. To be eligible for this course, law students must also have a B.S or equivalent in the life sciences, such as biology, biochemistry, genomics, molecular biology, etc. Offered as MGMT 467, LAWS 367, GENE 367 and GENE 467.
GENE 451. Principles of Genetic Epidemiology. 3 Units.
A survey of the basic principles, concepts and methods of the discipline of genetic epidemiology, which focuses on the role of genetic factors in human disease and their interaction with environmental and cultural factors. Many important human disorders appear to exhibit a genetic component; hence the integrated approaches of genetic epidemiology bring together epidemiologic and human genetic perspectives in order to answer critical questions about human disease. Methods of inference based upon data from individuals, pairs of relatives, and pedigrees will be considered. The last third of the course (1 credit) is more statistical in nature. Offered as EPBI 451, GENE 451, and MPHP 451.

GENE 467-1. Commercialization and Intellectual Property Management. 3 Units.
This interdisciplinary course covers a variety of topics, including principles of intellectual property and intellectual property management, business strategies and modeling relevant to the creation of start-up companies and exploitation of IP rights as they relate to biomedical-related inventions. The goal of this two-semester course is to address issues relating to the commercialization of biomedical-related inventions by exposing law students, MBA students, and Ph.D. candidates (in genetics and proteomics) to the challenges and opportunities encountered when attempting to develop biomedical intellectual property from the point of early discovery to the clinic and market. Specifically, this course seeks to provide students with the ability to value a given technological advance or invention holistically, focusing on issues that extend beyond scientific efficacy and include patient and practitioner value propositions, legal and intellectual property protection, business modeling, potential market impacts, market competition, and ethical, social, and healthcare practitioner acceptance. The course will meet over two consecutive semesters—fall and spring—and is six credit hours (three credits each semester). During these two semesters, law students, MBA students, and Ph.D. candidates in genomics and proteomics will work in teams of five (two law students, two MBA students, and one Ph.D. candidate), focusing on issues of commercialization and IP management of biomedical-related inventions. The instructors will be drawn from the law school, business school, medical school, and technology-transfer office. To be eligible for this course, law students must also have a B.S. or equivalent in the life sciences, such as biology, biochemistry, genomics, molecular biology, etc. Offered as LAWS 367, MGMT 467, GENE 367 and GENE 467.

GENE 467-2. Commercialization and Intellectual Property Management. 3 Units.
This interdisciplinary course covers a variety of topics, including principles of intellectual property and intellectual property management, business strategies and modeling relevant to the creation of start-up companies and exploitation of IP rights as they relate to biomedical-related inventions. The goal of this two-semester course is to address issues relating to the commercialization of biomedical-related inventions by exposing law students, MBA students, and Ph.D. candidates (in genetics and proteomics) to the challenges and opportunities encountered when attempting to develop biomedical intellectual property from the point of early discovery to the clinic and market. Specifically, this course seeks to provide students with the ability to value a given technological advance or invention holistically, focusing on issues that extend beyond scientific efficacy and include patient and practitioner value propositions, legal and intellectual property protection, business modeling, potential market impacts, market competition, and ethical, social, and healthcare practitioner acceptance. The course will meet over two consecutive semesters—fall and spring—and is six credit hours (three credits each semester). During these two semesters, law students, MBA students, and Ph.D. candidates in genomics and proteomics will work in teams of five (two law students, two MBA students, and one Ph.D. candidate), focusing on issues of commercialization and IP management of biomedical-related inventions. The instructors will be drawn from the law school, business school, medical school, and technology-transfer office. To be eligible for this course, law students must also have a B.S. or equivalent in the life sciences, such as biology, biochemistry, genomics, molecular biology etc. Offered as MGMT 467, LAWS 367, GENE 367 and GENE 467.

GENE 488. Yeast Genetics and Cell Biology. 3 Units.
This seminar course provides an introduction to the genetics and molecular biology of the yeast S. cerevisiae and S. pombe by a discussion of current literature focusing primarily on topics in yeast cell biology. Students are first introduced to the tools of molecular genetics and special features of yeasts that make them important model eukaryotic organisms. Some selected topics include cell polarity, cell cycle, secretory pathways, vesicular and nuclear/cytoplasmic transport, mitochondrial import and biogenesis, chromosome segregation, cytoskeleton, mating response and signal transduction. Offered as CLBY 488, GENE 488, MBio 488, and PATH 488.

GENE 500. Advanced Eukaryotic Genetics I. 3 Units.
Fundamental principles of modern genetics; transmission, recombination, structure and function of the genetic material in eukaryotes, dosage compensation, behavior and consequences of chromosomal abnormalities, mapping and isolation of mutations, gene complementation and genetic interactions. Recommended preparation: BIOL 362.

GENE 503. Readings and Discussions in Genetics. 0 - 3 Units.
(Credit as arranged.) In-depth consideration of special selected topics through critical evaluation of classic and current literature.

GENE 504. Advanced Eukaryotic Genetics II. 3 Units.
Fundamental principles of modern genetics: population and quantitative genetics, dissection of genome organization and function, transgenics, developmental genetics, genetic strategies for dissecting complex pathways in organisms ranging from Drosophila and C. elegans to mouse and human. Recommended preparation: GENE 500 or permission of instructor.
GENE 505. Genetics Journal Club. 1 Unit.
Genetics Journal Club is a graduate level course designed to facilitate discussion of topics in Genetics. Students choose "hot" papers in Genetics and present them to their peers. Group presentations are designed to encourage audience participation. The intent of this class is to expose students to cutting edge topics in Genetics and to instill teaching and leadership skills.

GENE 508. Bioinformatics and Computational Genomics. 3 Units.
The course is designed to provide an understanding of theory and application of computational methods for molecular biology research. The course will be divided into four primary sections: DNA methods, protein methods, structure analysis (RNA and protein) and phylogenetic analysis. Special emphasis will be placed on the use and development of tools to search and analyze large amounts of sequence data generated as part of the Genome Projects in human, Drosophila and other eukaryotic organisms. The course offers extensive hands-on computational training using UNIX, Web and PC-based software. As such, for every hour of lecture material there will be two corresponding hours of computational laboratory time. In the initial year, enrollment will be limited to five students. Preference will be given to senior-level genetics graduate students or post-doctoral fellows. Recommended preparation: GENE 500 and GENE 504 or permission of instructor.

GENE 511. Grant Writing and Reviewing Skills Workshop. 3 Units.
This is an introductory graduate course in grant writing and reviewing skills. During this course each student will write a research grant on a topic of his or her choice. Proposals may form the basis for the written component of the preliminary examination in the Genetics Department. Students will also participate in editing and reviewing the proposals of their classmates. Prereq: GENE 500 and GENE 504 or consent of instructor.

GENE 513. Stem Cell Genetics. 3 Units.
This course focuses on fundamental aspects of development with implications for stem cell therapy, tissue engineering, regenerative medicine and postnatal health. The goal of the class is to inform and promote critical thinking and discussion of research topics of medical importance in developmental biology. The themes of the course will include the conditions and factors which promote pluripotency and differentiation, regeneration and repair, epigenetic stability and reprogramming, and prenatal conditions which affect postnatal health. The topics will include early embryonic development and embryonic stem cells, cardiac development and regeneration, bone development and repair, pancreatic development and regeneration, germ line stem cells and conditions affecting postnatal health. The course will be structured around facilitated discussion of the primary literature.

GENE 521. Chromatin, Epigenetics, and Disease. 3 Units.
The Departments of Genetics and Biochemistry are pleased to announce "Chromatin, Epigenetics, and Disease" advanced graduate students. This course will review the history of chromatin and cover the relationships between chromatin structure and the processes of transcription, gene silencing, cell fate determination, DNA methylation, and RNA interference and other biological processes. The course will also cover epigenetic mechanisms and their effects on human disease. The course will emphasize critical reading of articles from the primary literature, presentations by students, and be predominantly discussion based. Limit: 12 students. Offered as BIOC 521 and GENE 521.

GENE 523. Embryonic Patterning in Development. 3 Units.
This course will focus on current understanding of patterning mechanisms in animal development. The seminal contributions of Turing, Stern, Crick, Lawrence, Wolpert, and Lewis will be covered, as will the most recent advances in the field. Models and theory will be considered, in addition to experimental analysis and the identification of patterning molecules. The course will end with a consideration of how development changes to create different adult morphologies over the course of evolution.

GENE 524. Advanced Medical Genetics: Cytogenetics. 2 - 3 Units.
Fundamental principles regarding clinical cytogenetics including discussion of autosomal numerical and structural abnormalities; sex chromosome abnormalities; population cytogenetics; mosaicism; uniparental disomy; contiguous gene deletions, and cancer cytogenetics.

GENE 525. Advanced Medical Genetics: Clinical Genetics. 2 - 3 Units.
Fundamental principles regarding congenital malformations, dysmorphology and syndromes. Discussion of a number of genetic disorders from a systems approach: CNS malformations, neurodegenerative disorders, craniofacial disorders, skeletal dysplasias, connective tissue disorders, hereditary cancer syndromes, etc. Discussions also include diagnosis, etiology, genetics, prognosis and management.

GENE 526. Advanced Medical Genetics: Molecular and Quantitative Genetics. 2 - 3 Units.
Molecular: Fundamental principles of gene structure; mechanisms, detection and effects of mutations; imprinting; triplet repeat disorders; X-chromosome inactivation; application of molecular analysis to genotype/phenotype correlations and gene therapy. Quantitative: Fundamental principles of pedigree analysis, segregation analysis, Bayes theorem; linkage analysis and disequilibrium; risk assessment and consanguinity.

GENE 527. Advanced Medical Genetics: Biochemical Genetics. 2 - 3 Units.
Fundamental principles of metabolic testing; amino acid disorders; organic acid disorders; carbohydrate disorders; peroxisomal disorders; mitochondrial disorders; etc. Discussion of screening principles and newborn screening as well as approaches to diagnosis, management and therapy for metabolic diseases.

GENE 528. Principles and Practices of Genetic Counseling. 3 Units.
Fundamental principles needed for the practicing genetic counselor. Topics include skills in obtaining histories (prenatal, perinatal, medical, developmental, psychosocial and family); pedigree construction and analysis, physical growth and development; the genetic evaluation; the physical examination and laboratory analyses; prenatal issues, prenatal screening and diagnosis; and teratogenicity.

GENE 529. Psychosocial Issues in Genetic Counseling. 3 Units.
Fundamental principles regarding the psychosocial aspects of genetic disease and birth defects, its psychological and social impact on the individual and family. Topics include the genetic counseling interview process, issues regarding pregnancy and prenatal diagnosis, chronicity, death and loss. Cultural issues and their impact on the genetic counseling session are addressed. Resources for families are also explored. Basic interviewing skills are presented. Students will have an opportunity for practice of skills through role play and actual interviewing situations.
GENE 530. Ethical and Professional Issues in Genetic Counseling. 2 Units.
Professional issues inherent in medical genetics and genetic counseling are addressed, including ethical, legal, religious, and cultural concepts. Fundamental principles of ethics are explored in some depth as they relate to genetic issues, such as autonomy and informed consent; use of the NSGC Code of Ethics is emphasized. Genetic counseling roles and responsibilities and aspects of a career as a professional are explored.

GENE 531. Cancer Genetics. 2 - 3 Units.
This seminar will discuss basic concepts in cancer epidemiology, principles of cancer genetics, inherited cancer syndromes, cytogenetics of cancers, pedigree analysis for familial cancer risk and approaches to the differential diagnosis of inherited and familial cancers. Additionally, topics of risk assessment, genetic testing, screening, management and psychosocial issues in providing genetic counseling to patients with familial and inherited cancers will be discussed.

GENE 532. Clinical Practicum in Genetic Counseling. 1 - 6 Unit.
This clinical practicum provides the student an opportunity to function as a genetic counselor by preparing for cases; obtaining appropriate histories; determining risks; performing psychosocial assessments; discussing disease characteristics, inheritance, and natural history; providing anticipatory guidance and supportive counseling; using medical and community resources; and follow-up. Students rotate through four clinical areas and one laboratory and will register for a total of 12 hours over the course of the program. Recommended preparation: Admission to Genetic Counseling Training Program.

GENE 533. Genetics of Aging. 3 Units.
Topics covered this course will focus on our current understanding of the genetic mechanisms underlying cellular and organismal aging as well as age-related diseases. Theories of aging will be covered as well as the most recent experimental analysis in a variety of systems (yeast, worms, flies, mice, and humans). While aging research has long been primarily descriptive in nature, the most recent genetic-based experiments are providing the first insights into the molecular pathways involved with striking similarities across model systems. Recommended preparation: GENE 500, GENE 504, or consent of instructor.

GENE 537. Microscopy-Principles and Applications. 3 Units.
This course provides an introduction to various types of light microscopy, digital and video imaging techniques, and their applications to biological and biomedical sciences via lectures and hands-on experience. Topics covered include geometrical and physical optics; brightfield, darkfield, phase contrast, DIC, fluorescence and confocal microscopes; and digital image processing. Offered as GENE 537, MBIO 537, and PHOL 537.

GENE 601. Research in Genetics. 1 - 9 Unit.
(Credit as arranged.)

GENE 651. Thesis M.S.. 1 - 9 Unit.
(Credit as arranged.) Master's Thesis Plan A.

GENE 701. Dissertation Ph.D.. 1 - 9 Unit.
(Credit as arranged.) Prereq: Predoctoral research consent or advanced to Ph.D. candidacy milestone.
Department of Neurosciences

Katie Wervey (http://bulletin.case.edu/schoolofmedicine/neurosciences/mailto:kathleen.wervey@case.edu), Department Assistant

Understanding how the nervous system develops and functions to process information and mediate behavior and how it is altered by disease, injury and the environment is one of the most exciting frontiers remaining in biological science. Neuroscience is inherently multidisciplinary and integrative and solving the major outstanding problems will require knowledge of molecular, cellular, systems, and behavioral levels of organization. It also requires a multidisciplinary approach combining the tools of electrophysiology, anatomy, biochemistry and molecular biology in studies of animals, brain slices, and tissue culture models.

The department offers a PhD program that provides interdisciplinary training in modern neurosciences through a combination of course work, seminars and research experience. Medical students are encouraged to pursue research projects with neurosciences faculty. Neuroscientists at CWRU are using state-of-the-art techniques and instrumentation to study diverse aspects of nervous system function, including neural circuitry and plasticity, development and regeneration, and cellular and molecular neurobiology. Techniques used include electrical recording and imaging to study the behavior of neurons from ion channels to how they function in awake, behaving animals; molecular genetic approaches to discover the roles of specific genes in circuit formation, synaptic function, and in neurological disorders; and anatomical, biochemical, computational, and behavioral methods to understand the normal nervous system and how it is affected by disease and injury.

PhD in Neurosciences

The Neurosciences graduate program has a strong emphasis on cellular and molecular mechanisms that mediate the function and development of the nervous system. Admissions to the Neurosciences PhD program may be obtained through the integrated Biomedical Sciences Training Program, by direct admission to the department or via the Medical Scientist Training Program. To earn a PhD in Neurosciences, a student must complete rotations in at least three laboratories, followed by selection of a research advisor, and complete Core and Elective coursework including responsible conduct of research as described in the plan of study, below. In general, students must be registered for a total of 9 credit hours each fall and spring semester until they advance to candidacy, at the end of their 2nd year. Students who previously completed relevant coursework, for example, with a MS, may petition to complete alternative courses. Each graduate program follows the overall regulations established and described in CWRU Graduate Studies and documented to the Regents of the State of Ohio.

In addition, each student must successfully complete a preliminary exam after year one, and a qualifier examination for advancement to candidacy in the form of a short grant proposal with oral defense. The qualifier is generally completed in the summer after year two. During the dissertation period, students are expected to meet twice a year with the thesis committee, present seminars in the department, and fulfill journal publication requirements. Throughout the doctoral training, students are expected to be enthusiastic participants in seminars, journal clubs, and research meetings in the lab and program. Completion of the PhD degree will require 36 hours of coursework (24 hours of which are graded) and 18 hours of NEUR 701 Dissertation Ph.D.

Plan of Study

§ Please also see Graduate Studies Academic Requirements for Doctoral Degrees (p. 662)

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<td>Research in Neuroscience (NEUR 601)</td>
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<td>Training Program (BSTP 400)</td>
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<td>or Research Rotation in Biomedical Sciences Program (MSTP 400)</td>
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<td>Principles of Neural Science (NEUR 402)</td>
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<tr>
<td>Complete preliminary exam by July 31</td>
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<tr>
<td>Begin thesis research</td>
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<td>Complete Qualifier Exam by July 31</td>
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<td>Form thesis committee</td>
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<td>Research</td>
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<th>Fall</th>
<th>Spring</th>
<th>Summer</th>
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<tr>
<td>Dissertation Ph.D. (NEUR 701)</td>
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<tr>
<td>Thesis committee meetings every 6 months</td>
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Total Units in Sequence: 34-97

* NEUR 540 Advanced Topics in Neuroscience Ethics is offered every other spring semester (beginning 2008), so can be taken in 3rd or 4th year.
Courses

NEUR 402. Principles of Neural Science. 3 Units.
Lecture/discussion course covering concepts in cell and molecular neuroscience, principles of systems neuroscience as demonstrated in the somatosensory system, and fundamentals of the development of the nervous system. This course will prepare students for upper level Neuroscience courses and is also suitable for students in other programs who desire an understanding of neurosciences. Recommended preparation: CBIO 453. Offered as BIOL 402 and NEUR 402.

NEUR 405. Cellular and Molecular Neurobiology. 3 Units.
Cell biology of nerve cells, including aspects of synaptic structure physiology and chemistry. The application of molecular biological tools to questions of synaptic function will be addressed. Recommended preparation: BIOL 473.

NEUR 411. Neurobiology of Disease. 3 Units.
Designed to show how basic research in neuroscience has contributed to the management of clinical problems in human neurology and to discuss some of the further challenges posed by human disease for research in neurobiology. The general format will include clinical descriptions of patient presentation, discussion of the disease mechanisms and an analysis of contributions of cellular and systems neuroscience to understanding of the human disorder. Specific topics to be discussed include Ischemia and Stroke, Neurodegenerative Diseases such as Alzheimer’s Parkinson’s Brain Tumors, Mood Disorders, and Demyelinating diseases such as Multiple Sclerosis. Recommended preparation: NEUR 402 or NEUR 405.

NEUR 415. Neuroscience Seminars. 1 Unit.
Current topics of interest in neurosciences. Students attend weekly seminars. From this series, students prepare critiques. No credit is given for less than 75% attendance.

NEUR 425. Stem Cell Biology and Therapeutics. 3 Units.
This course is intended to teach current understanding of stem cells as it relates to their characterization, function, and physiologic and pathological states. The course will expose students to the current understanding of various types of stem cells, including embryonic and adult stem cells of various tissues, techniques for their isolation and study. Experimental models and potential biomedical therapeutic applications will be discussed. The course will be taught by the faculty of the "Center for Stem Cell and Regenerative Medicine" who are affiliated with multiple departments of Case Western Reserve University, Cleveland Clinic Foundation and the partnering biomedical companies. Offered as NEUR 425 and PATH 425.

NEUR 427. Neural Development. 3 Units.
Topics include cell commitment, regulation of proliferation and differentiation, cell death and trophic factors, pathfinding by the outgrowing nerve fiber, synapse formation, relationships between center and periphery in development and the role of activity. Offered as BIOL 427 and NEUR 427.

NEUR 432. Current Topics in Vision Research. 3 Units.
Vision research is an exciting and multidisciplinary area that draws on the disciplines of biochemistry, genetics, molecular biology, structural biology, neuroscience, and pathology. This graduate level course will provide the student with broad exposure to the most recent and relevant research currently being conducted in the field. Topics will cover a variety of diseases and fundamental biological processes occurring in the eye. Regions of the eye that will be discussed include the cornea, lens, and retina. Vision disorders discussed include age-related macular degeneration, retinal ciliopathies, and diabetic retinopathy. Instructors in the course are experts in their field and are members of the multidisciplinary visual sciences research community here at Case Western Reserve University. Students will be exposed to the experimental approaches and instrumentation currently being used in the laboratory and in clinical settings. Topics will be covered by traditional lectures, demonstrations in the laboratory and the clinic, and journal club presentations. Students will be graded on their performance in journal club presentations (40%), research proposal (40%), and class participation (20%). Offered as NEUR 432, PATH 432, PHRM 432 and BIOC 432.

NEUR 435. Vision: Molecules to Perception. 3 Units.
The organization, physiology, and function of the vertebrate visual system are considered in detail. The visual pathway from retina to LGN and visual cortex is described with an emphasis on circuits that produce successively more complex receptive field properties. Classic papers and current literature form the basic course material. Assessment is based on student presentations, class participation, and a term paper. Recommended preparation: NEUR 402 or consent of department.

NEUR 466. Cell Signaling. 3 Units.
This is an advanced lecture/journal/discussion format course that covers cell signaling mechanisms. Included are discussions of neurotransmitter-gated ion channels, growth factor receptor kinases, cytokine receptors, G protein-coupled receptors, steroid receptors, heterotrimeric G proteins, ras family GTPases, second messenger cascades, protein kinase cascades, second messenger regulation of transcription factors, microtubule-based motility, actin/myosin-based motility, signals for regulation of cell cycle, signals for regulation of apoptosis. Offered as CLBY 466 and PHOL 466 and PHRM 466.

NEUR 473. Introduction to Neurobiology. 3 Units.
How nervous systems control behavior. Biophysical, biochemical, and molecular biological properties of nerve cells, their organization into circuitry, and their function within networks. Emphasis on quantitative methods for modeling neurons and networks, and on critical analysis of the contemporary technical literature in the neurosciences. Term paper required for graduate students. Offered as BIOL 373, BIOL 473, and NEUR 473.
NEUR 474. Neurobiology of Behavior. 3 Units.
In this course, students will examine how neurobiologists interested in animal behavior study the linkage between neural circuitry and complex behavior. Various vertebrate and invertebrate systems will be considered. Several exercises will be used in this endeavor. Although some lectures will provide background and context on specific neural systems, the emphasis of the course will be on classroom discussion of specific journal articles. In addition, students will each complete a project in which they will observe some animal behavior and generate both behavioral and neurobiological hypotheses related to it. In lieu of examinations, students will complete three written assignments, including a theoretical grant proposal, a one-page Specific Aims paper related to the project, and a final project paper. These assignments are designed to give each student experience in writing biologically-relevant documents. Classroom discussions will help students understand the content and format of each type document. They will also present their projects orally to the entire class. Offered as BIOL 374, BIOL 474, and NEUR 474.

NEUR 475. Protein Biophysics. 3 Units.
This course focuses on in-depth understanding of the molecular biophysics of proteins. Structural, thermodynamic and kinetic aspects of protein function and structure-function relationships will be considered at the advanced conceptual level. The application of these theoretical frameworks will be illustrated with examples from the literature and integration of biophysical knowledge with description at the cellular and systems level. The format consists of lectures, problem sets, and student presentations. A special emphasis will be placed on discussion of original publications. Offered as BIOC 475, CHEM 475, PHOL 475, PHRM 475, and NEUR 475.

NEUR 476. Neurobiology Laboratory. 3 Units.
Introduction to the basic laboratory techniques of neurobiology. Intracellular and extracellular recording techniques, forms of synaptic plasticity, patch clamping, immunohistochemistry and confocal microscopy. During the latter weeks of the course students will be given the opportunity to conduct an independent project. One laboratory and one discussion session per week. Recommended preparation for BIOL 476 and NEUR 476: BIOL 216. Offered as BIOL 376, BIOL 476 and NEUR 476.

NEUR 477. Cellular Biophysics. 4 Units.
This course focuses on a quantitative understanding of cellular processes. It is designed for students who feel comfortable with and are interested in analytical and quantitative approaches to cell biology and cell physiology. Selected topics in cellular biophysics will be covered in depth. Topics include theory of electrical and optical signal processing used in cell physiology, thermodynamics and kinetics of enzyme and transport reactions, single ion channel kinetics and excitability, mechanotransduction, and transport across polarized cell layers. The format consists of lectures, problem sets, computer simulations, and discussion of original publications. The relevant biological background of topics will be provided appropriate for non-biology science majors. Offered as BIOC 476, NEUR 477, PHOL 476, PHRM 476.

NEUR 478. Computational Neuroscience. 3 Units.
Computer simulations and mathematical analysis of neurons and neural circuits, and the computational properties of nervous systems. Students are taught a range of models for neurons and neural circuits, and are asked to implement and explore the computational and dynamic properties of these models. The course introduces students to dynamical systems theory for the analysis of neurons and neural learning, models of brain systems, and their relationship to artificial and neural networks. Term project required. Students enrolled in MATH 478 will make arrangements with the instructor to attend additional lectures and complete additional assignments addressing mathematical topics related to the course. Recommended preparation: MATH 222 and MATH 224 or BIOL 300 and BIOL 306. Offered as BIOL 378, COGS 378, MATH 378, BIOL 478, EBME 478, EECS 478, MATH 478 and NEUR 478.

NEUR 482. Drugs, Brain, and Behavior. 3 Units.
This course is concerned with the mechanisms underlying neurochemical signaling and the impact of drugs on those mechanisms. The first half of the course emphasizes the fundamental mechanisms underlying intra- and extracellular communication of neurons and the basic principles of how drugs interact with the nervous system. The second half of the course emphasizes understanding the neural substrates of disorders of the nervous system, and the mechanisms underlying the therapeutic effects of drugs at the cellular and behavioral levels. This course will consist of lectures designed to give the student necessary background for understanding these basic principles and class discussion. The class discussion will include viewing video examples of behavioral effects of disorders of the nervous system, and analysis of research papers. The goal of the class discussions is to enhance the critical thinking skills of the student and expose the student to contemporary research techniques. Offered as BIOL 382, BIOL 482, and NEUR 482.

NEUR 540. Advanced Topics in Neuroscience Ethics. 0 Units.
This course offers continuing education in responsible conduct of research for advanced graduate students. The course will cover the nine defined areas of research ethics through a combination of lectures, online course material and small group discussions. Six 2-hr meetings per semester. Maximum enrollment of 15 students with preference given to graduate students in the Neurosciences program. All neurosciences graduate students must complete this course during their 3rd or 4th year.

NEUR 601. Research in Neuroscience. 1 - 18 Unit.

NEUR 651. Master’s Thesis (M.S.). 1 - 6 Unit.
(Credit as arranged.) Recommended preparation: M.S. candidates only.

Prereq: Predoctoral research consent or advanced to Ph.D. candidacy milestone.
Department of Nutrition

Pamela Woodruff (http://bulletin.case.edu/schoolofmedicine/nutrition/mailto:pamela.woodruff@case.edu), Graduate Student Coordinator

The department’s focus is on human nutrition and the application of the science of nutrition to the maintenance and improvement of health. Undergraduate programs are designed for students interested in nutritional biochemistry and metabolism, molecular nutrition, professional study in dietetics, public health nutrition, medicine, physical therapy, pharmacy or dentistry. Graduate programs emphasize dietetics, public health nutrition, nutritional biochemistry and molecular nutrition.

The Department of Nutrition offers programs leading to the bachelor of science degree in nutrition, bachelor of arts degree in nutrition, bachelor of arts degree in nutritional biochemistry and metabolism, bachelor of science degree in nutritional biochemistry and metabolism, master of science degree in nutrition, master of science degree in public health nutrition, and doctor of philosophy degree. A nutrition minor is available. Graduate certificate programs are available in areas such as maternal and child nutrition or gerontology. The specialty is in addition to the basic graduate degree.

Human Nutrition | Nutritional Biochemistry and Metabolism | Minors

Undergraduate Degrees (NTRN)

Major Programs

The undergraduate degree in nutrition is appropriate for students who wish to:

1. pursue graduate programs in nutritional biochemistry, molecular nutrition, dietetics, public health nutrition or other biomedical sciences
2. enter professional schools of dentistry, medicine, physical therapy, or pharmacy
3. apply to dietetic internships or approved experience programs in order to prepare for the professional practice of dietetics
4. pursue technical careers in the food or pharmaceutical industry

This major offers flexibility in course selection within a framework of general program requirements. The selection of courses depends on the student’s choice of emphasis. Students wishing to qualify for admission to professional or graduate programs need to include specific courses considered prerequisites for admission. Students interested in applying to dietetic internships must meet specific course requirements (Didactic Program in Dietetics) as required by the Accreditation Council for Education in Nutrition and Dietetics of the Academy of Nutrition and Dietetics. These requirements are met in the courses that comprise the Didactic Program in Dietetics (DPD). The DPD at Case Western Reserve University is currently granted Accreditation by the Accreditation Council for Education in Nutrition and Dietetics of the Academy of Nutrition and Dietetics, 120 South Riverside Plaza, Suite 2000, Chicago, IL 60606-6995, 800.877.1600. A department advisor should be consulted in the freshman year to plan the dietetics course work.

Human Nutrition

Bachelor of Science degree requires:

Required Courses:

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<th>Units</th>
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<tr>
<td>NTRN 201</td>
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<tr>
<td>NTRN 342</td>
<td>Food Science</td>
<td>3</td>
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<tr>
<td>NTRN 342L</td>
<td>Food Science Lab</td>
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Bachelor of Arts degree requires:

Required Courses:

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<td>NTRN 201</td>
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<tr>
<td>NTRN 342</td>
<td>Food Science</td>
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<td>&amp; 342L and Food Science Lab</td>
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<tr>
<td>NTRN 343</td>
<td>Dietary Patterns</td>
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<td>NTRN 363</td>
<td>Human Nutrition I: Energy, Protein, Minerals</td>
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<td>NTRN 364</td>
<td>Human Nutrition II: Vitamins</td>
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<tr>
<td>NTRN 397</td>
<td>SAGES Capstone Proposal Seminar</td>
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<tr>
<td>NTRN 398</td>
<td>SAGES Senior Capstone Experience</td>
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Three nutrition electives chosen from:

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<td>NTRN 328</td>
<td>Child Nutrition, Development and Health</td>
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<td>NTRN 351</td>
<td>Food Service Systems Management</td>
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<td>NTRN 360</td>
<td>Guided Study in Nutrition Practice</td>
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<tr>
<td>NTRN 365</td>
<td>Nutrition for the Prevention and Management of Disease: Pathophysiology</td>
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<td>NTRN 371</td>
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<td>NTRN 435</td>
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<td>NTRN 437</td>
<td>Evaluation of Nutrition Information for Consumers</td>
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<td>NTRN 440</td>
<td>Nutrition for the Aging and Aged</td>
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<td>NTRN 452</td>
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<td>NTRN 460</td>
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Additional Required Courses:

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<td>CHEM 113</td>
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<td>CHEM 223</td>
<td>Introductory Organic Chemistry I (before NTRN 363)</td>
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<td>BIOL 214</td>
<td>Genes, Evolution and Ecology</td>
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<td>BIOL 216</td>
<td>Development and Physiology</td>
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<td>BIOL 346</td>
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<td>ANTH 319</td>
<td>Introduction to Statistical Analysis in the Social Sciences</td>
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<td>EPBI 431</td>
<td>Statistical Methods I</td>
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<td>PSCL 282</td>
<td>Quantitative Methods in Psychology</td>
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<tr>
<td>STAT 201</td>
<td>Basic Statistics for Social and Life Sciences</td>
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Total Units: 57

* Only one of these courses is permitted

Case Western Reserve University 751
## Bachelor of Science in Nutrition - Human Nutrition Major Example Plan of Study

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<th>Fall</th>
<th>Spring</th>
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<td>Genes, Evolution and Ecology (BIOL 214)</td>
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<td>Principles of Chemistry II (CHEM 106)</td>
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<tr>
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<tr>
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### Bachelor of Science degree requires:

#### Required courses:
- NTRN 201 Nutrition
- NTRN 342 Food Science
- NTRN 342L Food Science Lab
- NTRN 363 Human Nutrition I: Energy, Protein, Minerals
- NTRN 364 Human Nutrition II: Vitamins
- NTRN 397 SAGES Capstone Proposal Seminar
- NTRN 398 SAGES Senior Capstone Experience
- NTRN 452 Nutritional Biochemistry and Metabolism

One nutrition elective at 300-level or above 3

### Additional required courses:
- MATH 125 Math and Calculus Applications for Life, Managerial, and Social Sci 4
- or MATH 121 Calculus for Science and Engineering I

#### Bachelor of Arts degree requires:

- Additional required courses:
- NTRN 201 Nutrition
- NTRN 342 Food Science
- NTRN 342L Food Science Lab
- NTRN 363 Human Nutrition I: Energy, Protein, Minerals
- NTRN 364 Human Nutrition II: Vitamins
- NTRN 397 SAGES Capstone Proposal Seminar
- NTRN 398 SAGES Senior Capstone Experience
- NTRN 452 Nutritional Biochemistry and Metabolism

One nutrition elective at 300-level or above 3

### Additional required courses:
- MATH 125 Math and Calculus Applications for Life, Managerial, and Social Sci 4
- or MATH 121 Calculus for Science and Engineering I
## Bachelor of Arts in Nutrition - Nutritional Biochemistry and Metabolism Major Example Plan of Study

### First Year

<table>
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<tr>
<th>Units</th>
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<tbody>
<tr>
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<tr>
<td>Math and Calculus Applications for Life, Managerial, and Social Sci I (MATH 125)</td>
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<tr>
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<td>Genes, Evolution and Ecology (BIOL 214)</td>
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<tr>
<td>Principles of Chemistry I (CHEM 105)</td>
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<td>SAGES Breadth Requirements</td>
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<tr>
<td>Cells and Proteins (BIOL 215)</td>
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<td>Principles of Chemistry Laboratory (CHEM 113)</td>
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<td>Math and Calculus Applications for Life, Managerial, and Social Sci II (MATH 126)</td>
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### Second Year

<table>
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<tbody>
<tr>
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<td>Elective</td>
</tr>
<tr>
<td>SAGES University Seminar</td>
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<tr>
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### Third Year

<table>
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<tr>
<th>Units</th>
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<tbody>
<tr>
<td>Fall</td>
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<tr>
<td>General Biochemistry (BIOC 307)</td>
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<tr>
<td>Introductory Physics I (PHYS 115)</td>
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<td>SAGES Breadth Requirement</td>
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<td>SAGES Capstone Proposal Seminar (NTRN 397)</td>
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<tr>
<td>Introductory Physics II (PHYS 116)</td>
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<td>SAGES Breadth Requirement</td>
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### Fourth Year

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<tr>
<td>Proteins and Enzymes (BIOC 312)</td>
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<td>SAGES Senior Capstone Experience (NTRN 398)</td>
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<td>Nutritional Biochemistry and Metabolism (NTRN 452)</td>
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<tr>
<td>Human Nutrition I: Energy, Protein, Minerals (NTRN 363)</td>
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<tr>
<td>Human Nutrition II: Vitamins (NTRN 364)</td>
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<td>Structural Biology (BIOC 334)</td>
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### Minor Programs

The basic sequence for a minor program consists:

- Required courses:
  - NTRN 201 Nutrition
  - NTRN 343 Dietary Patterns
  - Nine credits selected from:
    - NTRN 328 Child Nutrition, Development and Health
    - NTRN 342 Food Science
    - NTRN 351 Food Service Systems Management
    - NTRN 363 Human Nutrition I: Energy, Protein, Minerals
    - NTRN 364 Human Nutrition II: Vitamins
    - NTRN 365 Nutrition for the Prevention and Management of Disease: Pathophysiology
    - NTRN 435 Maternal and Child Nutrition
    - NTRN 437 Evaluation of Nutrition Information for Consumers
    - NTRN 440 Nutrition for the Aging and Aged
    - NTRN 452 Nutritional Biochemistry and Metabolism
    - NTRN 460 Sports Nutrition
    - NTRN 550A Advanced Community Nutrition

### Total Units in Sequence:

<table>
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<tr>
<th>Units</th>
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<tr>
<td>122</td>
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Didactic Program in Dietetics (DPD)
The following courses must be included in the program.

Required courses:

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<tr>
<td>BIOC 307</td>
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<tr>
<td>BIOL 216 or BIOL 340 &amp; BIOL 346</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 216L</td>
<td>1</td>
</tr>
<tr>
<td>BIOL 343</td>
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<tr>
<td>CHEM 223</td>
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<td>PSCL 353</td>
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<td>PSCL 357</td>
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<td>NTRN 342</td>
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<td>NTRN 351</td>
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<td>NTRN 360</td>
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<tr>
<td>NTRN 550A</td>
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One of the following: 3

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<td>SOCI 311</td>
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<td>ANTH 480</td>
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One of the following: 3

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<td>ANTH 319</td>
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<td>EPBI 431</td>
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<tr>
<td>PSCL 282</td>
<td></td>
</tr>
<tr>
<td>STAT 201</td>
<td></td>
</tr>
<tr>
<td>STAT 243</td>
<td></td>
</tr>
<tr>
<td>STAT 312</td>
<td></td>
</tr>
<tr>
<td>STAT 313</td>
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</tr>
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</table>

Total Units 31-32

Masters Degrees
MS Nutrition

This degree program offers two options. For those pursuing the thesis option, 30 semester hours of a planned program of study are required, including six to nine semester hours of research, as well as a final oral defense of the thesis. The non-thesis option requires 30 semester hours and a final written, comprehensive examination.

All candidates are required to take 15 semester hours of nutrition, including six hours of advanced human nutrition. In addition, students are encouraged to pursue complementary studies in the biomedical, social and behavioral sciences. The plan of study may vary considerably depending on the education, goals and specific interests of each student. Students may elect to focus on nutritional biochemistry and metabolism, and molecular nutrition. The individual program also may be planned to fulfill the academic requirements for dietetic registration (Didactic Program in Dietetics).

MS Public Health Nutrition/Internship

The primary goal of this program is to prepare nutrition specialists to function in public health/community agencies. A minimum of 30 semester hours of combined academic work and field experience is required to earn the degree. Course work focuses on human nutrition, dietetics, and the public health sciences. Field experience is concurrent with course work utilizing local community agencies for direct application of theory to practice. The final phase of the program is an eight-ten week, full-time experience with a public health agency that has a strong nutrition component. The student works closely with an advisor throughout the program, on an individual basis.

In addition to the general public health program, students may elect to specialize in maternal and child nutrition or gerontology. The gerontology specialty is certified through the Center on Aging and Health located on campus. Each specialty requires additional credits of academic work. A portion of the field experience is specified for either population group.

For students wishing to become eligible to take the registered dietitian (RD) examination, the program also currently is granted accreditation by the Commission on Accreditation for Dietetics Education (CADE) of the American Dietetic Association as a dietetic internship. CADE is a specialized accrediting body recognized by the United States Department of Education.

Coordinated Dietetic Internship/ Master's Degree Program

The Coordinated Dietetic Internship/Master's Degree Program combines academic work with clinical practice at either of the dietetic internships at University Hospitals of Cleveland or the Louis Stokes Cleveland Department of Veterans Affairs Medical Center. A minimum of 27 semester hours is required. Admission is contingent on the student’s being selected and matched to one of the hospitals. Appointment to these internships follows the admission procedure outlined by the Commission on Accreditation for Dietetics Education of the American Dietetic Association. Contact the Department of Nutrition for information regarding application.

MS in Public Health Nutrition Internship Program

General Option: Plan of Study

<table>
<thead>
<tr>
<th>First Year</th>
<th>Units</th>
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</thead>
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<tr>
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<td>Fall</td>
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<tr>
<td>Graduate Course: Social and Behavioral Sciences</td>
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<tr>
<td>Advanced Human Nutrition I (NTRN 433)</td>
<td>4</td>
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<tr>
<td>Introduction to Public Health Nutrition (NTRN 528)</td>
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<tr>
<td>Nutritional Epidemiology (NTRN 529)</td>
<td>3</td>
</tr>
<tr>
<td>Advanced Human Nutrition II (NTRN 434)</td>
<td>3</td>
</tr>
<tr>
<td>Public Health Nutrition (NTRN 530)</td>
<td>3</td>
</tr>
<tr>
<td>Graduate Course: Public Policy</td>
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<tr>
<td>Public Health Nutrition Field Experience (NTRN 531)</td>
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<table>
<thead>
<tr>
<th>Second Year</th>
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<tbody>
<tr>
<td></td>
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<tr>
<td>Evaluation of Nutrition Information for Consumers (NTRN 437)</td>
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<tr>
<td>Public Health Nutrition Field Experience (NTRN 531)</td>
<td>1 - 6</td>
</tr>
</tbody>
</table>

Maternal and Child Nutrition (NTRN 435)
Students in Nutrition must complete:

- Selecting the appropriate courses for their interests.
- A mentor or the Graduate Program Director will assist the student in setting goals and responsibilities.
- Students must meet twice a year with the thesis committee, present seminars in the department, and fulfill journal publication requirements. Throughout the doctoral training, students are expected to meet twice a year with the thesis committee to discuss their progress.
- In addition, each student must successfully complete a qualifying examination for advancement to candidacy in the form of a short grant proposal with oral defense. During the dissertation period, students are expected to meet twice a year with the thesis committee, present seminars in the department, and fulfill journal publication requirements. Throughout the doctoral training, students are expected to meet twice a year with the thesis committee to discuss their progress.

**Coordinated Hospital Dietetic Internship / MS in Nutrition Program**

**Plan of Study**

Internship at University Hospitals, Case Medical Center or Louis Stokes Cleveland Department of Veterans Affairs Medical Center full-time Fall Semester of First Year through Summer Semester.

### First Year

<table>
<thead>
<tr>
<th>Course</th>
<th>Units</th>
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<th>Summer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seminar in Dietetics I (NTRN 516)</td>
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<td></td>
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<tr>
<td>Investigative Methods in Nutrition (NTRN 561)</td>
<td>1 - 4</td>
<td></td>
<td></td>
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<tr>
<td>Seminar in Dietetics II (NTRN 517)</td>
<td>4</td>
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<tr>
<td>Advanced Human Nutrition II (NTRN 434)</td>
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### Second Year

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<th>Course</th>
<th>Units</th>
<th>Fall</th>
<th>Summer</th>
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<tbody>
<tr>
<td>Advanced Human Nutrition I (NTRN 433)</td>
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<tr>
<td>Electives: Any NTRN 400 or 500 level courses and/or graduate course in basic science or social science</td>
<td>9</td>
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<tr>
<td>Year Total:</td>
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</table>

**Total Units in Sequence:** 25-28

**MD/MS Biomedical Investigation--Nutrition Track**

For Admissions and MD requirements, see the MD Dual Degree Programs section (p. 792). This track is designed to provide medical students with more in-depth knowledge and research experience in nutrition. Students may elect to focus on nutrition biochemistry and metabolism or molecular nutrition or clinical nutrition. The student's mentor or the Graduate Program Director will assist the student in selecting the appropriate courses for their interests.

### Students in Nutrition must complete:

- 8-18 credits or three courses from those listed below:
- Nutrition for the Aging and Aged (NTRN 440)
- Sports Nutrition (NTRN 460)
- Public Health Nutrition Field Experience (NTRN 531)
- Advanced Public Health Nutrition Field Experience (NTRN 534)
- NTRN 433 Advanced Human Nutrition I
- NTRN 434 Advanced Human Nutrition II
- NTRN 435 Maternal and Child Nutrition
- NTRN 437 Evaluation of Nutrition Information for Consumers
- NTRN 438 Trends in Diet Therapy
- NTRN 440 Nutrition for the Aging and Aged
- NTRN 452 Nutritional Biochemistry and Metabolism
- NTRN 454 Isotope Tracer Methodology
- NTRN 455 Molecular Nutrition
- NTRN 460 Sports Nutrition
- NTRN 530 Public Health Nutrition
- NTRN 533 Nutritional Care of Neonate
- Certificate in Gerontology Option
- NTRN 440 Nutrition for the Aging and Aged
- GER 498 Seminar in Gerontological Studies
- NTRN 532C Specialized Public Health Nutrition Field Experience

**PhD in Nutrition**

The PhD degree in Nutrition is awarded for study and research in nutrition. Areas of concentration are nutritional biochemistry and metabolism, and molecular nutrition. Admissions to the PhD in Nutrition program are obtained through the integrated Biomedical Scientist Training Program (BSTP), by direct admission to the department or via the Medical Scientist Training Program (MSTP).

In order to earn a PhD in Nutrition, a student must complete rotations in at least three laboratories followed by selection of a research advisor, completion of Core and Elective coursework, including responsible conduct of research, as described in the plan of study. Each graduate program follows the overall regulations established and described in CWRU Graduate Studies and documented to the Regents of the State of Ohio. Completion of the PhD degree will require 36 hours of coursework (24 hours of which are graded) and 18 hours of NTRN 701 Dissertation Ph.D..

In addition, each student must successfully complete a qualifying examination for advancement to candidacy in the form of a short grant proposal with oral defense. During the dissertation period, students are expected to meet twice a year with the thesis committee, present seminars in the department, and fulfill journal publication requirements. Throughout the doctoral training, students are expected to be enthusiastic participants in seminars, journal clubs, and research meetings in the lab and program.

**Plan of Study**

§ Please also see Graduate Studies Academic Requirements for Doctoral Degrees (p. 662)

<table>
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<th>Spring</th>
<th>Summer</th>
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<td>Cell Biology I (CBIO 453)</td>
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<td>Seminar in Advanced Nutrition (NTRN 551)</td>
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<td>Research Rotation in Biomedical Sciences Training Program (BSTP 400)</td>
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<tr>
<td>Molecular Biology I (CBIO 455)</td>
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<tr>
<td>Advanced Human Nutrition II (NTRN 434)</td>
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</table>
NTRN 201. Nutrition. 3 Units.
The nutrients, their functions, food sources, and factors affecting human needs throughout life.

NTRN 328. Child Nutrition, Development and Health. 3 Units.
The relationship between nutrition and physical/cognitive growth and development of the child from the prenatal period through adolescence, including individuality, maturation and biological needs. Nutritional influences (nutrient requirements, food choices, and nutritional/feeding problems) and effects on health are emphasized.

NTRN 342. Food Science. 3 Units.
Chemical, physical and biological properties of food constituents and their interactions in food preparation and processing and practical application of processing methods and their effect on nutritional quality and acceptability. Prereq: CHEM 106.

NTRN 342L. Food Science Lab. 2 Units.

NTRN 343. Dietary Patterns. 3 Units.
Examination of the food supply in the United States as it is affected by production, processing, marketing, government programs, regulation, and consumer selection. Nutritional evaluation of dietary patterns of different cultures. Recommended preparation: NTRN 201 or consent.

NTRN 351. Food Service Systems Management. 3 Units.
The application of organizational theory and skills in the preparation and service of quantity food. Laboratory experience in professional food services are included. Graduate students will analyze one aspect of food service management in depth. Offered as NTRN 351 and NTRN 451. Prereq: Nutrition major or consent of instructor.

NTRN 350. Investigative Methods in Nutrition. 4 Units.
Application of nutrition principles and knowledge for the prevention and management of disease. Case studies and other educational methods for the provision of nutrition services to individuals and groups. Principles of professional practice including ethics, standards, and regulatory issues. Recommended preparation: NTRN 363 or NTRN 433 or consent. Prereq: NTRN 201 and NTRN 342 or MS in Nutrition or MS in Public Health Nutrition.

NTRN 363. Human Nutrition I: Energy, Protein, Minerals. 3 Units.
Chemical and physiological properties of specific nutrients, including interrelationships and multiple factors, in meeting nutritional needs throughout the life cycle. Prereq: CHEM 223 and BIOL 216 (3 or 4 cr. hrs.).

NTRN 364. Human Nutrition II: Vitamins. 3 Units.
Chemical and physiological properties of vitamins, including interrelationships and multiple factors, in meeting nutritional needs throughout the life cycle. Prereq: NTRN 363.

NTRN 365. Nutrition for the Prevention and Management of Disease: Pathophysiology. 4 Units.
Interplay among etiology, metabolic perturbations, pathophysiology, clinical signs and symptoms, and nutrition principles for the prevention and management of disease. Prereq: NTRN 363 and BIOC 307 or equivalent or consent of instructor.

NTRN 366. Nutrition for the Prevention and Management of Disease: Clinical Applications. 3 Units.
Application of nutrition principles and knowledge for the prevention and management of disease. Case studies and other educational approaches and techniques will be used. Course includes evidence-based assessments and interpretation of key data (biochemical, dietary, physical) to develop nutritional interventions. Coreq: NTRN 365.

NTRN 371. Special Problems. 1 - 3 Unit.
Independent reading, research, or special projects supervised by a member of the nutrition faculty. Prereq: Junior or senior standing.

NTRN 372. Special Problems. 1 - 3 Unit.
Independent reading, research, or special projects supervised by a member of the nutrition faculty. Prereq: Junior or senior standing.
NTRN 388. Seminar in Nutrition. 1 - 3 Unit.
Prereq: Junior or senior standing.

NTRN 390. Undergraduate Research. 3 - 9 Units.
Guided laboratory research in nutritional biochemistry or molecular nutrition under the sponsorship of a nutrition faculty member.

NTRN 397. SAGES Capstone Proposal Seminar. 3 Units.
In this departmental seminar course, students will conceptualize, develop and prepare a written plan, known as the "Capstone Proposal," for their senior Capstone project (NTRN 398: Senior Capstone Experience). Discussion will include, but not be limited to basic research principles, different types of research, ethics and IRB procedures. The Capstone Proposal shall include the project design, aims, methodology, budget, data analysis and presentation. Upon completion of this course, students will have confirmed student/Capstone advisor and, if applicable, mentor relationships, written a Capstone proposal and given an oral presentation of their proposal at a departmental colloquium. Prereq: NTRN 201 and NTRN 342.

NTRN 398. SAGES Senior Capstone Experience. 3 Units.
Students will implement their "Capstone Proposal" projects as designed in NTRN 397: Capstone Proposal Seminar. Pertinent research activities will depend on the nature of the student's "Capstone Proposal" project. The student will meet regularly with their Capstone advisor, at least twice monthly, to provide progress reports, discuss the project, and for critique and guidance. By the end of this course, the student will have completed their SAGES Senior Capstone research project and presented their project results/findings orally at the Senior Capstone Fair and at a departmental colloquium. Prereq: NTRN 397.

NTRN 399. Senior Project. 3 Units.

NTRN 433. Advanced Human Nutrition I. 4 Units.
Emphasis on reading original research literature in energy, protein and minerals with development of critical evaluation and thinking skills. Recommended preparation: NTRN 201 and CHEM 223 and BIOL 348 or equivalent.

NTRN 434. Advanced Human Nutrition II. 3 Units.
Emphasis on reading original research literature on vitamins with development of critical evaluation and thinking skills. Recommended preparation: NTRN 433 or consent.

NTRN 435. Maternal and Child Nutrition. 3 Units.
Study of current research literature on nutrition for pregnancy, lactation, infancy and childhood, including assessment and requirements. Recommended preparation: Nutrition major or consent of instructor.

NTRN 437. Evaluation of Nutrition Information for Consumers. 3 Units.
Reading and appraisal of food and nutrition literature written for the general public, including books, magazines, newsletters. Prereq: Graduate standing and Nutrition or Public Health Nutrition major or consent of instructor.

NTRN 438. Trends in Diet Therapy. 3 Units.
Evaluation and interpretation of modern concepts of nutrition related to abnormalities requiring dietary modifications. Prereq: NTRN 365.

NTRN 440. Nutrition for the Aging and Aged. 3 Units.
Consideration of the processes of aging and needs which continue throughout life. The influences of food availability, intake, economics, culture, physical and social conditions and chronic disease as they affect the ability of the aged to cope with living situations. Recommended preparation: Nutrition major or consent of instructor.

NTRN 446. Advanced Maternal Nutrition: Special Topics. 3 Units.
Analysis of the problems commonly associated with high-risk pregnancies and fetal outcome. Discussion of causes, mechanisms, management and current research. Recommended preparation: NTRN 435 or consent.

NTRN 451. Food Service Systems Management. 3 Units.
The application of organizational theory and skills in the preparation and service of quantity food. Laboratory experience in professional food services are included. Graduate students will analyze one aspect of food service management in depth. Offered as NTRN 351 and NTRN 451. Prereq: Nutrition major.

NTRN 452. Nutritional Biochemistry and Metabolism. 3 Units.
Mechanisms of regulation of pathways of intermediary metabolism; amplification of biochemical signals; substrate cycling and use of radioactive and stable isotopes to measure metabolic rates. Recommended preparation: BIOC 307 or equivalent. Offered as BIOC 452 and NTRN 452.

NTRN 454. Isotope Tracer Methodology. 3 Units.
Stable and radioactive isotopes in metabolic research concentrating on the design of in-vitro and in-vivo investigative protocols using mostly stable isotopes and mass spectrometric analysis; critical interpretation of data from the recent literature; and pathway identification and kinetics. Recommended preparation: BIOC 407.

NTRN 455. Molecular Nutrition. 3 Units.
Nutrient control of gene expression in mammalian cells and deregulation of expression of these genes. The molecular basis of nutrition-related diseases, such as diabetes mellitus, PKU, and LDL-receptor deficiency, will be discussed. The application of genetic manipulation to metabolism and nutrition will be evaluated. Recommended preparation: BIOC 407.

NTRN 460. Sports Nutrition. 3 Units.
Study of the relationships of nutrition and food intake to body composition and human performance. Laboratory sessions include demonstrations of body composition and fitness measurements and participation in a research project. Recommended preparation: NTRN 363 or NTRN 433 or consent.

NTRN 516. Seminar in Dietetics I. 4 Units.
Study of scientific basis for clinical and community nutrition practice and developments in food service systems management. Recommended preparation: Dietetic internship.

NTRN 517. Seminar in Dietetics II. 4 Units.
Study of scientific basis for clinical and community nutrition practice and developments in food service systems management. Recommended preparation: Dietetic internship.

NTRN 528. Introduction to Public Health Nutrition. 3 Units.
Philosophy, objectives, organization, and focus of government and voluntary agencies with emphasis on nutrition components. Recommended preparation: Public health nutrition majors only.
NTRN 529. Nutritional Epidemiology. 3 Units.
This course uses epidemiology as a tool for assessing potential causal associations between dietary excesses, deficiencies and imbalances to the prevalent chronic diseases. It addresses the epidemiologic aspects of nutrition related chronic diseases, for example, the multi-factorial nature of etiology. Recommended preparation: Statistics and Public Health Nutrition students only.

NTRN 530. Public Health Nutrition. 3 Units.
Analysis of public health programs in government and voluntary health agencies and the effect of legislation. Emphasis on integration with other disciplines working in public health settings and the role of a public health nutritionist.

NTRN 531. Public Health Nutrition Field Experience. 1 - 6 Unit.
Individually planned public health experience. May be concurrent with course work in local agencies or in blocks of full-time work with a city, county, or state health agency. Prereq: Open to public health nutrition students only. Consent of instructor.

NTRN 532A. General Nutrition Care. 1 - 3 Unit.
Individually arranged clinical experience.

NTRN 532C. Specialized Public Health Nutrition Field Experience. 1 - 3 Unit.
Individually arranged clinical experience. Prereq: Public Health Nutrition students only. Consent of instructor.

NTRN 532E. Clinical Research: Methods in Nutrition and Metabolism. 3 Units.
Individually arranged.

NTRN 533. Nutritional Care of Neonate. 3 Units.
Nutritional assessment and management of high-risk newborns with emphasis on prematurity and low birth weight. Review of current literature coordinated with clinical experience in the neonatal intensive care unit. Issues on follow-up included. Recommended preparation: NTRN 435 or consent.

NTRN 534. Advanced Public Health Nutrition Field Experience. 1 - 6 Unit.
Individually planned advanced public health experience. Prereq: Open to public health nutrition students only.

NTRN 550A. Advanced Community Nutrition. 3 Units.
Development of skills needed by the community dietitian. Emphasis on effective tools for service development and delivery. Recommended courses of action for the professional. Prereq: Open to nutrition graduate students and senior undergraduate nutrition majors only.

NTRN 551. Seminar in Advanced Nutrition. 1 Unit.
Ph.D. students meet weekly to discuss topical journal articles. Students gain experience in critical evaluation of research and develop presentation/communication skills. Discussion of research integrity and ethics. Students participate in departmental seminars with invited speakers.

NTRN 561. Investigative Methods in Nutrition. 1 - 4 Unit.
Research methods appropriate for nutrition. Methods for conducting research in nutrition and food sciences, food service management and dietetics. Designing research proposals. Prereq: Nutrition major.

NTRN 601. Special Problems. 1 - 18 Unit.

NTRN 651. Thesis M.S.. 1 - 18 Unit.
Prereq: Predoctoral research consent or advanced to Ph.D. candidacy milestone.
Department of Pathology

Christine Kehoe (http://bulletin.case.edu/schoolofmedicine/pathology/mailto:christine.kehoe@case.edu), Student Affairs

The clinical, research, and educational activities of the Case Department of Pathology are centered at the Case School of Medicine and University Hospitals Case Medical Center (UHCMC). The core components of the department are the Basic Science Pathology Program at Case School of Medicine and the three clinical divisions of Pathology at University Hospitals Health System (UHHS), including the Division of Anatomic Pathology at UHCMC, the Division of Clinical Pathology at UHCMC, and the UHHS Pathology Division of Community Hospitals. In addition, our affiliates include the Cuyahoga County Medical Examiner’s Office, the Pathology Department at the Louis Stokes Veteran’s Administration Medical Center, and the Pathology Department at MetroHealth Medical Center. Research laboratories of the department are located in the Wolstein Research Building and Institute of Pathology. Both are situated adjacent to University Hospitals of Cleveland, the primary teaching hospital of the Case School of Medicine and the location of the department’s Pathology Residency Program.

World-class research is conducted in the department in biomaterials biocompatibility, cancer biology, immunology, neuropathology and neurodegenerative disease, outcomes research, and tissue injury and healing. The department’s research activities are characterized by highly cooperative and collaborative interactions within the department, and with many other departments at Case and its affiliated institutions. In FY 2011, the department’s annual research grant support totaled $15,463,639, $13,080,886 of which was from NIH. This places the Department of Pathology 12th nationally amongst 91 medical school pathology/training/graduate.html).

Masters Degrees

MS in Pathology

A program leading to the Master of Science degree in Pathology is available to laboratory staff who are employed by Case Western Reserve University. Students in this program must be full-time university employees and must have the agreement of their supervisor to begin studies as a part-time student. Courses are available as an employee fringe benefit (up to 6 credits per semester for Fall and Spring, and 3 credits for Summer) and can only be taken as limited by the fringe benefit regulations.

A formal application for this program must be submitted to the graduate school. Prior to submission of this application, the employee, the supervisor, and the Director of the Pathology Graduate Program must meet to review and facilitate the student’s application for admission.

This program can lead to an M.S. degree through Plan A. Required core courses include CBIO 453 Cell Biology I (4 credits), CBIO 455 Molecular Biology I (4 credits), PATH 510 Basic Pathologic Mechanisms (4 credits), and participation in a seminar course (PATH 511 Experimental Pathology Seminar I and/or PATH 512 Experimental Pathology Seminar II) for at least one semester. CBIO 453 Cell Biology I, CBIO 455 Molecular Biology I and PATH 510 Basic Pathologic Mechanisms must be taken as graded courses (not P/F).

Plan A requires a minimum of 27 total coursework credits. In addition to the required core courses, the student must take a minimum of 6 credits of PATH 651 Thesis, which involves research in the laboratory of the supervisor (who serves as the M.S. Thesis Mentor) and thesis preparation. The student must register for at least one credit of PATH 651 Thesis M.S. every semester until graduation. A GPA of 2.75 or better must be maintained for a terminal M.S. (Students considering using the M.S. in Pathology as a “stepping stone” to the Ph.D. degree must maintain a GPA of 3.0 or better.) An M.S. thesis must be prepared based on the research, and the student must pass an M.S. Degree Examination in which the thesis is defended.

MD/MS Biomedical Investigation—Pathology Track

For Program Admissions and MD requirements, see MD Dual Degree Programs (p. 792). This track is designed to provide students with an in-depth understanding of the cellular basis of disease or immunity. During the first year of medical school the student should identify a mentor and begin planning coursework and a research project leading to the MS degree. Because the background and interest of applicants varies widely, members of the Program Oversight Committee will assist each student in designing an individualized schedule of graduate courses for any track.

Students are expected to complete at least two graduate courses (3 credits each or total 6 credits) before beginning the laboratory research period (year 3), and students should take three graduate courses before the research period if this is possible. For students to receive graduate credit for any medical coursework (as IBIS credit, e.g. IBIS 403 Integrated Biological Sciences III), they must register at the beginning of the semester. Students in the MD/MS joint degree program must attain a cumulative GPA of 3.0 in the graduate courses. Students in this program may participate in any of the three tracks of the Department of Pathology Graduate Program.

For information about the Pathology Track in the MD/MS program, contact Dr. James Anderson (http://bulletin.case.edu/schoolofmedicine/pathology/mailto:james.anderson@case.edu), 216.368.0279, or Dr. Clive Hamlin (http://bulletin.case.edu/schoolofmedicine/pathology/mailto:clive.hamlin@case.edu), 216.368.0512.

Students in the Pathology track must complete:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PATH 601</td>
<td>Special Problems</td>
<td>18</td>
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<tr>
<td>PATH 511</td>
<td>Experimental Pathology Seminar I</td>
<td>1</td>
</tr>
<tr>
<td>or PATH 512</td>
<td>Experimental Pathology Seminar II</td>
<td>1</td>
</tr>
<tr>
<td>IBIS 600</td>
<td>Exam in Biomedical Investigation</td>
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</table>

And 9 credits from the Pathology courses listed below or other Approved courses. Other department’s graduate level course may be accepted provided it is appropriate to the student’s project and is approved by his/her Thesis Committee or the Graduate Program Director in Pathology.

<table>
<thead>
<tr>
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<th>Course Title</th>
<th>Credits</th>
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<td>PATH 415</td>
<td>Cytoskeleton and Disease</td>
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<tr>
<td>PATH 416</td>
<td>Fundamental Immunology</td>
<td>4</td>
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<tr>
<td>PATH 417</td>
<td>Cytokines: Function, Structure, and Signaling</td>
<td>3</td>
</tr>
<tr>
<td>PATH 430</td>
<td>Oxidative Stress and Disease Pathogenesis</td>
<td>1</td>
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<tr>
<td>PATH 432</td>
<td>Current Topics in Vision Research</td>
<td>3</td>
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<tr>
<td>PATH 444</td>
<td>Neurodegenerative Diseases-Pathological,Cell. &amp; Molecular Perspectives</td>
<td>3</td>
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<tr>
<td>PATH 477</td>
<td>Cellular and Molecular Basis of Immune Dysfunction</td>
<td>3</td>
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<td>PATH 480</td>
<td>Logical Dissection of Biomedical Investigations</td>
<td>3</td>
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<tr>
<td>PATH 481</td>
<td>Immunology of Infectious Diseases</td>
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Example Plan of Study of Minimum Coursework:

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<th>Summer</th>
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<td>MD Curriculum</td>
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<tr>
<td>MD Curriculum</td>
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<tr>
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Fifth Year

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Total Units in Sequence: 32-34

* 15 graded credits of graduate school courses should be taken in the first 2 years, including IBIS 403 Integrated Biological Sciences III (6 credits) and three PATH graduate courses (3 credits each). Students may defer a maximum of one 3-credit hour course to Year 3.

PhD in Pathology

PhD Training in the Pathology Graduate Program occurs in three tracks that share a common core curriculum but provide additional track-specific curricular offerings. This provides a cohesive program that addresses the specific needs of different Pathology-related areas of research training. Section II of the handbook “Pathology PhD Program” describes core features of the program that are shared and provides detailed descriptions of the three training tracks:

- Molecular and Cellular Basis of Disease Training Program (MCBTP)
- Immunology Training Program (ITP)
- Cancer Biology Training Program (CBTP)

To earn a PhD in Pathology, a student must complete rotations in at least three laboratories followed by selection of a research advisor, and complete Core and Elective coursework including responsible conduct of research as described in the Course of Study, below. Students who previously completed relevant coursework, (for example, with a MS) may petition to complete alternative courses. Each training track follows the overall regulations established and described in CWRU Graduate Studies and documented to the Regents of the State of Ohio. Completion of the PhD degree will require 36 hours of coursework (24 hours of which are graded) and 18 hours of PATH 701 Dissertation Ph.D..

In addition, each PhD student must successfully complete a qualifier examination for advancement to candidacy in the form of a short grant proposal with oral defense. The qualifier is generally completed in the summer after year two. During the dissertation period, students are expected to meet twice a year with the thesis committee, present seminars in the department, and fulfill journal publication requirements. Throughout the doctoral training, students are expected to be enthusiastic participants in seminars, journal clubs, and research meetings in the lab and program.

§ Please also see Graduate Studies Academic Requirements for Doctoral Degrees (p. 662)

Molecular and Cellular Basis of Disease Training Program (MCBTP)

First Year

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<tr>
<td>Mentor and track chosen</td>
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<tr>
<td>Basic Pathologic Mechanisms (PATH 510)</td>
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<tr>
<td>Fundamental Immunology (PATH 416)</td>
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<td>4</td>
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<tr>
<td>Experimental Pathology Seminar II (PATH 512)</td>
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</tr>
<tr>
<td>Thesis committee chosen: preproposal meeting scheduled</td>
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<td>Special Problems (PATH 601)</td>
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<td>On Being a Professional Scientist: The Responsible Conduct of Research (IBMS 500)</td>
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Second Year

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<td>Special Problems (PATH 601)</td>
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<tr>
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<td>Experimental Pathology Seminar I (PATH 511)</td>
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<tr>
<td>Electives (Core, MCBDTI track or other)</td>
<td>4-6</td>
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Special Problems (PATH 601) or Dissertation Ph.D. (PATH 701) 1-9

Thesis proposal defense and advancement to candidacy must be completed**++

Year Total: 8-16 6-16

### Third Year

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<td>Experimental Pathology Seminar II (PATH 512)</td>
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<tr>
<td>Dissertaiton Ph.D. (PATH 701)**</td>
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### Fourth Year

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### Fifth Year

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<tr>
<td>Year Total:</td>
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<td>2-10</td>
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</table>

**Alternate courses for MSTP students: IBIS 401-404. MSTP students in the MCBDTCP do not need to take CBIO 453 Cell Biology I, CBIO 455 Molecular Biology I, PATH 510 Basic Pathologic Mechanisms or PATH 416 Fundamental Immunology although PATH 416 Fundamental Immunology may still be taken as a Track Elective**

**^Alternate course is MSTP 400 Research Rotation in Medical Scientist Training Program for MSTP students and PATH 601 Special Problems for direct admit students**

---

### Immunology Training Program (ITP)

#### First Year

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<th>Units</th>
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<th>Summer</th>
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<td>Immunology Journal Club (optional this semester)</td>
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<td>Basic Pathologic Mechanisms (PATH 510)</td>
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#### Second Year

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#### Fourth Year

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**Alternate courses for MSTP students: IBIS 401-404. MSTP students in the MCBDTCP do not need to take CBIO 453 Cell Biology I, CBIO 455 Molecular Biology I, PATH 510 Basic Pathologic Mechanisms or PATH 416 Fundamental Immunology although PATH 416 Fundamental Immunology may still be taken as a Track Elective**

**^Alternate course is MSTP 400 Research Rotation in Medical Scientist Training Program for MSTP students and PATH 601 Special Problems for direct admit students**

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On Being a Professional Scientist: The Responsible Conduct of Research (IBMS 500) 0

Year Total: 8-17 10-18

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**Total Units in Sequence:** 44-127
Alternate courses for MSTP students: IBIS 401-404. MSTP students in the ITP do not need to take CBIO 453 Cell Biology I, CBIO 455 Molecular Biology I or PATH 510 Basic Pathologic Mechanisms. PATH 416 Fundamental Immunology is required for MSTP students in the ITP unless they have sufficient prior immunology background as determined by the ITP Chair and curriculum coordinators (e.g. Drs. Harding and Nedrud)

Alternate course is MSTP 400 Research Rotation in Medical Scientist Training Program for MSTP students and PATH 601 Special Problems for direct admit students.

PATH 520 Basic Cancer Biology and the Interface with Clinical Oncology + PATH 521 Special Topics in Cancer Biology and Clinical Oncology is included as a Track Elective for ITP students.

Cancer Biology Training Program (C BTP)

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^ Alternate course is MSTP 400 Research Rotation in Medical Scientist Training Program for MSTP students with PATH 601 Special Problems for direct admit students.

** PATH 416 Fundamental Immunology is included as a Track Elective for CBTP students.

+ Petition to convert 601 credits to 701 credits for semester in which advancement occurs.

++ Once 36 credits including 24 graded credits have been completed, register for up to 6 credits of PATH 701 Dissertation Ph.D. per semester. Also petition to convert as many 601 credits as possible to 701 credits for semester in which advancement occurs. Exception: Take 1-3 credits of PATH 701 Dissertation Ph.D. if this will accelerate graduation. Also, take 1 credit of PATH 701 Dissertation Ph.D. if the PhD thesis will be completed in the summer semester (including anytime after the end of the spring semester).
Important: Students should take the following steps to reduce charges to their mentor and department:

AFTER ADVANCE TO CANDIDACY, IT IS NO LONGER NECESSARY TO REGISTER FOR 9 CREDITS PER SEMESTER TO MAINTAIN FULL-TIME STUDENT STATUS. In the first semester after advancement to candidacy, students should register only for the number of credits of PATH 701 Dissertation Ph.D. needed to bring their total number of accumulated credits of PATH 701 to 9 by the end of the semester (and should register for no other courses). In subsequent semesters, students should register for only 1 credit of PATH 701 (and no other courses), except that in the final semester registration should be for the number of credits of PATH 701 needed to complete a total of 18 credits by the end of the semester. EXCEPTION: IT IS IMPORTANT TO MAXIMIZE THE NUMBER OF PATH 701 CREDITS THAT CAN BE COMPLETED DURING PERIODS WHERE TRAINING GRANT SUPPORT IS AVAILABLE. If the student is on the NIH T32 training grant of NRSA award or other funding mechanism that supports this level of tuition, registration should be for the full 9 credits during semesters when grant support for tuition will be available, until a total of 18 credits of PATH 701 is accumulated, after which registration should be for only 1 credit of PATH 701 each semester until graduation. Even prior to advancing to candidacy, if a student has completed 36 "foundation" credits of graduate courses (at least 24 of which must be graded courses), the student should enroll in as many credits of PATH 701 as possible up to a maximum of 6 credits with the remaining credits to be graded courses or PATH 601. In the semester in which the student advances to candidacy, any PATH 601 credits for that semester that are beyond the 36 "foundation" credits should be converted to PATH 701 by petition to Graduate Studies. Students registering for PATH 601, PATH 651 or PATH 701 must indicate their thesis advisor as the Instructor. If a Class Section does not exist with your Thesis Advisor as Instructor, please see the Student Affairs Coordinator to add the Section in order for you to register.

NOTE: Schedule beyond year 5 will generally be the same as year 5.

Courses

PATH 316. Fundamental Immunology. 4 Units.
Introductory immunology providing an overview of the immune system, including activation, effector mechanisms, and regulation. Topics include antigen-antibody reactions, immunologically important cell surface receptors, cell-cell interactions, cell-mediated immunity, innate versus adaptive immunity, cytokines, and basic molecular biology and signal transduction in B and T lymphocytes, and immunopathology. Three weekly lectures emphasize experimental findings leading to the concepts of modern immunology. An additional recitation hour is required to integrate the core material with experimental data and known immune mediated diseases. Five mandatory 90 minute group problem sets per semester will be administered outside of lecture and recitation meeting times. Graduate students will be graded separately from undergraduates, and 22 percent of the grade will be based on a critical analysis of a recently published, landmark scientific article. Offered as BIOL 316, BIOL 416, CLBY 416, and PATH 416. Prereq: BIOL 215 and 215L.

PATH 390. Undergraduate Research in Cancer Biology, Immunology, or Pathology. 1 - 3 Unit.
Students undertake a research project directly related to ongoing research in the investigator's/instructor's laboratory. Written proposal outlining research topic, a schedule of meetings and format and length of final written report to be prepared prior to registration for credit. Recommended preparation: One year of college chemistry and consent of instructor.

PATH 395. Selected Readings in Immunology, Cancer Biology, or Pathology. 1 - 3 Unit.
Relevant readings and literature search on particular immunology, cancer biology or pathology topic(s) chosen by the student and directed by the instructor. Written proposal outlining chosen topic, type of work to be done, a schedule of meetings and format and length of final written report to be prepared prior to registration for credit.

PATH 410. Aging and the Nervous System. 1 Unit.
Lectures and discussion on aspects of neurobiology of aging in model systems; current research on Alzheimer’s, Parkinson’s, and Huntington’s diseases.

PATH 415. Cytoskeleton and Disease. 1 Unit.
Discussion of recent papers that have added to knowledge of normal cytoskeletal functions and their alterations in disease.

PATH 416. Fundamental Immunology. 4 Units.
Introductory immunology providing an overview of the immune system, including activation, effector mechanisms, and regulation. Topics include antigen-antibody reactions, immunologically important cell surface receptors, cell-cell interactions, cell-mediated immunity, innate versus adaptive immunity, cytokines, and basic molecular biology and signal transduction in B and T lymphocytes, and immunopathology. Three weekly lectures emphasize experimental findings leading to the concepts of modern immunology. An additional recitation hour is required to integrate the core material with experimental data and known immune mediated diseases. Five mandatory 90 minute group problem sets per semester will be administered outside of lecture and recitation meeting times. Graduate students will be graded separately from undergraduates, and 22 percent of the grade will be based on a critical analysis of a recently published, landmark scientific article. Offered as BIOL 316, BIOL 416, CLBY 416, and PATH 416. Prereq: Graduate standing and consent of instructor.
PATH 417. Cytokines: Function, Structure, and Signaling. 3 Units.
Regulation of immune responses and differentiation of leukocytes is modulated by proteins (cytokines) secreted and/or expressed by both immune and non-immune cells. Course examines the function, expression, gene organization, structure, receptors, and intracellular signaling of cytokines. Topic include regulatory and inflammatory cytokines, colony stimulating factors, chemokines, cytokine and cytokine receptor gene families, intracellular signaling through STAT proteins and tyrosine phosphorylation, clinical potential, and genetic defects. Lecture format using texts, scientific reviews and research articles. Recommended preparation: PATH 416 or equivalent. Offered as BIOL 417, CLBY 417, and PATH 417.

PATH 419. Reproductive Immunology. 3 Units.
This will be a lecture and literature-based course that will include classic and recent publications. The course will cover subjects related to the cellular and molecular biology of fertilization and development of the placenta and fetus in humans and how this process is affected by the maternal immune system. Specific areas of discussion will include mechanisms by which the antigenically foreign placenta and fetus create an apparent state of maternal immune tolerance, the physiologic role of endogenous retroviruses in trophoblast differentiation, the participation of maternal and placental cytokines in pregnancy, the effects of maternal alloimmune and autoimmune responses on differentiation of the trophoblast and development of the placenta/fetus, the development and effects of fetal lymphocyte microchimerism in maternal tissues, and a variety of current controversies in Reproductive Immunology. Recommended preparation: PATH 416 or equivalent, or permission of the instructor.

PATH 420. The Rhetoric of Science. 3 Units.
In this course, we shall analyze both written and oral communication of scientific results in order to understand the principles of effective exposition. The students will be expected to attend selected seminars and to participate in writing and speaking exercises. The goal of the course is to improve the written and oral communication skills of the students. Instructor approval is required for registration. Recommended preparation: Completion of the first year of the Biomedical Scientist Training Program.

PATH 422. Molecular Genetics of Cancer. 3 Units.
Cancer is a genetic disease, not only in the Mendelian sense of inheritance, but also in the sense that it is caused by somatic mutation. The targets of mutation are a set of proto-oncogenes and tumor suppressor genes whose products govern cellular proliferation, death and differentiation. The objectives of this course are to examine the types of genes that are the targets of mutational activation or inactivation and the mechanistic outcome of mutational changes that lead to oncogenesis. The course will also explore viral mechanisms of oncogenesis related to the products of cellular proto-oncogenes or tumor suppressor genes. In the course of these examinations we will explore the genetic and molecular genetic approaches used to identify and study oncogenes and tumor suppressor genes. Students should be prepared to present and discuss experimental design, data and conclusions from assigned publications. There will be no exams or papers but the course will end with a full-day, student-run symposium on topics to be decided jointly by students and instructors. Grades will be based on class participation and symposium presentation. Offered as BIOL 420, MBIO 420, MVIR 420, PATH 422, and PHRM 420. Prereq: CBIO 453 and CBIO 455.

PATH 425. Stem Cell Biology and Therapeutics. 3 Units.
This course is intended to teach current understanding of stem cells as it relates to their characterization, function, and physiologic and pathological states. The course will expose students to the current understanding of various types of stem cells, including embryonic and adult stem cells of various tissues, techniques for their isolation and study. Experimental models and potential biomedical therapeutic applications will be discussed. The course will be taught by the faculty of the “Center for Stem Cell and Regenerative Medicine” who are affiliated with multiple departments of Case Western Reserve University, Cleveland Clinic Foundation and the partnering biomedical companies. Offered as NEUR 425 and PATH 425.

PATH 430. Oxidative Stress and Disease Pathogenesis. 1 Unit.
Oxidative stress and free radicals are implicated in a number of disease processes including aging, arthritis, emphysema, Alzheimer’s disease and cancer. Lecture course with discussion of recent studies concerning the formation and destructive mechanisms of free radicals in the context of various disease processes. Students read assigned papers and discuss these in class.

PATH 432. Current Topics in Vision Research. 3 Units.
Vision research is an exciting and multidisciplinary area that draws on the disciplines of biochemistry, genetics, molecular biology, structural biology, neuroscience, and pathology. This graduate level course will provide the student with broad exposure to the most recent and relevant research currently being conducted in the field. Topics will cover a variety of diseases and fundamental biological processes occurring in the eye. Regions of the eye that will be discussed include the cornea, lens, and retina. Vision disorders discussed include age-related macular degeneration, retinal ciliopathies, and diabetic retinopathy. Instructors in the course are experts in their field and are members of the multidisciplinary visual sciences research community here at Case Western Reserve University. Students will be exposed to the experimental approaches and instrumentation currently being used in the laboratory and in clinical settings. Topics will be covered by traditional lectures, demonstrations in the laboratory and the clinic, and journal club presentations. Students will be graded on their performance in journal club presentations (40%), research proposal (40%), and class participation (20%). Offered as NEUR 432, PATH 432, PHRM 432 and BIOC 432.

PATH 435. Tissue Engineering and Regenerative Medicine. 3 Units.
This course will provide advanced coverage of tissue engineering with a focus on stem cell-based research and therapies. Course topics of note include stem cell biology and its role in development, modeling of stem cell function, controlling stem cell behavior by engineering materials and their microenvironment, stem cells’ trophic character, and state-of-the-art stem cell implementation in tissue engineering and other therapeutic strategies. Offered as EBME 425 and PATH 435. Prereq: EBME 325 or equivalent or graduate standing.

PATH 444. Neurodegenerative Diseases: Pathological, Cell. & Molecular Perspectives. 3 Units.
This course, taught by several faculty members, encompasses the full range of factors that contribute to the development of neurodegeneration. Subjects include pathological aspects, neurodegeneration, genetic aspects, protein conformation and cell biology in conditions such as Alzheimer’s disease, Parkinson’s disease, amyotrophic lateral sclerosis and prion diseases. Students read assigned primary literature and present and discuss these in class.
PATH 460. Introduction to Microarrays. 3 Units.
Microarray technology is an exciting new technique that is used to analyze gene expression in a wide variety of organisms. The goal of this course is to give participants a hands-on introduction to this technology. The course is intended for individuals who are preparing to use this technique, including students, fellows, and other investigators. This is a hands-on computer-based course, which will enable participants to conduct meaningful analyses of microarray data. Participants will gain an understanding of the principles underlying microarray technologies, including: theory of sample preparation, sample processing on microarrays, familiarity with the use of Affymetrix Microarray Suite software and generation of data sets. Transferring data among software packages to manipulate data will also be discussed. Importation of data into other software (GeneSpring and DecisionSite) will enable participants to mine the data for higher-order patterns. Participants will learn about the rationale behind the choice of normalization and data filtering strategies, distance metrics, use of appropriate clustering choices such as K-means, Hierarchical, and Self Organizing Maps. Course Offered as BIOC 460, PATH 460, CNCR 460.

PATH 477. Cellular and Molecular Basis of Immune Dysfunction. 3 Units.
Lectures and student presentations focusing on immunologic mechanisms of tissue injury, disorders of the immune response and diseases of immunocompetent cells. Hypersensitivity, allergy, immune complex disease, immune deficiency, lymphoma and multiple myeloma discussed from chemical, cellular and physiological perspectives. Recommended preparation: PATH 416 or consent of instructor.

PATH 480. Logical Dissection of Biomedical Investigations. 3 Units.
PATH 480 is an upper level graduate course encompassing discussion and critical appraisal of both published and pre-published research papers, book chapters, commentaries and review articles. Emphasis will be placed on evaluating the logical relationships connecting hypotheses to experimental design and experimental data to conclusions drawn. Thus, the course will aim to develop students’ capacities for independent thinking and critical analysis. Half of the course will be devoted to an analysis of fundamental conceptual issues pertaining to immunology, but this material will be applicable to a wide variety of fields. The other half of the course will be devoted to the analysis of papers that have been submitted for publication (with the students acting as primary reviewers of these papers). Our expectation is that this course will have practical relevance for students by providing them with methods to review their own prepublication manuscripts and eliminate common errors. It should also give students the tools to question widely held beliefs in diverse biomedical fields. Recommended preparation is completion of the C3MB curriculum and 2nd year or higher graduate school training. Previous exposure to immunology and molecular biology will be helpful but not required.

PATH 481. Immunology of Infectious Diseases. 3 Units.
Lectures and discussion on the immune response to infectious organisms, including bacteria, viruses and parasites. Emphasis on human responses but includes discussions of animal models. Other topics include vaccines and infections in immuno-compromised hosts. Recommended preparation: PATH 416 or consent of instructor. Offered as MVIR 481 and PATH 481.

PATH 486. HIV Immunology. 3 Units.
This course will examine the unique immunology of HIV disease. The course content will include the study of HIV pathogenesis, immune control, immune dysfunctions, HIV prevention and immune restoration. Students will be expected to attend lectures and participate in class discussions. A strong emphasis will be placed on reviewing scientific literature. Students will be asked to help organize and to administer an HIV immunology journal club and will be asked to prepare a written proposal in the area of HIV immunology. Offered as PATH 486 and MBIO 486. Prereq: PATH 416 or permission from the instructor.

PATH 488. Yeast Genetics and Cell Biology. 3 Units.
This seminar course provides an introduction to the genetics and molecular biology of the yeasts S. cerevisiae and S. pombe by a discussion of current literature focusing primarily on topics in yeast cell biology. Students are first introduced to the tools of molecular genetics and special features of yeasts that make them important model eukaryotic organisms. Some selected topics include cell polarity, cell cycle, secretory pathways, vesicular and nuclear/cyttoplasmic transport, mitochondrial import and biogenesis, chromosome segregation, cytoskeleton, mating response and signal transduction. Offered as CLBY 488, GENE 488, MBIO 488, and PATH 488.

PATH 510. Basic Pathologic Mechanisms. 4 Units.
An interdisciplinary introduction to the fundamental principles of molecular and cellular biology as they relate to the pathologic basis of disease. Lectures, laboratories, conferences.

PATH 511. Experimental Pathology Seminar I. 1 Unit.
Weekly discussions of current topics and research by students, staff and distinguished visitors.

PATH 512. Experimental Pathology Seminar II. 1 Unit.
Weekly discussions of current topics and research by students, staff and distinguished visitors.

PATH 520. Basic Cancer Biology and the Interface with Clinical Oncology. 3 Units.
This is an introductory cancer biology course that is intended to give students a broad and basic overview of Cancer Biology and Clinical Oncology. The course will cover not only fundamental principles of cancer biology, but will also highlight advances in the pathobiology and therapeutics of cancer. Classes will be of lecture and discussion format, with emphasis on critically reading original journal articles. The specific topics presented will include carcinogenesis, oncogenes, tumor suppressor genes, genetic epidemiology, DNA repair, growth factor action/signal transduction, apoptosis, cell cycle control, cell adhesion, angiogenesis, tumor cell heterogeneity, metastasis, chemotherapy, photodynamic therapy, gene therapy, signal transduction inhibitor therapy, chemoprevention, and clinical oncology of the breast, prostate, lymphatic tissue, colon and other related malignancies. Course grades will be from participation/discussion, presentation and mid-term/final exams. Recommended preparation: CBIO 453 and CBIO 455. Offered as PATH 520 and PHRM 520.
PATH 521. Special Topics in Cancer Biology and Clinical Oncology. 1 Unit.
This one credit hour course in Cancer Biology is intended to give students an opportunity to do independent literature research while enrolled in PHRM 520/PATH 520. Students must attend weekly Hematology/Oncology seminar series and write a brief summary of each of the lectures attended. In addition, students must select one of the seminar topics to write a term paper which fully reviews the background related to the topic and scientific and clinical advances in that field. This term paper must also focus of Clinical Oncology, have a translational research component, and integrate with concepts learned in PHRM 520/PATH 520. Pharmacology students must provide a strong discussion on Therapeutics, while Pathology students must provide a strong component on Pathophysiology of the disease. Recommended preparation: CBIO 453 and CBIO 455, or concurrent enrollment in PHRM 520 or PATH 520. Offered as PATH 521 and PHRM 521.

PATH 522. Skeletal Biology. 3 Units.
This is an advanced graduate level course for students interested in the morphogenesis, structure, function, and maintenance of the skeletal system taught jointly by faculty from Case Western Reserve University (CWRU), Cleveland Clinic Foundation (CCF), and the Northeastern Ohio Universities College of Medicine (NEOUCOM). It will meet twice per week for 90 minutes per session. The format will include an overview of the topic by the responsible faculty, followed by a discussion of important papers on the topic. The students will be expected to discuss the papers for each session and grading will be based on those discussions. The intent of the course is to enable students to understand the important problems in skeletal biology and both classical and modern approaches for solving them.

PATH 523. Histopathology of Organ Systems. 3 Units.
Comprehensive course covering the underlying basic mechanisms of injury and cell death, inflammation, immunity, infection, and neoplasia followed by pathology of specific organ systems. Material will include histological ('structure') and physiological ('function') aspects related to pathology (human emphasis). Recommended preparation: ANAT 412 or permission of instructor. Offered as ANAT 523 and PATH 523.

PATH 524. Cell Biology of Neurodegenerative Disorders. 3 Units.
PATH 524 is a course on neurodegenerative disorders intended for graduate, MSTP, first and second year medical students, and interested senior members of the community. This course will bridge the gap between molecular mechanisms at the cellular level with disease presentation and therapeutic strategies for a limited set of neurodegenerative conditions. The subject matter is intended to excite and prepare graduate and medical students for a career in translational research, and provide the necessary background for PATH 525, a more advanced seminar course on neurodegenerative disorders. This course will introduce the students to common neurodegenerative disorders of protein misfolding and metal mis-metabolism. Following an introductory lecture, the students will read assigned contemporary literature on a specific topic and discuss recent scientific reports in the class. The course will cover topics related to Alzheimer's disease, Parkinson's disease, Huntington's disease, Amyotrophic lateral sclerosis, Multiple sclerosis, Friedreich's ataxia, disorders of iron metabolism, disorders of copper metabolism, multiple system atrophy, metabolic disturbances including hypoglycemia and hepatic encephalopathy, toxic disorders including alcoholism, and other disorders of interest to the students. Students will be expected to participate actively in class and defend a research proposal for the final.

PATH 525. Transport and Targeting of Macromolecules in Health and Disease. 3 Units.
Each class includes introductory lecture, followed by student participation in interactive discussion of 3 to 5 research publications. At the end of the course, the students are expected to submit a paper or a short research proposal on any of the topics discussed during the course. Recommended preparation: CBIO 453, CBIO 454, CBIO 455, and CBIO 456. Offered as CLBY 525 and PATH 525.

PATH 601. Special Problems. 1 - 18 Unit.
Research on the nature and causation of disease and on host factors which tend to protect against disease. Special courses and tutorials in subspecialty areas of general and/or systemic anatomic and/or clinical pathology.

PATH 651. Thesis M.S.. 1 - 18 Unit.
Prereq: Predoctoral research consent or advanced to Ph.D. candidacy milestone.
Department of Pharmacology

Cami Thompson (http://bulletin.case.edu/schoolofmedicine/pharmacology/mailto:camila.thompson@case.edu), Coordinator

The Department of Pharmacology offers training leading to MS, PhD or MD/PhD degrees for highly qualified post-undergraduate candidates committed to academic research careers in the biomedical sciences. Adequate preparation in the biological sciences, mathematics, organic chemistry, and physics or physical chemistry is a prerequisite for admission.

Multidisciplinary training, carried out by faculty in pharmacology and other basic science departments, emphasizes molecular, cellular, physiological, and clinical aspects of the pharmacological sciences. Areas of faculty expertise include drug/xenobiotic metabolism; receptor-ligand interactions, and biochemical reaction mechanisms; cell biology of signaling pathways; structure-function of membrane components; endocrine and metabolic regulation; cell surface and nuclear receptors, hormonal regulation of gene expression; cancer biology and therapeutics, bacterial and viral pathogenesis, neuroscience/neuropharmacology, and drug resistance.

Students who desire the combined MD/PhD degrees are admitted to the Medical Scientist Training Program (MSTP, please see separate listing in this publication). These students participate in the two-year integrated preclinical curriculum of the School of Medicine (University Program), which features clinical correlation of basic biologic concepts. Combined degree students who select the PhD in pharmacology undertake a series of advanced courses, research rotations, preliminary examinations and dissertation research in the same manner as that described for the PhD program.

Facilities

The Department of Pharmacology occupies about 25,000 net square feet distributed among several locations, namely the Biomedical Research Building, the School of Medicine Harland Golf Wood Building and the adjacent Wood Research Tower, as well as facilities in the West Quad Bldg. Facilities include extensive chromatographic and tissue culture facilities, a transgenic mouse laboratory, imaging and confocal microscopy equipment, and ready access to specialized research techniques, including various aspects of recombinant DNA and hybridoma technology, in situ hybridization histochemistry, fluorescence cell sorting, NMR and mass spectroscopy, X-ray crystallography, and cryo electron microscopy.

Masters Degrees

Although training efforts by the Department of Pharmacology are primarily directed toward the award of the PhD degree, training for the MS degree is offered also in a variety of contexts. For example, research assistants in the Department who seek educational advancement may pursue the MS degree via Plan A (thesis) or Plan B (coursework only). Medical students who seek to specialize in Pharmacology during the scholarly research component of their preclinical program may pursue the MS degree. Employees in the Biotechnology Industry may seek advanced training in Pharmacology by pursuing the MS degree at Case. Finally, a PhD candidate who is unable to complete the PhD requirements for extraordinary reasons may petition to have earned credits transferred to fulfill MS degree requirements.

Masters Plan B (Coursework, MS direct admit)

This program is aimed at students who seek a Master’s Degree but do not intend to specialize in research following their Master’s work. To satisfy the requirement for a Comprehensive Exam for the MS Degree, students register for 1 credit of EXAM 600 during their final semester and sit for an integrative essay question-style examination on the content of the required coursework. A total of 27 credit hours are required (see below).

The advancement of understanding and practice of therapeutics is based on research. Therefore all students in degree programs in Pharmacology are expected to become involved in independent research and scholarship. Registration for PHRM 601 Independent Study and Research requires a pre-arrangement with a faculty mentor who will oversee the combination of study and bench research and prescribe the basis for satisfactory performance, including oral and written reports. With pre-approval of the Departmental Director of Graduate Studies, a student’s study plan may substitute additional specific advanced courses to replace PHRM 601 Independent Study and Research credits.

Sample Plan of Study for Plan B

<table>
<thead>
<tr>
<th>First Year</th>
<th>Units</th>
<th>Fall</th>
<th>Spring</th>
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<tbody>
<tr>
<td>Cell Biology I (CBIO 453)</td>
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<td>Molecular Biology I (CBIO 455)</td>
<td>4</td>
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<tr>
<td>Principles of Pharmacology I (PHRM 401)</td>
<td>3</td>
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<tr>
<td>Principles of Pharmacology II: The Molecular Basis of Therapeutics (PHRM 402)</td>
<td>3</td>
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<tr>
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<th>Spring</th>
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<tr>
<td>Pharmacology Seminar Series (PHRM 511)</td>
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<td></td>
</tr>
<tr>
<td>PHRM Elective</td>
<td>3</td>
<td></td>
<td></td>
</tr>
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<td>Independent Study and Research (PHRM 601)</td>
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<td>5-6</td>
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Total Units in Sequence: 25-27

Masters Plan A (Research, direct admit)

In addition to the course requirements below, candidates for this degree are required to submit an acceptable written thesis based on their original research, and register for at least 9 credit hours of PHRM 651 Thesis M.S. (master’s dissertation research). The acceptability of the thesis will be determined by an oral examination administered by the student’s Thesis Advisory Committee. This committee must be chaired by a member of the primary Faculty of Pharmacology, and it should include the research mentor and two other faculty members (total of four faculty members, two from the Department of Pharmacology). As above, a minimum of 27 credit hours are required. For these students, passing the final exams in PHRM 401 Principles of Pharmacology I and PHRM 402 Principles of Pharmacology II: The Molecular Basis of Therapeutics satisfies the requirement for a Comprehensive Exam for the MS Degree.
Required courses for Plan A

First Year

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<tr>
<th>Course</th>
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<th>Spring</th>
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<tbody>
<tr>
<td>Cell Biology I (CBIO 453)</td>
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<td>Molecular Biology I (CBIO 455)</td>
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<tr>
<td>Principles of Pharmacology I (PHRM 401)</td>
<td>3</td>
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<td>Principles of Pharmacology II: The Molecular Basis of Therapeutics (PHRM 402)</td>
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<tr>
<td>Thesis M.S. (PHRM 651)</td>
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Year Total: 9 9

Second Year

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<td>Pharmacology Seminar Series (PHRM 511)</td>
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<td>PHRM Elective</td>
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<td>Thesis M.S. (PHRM 651)</td>
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Year Total: 9 9

Total Units in Sequence: 36

MD/MS Biomedical Sciences - Pharmacology

For Program Admissions information and MD requirements, see MD Dual Degree Programs (p. 792). A sample plan of study for the Pharmacology track is below.

First Year

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<tr>
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Year Total: 1-9 1-9 3

Second Year

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<td>Pharmacology Seminar Series (PHRM 511)</td>
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<tr>
<td>Principles of Pharmacology II: The Molecular Basis of Therapeutics (PHRM 402)</td>
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<tr>
<td>Advanced Elective Course complimentary to research focus</td>
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<td>On Being a Professional Scientist: The Responsible Conduct of Research (IBMS 500)</td>
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Year Total: 5-13 6

Third Year

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<tr>
<td>Exam in Biomedical Investigation (IBIS 600)</td>
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Year Total: 10 10

Fourth Year

Medical School Curriculum

Year Total:

Fifth Year

Medical School Curriculum

Year Total:

Total Units in Sequence: 36-60

PhD in Pharmacology

Students seeking the PhD degree are admitted directly into the Department of Pharmacology through the Molecular Therapeutics Training Program, through the Biomedical Sciences Training Program, each of which provides an introduction to many related training areas within the biomedical field during the first year, or through the Medical Scientist Training Program (MSTP).

The PhD program is divided into three phases. The first phase allows students to follow an integrated first-year sequence of course work that involves a core curriculum in cell and molecular biology. In addition, the first year includes three research rotations that allow the students to sample areas of research and become familiar with faculty members and their laboratories. Selection of a specific training program and thesis advisor is made before the end of the first year. The second phase involves a two part course in intensive Pharmacology study, oral presentations and laboratory experience, which cumulates in a comprehensive written exam designed to challenge students to apply key concepts in new context.

After advancing to PhD candidacy by passing the comprehensive written exam, students select one of four advanced tracks in Pharmacology. Choice among the tracks is based on the area of research expertise of the thesis advisor and the student’s interest in specific coursework. The four tracks are: Cancer Therapeutics, Membrane Biology and Pharmacology, Molecular Pharmacology and Cell Regulation, and Translational Therapeutics.

The PhD degree is awarded to students who complete a research project leading to two original and meritorious scientific contributions that are submitted for publication to leading journals in the field of study; at least one manuscript must be accepted for publication before scheduling the PhD defense. Completion of the PhD degree will also require 36 hours of coursework (24 hours of which are graded) and 18 hours of PHRM 701 Dissertation Ph.D..

Core course requirements for the PhD in Pharmacology

The first year consists of the Core curriculum in Cell Biology and Molecular Biology (CBIO 453 Cell Biology I, CBIO 455 Molecular Biology I) and research rotations, as well as a scientific ethics course (15 credit hours). This is included with the additional 15 formal course credit hours which are required in Pharmacology as listed and then described below.

PHRM 400 Research Experience in Pharmacology 0
CBIO 453 Cell Biology I 4
CBIO 455 Molecular Biology I 4
PHRM 401 Principles of Pharmacology I 3
PHRM 402 Principles of Pharmacology II: The Molecular Basis of Therapeutics 3
### Plan of Study

§ Please also see Graduate Studies Academic Requirements for Doctoral Degrees (p. 662)

#### First Year

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<thead>
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<th>Units</th>
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<th>Spring</th>
<th>Summer</th>
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<tbody>
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<td>Cell Biology I (CBIO 453)</td>
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<td>Selection of Thesis Advisor</td>
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<td>Principles of Pharmacology II: The Molecular Basis of Therapeutics (PHRM 402)</td>
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<td>Independent Study and Research (PHRM 601)</td>
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#### Second Year

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<td>Pharmacology Seminar Series (PHRM 511)</td>
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Total Units in Sequence: 26-79

* Rotation 1 takes place during Summer prior to First Year Fall Semester.

### Courses

**PHRM 301. Undergraduate Research.** 1 - 18 Unit.

**PHRM 309. Principles of Pharmacology.** 3 Units.

Principles of Pharmacology introduces the basic principles that underlie all of Pharmacology. The first half of the course introduces, both conceptually and quantitatively, drug absorption, distribution, elimination and metabolism (pharmacokinetics) and general drug receptor theory and mechanism of action (pharmacodynamics). Genetic variation in response to drugs (pharmacogenetics) is integrated into these basic principles. The second half of the course covers selected drug classes chosen to illustrate these principles. Small group/recitation sessions use case histories to reinforce presentation of principles and to discuss public perceptions of therapeutic drug use. Graduate students will be expected to critically evaluate articles from the literature and participate in a separate weekly discussion session. Recommended preparation for PHRM 409: Undergraduate degree in science or permission of instructor. Offered as PHRM 309 and PHRM 409. Prereq: CHEM 223 and CHEM 224 or EBME 201 and EBME 202 or BIOL 116 and BIOL 117

**PHRM 315. Nuclear Receptors in Health and Disease.** 3 Units.

This course focuses on hormone-gene interactions mediated by the ligand-inducible transcription factors termed nuclear hormone receptors. The class will address the mechanisms of action, regulatory features, and biological activities of several nuclear receptors. The usage of nuclear receptors as therapeutic targets in disease states such as cancer, inflammation, and diabetes will also be discussed. The course aims to teach students to critically evaluate primary literature relevant to nuclear hormone receptors biology, and to reinforce presentation/discussion skills. Grades for undergraduates will be based on midterm, final exam; grades for graduates will be based on midterm, final exam, and presentation of a recently published research article related to the role of nuclear receptors in health and disease. Offered as PHRM 315, BIOC 315, PHRM 415 and BIOC 415.

**PHRM 340. Science and Society Through Literature.** 3 Units.

This course will examine the interaction of scientific investigation and discovery with the society it occurred in. What is the effect of science on society and, as importantly, what is the effect of society on science? An introduction will consider the heliocentric controversy with focus on Galileo. Two broad areas, tuberculosis and the Frankenstein myth, will then be discussed covering the period 1800-present. With tuberculosis, fiction, art and music will be examined to understand the changing views of society towards the disease, how society’s perception of tuberculosis victims changed, and how this influenced their treatments and research. With Frankenstein, the original novel in its historical context will be examined. Using fiction and film, the transformation of the original story into myth with different connotations and implications will be discussed. Most classes will be extensive discussions coupled with student presentations of assigned materials. Offered as PHRM 340, BETH 440, PHRM 440, and HSTY 440.

**PHRM 400. Research Experience in Pharmacology.** 0 - 1 Units.

Research rotation in pharmacology.
PHRM 401. Principles of Pharmacology I. 3 Units.
This course focuses on the chemical and biochemical properties of therapeutic agents, molecular mechanisms of therapeutic action including kinetic and thermodynamic principles of enzyme catalysis and drug-receptor interactions, signal transduction, the genetic basis of disease states, and interindividual variation in response to drugs. The primary learning objective is to develop a self-directed, critical approach to the evaluation and design of experimental research in the broad context of specific diseases. This is a team-taught course involving focal lectures by faculty followed by student-directed learning experiences including discussion, problem solving applications, and primary literature presentations. A laboratory exercise introduces experimental methodologies widely applied during the study of molecular interactions between therapeutic agents and receptor targets to reinforce fundamental principles of molecular drug action. This 3 credit hour course meets 6 hours per week during the first half of the Spring semester (January through mid-February).

PHRM 402. Principles of Pharmacology II: The Molecular Basis of Therapeutics. 3 Units.
This course focuses on human physiology of organ systems that are involved in determining the time course of drug action in vivo (pharmacokinetics). Emphasis will be placed on fundamental principles of pharmacokinetics, including the absorption, distribution, metabolism, and excretion of drugs. Mathematical concepts needed to understand appropriate administration of drugs and maintaining therapeutic concentrations of drugs in the body will be discussed. A second broad area of emphasis is on fundamental principles of drug action within the body (pharmacodynamics), including drug-receptor theory, log dose-response relationships, therapeutic index, receptor turnover, and signal transduction mechanisms. This is a highly interactive course in which faculty lectures are minimized and student-directed learning in emphasized. An animal laboratory explores the actions of cardiovascular drugs in an in vivo setting. This 3-credit hour course meets 6 hours per week mid-February through April.

PHRM 403. Public and Professional Views of Modern Therapeutics. 3 Units.
This course will present the students with headline news stories from the popular press along with pertinent published articles from the scientific literature. The object is to engage the students in critical evaluation of the scientific literature and news reports to discern the scientific basis for decisions such as removal of drugs from the market. The course will focus on topics such as Cox-2 inhibitors and Heart Disease, Antidepressant Use for Adolescents, and Parkinson’s Disease and Stem Cell Therapy, among others. Evaluation will be based on participation in student-led discussion sessions, weekly topical quizzes, and on written critiques of the primary literature.

PHRM 409. Principles of Pharmacology. 3 Units.
Principles of Pharmacology introduces the basic principles that underlie all of Pharmacology. The first half of the course introduces, both conceptually and quantitatively, drug absorption, distribution, elimination and metabolism (pharmacokinetics) and general drug receptor theory and mechanism of action (pharmacodynamics). Genetic variation in response to drugs (pharmacogenetics) is integrated into these basic principles. The second half of the course covers selected drug classes chosen to illustrate these principles. Small group/recitation sessions use case histories to reinforce presentation of principles and to discuss public perceptions of therapeutic drug use. Graduate students will be expected to critically evaluate articles from the literature and participate in a separate weekly discussion session. Recommended preparation for PHRM 409: Undergraduate degree in science or permission of instructor. Offered as PHRM 309 and PHRM 409.

PHRM 412. Membrane Transport Processes. 3 Units.
Membranes and membrane transporters are absolutely required for all cells to take up nutrient, maintain membrane potential and efflux toxins. This course will consider the classification and structure of membrane transport proteins and channels, examine the common mechanistic features of all systems and the specific features of different classes of transporter. Understanding the physiological integration of transport processes into cell homeostasis and consideration of transporters and channels as drug targets will be a goal. Course format is minimal lecture, primarily student presentations of primary literature papers. Offered as PHOL 412, PHRM 412. Prereq: CBIO 453 and CBIO 455.

PHRM 415. Nuclear Receptors in Health and Disease. 3 Units.
This course focuses on hormone-gene interactions mediated by the ligand-inducible transcription factors termed nuclear hormone receptors. The class will address the mechanisms of action, regulatory features, and biological activities of several nuclear receptors. The usage of nuclear receptors as therapeutic targets in disease states such as cancer, inflammation, and diabetes will also be discussed. The course aims to teach students to critically evaluate primary literature relevant to nuclear hormone receptors biology, and to reinforce presentation/discussion skills. Grades for undergraduates will be based on midterm, final exam; grades for graduates will be based on midterm, final exam, and presentation of a recently published research article related to the role of nuclear receptors in health and disease. Offered as PHRM 315, BIOC 315, PHRM 415 and BIOC 415.
PHRM 420. Molecular Genetics of Cancer. 3 Units.
Cancer is a genetic disease, not only in the Mendelian sense of inheritance, but also in the sense that it is caused by somatic mutation. The targets of mutation are a set of proto-oncogenes and tumor suppressor genes whose products govern cellular proliferation, death and differentiation. The objectives of this course are to examine the types of genes that are the targets of mutational activation or inactivation and the mechanistic outcome of mutational changes that lead to oncogenesis. The course will also probe viral mechanisms of oncogenesis related to the products of cellular proto-oncogenes or tumor suppressor genes. In the course of these examinations we will explore the genetic and molecular genetic approaches used to identify and study oncogenes and tumor suppressor genes. Students should be prepared to present and discuss experimental design, data and conclusions from assigned publications. There will be no exams or papers but the course will end with a full-day, student-run symposium on topics to be decided jointly by students and instructors. Grades will be based on class participation and symposium presentation. Offered as BIOC 420, MBIO 420, MVIR 420, PATH 422, and PHRM 420. Prereq: CBIO 453 and CBIO 455.

PHRM 430. Advanced Methods in Structural Biology. 1 - 6 Unit.
The course is designed for graduate students who will be focusing on one or more methods of structural biology in their thesis project. This course is divided into 3-6 sections (depending on demand). The topics offered will include X-ray crystallography, nuclear magnetic resonance spectroscopy, optical spectroscopy, mass spectrometry, cryo-electron microscopy, and computational and design methods. Students can select one or more modules. Modules will be scheduled so that students can take all the offered modules in one semester. Each section is given in 5 weeks and is worth 1 credit. Each section covers one area of structural biology at an advanced level such that the student is prepared for graduate level research in that topic. Offered as BIOC 430, CHEM 430, PHOL 430, and PHRM 430.

PHRM 432. Current Topics in Vision Research. 3 Units.
Vision research is an exciting and multidisciplinary area that draws on the disciplines of biochemistry, genetics, molecular biology, structural biology, neurosciences, and pathology. This graduate level course will provide the student with broad exposure to the most recent and relevant research currently being conducted in the field. Topics will cover a variety of diseases and fundamental biological processes occurring in the eye. Regions of the eye that will be discussed include the cornea, lens, and retina. Vision disorders discussed include age-related macular degeneration, retinal ciliopathies, and diabetic retinopathy. Instructors in the course are experts in their field and are members of the multidisciplinary visual sciences research community here at Case Western Reserve University. Students will be exposed to the experimental approaches and instrumentation currently being used in the laboratory and in clinical settings. Topics will be covered by traditional lectures, demonstrations in the laboratory and the clinic, and journal club presentations. Students will be graded on their performance in journal club presentations (40%), research proposal (40%), and class participation (20%). Offered as NEUR 432, PATH 432, PHRM 432 and BIOC 432.

PHRM 434. Mechanisms of Drug Resistance. 3 Units.
Resistance to drugs is an important health concern in the new millennium. Over the past century, modern medicine has developed and prescribed drugs for various ailments and diseases with known therapeutic benefit. Since the discovery of antibiotics by Dr. Fleming, we have struggled with a new complication in infectious diseases, development of drug resistance. This course will focus on and compare the drug resistant mechanisms selected by viruses, bacteria, parasites, fungi, and tumor cells. Topics to be covered include antiretroviral resistance (e.g., AZT and protease inhibitors), antibiotic resistance (e.g., B-lactams), resistance to chemotherapy agents, and resistance to anti-malarial drugs (e.g., chloroquine). Offered as MBIO 434, MVIR 434, and PHRM 434.

PHRM 440. Science and Society Through Literature. 3 Units.
This course will examine the interaction of scientific investigation and discovery with the society it occurred in. What is the effect of science on society and, as importantly, what is the effect of society on science? An introduction will consider the heliocentric controversy with focus on Galileo. Two broad areas, tuberculosis and the Frankenstein myth, will then be discussed covering the period 1800-present. With tuberculosis, fiction, art and music will be examined to understand the changing views of society towards the disease, how society’s perception of tuberculosis victims changed, and how this influenced their treatments and research. With Frankenstein, the original novel in its historical context will be examined. Using fiction and film, the transformation of the original story into myth with different connotations and implications will be discussed. Most classes will be extensive discussions coupled with student presentations of assigned materials. Offered as PHRM 340, BETH 440, PHRM 440, and HSTY 440.

PHRM 466. Cell Signaling. 3 Units.
This is an advanced lecture/journal/discussion format course that covers cell signaling mechanisms. Included are discussions of neurotransmitter-gated ion channels, growth factor receptor kinases, cytokine receptors, G protein-coupled receptors, steroid receptors, heterotrimeric G proteins, ras family GTPases, second messenger cascades, protein kinase cascades, second messenger regulation of transcription factors, microtubule-based motility, actin/myosin-based motility, signals for regulation of cell cycle, signals for regulation of apoptosis. Offered as CLBY 466 and PHOL 466 and PHRM 466.

PHRM 475. Protein Biophysics. 3 Units.
This course focuses on in-depth understanding of the molecular biophysics of proteins. Structural, thermodynamic and kinetic aspects of protein function and structure-function relationships will be considered at the advanced conceptual level. The application of these theoretical frameworks will be illustrated with examples from the literature and integration of biophysical knowledge with description at the cellular and systems level. The format consists of lectures, problem sets, and student presentations. A special emphasis will be placed on discussion of original publications. Offered as BIOC 475, CHEM 475, PHOL 475, PHRM 475, and NEUR 475.
PHRM 476. Cellular Biophysics. 4 Units.
This course focuses on a quantitative understanding of cellular processes. It is designed for students who feel comfortable with and are interested in analytical and quantitative approaches to cell biology and cell physiology. Selected topics in cellular biophysics will be covered in depth. Topics include theory of electrical and optical signal processing used in cell physiology, thermodynamics and kinetics of enzyme and transport reactions, single ion channel kinetics and excitability, mechanotransduction, and transport across polarized cell layers. The format consists of lectures, problem sets, computer simulations, and discussion of original publications. The relevant biological background of topics will be provided appropriate for non-biology science majors. Offered as BIOC 476, NEUR 477, PHOL 476, PHRM 476.

PHRM 511. Pharmacology Seminar Series. 0 - 1 Units.
Current topics of interest in the pharmacologist sciences.

PHRM 513. Structural Journal Club. 1 Unit.
Current topics of interest in structural biology, and protein biophysics. Offered as PHOL 513 and PHRM 513.

PHRM 520. Basic Cancer Biology and the Interface with Clinical Oncology. 3 Units.
This is an introductory cancer biology course that is intended to give students a broad and basic overview of Cancer Biology and Clinical Oncology. The course will cover not only fundamental principles of cancer biology, but will also highlight advances in the pathobiology and therapeutics of cancer. Classes will be of lecture and discussion format, with emphasis on critically reading original journal articles. The specific topics presented will include carcinogenesis, oncogenes, tumor suppressor genes, genetic epidemiology, DNA repair, growth factor action/signal transduction, apoptosis, cell cycle control, cell adhesion, angiogenesis, tumor cell heterogeneity, metastasis, chemotherapy, photodynamic therapy, gene therapy, signal transduction inhibitor therapy, chemoprevention, and clinical oncology of the breast, prostate, lymphatic tissue, colon and other related malignancies. Course grades will be from participation/discussion, presentation and mid-term/final exams. Recommended preparation: CBIO 453 and CBIO 455. Offered as PATH 520 and PHRM 520.

PHRM 521. Special Topics in Cancer Biology and Clinical Oncology. 1 Unit.
This one credit hour course in Cancer Biology is intended to give students an opportunity to do independent literature research while enrolled in PHRM 520/PATH 520. Students must attend weekly Hematology/Oncology seminar series and write a brief summary of each of the lectures attended. In addition, students must select one of the seminar topics to write a term paper which fully reviews the background related to the topic and scientific and clinical advances in that field. This term paper must also focus of Clinical Oncology, have a translational research component, and integrate with concepts learned in PHRM 520/PATH 520. Pharmacology students must provide a strong discussion on Therapeutics, while Pathology students must provide a strong component on Pathophysiology of the disease. Recommended preparation: CBIO 453 and CBIO 455, or concurrent enrollment in PHRM 520 or PATH 520. Offered as PATH 521 and PHRM 521.

PHRM 525. Topics in Cell and Molecular Pharmacology. 0 - 18 Units.
Individual library research project under the guidance of a pharmacology sponsor. Projects will reflect the research interest of the faculty sponsor, including molecular endocrinology, neuropharmacology, receptor activation and signal transduction, molecular mechanisms of enzyme action and metabolic regulation.

PHRM 527. Pathways to Personalized Medicine. 3 Units.
This is a course of independent study designed to take the student from the bedside to the bench and back again. Students will select a problem from a list of important therapeutic issues related to variability in drug responsiveness and design a research program to elucidate its molecular, biochemical, genetic and pathophysiological basis. The resulting research proposal is expected to be multidimensional and include molecular, cellular, whole animal and clinical investigations. To guide the process students will assemble a mentoring group including at least one member of the Translational Therapeutics Track Faculty, a clinician working in the clinical realm in which the problem originates and a basic scientist with relevant experience. The written proposal will be defended orally. Recommended preparation: 1st year Pharm Graduate required courses.

PHRM 528. Classic and Contemporary Approaches to Drug Discovery. 3 Units.
This course will provide the student with a deeper understanding of the mechanism of drug action and target validation. The first portion of the course will describe the basis for classical approaches in drug discovery that include kinetic and thermodynamic analyses for small molecule interactions with enzymes and receptors. The second portion of the course will describe new technologies and agents such as interference RNA and peptoids as therapeutic agents. The final section will describe pre-clinical and clinical trials as well as practical issues for start-up companies and licensing agreements. Prereq: Public health nutrition students and graduate nutrition students only.

PHRM 555. Current Proteomics. 3 Units.
This course is designed for graduate students across the university who wish to acquire a better understanding of fundamental concepts of proteomics and hands-on experience with techniques used in current proteomics. Lectures will cover protein/peptide separation techniques, protein mass spectrometry, bioinformatics tools, and biological applications which include quantitative proteomics, protein modification proteomics, interaction proteomics, structural genomics and structural proteomics. Laboratory portion will involve practice on the separation of proteins by two-dimensional gel electrophoresis, molecular weight measurement of proteins by mass spectrometry, peptide structural characterization by tandem mass spectrometry and protein identification using computational tools. The instructors’ research topics will also be discussed. Recommended preparation: CBIO 453 and CBIO 455. Offered as PHRM 555 and SYBB 555.
PHRM 600. Preparation for Qualifying Exam. 1 Unit.
Students pursuing the M.S. or Ph.D. degrees in Pharmacology are required to prepare systematically for the comprehensive qualifying exam by reviewing the concepts of cellular and molecular biology and pharmacology. The qualifier is comprised of a two-part written exam administered simultaneously to all eligible students. It is designed to evaluate their understanding of concepts presented in the various core courses. It also assesses their skills in critical reading of research articles and design of experiments. The division into two parts allows each student to receive feedback on deficient areas and work toward improvement on the second segment. Eligibility: Students may register for the exam when they have fulfilled two criteria: (a) Successful completion (grade B or better) in all of the Core Courses, and an overall GPA of 3.0 or better. (b) Satisfactory performance in all research rotations and consistent research effort in the thesis laboratory as documented formally by the Ph.D. mentor. No student on probation may sit for the Qualifying Exam (Prelim I). Prereq: CBIO 453, CBIO 455, PHRM 401 and PHRM 402.

PHRM 601. Independent Study and Research. 1 - 18 Unit.

PHRM 651. Thesis M.S.. 1 - 18 Unit.

Prereq: Predoctoral research consent or advanced to Ph.D. candidacy milestone.
Department of Physiology and Biophysics

Jean Davis (http://bulletin.case.edu/schoolofmedicine/physiologyandbiophysics/mailto:jean.davis@case.edu), Coordinator

The Department of Physiology and Biophysics at Case is a multidisciplinary department that takes great pride in its history of conducting research and training graduate students. The department includes 20 Primary and 33 Secondary faculty members, more than 25 post-doctoral associates, and 34, full-time PhD, MD/PhD, and Master of Science degree students. The training programs are designed to provide a mentored training environment that maximizes faculty-student interaction.

As outlined below, the department offers PhD, MD/PhD and Master of Science degrees. These programs are tailored to prepare students for successful careers in biomedical, pharmaceutical and industrial research. The department offers multiple graduate-level programs, each of which uses state-of-the-art molecular, cell biology, and biophysical approaches to study physiological questions at a variety of different organizational levels. The goal is to provide an outstanding training opportunity. The major goals of the PhD and Tech Masters programs are to provide students with a broad knowledge base in organ systems and integrated physiology and in-depth expertise and outstanding research potential in the fields of cellular and molecular physiology and molecular and cellular biophysics. These goals are accomplished using a series of foundation and advanced topic courses, skill development courses, laboratory rotations and thesis research. The MS in Medical Physiology program is a post-baccalaureate program designed to help students prepare for admission to medical, dental, pharmacy, or veterinary school or for opportunities to work in the biotechnology industry.

Masters Degrees

The Master’s Program in Medical Physiology is designed for students with at least a bachelor’s degree in a chemical, physical, or biological science who are seeking advanced training in the physiological sciences, typically in preparation for admission to a professional medical program (e.g. Medical School, Dental School). The program is flexible in duration. It can take as little as 1 year (2 semesters, 9 months) to complete the required 30 credit hours of course work. However, students who wish to decompress the program can take 14 months or more to complete the requirements. Core courses and flexible electives allow students to focus their work in key areas of medical physiology, including Anatomy, Biochemistry, or Pharmacology. Graduates of the Medical Physiology Master’s Program also can pursue careers in basic and clinical research, research administration, teaching or management in academia, the pharmaceutical and biotechnology industries, private research institutions, government science or regulatory agencies, or medicine and health care.

MS Medical Physiology - Type B Non-Thesis Option

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Total Units in Sequence: 28-45

MS Physiology - Type A Thesis Option

The Department of Physiology and Biophysics encourages research staff members to expand their critical research knowledge and skills by enrolling in our Master’s of Science in Physiology and Biophysics program. This Tech Master’s Program, is specifically designed for staff working full time. Each employer has their own policy on allowing staff to take classes and enroll in graduate programs. CWRU’s policy is to allow staff, with their supervisor’s permission, to take up to 6 credit hours per term, with tuition being covered by CWRU as part of the employee benefit package. Staff are expected to make up the time they spend in class during the day after hours.

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Total Units in Sequence: 27

MD/MS Biomedical Investigation - Physiology Track

This track offers training in physiology and biomedical laboratory technology, including emphasis on mentored independent research training which includes both laboratory experience and formal course work in modern laboratory methodology and instrumentation.

Students in Physiology and Biotechnology track must complete:

- PHOL 498 \text{ Physiology and Biophysics Departmental Seminar } 1
- PHOL 601 \text{ Research } 1 - 18
- IBIS 600 \text{ Exam in Biomedical Investigation } 0

And 9 credits from the following course list:

- PHOL 432 \text{ Cell Structure and Function } 3
- PHOL 456 \text{ Proteins and Nucleic Acids } 3
- PHOL 466 \text{ Cell Signaling } 3
- PHOL 468 \text{ Membrane Physiology } 3
- PHOL 480 \text{ Physiology of Organ Systems } 4
- PHOL 530 \text{ Technology in Physiological Sciences } 3
PhD in Physiology and Biophysics

The Physiology and Biophysics Graduate Program provides comprehensive training leading to the PhD degree and MD/PhD degrees. This program has three tracks of study with emphasis on Cell and Molecular Physiology, Structural Biology and Biophysics, and Organ Systems Physiology. Admissions to the Physiology and Biophysics program may be obtained in the integrated Biomedical Sciences Training Program, by direct admission to the department or via the MSTP program.

To earn a PhD in Physiology and Biophysics, a student must complete rotations in at least three laboratories followed by selection of a research advisor, and complete Core and Elective coursework including responsible conduct of research as described in the course of study, below. Students who previously completed relevant coursework, for example with a MS, may petition to complete alternative courses.

Each graduate program follows the overall regulations established and described in CWRU Graduate Studies and documented to the Regents of the State of Ohio. Completion of the PhD degree will require 36 hours of coursework (24 hours of which are graded) and 18 hours of PHOL 701 Dissertation Ph.D..

In addition, each student must successfully complete a qualifier examination for advancement to candidacy in the form of a short grant proposal with oral defense. The qualifier is generally completed in the summer after year two. During the dissertation period, students are expected to meet twice a year with the thesis committee, present seminars in the department, and fulfill journal publication requirements. At the completion of the program, successful defense of a doctoral dissertation is required. Throughout the doctoral training, students are expected to be enthusiastic participants in seminars, journal clubs, and research meetings in the lab and program.

Plan of Study for PhD in Cell and Molecular Physiology *

§ Please also see Graduate Studies Academic Requirements for Doctoral Degrees (p. 662)

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| Total Units in Sequence: | 36-68 |

* After passing qualifying exam - full-time thesis research (PHOL 701) - 18 total credit hours total

Plan of Study for PhD in Structural Biology and Biophysics *

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Program of Study for PhD in Organ Systems and Integrated Physiology *

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* After passing qualifying exam - full-time thesis research (701) - 18 total credit hours total

Courses

PHOL 351. Independent Study. 1 - 6 Unit.
This course is a guided program of study in physiology textbooks, reviews, and original articles. Guided laboratory projects to reproduce and extend classical physiological experiments are offered to the undergraduate science major. This course is being offered in conjunction with the Graduate level course PHOL 451. Students are required to consult with the faculty member whose work they have interest in and plan their individual experience.

PHOL 398. Physiology and Biophysics Departmental Seminar. 1 Unit.
Weekly one-hour reviews from invited speakers describing their research. Students will present literature reviews or summaries of their research.

PHOL 412. Membrane Transport Processes. 3 Units.
Membranes and membrane transporters are absolutely required for all cells to take up nutrient, maintain membrane potential and efflux toxins. This course will consider the classification and structure of membrane transport proteins and channels, examine the common mechanistic features of all systems and the specific features of different classes of transporter. Understanding the physiological integration of transport processes into cell homeostasis and consideration of transporters and channels as drug targets will be a goal. Course format is minimal lecture, primarily student presentations of primary literature papers. Offered as PHOL 412, PHRM 412. Prereq: CBIO 453 and CBIO 455.

PHOL 419. Applied Probability and Stochastic Processes for Biology. 3 Units.
Applications of probability and stochastic processes to biological systems. Mathematical topics will include: introduction to discrete and continuous probability spaces (including numerical generation of pseudo random samples from specified probability distributions), Markov processes in discrete and continuous time with discrete and continuous sample spaces, point processes including homogeneous and inhomogeneous Poisson processes and Markov chains on graphs, and diffusion processes including Brownian motion and the Ornstein-Uhlenbeck process. Biological topics will be determined by the interests of the students and the instructor. Likely topics include: stochastic ion channels, molecular motors and stochastic ratchets, actin and tubulin polymerization, random walk models for neural spike trains, bacterial chemotaxis, signaling and genetic regulatory networks, and stochastic predator-prey dynamics. The emphasis will be on practical simulation and analysis of stochastic phenomena in biological systems. Numerical methods will be developed using both MATLAB and the R statistical package. Student projects will comprise a major part of the course. Offered as BIOL 319, EECS 319, MATH 319, BIOL 419, EBME 419, and PHOL 419.

PHOL 430. Advanced Methods in Structural Biology. 1 - 6 Unit.
The course is designed for graduate students who will be focusing on one or more methods of structural biology in their thesis project. This course is divided into 3-6 sections (depending on demand). The topics offered will include X-ray crystallography, nuclear magnetic resonance spectroscopy, optical spectroscopy, mass spectrometry, cryo-electron microscopy, and computational and design methods. Students can select one or more modules. Modules will be scheduled so that students can take all the offered modules in one semester. Each section is given in 5 weeks and is worth 1 credit. Each section covers one area of structural biology at an advanced level such that the student is prepared for graduate level research in that topic. Offered as BIOC 430, CHEM 430, PHOL 430, and PHRM 430.
PHOL 432. Cell Structure and Function. 3 Units.
This course provides knowledge regarding cell structure and function, chiefly in mammalian cells but also in relevant model systems. The basic structure of the cell is discussed, as are various systems that regulate this structure. Topics to be covered include DNA transcription, translation and protein synthesis, intracellular transport, cell interaction with the external environment, cell cycle regulation, cell death and differentiation, signal transduction, and cell specialization and organization into tissues. The course emphasizes lectures and problem-based discussions with an emphasis on faculty-directed student self-learning. The major goals of this course are to provide students with a working knowledge of the cell to facilitate understanding of the scientific literature, and to familiarize students with current techniques in cell biology.

PHOL 451. Independent Study. 1 - 18 Unit.
Guided program of study using physiology textbooks, research reviews, and original research articles. An independent laboratory research project may also be included.

PHOL 456. Proteins and Nucleic Acids. 3 Units.
The goal of this course is to provide a basic working knowledge of protein structure/function and molecular biology. The course begins with a discussion of protein structure and enzyme catalysis followed by protein purification and characterization. The course then addresses concepts relating to the application of modern molecular biology techniques. Students are taught how to clone genes and use these clones in animal and cell-based studies. The overall goal is to provide students with an understanding of proteins and genetic approaches that can be used in experimental work and to facilitate comprehension of the scientific literature. Offered as BIOL 457 and PHOL 456.

PHOL 466. Cell Signaling. 3 Units.
This is an advanced lecture/journal/discussion format course that covers cell signaling mechanisms. Included are discussions of neurotransmitter-gated ion channels, growth factor receptor kinases, cytokine receptors, G protein-coupled receptors, steroid receptors, heterotrimeric G proteins, ras family GTPases, second messenger cascades, protein kinase cascades, second messenger regulation of transcription factors, microtubule-based motility, actin/myosin-based motility, signals for regulation of cell cycle, signals for regulation of apoptosis. Offered as CLBY 466 and PHOL 466 and PHRM 466.

PHOL 467. Topics in Evolutionary Biology. 3 Units.
The focus for this course is on a special topic of interest in evolutionary biology will vary from one offering to the next. Examples of possible topics include theories of speciation, the evolution of language, the evolution of sex, evolution and biodiversity, molecular evolution. ANAT/ANTH/EEPS/PHIL/PHOL 467/BIOL 468 will require a longer, more sophisticated term paper, and additional class presentation. Offered as ANTH 367, BIOL 368, EEPS 367, PHIL 367, ANAT 467, ANTH 467, BIOL 468, EEPS 467, PHIL 467 and PHOL 467.

PHOL 468. Membrane Physiology. 3 Units.
This student-guided discussion/journal course focuses on biological membranes. Topics discussed include thermodynamics and kinetics of membrane transport, oxidative phosphorylation and bioenergetics, electro-physiology of excitable membranes, and whole and single channel electrophysiology, homeostasis and pH regulation, volume and calcium regulation. Offered as CLBY 468 and PHOL 468.

PHOL 475. Protein Biophysics. 3 Units.
This course focuses on in-depth understanding of the molecular biophysics of proteins. Structural, thermodynamic and kinetic aspects of protein function and structure-function relationships will be considered at the advanced conceptual level. The application of these theoretical frameworks will be illustrated with examples from the literature and integration of biophysical knowledge with description at the cellular and systems level. The format consists of lectures, problem sets, and student presentations. A special emphasis will be placed on discussion of original publications. Offered as BIOC 475, CHEM 475, PHOL 475, PHRM 475, and NEUR 475.

PHOL 476. Cellular Biophysics. 4 Units.
This course focuses on a quantitative understanding of cellular processes. It is designed for students who feel comfortable with and are interested in analytical and quantitative approaches to cell biology and cell physiology. Selected topics in cellular biophysics will be covered in depth. Topics include theory of electrical and optical signal processing used in cell physiology, thermodynamics and kinetics of enzyme and transport reactions, single ion channel kinetics and excitability, mechanotransduction, and transport across polarized cell layers. The format consists of lectures, problem sets, computer simulations, and discussion of original publications. The relevant biological background of topics will be provided appropriate for non-biology science majors. Offered as BIOC 476, NEUR 477, PHOL 476, PHRM 476.

PHOL 480. Physiology of Organ Systems. 4 Units.
Our intent is to expand the course from the current 3 hours per week (1.5 hour on Monday and Wednesday) to 4 hours per week (1.5 hours on Monday and Wednesday plus 1 hour on Friday). Muscle structure and Function, Myostatin gravis and Sarcopenia; Central Nervous System, (Synaptic Transmission, Sensory System, Autonomic Nervous System, CNS circuits, Motor System, Neurodegenerative Diseases, Paraplegia and Nerve Compression); Cardiovascular Physiology (Regulation of Pressure and flow; Circulation, Cardiac Cycle, Electrophysiology, Cardiac Function, Control of Cardiovascular function, Hypertension); Hemorraghy, Cardio Hypertrophy and Fibrillation; Respiration Physiology (Gas Transport and Exchange, Control of Breathing, Acid/base regulation, Cor Pulmonaris and Cystic Fibrosis, Sleeping apnea and Emphysema); Renal Physiology (Glomerular Filtration, Tubular Function/transport, Glomerulonephritis, Tubulopathies); Gastro-Intestinal Physiology (Gastric motility, gastric function, pancreas and bile function, digestion and absorption, Liver Physiology; Pancreatitis, Liver Disease and cirrhosis); Endocrine Physiology (Thyroid, Adrenal glands, endocrine pancreas, Parathyroid, calcium sensing receptor, Cushing and diabetes, Reproductive hormones, eclampsia); Integrative Physiology (Response to exercise, fasting and feeding, aging). For all the classes, the students will receive a series of learning objectives by the instructor to help the students address and focus their attention to the key aspects of the organ physiology (and physiopathology). The evaluation of the students will continue to be based upon the students’ participation in class (60% of the grade) complemented by a mid-term and a final exam (each one accounting for 20% of the final grade). Offered as BIOL 480 and PHOL 480.
PHOL 481. Medical Physiology I. 6 Units.
Physiology is the dynamic study of life. It describes the vital functions of living organisms and their organs, cells, and molecules. For some, physiology is the function of the whole person. For many practicing clinicians, physiology is the function of an individual organ system. For others, physiology may focus on the cellular principles that are common to the function of all organs and tissues. Medical physiology deals with how the human body functions, which depends on how the individual organ systems function, which depends on how the component cells function, which in turn depends on the interactions among subcellular organelles and countless molecules. Thus, it requires an integrated understanding of events at the level of molecules, cells, and organs. Medical Physiology I is a lecture course (3, 2 hr. lectures/week). It is the first of a two-part, comprehensive survey of physiology that is divided into five blocks: Block 5 covers the physiology of the urinary system; Block 4 covers the respiratory system; Block 3 covers the cardiovascular system, and; Block 2 covers the nervous system; Block 1 covers the physiology of cells and molecules, signal transduction, basic electrophysiology, and muscle physiology; Block 6 covers the gastrointestinal system; Block 7 covers reproduction; and Block 9 covers the physiology of everyday life. Grading in the course will be based on performance on multiple choice/short essay examinations administered at the end of each block with each examination weighted according to the number of lectures contained in that block.

PHOL 482. Medical Physiology II. 6 Units.
Physiology is the dynamic study of life. It describes the vital functions of living organisms and their organs, cells, and molecules. For some, physiology is the function of the whole person. For many practicing clinicians, physiology is the function of an individual organ system. For others, physiology may focus on the cellular principles that are common to the function of all organs and tissues. Medical physiology deals with how the human body functions, which depends on how the individual organ systems function, which depends on how the component cells function, which in turn depends on the interactions among subcellular organelles and countless molecules. Thus, it requires an integrated understanding of events at the level of molecules, cells, and organs. Medical Physiology II is a lecture course (3, 2hr. lectures/week). It is the second of a two-part, comprehensive survey of physiology that is divided into five blocks: Block 5 covers the physiology of the urinary system; Block 6 covers the gastrointestinal system; Block 7 covers the endocrine system; Block 8 covers reproduction; and Block 9 covers the physiology of everyday life. Grading in the course will be based on performance on multiple choice/short essay examinations administered at the end of each block with each examination weighted according to the number of lectures contained in that block.

PHOL 483. Translational Physiology I. 2 Units.
Physiology is the dynamic study of life, describing the vital functions of living organisms and their organs, cells, and molecules. For some, physiology is the function of the whole person. For many practicing clinicians, physiology is the function of an individual organ system. For others, it focuses on the cellular principles that are common to the function of all organs and tissues. Medical physiology deals with how the human body functions, which depends on how the individual organ systems function, which depends on how the component cells function, which in turn depends on the interactions among subcellular organelles and countless molecules. Translational Physiology I will explore examples of how the latest basic research in physiology and biophysics is being applied to the treatment of human disease. For example, while the students are studying the basic principles of cardiovascular physiology, they will also be investigating how these principles are being applied to treat/cure human cardiovascular disorders such as congestive heart failure, coronary artery disease, high blood pressure, etc. Translational Physiology I is a lecture course (1, 2 hr lecture/week) taught primarily by clinical faculty. It is the first of a two-part course that follows the topics being simultaneously covered in the Medical Physiology I course. It is divided into four blocks: Block 1 covers the physiology of cells and molecules, signal transduction, basic electrophysiology, and muscle physiology; Block 2 covers the nervous system; Block 3 covers the cardiovascular system; and Block 4 covers the respiratory system. Grading in the course will be based on performance on multiple choice/short essay examinations administered at the end of each block with each examination weighted according to the number of lectures contained in that block.

PHOL 484. Translational Physiology II. 2 Units.
Physiology is the dynamic study of life, describing the vital functions of living organisms and their organs, cells, and molecules. For some, physiology is the function of the whole person. For many practicing clinicians, physiology is the function of an individual organ system. For others, it focuses on the cellular principles that are common to the function of all organs and tissues. Medical physiology deals with how the human body functions, which depends on how the individual organ systems function, which depends on how the component cells function, which in turn depends on the interactions among subcellular organelles and countless molecules. Translational Physiology II will explore examples of how the latest basic research in physiology and biophysics is being applied to the treatment of human disease. For example, while the students are studying the basic physiology of the urinary system, they will also be investigating how these principles are being applied to treat/cure human kidney disorders such as renal failure, high blood pressure, glomerular disease, polycystic kidney disease, etc. Translational Physiology II is a lecture course (1, 2hr lecture/week) taught primarily by clinical faculty. It is the first of a two-part course that follows the topics being simultaneously covered in the Medical Physiology II course. It is divided into five blocks: Block 5 covers the physiology of the urinary system; Block 6 covers the gastrointestinal system; Block 7 covers the endocrine system; Block 8 covers reproduction; and Block 9 covers the physiology of everyday life. Grading in the course will be based on performance on multiple choice/short essay examinations administered at the end of each block with each examination weighted according to the number of lectures contained in that block. Coreq: PHOL 482.
PHOL 498. Physiology and Biophysics Departmental Seminar. 1 Unit.
Weekly one-hour reviews by invited speakers of their research. Students present literature reviews or summaries of their research.

PHOL 505. Laboratory Research Rotation. 3 Units.
One-semester experience in a selected faculty research laboratory designed to introduce the student to all aspects of modern laboratory research including the design, execution and analysis of original experimental work. Recommended preparation: Consent of instructor and scheduled laboratory.

PHOL 512. Skeletal Biology. 3 Units.
This is an advanced graduate level course for students interested in the morphogenesis, structure, function, and maintenance of the skeletal system taught jointly by faculty from Case Western Reserve University (CWRU), Cleveland Clinic Foundation (CCF), and the Northeastern Ohio Universities College of Medicine (NEOUCOM). It will meet twice per week for 90 minutes per session. The format will include an overview of the topic by the responsible faculty, followed by a discussion of important papers on the topic. The students will be expected to discuss the papers for each session and grading will be based on those discussions. The intent of the course is to enable students to understand the important problems in skeletal biology and both classical and modern approaches for solving them.

PHOL 513. Structural Journal Club. 1 Unit.
Current topics of interest in structural biology, and protein biophysics. Offered as PHOL 513 and PHRM 513.

PHOL 514. Cardiovascular Physiology. 3 Units.
The goal of this course is to provide the student with a solid foundation in cardiovascular physiology and pathophysiology. The course will begin by providing a solid foundation in the structure, phenotype and function of cardiac and vascular muscle. In addition, electrophysiology and metabolism will be addressed. Both basic physiology and more advanced topics, such as pathophysiology, will be covered using a journal club format. (Twice weekly; 1.5hrs/class.) Student participation is required.

PHOL 519. Cardio-Respiratory Physiology. 3 Units.
This course is designed to integrate systemic, cellular and molecular aspects of cardio-respiratory systems in physiological and pathophysiological states. The course requires prior knowledge of basic physiology of the cardiovascular systems. Extensive student participation is required. Instructors provide a brief overview of the topic followed by presentation and critical appraisal of recent scientific literature by students.

PHOL 522. Special Topics in Cardiac Electrophysiology. 3 Units.
Introduction to current topics in cellular cardiac electrophysiology and cardiac ion channel structure, function, and regulation. The format includes informal lectures as well as student presentations and class discussion of current literature.

PHOL 530. Technology in Physiological Sciences. 3 Units.
This lecture/discussion/journal course focuses on techniques in the physiological sciences. Topics include spectroscopy, microscopy, and electrophysiology. The theory and practice are covered with an emphasis on examples taken from the scientific literature.

PHOL 537. Microscopy-Principles and Applications. 3 Units.
This course provides an introduction to various types of light microscopy, digital and video imaging techniques, and their applications to biological and biomedical sciences via lectures and hands-on experience. Topics covered include geometrical and physical optics; brightfield, darkfield, phase contrast, DIC, fluorescence and confocal microscopes; and digital image processing. Offered as GENE 537, MBIO 537, and PHOL 537.

PHOL 601. Research. 1 - 18 Unit.
Cellular physiology laboratory research activities that are based on faculty and student interests.

PHOL 610. Oxygen and Physiological Function. 3 Units.
Lecture/discussion course which explores the significance and consequences of oxygen and oxygen metabolism in living organisms. Topics to be covered include oxygen transport by blood tissues, oxygen toxicity, and mitochondrial metabolism. Emphasis will be placed on mammalian physiology with special reference to brain oxidative metabolism and blood flow as well as whole body energy expenditure and oxidative stress related to disease. Offered as ANAT 610 and PHOL 610.

PHOL 651. Thesis M.S.. 1 - 18 Unit.

Prereq: Predoctoral research consent or advanced to Ph.D. candidacy milestone.
Doctor of Medicine (MD)

Programs Leading to MD

Today, applicants can choose from three paths to obtain a medical degree at Case Western Reserve University: the University Track, the College Track (Cleveland Clinic Lerner College of Medicine of Case Western Reserve University), and the Medical Scientist Training Program (p. 793). Students in all three programs:

- are introduced to clinical work and patients almost as soon as they arrive on campus.
- learn medicine using an integrated, organ system-based approach.
- are treated as junior colleagues by faculty members.
- are taught the science of medicine infused with the skills of communication and compassion.
- learn how to learn, a skill they will call on throughout their careers in the quickly changing field of medicine.

Educational Authority

Governance of the educational programs leading to the medical degree resides in the Faculty of Medicine. Each class of students selects representatives who become voting members of the Faculty of Medicine. The faculty of the School of Medicine is responsible for the content, implementation and evaluation of the curriculum. The dean of the School of Medicine serves as its chief academic officer with overall responsibility to the university for the entire academic program. The vice dean for education and academic affairs carries the dean’s academic and administrative authority and has direct supervisory responsibility over the units that lead and support the curriculum.

The faculty’s Committee on Medical Education (CME) evaluates, reviews and makes recommendations concerning overall goals and policies of the School’s medical education program which includes the University and College tracks. Acting for the faculty, the Committee on Medical Education is responsible for 1) the formal approval and adoption of the School’s educational program objectives and ongoing monitoring to ensure that the objectives serve as guides for establishing curriculum and provide the basis for evaluating program effectiveness; 2) the review class cohort performance in each track’s competencies; and 3) the evaluation of the overall content and appropriateness of the educational program and curriculum leading to the MD degree. The faculty elects the majority of the members of the Committee on Medical Education; student representatives also serve on this committee and its curriculum councils.

The operational responsibility for the medical curriculum is invested in curriculum councils that report to the Committee on Medical Education. There are five Curriculum Councils: (a) the Curriculum Monitoring Council (University track), (b) the Medical Science Education Council (University track), (c) the Clinical Curriculum Council (University track), (d) the Curriculum Steering Council (College track), and (e) the Joint Clinical Oversight Group. These councils are responsible for the strategic planning, content, design, selection of teaching leadership, and oversight of the curriculum, student assessment and program evaluation.

Expectations for Personal and Professional Characteristics

Students are evaluated on knowledge base, clinical skills and professional behavior and attitudes. The following characteristics are evaluated throughout the medical curriculum, and students are expected to adhere to these standards in both their academic and personal pursuits:

Interpersonal relationships: Provides supportive, educational and empathetic interactions with patients and families, and is able to interact effectively with “difficult” patients. Demonstrates respect for and complements roles of other professionals, and is cooperative, easy to work with; commanding respect of the health care team.

Initiative: Independently identifies tasks to be performed and makes sure that tasks are completed. Performs duties promptly and efficiently, and is willing to spend additional time, assume new responsibilities, and able to recognize the need for help and ask for guidance when appropriate.

Dependability: Completes tasks promptly and well. Present on time and actively participates in clinical and didactic activities. Always follows through and is exceptionally reliable.


Integrity and honesty: Demonstrates integrity. Is honest in professional encounters. Adheres to professional ethical standards.

Tolerance: Demonstrates exceptional ability to accept people and situations. Acknowledges her or his biases and does not allow them to affect patient care.

Function under stress: Consistently maintains professional composure and exhibits good clinical judgment in stressful situations.

Appearance: Always displays an appropriate professional appearance.

Graduation

A medical student who has satisfactorily met the standards and achievement levels for the core competencies of the medical school track in which he or she is enrolled may be granted the degree of doctor of medicine (MD) by Case Western Reserve University, provided that:

1. He or she has been registered at Case Western Reserve University School of Medicine for at least four academic years, (five years for the College track) or has transferred to the University Track after two years at another accredited medical school.

2. The Committee on Students for the University Track or the Medical Student Promotions and Review Committee for the College Track approves his or her record of performance, and the faculty recommends him or her to the trustees for graduation.

3. He or she has discharged all financial obligations to the university and to the track in which he or she is enrolled.

4. He or she has taken the U.S. Medical Licensing Examination (USMLE) Steps 1 and 2 and the USMLE Step 2 Clinical Skills Examination, and has obtained a minimum passing score on the examinations as determined by the USMLE Composite Committee. There are other academic requirements that must be met which are delineated in another section. The requirements for graduation of any class may be altered by action of the faculty of the School of Medicine.

Licensure

Licensure to practice medicine in the United States and its territories is a privilege granted by the individual licensing boards of the states and territories. Each licensing board of the individual jurisdictions establishes its policies, eligibility and requirements for the practice of medicine within its boundaries pursuant to statutory and regulatory provisions. The degree of doctor of medicine awarded by Case Western Reserve University is an academic degree and does not provide a legal basis for the practice of medicine.
The Electronic Curriculum

The School of Medicine has developed an integrated electronic curriculum for all years of the medical curriculum that contains a list of learning objectives as well as the resources that allow the students to achieve the objectives. These resources include references to traditional textbooks and journal articles, original textual material, PowerPoint files, illustrations, animations, videos, audio files, and links to Internet-based learning resources (including original journal articles in electronic format). These resources are made available on the Internet by an NT/Internet server system.

University track students have access to the Internet and the electronic curriculum from their assigned personal desks via fiber optic Ethernet connection to CWRUnet and via wireless access when away from their desks. College track students have access to the Internet and the College track curriculum via wireless access at the Cleveland Clinic.

Medical Student Organizations

The list of organizations and activities available to medical students continually evolves to reflect the interests of current students. Visit here for the most up-to-date list of student organizations. (http://casemed.case.edu/csr/organizations.html)

Admission

There are three paths to a medical degree at Case Western Reserve University School of Medicine: the University Track, the Cleveland Clinic Lerner College of Medicine of Case Western Reserve University (College Track), and the Medical Scientist Training Program (MSTP). Inquiries about admission and application should be addressed to the appropriate office:

Office of Admissions-University Track
School of Medicine
10900 Euclid Avenue
Cleveland, Ohio 44106-4920
Phone: 216.368.3450 or casemed-admissions@case.edu

Office for Admissions and Student Affairs-College Track
Cleveland Clinic Lerner College of Medicine of Case Western Reserve University
9500 Euclid Avenue NA21
Cleveland, Ohio 44195
Phone: 216.445.7170 or 866.735.1912 or cclcm@ccf.org (http://bulletin.case.edu/schoolofmedicine/md/mailto://cclcm@ccf.org)

Medical Scientist Training Program
School of Medicine
Case Western Reserve University
10900 Euclid Avenue
Cleveland, Ohio 44106-4936
Phone: 216.368.3404 or mstp@case.edu

Getting Started

Students wishing to apply to any MD program at the School of Medicine must initiate the process on the internet through the American Medical Colleges Application Service (AMCAS). Visit AMCAS (https://www.aamc.org/students/applying/amcas) to learn more about the medical school application process.

Admissions Process

After the American Medical College Application Service (https://www.aamc.org/students/applying/amcas) (AMCAS) receives an applicant’s electronic application, he or she receives an e-mail directing him or her to the CWRU School of Medicine online secondary (final) application where the applicant can designate to which MD track(s) they wish to apply. Applicants can apply to both MD tracks and/or the MSTP track. It is possible for an applicant to be interviewed by and receive an admission offer from both the University track and the College track.

Applicants should complete this secondary application as instructed. After the applicant has submitted the secondary application and all supporting materials, the appropriate admissions committee will review the information and decide whether to invite the applicant for an interview. After the interview, the committee will decide whether to extend an offer of admission. Applicants are notified of the committee’s decision no later than May 1.

Admissions Criteria

Although academic credentials are important in the admissions process, high grades and a high score on the MCAT are not the only criteria for admission. Just as important are interpersonal skills, exposure to medicine, well-roundedness and qualities such as professionalism, empathy and leadership ability. The School of Medicine includes a widely diverse student body.

Academic Requirements

In order to understand modern biomedical information, you must have a solid foundation in the basic sciences. At a minimum, the potential applicant should engage in the following coursework:

- **Biology** - Students ordinarily satisfy this requirement if they’ve taken a one-year biology course, including lab, that stresses molecular and quantitative concepts. Courses in taxonomy, botany and ecology will not satisfy this requirement.
- **General/Inorganic and Organic Chemistry** - Students normally meet this requirement if they’ve completed a one-year course in basic chemistry with lab and a one-year course in organic chemistry with lab.
- **Basic Physics** - Students generally satisfy this requirement if they’ve taken a one-year course in physics with lab.
- **Writing skills** - Students typically meet this requirement if they’ve taken one semester of an introductory course in expository writing. The committee will consider other courses that required extensive writing, however.
- **Biochemistry** - A course in biochemistry is required of all students applying to the Cleveland Clinic Lerner College of Medicine Program. It is not required (although highly recommended) for those applying to the University Track and MSTP.
- **Calculus** - One year of college Calculus is required for students applying to the Medical Scientist Training Program.

If these pre-requisites were not fulfilled at an accredited, four-year, degree-granting American or Canadian college or university, the applicant should be prepared to take at least 1 year of challenging, upper-level sciences at one of these institutions prior to application.

If all science pre-requisites were taken at a community college, the committee strongly recommends that the applicant take at least of year of upper-level sciences from an accredited four-year degree granting university within the United States or Canada. If a few science pre-
requisite courses were taken at a community college, the committee will evaluate them on a case-by-case basis.

**AP credits** are acceptable for physics and general chemistry. They are **not acceptable** for organic chemistry or biology. If a student does have AP biology credits, they must complete two upper level biology courses to satisfy the premedical requirements.

As an undergraduate, students should pursue a major in a subject of their own choosing; they should not structure their undergraduate experiences in an attempt to sway the medical school admissions committee. Most applicants to medical school, however, are chemistry or biological science majors.

**Financial Aid**

About 70 percent of the University Track’s medical students receive some financial aid based strictly on financial need. It’s impossible to provide precise figures on financial aid before each specific situation is completely analyzed, but here is a description of the general aspects of the process:

The School of Medicine adheres to the unit loan concept used by most private medical schools. Under this concept, if a student qualifies for financial aid, he or she is expected to obtain a specific portion of his or her support from outside sources such as a Federal Direct Loan, savings and family. Once the student obtains this amount, the remaining aid would be provided through School of Medicine resources, up to the amount determined to be his or her reasonable need. The school’s contribution would be a combination of loan and scholarship, with the exact ratio determined by the student’s particular circumstances.

All students within the College Track receive full scholarship covering tuition and fees. Programs such as the Medical Scientist Training Program, the MD/PhD in health services research program, and others offer financial support for participants. For more information, see other entries in this publication and contact the specific program.

Also, the University Track offers a number of merit scholarships annually to each class though its Dean’s Scholars program and David Satcher, MD, PhD-Rubens Pamies, MD Minority Student Scholarship program. These scholarships, which vary in annual amounts are awarded for up to four years for selected students. Application for the scholarships is by invitation of the admissions committee. Recipients are students with records of exceptional academic and personal achievement.

**To Those Currently in College**

The admissions committee give preference to candidates who will have completed the requirements for a bachelor of arts or bachelor of science degree before entering medical school. Most accepted candidates rank in the top one-third of their classes, and a large proportion of them have outstanding scholastic records.

The committee’s main considerations are the overall quality of college performance and general ability and potential. In most instances, applicants are given priority if they have completed all minimum academic requirements and have taken the MCAT by the time they submit their AMCAS applications. Although no special emphasis is placed on the applicant’s major / field of study, the committee strongly favors the concept of a broad, general college education.

Students who have been out of college a year or more:

Those who have been out of college for a year or more are encouraged to apply. Approximately half of the students at the School of Medicine have a year or more between the time they graduate from college and the time they enter medical school, and about 10 percent of them begin medical school when they are 30 years old or older.

Those two or more years removed from full-time college course work should plan to take challenging, advanced-level (junior-, senior- or graduate-level) courses in the biological sciences to prepare for entry.

**Overview of the University Track**

The University Track curriculum always has reflected the most current educational principles, practices, and knowledge. In the 1950s the School of Medicine was the first to introduce the organ systems approach to teaching the basic sciences. In July 2006, the University Track launched the Western Reserve2 Curriculum (WR2) to develop a learner-centered and self-directed curriculum framework and implement dynamic small group learning teams. Students learn in an environment that fosters scientific inquiry and excitement. The School prepares students for the ongoing practice of evidence-based medicine in the rapidly changing healthcare environment of the 21st century.

The WR2 Curriculum has high expectations for self-directed learning, and seeks to train physician scholars who are prepared to treat disease, promote health and examine the social and behavioral context of illness. It interweaves four themes - 1) research and scholarship, 2) clinical mastery, 3) teamwork and leadership, and 4) civic professionalism and health advocacy to prepare students for the ongoing practice of evidence-based medicine in the rapidly changing healthcare environment of the 21st century.

Scholarship and clinical relevance are the benchmarks for learning, and clinical experiences and biomedical and population sciences education are integrated across the four years of the curriculum. The WR2 Curriculum also creates an independent, educational environment where learning is self-directed and where student education primarily occurs through:

1. facilitated, small-group student-centered discussions
2. large group interactive sessions such as Team-Based Learning or didactic sessions that offer a framework or synthesis
3. interactive anatomy sessions
4. clinical skills training
5. patient-based activities

Clinical experiences begin in the first week of the University Track when students participate in community-based health care field experiences. In the second month of medical school, students begin the Rotating Apprenticeship in Medicine Program (RAMP). This program involves students in several patient care settings. In January of the first year, the Community Patient Care Preceptorship (CPCP) rotations begin. Each student works with a community physician one afternoon a week for 3 months.

Research and Scholarship begin early in the curriculum with special sessions led by faculty engaged in cutting edge research. In the summer following year one, the majority of students engage in summer research opportunities. All students participate in a mentored 16-week experience in research and scholarship and complete an MD thesis prior to graduation.

Electronic resources make the most of classroom time while improving opportunities for self-directed learning and capitalizing on the innovative technology available at Case Western Reserve University.
A key component of the University Track is the unscheduled time on Thursday mornings and weekday afternoons. Students use this time for self-directed learning as well as to pursue a joint degree, take electives, participate in interest groups, shadow a practicing physician, or become active in student organizations.

Each student in the University Track is a member of one of the following advising societies: Emily Blackwell Society, Frederick Robbins Society, David Satcher Society, or Joseph Wearn Society. Each society is headed by an advising dean, who helps the students navigate the curriculum, advises them on residency and career planning, and writes their dean’s letters. The society deans hold regularly scheduled small group and individual meetings with the students. The society deans are all members of the faculty of the School of Medicine and participate actively in the educational programs of the school. Some aspects of the curriculum are coordinated through the societies.

The University Track in Detail
The Western Reserve2 Curriculum (WR2) has high expectations for self-directed learning, and seeks to train physician scholars who are prepared to treat disease, promote health and examine the social and behavioral context of illness. It interweaves four themes of research and scholarship, clinical mastery, teamwork and leadership, and civic professionalism and health advocacy, to prepare students for the ongoing practice of evidence-based medicine in the rapidly changing healthcare environment of the 21st century.

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1. facilitated, student-centered learning teams
2. large group interactive sessions such as Team-Based Learning or didactic sessions that offer a framework or synthesis of a concept area
3. interactive anatomy sessions
4. clinical skills training
5. patient-based activities

Education throughout the Four Years Is Centered on:

1. Fostering experiential and interactive learning in a clinical context;
2. Stimulating educational spiraling by revisiting concepts in progressively more meaningful depth and increasingly sophisticated contexts;
3. Promoting integration of the biomedical and population sciences with clinical experience;
4. Transferring concepts and principles learned in one context to other contexts;
5. Enhancing learning through deliberate practice, or providing learners with direct observation, feedback, and the opportunity to practice in both the clinical environment and in the CWRU School of Medicine’s Mt. Sinai Skills and Simulation Center.

The Western Reserve2 Curriculum has 10 Guiding Principles:

1. The core concepts of health and disease prevention are fully integrated into the curriculum.
2. Medical education is experiential and emphasizes the skills for scholarship, critical thinking, and lifelong learning.
3. Educational methods stimulate an active interchange of ideas among students and faculty.
4. Students and faculty are mutually respectful partners in learning.
5. Students are immersed in a graduate school educational environment characterized by flexibility and high expectations for independent study and self-directed learning.
6. Learning is fostered by weaving the scientific foundations of medicine and health with clinical experiences throughout the curriculum. These scientific foundations include basic science, clinical science, population-based science, and social and behavioral sciences.
7. Every student has an in-depth mentored experience in research and scholarship.
8. Recognizing the obligations of physicians to society, the central themes of public health, civic professionalism and teamwork & leadership are woven through the curriculum.
9. The systems issues of patient safety, quality medical care, and health care delivery are emphasized and integrated throughout the curriculum.
10. Students acquire a core set of competencies in the knowledge, mastery of clinical skills and attitudes that are pre-requisite to graduate medical education. These competencies are defined, learned and assessed and serve as a mechanism of assessment of the school’s success.

Curricular Composition
The four years of the WR2 Curriculum are divided into four major components, each of which focuses on health as well as disease.

Foundations of Medicine and Health
This component is made up of six curricular blocks.

The first block, Becoming a Doctor, is five weeks in duration, and gives students an understanding of population health and the doctor’s role in society. Typically students begin their medical education by studying basic science at the molecular level, and are often not fully aware of the relevance that this knowledge has in their future education as physicians or how it relates to the actual practice of medicine. This curricular block focuses on how physicians can act as advocates for their patients in the health care system; how social and environmental factors impact health; and the importance of population health. Medical students participate in an Extensive Care Unit, an experiential, longitudinal, service learning project intended to introduce them to key population health concepts including epidemiology, biostatistics, community assessment, health risk behavior, and social-environmental determinants of health.

The next five blocks in the Foundations of Medicine and Health are comprised of basic science education complemented by clinical immersion experiences, early contact with patients in clinical preceptorships and simulated clinical experiences. Subject matter is integrated across entire biological systems, which permits faculty in the different disciplines to leverage teaching time to convey content and concepts common to their disciplines. Content is divided into the following blocks:

- **The Human Blueprint**: Comprised of endocrine, reproductive development, genetics, molecular biology, and cancer biology.
- **Food to Fuel**: Encompasses gastro-intestinal system, nutrition, energy, metabolism and biochemistry.
• **Homeostasis:** Includes cardiovascular system, pulmonary system, renal system, cell regulation, and pharmacology.

• **Host Defense and Host Response:** Focuses on host defense, microbiology, blood, skin, and the auto-immune system.

• **Cognition, Sensation and Movement:** Comprising of neurosciences, mind, and the musculoskeletal system.

Several themes stretch longitudinally across these blocks, including anatomy, histopathology and radiology, as well as clinical mastery. Teamwork, interprofessional collaboration and bioethics are likewise incorporated longitudinally.

Blocks 2-6 follow a common pattern. Each block has a Clinical Immersion Week and each has a Reflection and Integration Week. During the Clinical Immersion Week, students leave the classroom and enter the clinical setting to see the relevance of the basic science they have been studying as the concepts are used in the setting of patient care.

The Reflection and Integration week is the final week of blocks 2-6. During this week, no new material is introduced. Learning activities are planned to help students spiral back to concepts introduced earlier in the block by presenting these concepts again, sometimes in new contexts, and now integrated with other concepts previously learned. End of block assessment takes place during the reflection and integration week.

**Research and Scholarship**

The WR2 Curriculum is in concert with CWRU’s emphasis on research and scholarship to encourage student career development in the areas of clinical investigation and population research. The practice of medicine is becoming increasingly evidence and science-based, and research teaches students a way of framing questions and developing an approach to answering them. The focus on research and scholarship provides students with opportunities to pursue individualized areas of interest in great depth. Through this 16-week, mentored experience in research and scholarship (which can be taken at any point from March of the second year onward), students acquire the intellectual tools needed to formulate research questions, critically assess scientific literature and continue the life-long pursuit of learning that is a critical aspect in the careers of all physicians and physician/scientists. The research project culminates in a thesis, which is written in the format of a manuscript of the leading journal in the particular area of interest.

**Clinical Experiences**

The clinical curriculum cuts across all four years of the medical school curriculum, and can be divided into three areas of involvement:

1. **Foundations of Clinical Medicine:** This segment of the clinical curriculum runs longitudinally through the Foundations of Medicine and Health and seeks to develop a broad range of clinical and professional capabilities. FCM develops the necessary skill sets through 4 separate, but integrated, programs:

   • **Tuesday Seminars:** Course continues the theme of “doctoring” begun in Block 1 through the Year 1 and Year 2 curriculum. Topics examined include the relationship between the physician and the patient, the family and the community; professionalism; healthcare disparities; cultural competence, quality improvement; law and medicine; medical error/patient safety, development of mindful practitioners and end of life issues.

   • **Communications in Medicine:** Course is comprised of seven workshops running through Year 1 and Year 2 that focus on the range of skills needed for effectively talking with patients including the basic medical interview, educating patients about a disease, counseling patients for health behavior change, and presenting difficult news and diagnosis.

   • **Physical Diagnosis:** Course runs throughout Year 1 and Year 2 and includes: Physical Diagnosis 1 introducing the basic adult exam to Year 1 students for one session per week for eight weeks, Physical Diagnosis 2 in depth regional exams in various formats during Year 1 and Year 2, and Physical Diagnosis 3 in Year 2 where students spend five session doing complete histories, physicals and write ups on patients they see in an in-patient setting.

   • **Patient-based Programs:** RAMP: Rotating Apprenticeships in Medical Practice is a Year 1 course where students rotate through patient care encounters in multiple settings. This course is designed to expose students to various clinical settings to enhance observational and reflection skills in the context of the doctor/patient relationship and the role of physicians in society. CPCP: Community Patient Care Preceptorship during either Year 1 or Year 2 students spend 11 afternoons in a community physician’s office developing and reinforcing medical interviewing, physical exam and presentation skills (written and oral) with ongoing mentorship from a preceptor and an innovative online curriculum.

2. **Core Clinical Rotations:**

The Core Clinical Rotations are designed to provide students from both the University and College tracks of the Medical School with both breadth and depth in clinical care. Experiences are developmental, with opportunities to reinforce, build upon, and transfer knowledge and skills from all parts of the curriculum. Clinical learning is integrated across disciplines whenever possible through a unique block structure, and important themes related to scholarship, humanism, and science are supported through specially designed weekly small group programs. A unified approach to addressing and assessing a core clinical curriculum is utilized at all teaching sites with the flexibility to take advantage of the unique strengths of each clinical setting.

   • **Core Rotations:** Beginning in March of their second year, students have the opportunity to begin their core clinical rotations. These rotations are organized in blocks of that integrate core specialties in at one site for 8 or 12 weeks. Core 1 combines Internal Medicine, Family Medicine, and Geriatrics for 12 weeks, Core II combines Pediatrics and OB/Gyn for 12 weeks, Core 3 combines Neuroscience and Psychiatry for 8 weeks, and Core 4 combines Surgery and Emergent Care for 8 weeks. Each of these clinical rotations is offered at all of the School of Medicine’s hospital affiliates (including University Hospitals of Cleveland, the Cleveland Clinic Foundation, MetroHealth Medical Center and the Louis Stokes VA Medical Center), and the Basic Core 2 rotation is also offered as a longitudinal integrated clerkship at Kaiser Permanente.

3. **Advanced Clinical and Scientific Studies**

Advanced clinical and scientific studies provide students with flexible learning opportunities that support ongoing professional development and residency preparation and planning:

   • Two Acting Internships are required: one in Internal Medicine, Surgery, Pediatrics, or Inpatient Family Medicine, and one in a area of student choice.

   • One Acting Internship and all electives can potentially be done outside of the CWRU system.
• Students are encouraged to augment their interest in scholarship through rotations and activities that focus on sciences basic to medicine as well as clinical rotations.

Evaluation and Assessment

Student assessment in the WR2 Curriculum is designed to accomplish three goals:

1. drive the types of conceptual learning and scientific inquiry that are goals for the WR2 Curriculum
2. assess whether students have attained the level of mastery set for each phase of the curriculum
3. prepare students for medical licensure

These three goals are accomplished through multiple assessment methods.

Independent study and inquiry are hallmarks of WR2 through assessment strategies that are formative, focus on the synthesis of concepts, and promote student responsibility for the mastery of skills and material. The following assessments are used in Foundations of Medicine and Health:

1. Assessment of students’ participation in weekly Case Inquiry (IQ) groups by faculty facilitators, utilizing observable behavior anchors and focusing on contributions to teamwork and content, critical appraisal skills, and professional behaviors.
2. Synthesis Essay Questions (SEQs). Weekly, formative, open book concept reasoning exercises in which students are given a brief written clinical scenario and asked to explain a clinical phenomenon and its basic science underpinnings. Throughout a teaching block, students complete SEQs at the end of each week. They compare their own answers to an ‘ideal’ answer and receive feedback from their IQ group facilitator.
3. Summative Synthesis Essay Questions (SSEQs), or exercises that measure what students know at specific points in their education, are closed book exercises with approximately 5 clinical vignettes that take an estimated 3-4 hours to complete. These SSEQs are based on the synthesis essays students have been assigned throughout the block. In the final week of the block SSEQs present concepts from previous exercises in new contexts and require concept integration. These summative exercises are scheduled at the end of each large teaching module (every 3-4 months) and are graded by faculty.
4. Structure Practical Exercises. These assessments occur in the final week of blocks 2-6 and assess anatomy, histo-pathology and radiology through clinical scenarios and questions that require anatomic localization and histo-pathologic identification.
5. Self-Assessment Multiple Choice Questions (MCOs). Throughout each 12 week teaching block students are required to complete MCOs. These are drawn from the School of Medicine’s extensive bank of questions which are mapped to learning objectives for the block. Students use these MCOs throughout the block as a study aid and method of self-assessment.
6. Cumulative Achievement Tests (CAT). At the end of each block, students complete a secure formative MCO achievement test, based on content covered in the current teaching block as well as on content from each previous block. These exams are designed utilizing test question resources available through the National Board of Medical Examiners (NBME). Tests will become progressively longer throughout the Foundations of Medicine and Health. The final CAT reflects material across all curriculum blocks. These formative tests enable students to gain perspectives on their overall progress and preparedness for the USMLE Step 1.
7. Student progress in Foundations of Clinical Mastery is measured by small group facilitator assessment in the Seminars of Clinical Practice, direct observation of skills, preceptor evaluation of patient-based activities, and OSCE examinations.
8. Personal Learning Plan. During the Block, students review learning objectives and reflect on their learning, identifying their strengths and areas for further study. A reflective essay is completed that links to pieces of evidence, accumulated throughout the block, to support areas of strength and areas for further growth that have been identified. Students, working with their Society Deans develop a plan for further learning.

The WR2 Curriculum provides students with a focused education that is faculty directed and student centered. Classroom hours are limited. The content of WR2, organized across biological systems, provides students with an integrated view of medicine and health and an understanding of how the basic sciences and clinical practice relate to one another. The flexibility of WR2 permits students to explore in depth an area of interest to them alongside a mentor. The curriculum places great emphasis on the social and behavioral context of health and disease as well as on population medicine which will prepare students to face the emerging challenges of today’s health care system.

Assessment for Promotion and Graduation

The faculty of the School of Medicine is charged with assessing student performance, including knowledge, skills and personal characteristics that are important qualities of a responsible, competent and humane physician. This responsibility is delegated by the faculty to the Committee on Students, a standing committee of the faculty of medicine, with a majority of its members faculty-elected.

The Committee on Students reviews the performance of every medical student in the University Track during each of the four years, determines each student’s continuing status as a student in the school, and recommends candidates for graduation. The committee reviews a medical student’s total performance, which includes the usual indices such as formal grades and assessments, as well as the professional attitudes and behavior manifested by the student. Medical education entails the mastery of didactic, theoretical, and technical matters as well as the demonstration of appropriate professional and interpersonal behavior, sensitivity, sense of responsibility and ethics, and the ability to comport oneself suitably with patients, colleagues and co-workers. To be eligible for promotion and graduation, students must complete the requirements and perform satisfactorily in all components of the curriculum. Medical students in the University Track are graded “satisfactory” or “identified for remediation” in the first two years and as “honors,” “commendable,” “satisfactory,” “unsatisfactory,” or “incomplete” in the clerkships of the third and fourth years. There is no class ranking. Medical students must obtain a passing score on the United States Medical Licensing Examination (USMLE) Step 1, Step 2 Clinical Knowledge (CK) and Step 2 Clinical Skills(CS) to be eligible for graduation.

Overview of the College Track

The Cleveland Clinic Lerner College of Medicine (CCLCM) is a distinct 5-year track within the School of Medicine. In 2002, Cleveland Clinic and CWRU formed a historic partnership to collaborate in education and research through creation of the CCLCM. As stated in the affiliation
agreement between the two institutions, “the principal purpose and educational mission of the College shall be to attract and educate, in specially designed programs, a limited number of highly qualified persons who seek to become physician investigators and scientists who will advance biomedical research and practice.” To achieve this mission, the CCLCM selects students with a desire to pursue careers as physicians and researchers, educates them to be excellent doctors, nurtures their curiosity about science and medicine, provides them with substantive research experience and core research skills, and offers financial support to ensure that excess debt does not preclude their ability to follow careers in research and medicine.

The College Track in Detail

Training the Physician Investigators of Tomorrow: A Synopsis of the Program

Recognizing the critical shortage of physicians engaged in research, the College Track offers an educational program that provides medical students with the necessary skills and knowledge to enter academic residencies and pursue successful careers as basic, translational or clinical investigators and expert doctors – without requiring them to complete an advanced degree in addition to the MD. Graduates are expected to be scientifically inquisitive, to be life-long learners, to be independent thinkers with excellent teamwork skills, to have broad-based research knowledge as well as strong clinical acumen, and to be reflective practitioners of medicine and science who take a critical approach to self-assessment and self-improvement. All three components of the curriculum – basic science, clinical and research – in addition to the advising and assessment processes have been created to support the development of these attributes in our medical students.

The basic science curriculum applies adult learning principles, building on problem-based learning (PBL) to create an early link between clinical problems and basic science learning and to help students develop their skills in hypothesis generation, critical thinking, self-identification of learning objectives, oral presentation and teamwork. Almost all faculty-student contact time involves some form of active learning – graduate school-style seminars and problem sets rather than lectures, case-based anatomy sessions using prostheses and cross-sectional images rather than full cadaver dissections, interactive lab sessions rather than demonstrations, and journal clubs. To support this educational model, curriculum schedules provide extensive time for independent study. The basic science curriculum is organ-system based, with the disciplines of anatomy/embryology, biostatistics/epidemiology, cell biology, histology, imaging, immunology, pathology, pharmacology, physiology, infectious disease, oncology, genetics, evidence based medicine, bioinformatics and ethics designated as curricular threads woven through every organ-based basic science course and extending into the year 3-5 clinical curriculum. Learning objectives for the thread disciplines are used to determine the organ system curriculum structure in the first two years, with the goal of providing a logical, coherent two-year curriculum in each of these topics basic to medicine. Courses in Year 1 focus on normal human structure and function; in Year 2, courses focus on pathophysiology of disease. Later, in Years 3 through 5, students revisit advanced basic science concepts in their core clinical rotations, clinical electives, and College track specific pullout sessions.

The clinical curriculum begins in the fall of the first year contiguous with the first basic science course in Year 1. At its foundation is a continuity teaching and learning experience with a primary care preceptor and his/her patients throughout the first two years. Students spend one half-day every other week in Year 1 and one half-day every week in Year 2 with the same preceptor. During Year 1, students learn core clinical skills in doctor-patient communications and physical diagnosis in sessions linked whenever possible to the basic science courses (e.g., learning the cardiac and lung exams during the Cardiovascular and Respiratory Sciences course and the basic neurological exam during the Neural and Behavioral Sciences course) and then practice those skills with real patients in their preceptors’ offices on alternate weeks. Once they have mastered the basics of the history and physical, they begin to apply their skills to more complete evaluations of ambulatory patients with direct observation and feedback from their preceptors. By the end of Year 2, students are capable of performing a complete history and physical and confidently evaluating adults with common outpatient problems.

In Year 2, students spend a second half-day each week in sessions focused on building advanced clinical skills or clinical activities designed to complement concomitant basic science systems topics (e.g., a session in the Diabetes Clinic during the week devoted to learning about Diabetes). The other key component of the clinical curriculum in Years 1 and 2 is the weekly Foundations of Clinical Medicine Seminar Series. This course focuses on principles of leadership and their application to medical practice, professionalism and ethics, health care systems, population medicine, and provides a setting for students to reflect on their experiences and observations of the health care system. In Years 3 through 5, students in CCLCM participate in the same core clinical experiences as students in CWRU’s University Track. Friday afternoon sessions in Years 3-5 bring CCLCM students together regardless of clinical location and focus on program-specific topics in research and human values.

During all five years there are close mentoring and advising relationships between students and faculty. To ensure this happens, at the beginning of medical school each student is assigned a physician advisor who serves as the student’s partner and guide in navigating and mastering the curriculum throughout all five years. In addition, during the first summer, each student is assigned to an experienced basic or translational research preceptor who integrates the student into all activities in his/her lab and provides guidance and feedback to the student in such areas as working effectively with the lab team, research design, data analysis, and oral and written presentations of research. During the second summer, each student develops a similar relationship with an experienced clinical researcher who includes the student as an active participant in one or more ongoing research projects. Students are exposed to a broad range of basic, translational and clinical researchers during the first two years – during the summer research blocks, during weekly research seminars (Advanced Research in Medicine series), at Deans’ Dinners where they discuss research careers with the speakers over dinner following a formal presentation of the speaker’s research, and in class during basic science and clinical courses. Students then select a research advisor for the master’s level research project on which they will spend 12 to 15 months during the last three years of medical school.

The College uses a unique approach to student assessment designed to enhance student learning and to promote self-directed learning. There are no grades for any course or rotation, and no class ranking. Instead, each student is expected to attain a defined level of achievement in each of 9 competencies. Seven of these defined competencies encompass the 6 core competencies defined for all US graduate medical education programs accredited by the ACGME (Accreditation Council for Graduate Medical Education) as well as research and personal development. Starting on the first day of medical school, students begin collecting evidence from faculty and peers of their progress in achieving the standards in each of the 9 competencies and reflecting on how the evidence demonstrates their development as doctors and researchers – the two interrelated professional roles for which they are preparing.
One of the principles of the College is that assessment drives learning – that a curriculum designed to foster self-directed learning and achievement of competencies is ineffective if assessment focuses on what the "teacher" said in class and factual recall. Therefore the College uses a student-centered, student-driven approach to assessment with strong support from the physician advisors who know the students well and guide them as they develop skills and self-confidence as self-directed learners.

Students gather a broad range of types of evidence over their five years of study and work as partners with their physician advisors to review the evidence and their reflections, to create individual learning plans to address areas of relative weakness, and to tailor the curriculum to build on their areas of particular strength. Evidence of achievement and reflections on progress in their professional development are collected in electronic Student Portfolios and used to document readiness for promotion and graduation from the program. By training students in accurate self-assessment and developing their reflective ability, we intend to send them out of medical school already skilled in the kind of independent, self-directed learning habits that will be required of them as residents and throughout the rest of their professional lives.

CCLCM’s Foundation: A Comprehensive Research Curriculum

The research curriculum begins on the first day of medical school with the basic and translational research block and extends throughout all five years of the College Track. Every student participates actively in a “bench” project in the first summer, prepares an oral presentation describing the project in the format used at most scientific meetings, and develops a mock research proposal that extends the summer research project to the next research question. In addition, students learn the basic principles of research design and data analysis, ethics of the use of animals in research, and critical appraisal and interpretation of the basic science research literature in a journal club. At the end of the summer students formally present their research project and findings to students and preceptors. Linked with the summer research curriculum is a core curriculum in basic biochemistry, cell biology, molecular biology and genetics.

The second summer is devoted to clinical research. Course work focuses on applied medical biostatistics, clinical epidemiology including appropriate design and analysis of various kinds of clinical research protocols, and ethical issues such as human subjects protection including a discussion of an Institutional Review Board (IRB) proposal with members of the IRB. Each student participates actively in an ongoing clinical research project and writes an original clinical research protocol to extend the summer research project to the next research question, prepares an oral presentation describing the proposed research protocol, and formally presents this proposal at the end of the summer.

During the remainder of Years 1 and 2, students participate in Advanced Research in Medicine (ARM), a weekly series of highly interactive research seminars linked to the content of the basic science courses. Molecular Medicine PhD students join to participate in ARM sessions. In Year 1 ARM 1 is designed to provide students opportunities for interaction with a wide range of successful investigators to help them understand the sequence of problem identification, exploring prior work in the area, hypothesis development, experimentation, successes and failures that lead to new research findings. ARM 1 also helps students appreciate the interaction between basic and clinical research – how basic science discoveries translate into changes in the clinical care of patients and how clinical observations or research findings result in new directions in basic science research. In ARM 2, the presentations are linked to the basic science content each week but are more focused on current research projects and development of well-constructed research questions and reinforcement of epidemiology and biostatistics principles learned in the Year 2 summer. The sessions take on the format of a formal research presentation at a scientific meeting. Several times during the year, the students are divided into small groups to develop research hypotheses and design research methods to evaluate the hypotheses.

Deans’ Dinners are held 2 times a year separately for the first and second year classes to provide students the opportunity to attend a formal research seminar by a distinguished physician investigator, followed by dinner and an informal question and answer period to learn how that investigator achieved success in his/her career. This is an opportunity to discuss different career options and pathways, the challenges of balancing research and clinical work, and approaches to balancing career and family or other interests. The goal is to provide role modeling as a supplement to the advising and mentoring systems in CCLCM, helping students gain an early understanding of the various approaches that can lead to successful careers in research for physicians.

By the end of Year 2, each student has experienced basic and clinical research first-hand, has met a large number of investigators with different research interests, has developed essential research skills, and is ready to choose an advisor to supervise and support his/her research project. A Thesis Committee made up of the research advisor and two or more additional faculty supervise and approve the student’s research proposal, progress, and final master’s level thesis that must be completed by February 15 of Year 5.

The last three years of the curriculum are specifically designed to provide flexibility to students in scheduling their research and clinical rotations. Working together, the student, research advisor and physician advisor tailor the curriculum to the student. Students complete their research projects in one 12- to 15-month block of time. Every student regardless of the overall schedule will continue to engage in clinical experiences at least one half-day per week during blocks devoted primarily to research – to ensure that students maintain clinical skills and contact with patients, develop a deeper appreciation of the connection between advances in biomedical research and patient care, and have the opportunity to reflect on their ongoing development as both physicians and researchers.

Throughout all five years of medical school, research topics are integrated with basic science and clinical content. Learning objectives for problem-based learning (PBL) cases in the basic science courses include identifying the latest advances in what is known about the basic science underlying a specific disease, with students encouraged by their facilitators to think about how they could go about finding the answer. Some of the core basic science concepts are learned from studying journal articles rather than textbooks, so students appreciate the research that led to current accepted basic science knowledge. Evidence-based practice is emphasized in the clinical curriculum and students are expected to identify clinical questions for which the evidence is lacking and think about ways to obtain it.

Curriculum Timeline: Years 1 and 2

Students begin Year 1 with a one week Orientation in which they are formally welcomed to the profession of medicine by the Deans and their physician advisors. The week includes individual meetings with the student’s summer research preceptor and physician advisor, an introduction to the unique assessment system and the Student Portfolio, and an introduction to the summer curriculum and its expectations. A White Coat Ceremony that commemorates the entry of all students in both the college and university tracks into the CWRU School of Medicine highlights the week.
The Basic and Translational Research Block occupies the first 10 weeks of Year 1 and includes a course reviewing core concepts in cell biology, molecular biology and biochemistry. Scheduled classes occur 4 days a week for 2 hours, with the remainder of each day devoted to independent study and hands-on experience in the lab of the student’s summer research preceptor. This block sets the stage for active learning in the rest of the curriculum. Throughout the core basic science course and all the basic science courses, each week has a conceptual “theme” within which more detailed learning objectives fall. All assignments and scheduled activities are designed to help students master the core concepts for the week. Mastery is defined as being able to explain the concepts and to apply them to new or different problems or situations, rather than simply “listing” all the factual details. Sessions for the core basic science course are held on Monday, Wednesday and Friday mornings and students are expected to study background material before class and self-assess their understanding of the readings. They then work together in class to solve complex problems related to what they have studied. Tuesday mornings are devoted to focused discussions and presentations related to the science topics discussed that week or introduce students to key concepts in areas such as genetics, oncology, and bioinformatics.

Students meet each Friday for a journal club aimed at enhancing skills in critically assessing the basic science research literature. Each week, two students present an article. The other students are expected to read the articles carefully and come prepared with questions. Each presenter works with a faculty facilitator to review the paper and presentation before journal club. Using feedback from faculty and other students on their presentations and on the questions they ask of others, students begin to hone their communication skills and develop confidence participating as speakers in this setting.

The primary focus of the Year 1 Basic and Translational Research Block is the summer research project. Students are assigned to a summer research preceptor with attention to individual preferences for specific research areas. They are expected to engage fully in all activities in the preceptor’s research group, such as special lab meetings or journal clubs, in addition to working on their defined project. At the end of week 2, they submit a draft plan for their summer research project and review it with their preceptor to set the expectations for the summer. During the summer students also develop a brief “mock” research proposal that extends their research project. At the end of week 5, they submit a draft outline of their brief research proposal. The final document is due in week 9. During week 10, students present their projects orally in the format used at many scientific meetings – a 10-minute presentation with audiovisuals followed by 5 minutes for questions. Thus, in addition to actually working on a “bench” project, students are guided by their preceptors in developing a number of other key skills. Students receive feedback from their preceptors, other members of the lab team, and peers on their contributions in the lab and their written and oral presentations.

At the end of the summer, students schedule their first formal meeting with their physician advisors to review the evidence in their Student Portfolios, to discuss their reflections on their development in their new professional roles, and to review their learning plans to address any specific weaknesses or gaps they have identified. They review feedback on their activities in small group and journal club, lab work, mock grant proposal, oral presentations and scientific writing. This evidence is provided by their summer preceptors, peers, and self-assessments of their mastery of the core basic science concepts. Just as the interactive learning in class sets the stage for research and the rest of the curriculum, the first summer sets the stage for student success in the unique assessment process used in College track.

Each week of the Year 1 and 2 basic science courses is organized around a theme that provides a focus of learning for the students and an opportunity to integrate when possible the basic science, clinical, and research curriculum components. For example, the theme of the last week of the Gastrointestinal System 1 course is “Liver, Gallbladder, and Pancreas”. The Problem-Based Learning (PBL) case focuses on a patient who takes an overdose of acetaminophen and alcohol and subsequently develops liver failure. Students learn normal liver function as they explore this case. (All PBL cases used in the curriculum are based on real cases at the Cleveland Clinic.) The case provides the frame work for the anatomy and other seminar sessions which focus on liver, gallbladder and pancreas anatomy, histology, drug elimination, and genetics. Friday Advanced Research in Medicine session is a meeting of the Liver Transplant Selection Committee attended by all the students where research, bioethics, and clinical care are integrated in the discussion of liver transplant applicants. During Years 1 and 2 the topics of the 3 Dean’s Dinners for each class are also coordinated with the basic science course and weekly theme.

The first basic science course in Year 1, Cardiovascular and Respiratory Sciences 1 (CRS1), is a 7-week course in which students learn basic concepts of the normal structure and function of these systems. There are 14 hours of scheduled curricular time each week in the basic science courses, including 6 hours devoted to PBL cases and 8 hours devoted to other activities such as labs, seminars, and problem sets.

Throughout Year 1, anatomy, imaging, and embryology are integrated into the basic science courses with information presented in two ways – self-directed learning modules that cover basic anatomical information (and are available online), and Case Directed Anatomy Sessions on Monday mornings for which students study clinical cases designed to introduce anatomical concepts and facts before coming to the lab. In the lab, students rotate among a number of stations using cadaver prosections to demonstrate anatomy relevant to the cases and radiological images such as 3-dimensional CT scans. For example, a case of a patient who has suffered a penetrating injury to the chest may be used to focus students on the anatomical structures that might be injured and their relationship to one another.

Histology is also integrated into the basic science courses, with students using a computer based virtual microscopy system rather than a mechanical microscope to look at slides. This allows students not only to scan slides but also to see slide annotations and related gross and radiographic images. Specific learning objectives for histology are included in PBL cases in addition to seminars devoted to histology. The goal is for students to understand the gross and histological structures of each organ system in relation to its function, rather than as isolated anatomical facts. For example, during the week in CRS1 devoted to the theme, “The Heart as a Pump,” students learn the structure and anatomical relationships of the 4 chambers of the heart and heart valves and the histological appearance of myocardial cells while they are studying the physiological concepts of preload, afterload and contractility.

In addition to Anatomy/Embryology, Imaging, and Histology, the other “threads” in Year 1 include cell biology, pharmacology, physiology, bioinformatics, evidence-based medicine, genetics, and ethics, building on the core concepts from the summer in specific relation to each organ system. In CRS1, students learn not only the molecular structures and functions of a- and b-receptors but also the pharmacology of endogenous and exogenous agonists and antagonists of these receptors as they
study myocardial contractility and physiological regulation of blood pressure. They learn the biochemical pathways involved in aerobic and anaerobic production of ATP as they study determinants of oxygen delivery to myocardial cells, concepts they will revisit and build upon during subsequent courses when they study skeletal muscle metabolism during exercise and the role of the liver in maintenance of normal blood glucose levels. They study physiology of the heart, lungs, red blood cells and plasma as an integrated system providing oxygen and removing carbon dioxide, supporting metabolic needs of the entire body. During each course, students return to the core concepts they mastered in previous courses, using those concepts as a framework for building their understanding of the human organism as a whole. The basic science curriculum continues with Gastrointestinal System (4.5 weeks), Endocrinology and Reproductive Biology (4 weeks), Renal Biology (3 weeks), Musculoskeletal Sciences (3 weeks), Neurological and Behavioral Sciences (5 weeks), and Hematology, Immunology and Microbiology (7 weeks). Each basic science course focuses on normal structure and function, relating back to previous courses and preparing students for concepts in future courses.

Starting in the fall of Year 1, the Basic and Translational Research Summer Block’s Friday journal clubs are replaced by Advanced Research in Medicine 1, a weekly series of research seminars in which students are exposed to a wide range of basic and clinical research topics in interactive discussions with accomplished investigators. Presentations are linked closely with the basic science curriculum in order to reinforce core basic science concepts, help students feel confident in questioning the investigators based on what they are learning at the time, and illustrate the process whereby new biomedical discoveries change clinical practice.

Foundations of Medicine (FM) begins at the same time as the first basic science course and continues throughout Years 1 and 2. The guiding principle is that early exposure to patients, with direct observation and feedback by experienced faculty physicians, is optimal for real time assessment and feedback of student clinical skills. FM has 3 interrelated components — clinical skills training, patient care experiences, and Foundation of Clinical Medicine Seminar Series. The FM Seminar Series is a two-year continuum addressing professionalism, ethics, leadership and its application to the care of patients and the practice of medicine, evidence-based medicine, health care systems and patient safety introduced to students primarily through the humanities.

Core clinical skills training occurs every other week from September through January and is coordinated with the organ systems under study. On alternate weeks, students practice the basic skills they just learned with standardized patients in the classroom by conducting histories and physical exams with real patients and writing chart notes on the previous week under the supervision of their longitudinal preceptors. Starting in February, students are exposed to special aspects of the history and physical for geriatric and pediatric patients, while continuing to work on basic skills every other week with their preceptors. They also begin to take on more patient care responsibility in preparation for their weekly clinics with the same preceptor in Year 2. An Objective Structured Clinical Examination (OSCE) with feedback from preceptors is used to help students chart their progress in mastering core skills.

Year 2 begins with the 9-week Clinical Research Block. Students work with a preceptor in an active clinical research environment on an ongoing project, continuing to develop their skills in building relationships with members of a research team. They also write a mock clinical research proposal that extends the research question on which the student is working during the summer. Scheduled coursework occupies 2 hours each weekday and includes a rigorous immersion in Biostatistics with students using statistical software to analyze real data sets and a Clinical Epidemiology course focusing on formulation of scientific questions, study design, clinical trials, and legal and ethical issues in research including human subjects’ protection. The coursework requires significant class preparation for students, thus students must balance their time and effort between the class work and research project in the Year 2 summer. Journal club sessions on Fridays focus on articles from the clinical research literature, with students using knowledge gained from Biostatistics and Epidemiology to help them analyze the papers.

Feedback from peers and faculty facilitators help students enhance their presentation skills and ability to critically read and present scientific papers. Students complete the second summer with a comprehensive range of clinical research skills and knowledge, complementing their basic research experience in the first summer and preparing them to engage in basic, translational or clinically oriented research for their thesis.

For the remainder of Year 2, students return to the same organ-system based basic science curriculum they studied in Year 1, this time focusing on learning the pathophysiology of common diseases. Immunology, Pathology, Oncology, Infectious Disease/Microbiology, and Biostatistics/Epidemiology are now integrated as threads throughout the Year 2 basic science curriculum. The first basic science course is Musculoskeletal Sciences (2 weeks), followed by Neurological and Behavioral Sciences (6 weeks), Endocrinology and Reproductive Biology (4.5 weeks), Cardiovascular and Respiratory Sciences (7 weeks), Hematology (4 weeks), Gastrointestinal System (4 weeks), and Renal Biology (4 weeks). Anatomy and embryology seminars are conducted less often during Year 2, usually 1-3 sessions per course. The clinical curriculum continues to be closely linked to the basic science courses. Students spend one half-day every week in their primary care longitudinal preceptor’s office. An additional clinical half-day is added and students see patients who demonstrate the pathophysiology being studied that week. Some of the additional half-days are devoted to learning advanced clinical skills (the gynecologic and urologic exams, evaluation of geriatric and pediatric patients with common problems) and an exposure near the end of Year 2 to the acute care setting helps to prepare students for Year 3. Foundations of Clinical Medicine Seminar Series begins in September of Year 1 and ends in April of Year 2. Students also participate in two OSCEs, one at the beginning of Year 2 to help students identify skills to address over the year and the second at the end of Year 2 to help students document their skills for their portfolio and to prepare for the USMLE Step 2 CS Examination. After classes end in mid-May, students have 6 weeks available to study for and take the USMLE Step 1 Examination. By the end of Year 2, students have engaged actively in both basic and clinical research, learned and practiced a wide range of research skills. They have extensive experience in self-directed learning both independently and in teams and have mastered core basic science concepts related to human health and disease. They are comfortable “doctoring” adult outpatients and competent in the complete history, physical examination, oral and written presentations, and basic clinical skills such as reading EKGs. Perhaps most important, they have learned to accurately assess their own strengths and weaknesses and create learning plans for themselves — preparing them to succeed in the next three years of the curriculum and a lifetime of professional practice.

Curriculum Timeline: Years 3 through 5

The clinical curriculum for the College Track is the same as the University Track. In all Core Clinical Rotations, students experience both breadth and depth in clinical care, and clinical experiences are developmental, with opportunities to reinforce, build upon, and transfer knowledge
and skills. Clinical learning is also integrated across disciplines whenever possible, and the roles of basic science, civic professionalism, scholarship, and population health in clinical care are evident throughout the clinical curriculum. Students likewise have patient care responsibilities that are progressive in sophistication and increasing in amount as their level of clinical skill and knowledge increases, and all core clinical competencies are addressed and assessed using common methods applied at the clinical sites at which rotations occur.

**Basic Core Rotations:** Beginning in July of their third year, students have the opportunity to begin their core clinical rotations. These rotations are organized in blocks of that integrate core specialties in at one site for 8 or 12 weeks. Basic Core 1 combines Internal Medicine, Family Medicine and Geriatrics for 12 weeks, Basic Core 2 combines Pediatrics and OB/Gyn for 12 weeks, Basic Core 3 combines Neuroscience and Psychiatry for 8 weeks, and Basic Core 4 combines Surgery and Undifferentiated Care for 8 weeks. Each of these clinical rotations is offered at all of the School of Medicine’s hospital affiliates (including University Hospitals of Cleveland, the Cleveland Clinic, MetroHealth Medical Center and the Louis Stokes VA Medical Center), and the Basic Core 2 rotation is also offered at a longitudinal integrated clerkship at Kaiser Permanente.

These Core Clinical Rotations, launched in July 2006 and modified in 2009 and 2012, represent an integrated approach to clinical education that is shared by students from both the University and College tracks of the Medical School. Students engage in clinical learning with basic science correlation through patient-based experiences that are developmental and provide opportunities to acquire, reinforce, build upon, and transfer knowledge and skills. In the Basic Cores, students are based at one of the five affiliated healthcare systems (UH/VA, MetroHealth, CC, and Kaiser for Basic Core 2 only) for an entire 8-12 week experience, facilitating meaningful educational relationships and support.

**Advanced Core Rotations:** In 2012, the topics covered in the Advanced Cores were incorporated into the Basic Cores.

**Advanced Clinical and Scientific Studies**

Advanced clinical and scientific studies provide students with flexible learning opportunities that support ongoing professional development and residency preparation and planning:

- Two Acting Internships are required: one in Internal Medicine, Surgery, Pediatrics, or Inpatient Family Medicine, and one in an area of student choice.
- One Acting Internship and all electives can potentially be done outside of the CWRU system.
- Students are encouraged to augment their interest in scholarship through rotations and activities that focus on sciences basic to medicine as well as clinical rotations.

The last three years are purposely designed as a flexible continuum of core clinical rotations, clinical and other electives, and research – to allow each student to individualize the curriculum to address his/her own career goals, learning needs and research interests. Each student plans the last three years with the advice of his/her physician and research advisors. Required clinical rotations are the same for students in both of CWRU’s MD Tracks and include experiences in medicine, family medicine, pediatrics, surgery, obstetrics and gynecology, psychiatry and neurosciences. Students may elect core rotations at any of CWRU’s affiliated medical centers – the Cleveland Clinic, the Louis Stokes VA Medical Center, MetroHealth Medical Center and Case Medical Center/University Hospitals of Cleveland.

Every CWRU student must pass the CWRU Clinical Skills Examination and USMLE Step 2 CK (Clinical Knowledge) and CS (Clinical Skills) Examinations to graduate from the CWRU School of Medicine. Students take OSCEs similar in format and content to the USMLE Step 2 CS Examination as part of routine assessments of their clinical skills beginning in Year 1 and are well prepared for the CWRU Clinical Skills Examination and USMLE Step 2 CS Examination by the time they have completed the required clinical rotations. These examinations must be completed by the end of Year 4. Students must take the USMLE Step 2 CK Examination by December 31 of their 5th year.

Students spend 12 to 15 months during the last three years on their mentored research project, including preparation and defense of a masters’ level thesis. Students are expected to complete their research in one block of time; however, in unusual circumstances students under the guidance of their Physician and Research Advisors and with permission from the Research Education Committee may divide their research over the final three years, depending on the student’s research project. During time devoted primarily to research, students spend one half-day each week in related clinical activities. Students must complete all required thesis research rotations by December 31 of Year 5 and defend the Research Thesis within 3 months of research completion, but no later than February 15 of Year 5. Within these guidelines, students and their advisors are encouraged to be as creative as possible in designing the final 3-year continuum. Research may be conducted with faculty research advisors at any CWRU campus or in some instances with advisors at other institutions (e.g., the NIH) with approval from the Research Education Committee. Student research may focus on clinical, translational or basic research. Some students may wish to engage in health services research, research in biomedical ethics, or other areas relevant to the advancement of biomedical science and the care of patients in addition to the more “traditional” research areas.

**The Integrated Sciences Concentration (ISC) is** designed to provide medical students with an in-depth exposure to an area of medical interest, with an emphasis on integration of sciences basic to medicine with clinical medicine in a multidisciplinary approach. The ISC program lasts 8-12 weeks (consecutive or non-consecutive) and is designed to partially overlap with ongoing elective clinical rotations. The ISC provides students with exposure to numerous faculty in an area of clinical interest, allows time for the consideration of future directions of the field of interest, and allows for a creative process of “designing your own curriculum”. The culmination of the ISC is a document generated by the student that can take a variety of forms (future directions article, patient materials, artwork) that is relevant to the field and has the potential for distribution.

**The Student Portfolio: Competency-Based Assessment and Reflective Practice**

The College’s approach to student assessment is based on two key educational concepts —“competency-based assessment” and “reflective practice.” Competency-based assessment emphasizes the need for every student to achieve the broad range of required learning outcomes by providing an appropriate curriculum, learning resources, and regular formative assessments. No grades are assigned in the College Track during the 5 year program; when a student achieves the standards for a all competencies, they are assigned a “Meets or Exceeds” (“ME”) for each course on their transcript. Assessment of student performance is criterion-referenced, not norm-referenced; students are not compared to one another but to faculty-defined standards of achievement. A full range of assessment methods are used to profile learning outcomes. Reflective practice emphasizes that learning is dependent upon the integration of reflection and experience. Professionals learn by reflecting
on their experiences both during the experiences ("reflection-in-action") and after the experiences ("reflection-on-action") and by using these reflections to develop new knowledge and skills. We have designed an assessment process that helps our students develop their reflective practice skills – the ability to accurately describe, analyze and evaluate their performance and to identify and follow through on effective learning plans. We are committed to helping every student achieve our competency standards and develop reflective practice skills through frequent formative assessments and close advising.

Evidence of achievement for each of the College Track’s 9 competencies is collected and managed in an electronic portfolio. Students and their advisors share access to the e-Portfolio database of evidence and thus can track and document student progress in meeting our nine competencies. A broad range of types of evidence are collected from the learning experiences in the research, basic science, and clinical curriculum.

During research blocks, research preceptors, journal club facilitators, problem solving session facilitators, and student peers provide written assessments of both individual work and teamwork in the lab, written and oral presentations, and critical thinking and reasoning skills. Written research proposals and reports and the final thesis are also included in the e-Portfolio.

During the basic science courses, students complete weekly online quizzes called Self Assessment Questions (SAQs) that cover the breadth of knowledge for each week’s theme at the level of factual recall and simple application of the facts. Faculty design the SAQs so that students who are actively participating and studying should expect to know at least 80% of the answers; the individual results of the SAQs are available only to the students, but students are encouraged to contact the course director for help with any difficulties they are having. Students have the option of repeating the SAQs to assess their retention of this basic science knowledge. At the end of each week, students complete 1-2 open book Concept Appraisals (CAPPs) designed to determine if they have mastered the concepts for that week well enough to apply them to new or different problems or situations in brief, well-organized, clearly written essay(s). CAPPs are designed to assess depth of knowledge in key concept areas. Other evidence is provided by PBL facilitators and peers who provide assessments of performance in PBL sessions.

Assessments in the clinical curriculum include written feedback on performance from longitudinal preceptors and other faculty physicians and residents, results of OSCEs, patient logs documenting breadth of clinical exposure, patient journals in which students record their reflections on specific patients and their problems, self-assessments of videotaped interviews with patients (both standardized and real), and feedback from patients and other health care providers.

Students are expected to meet regularly their physician advisor to discuss their progress. Several times each year, they are required to review their assessment evidence in relation to expected levels of achievement in the 9 competencies and write Formative Portfolios composed of structured reflective essays on how the evidence demonstrates their development as doctors and researchers. Based on this analysis, they develop learning plans to address areas needing improvement. The essays also include judgments on whether previously established learning goals have been achieved and reflections on the process of achieving these goals. Students discuss these materials with their physician advisors during Formative Assessment meetings. During the last three years, students submit learning plans on a bi-annual basis, and meet with their physician advisor to review their progress. Students are expected to assume more and more responsibility and independence in accurate self-assessment, in developing learning plans and following through on addressing their own learning needs, and in recognizing and building on their own strengths.

At the end of Year 1 and 2 and Year 4, students assemble a Summative Portfolio for review by the Medical Student Promotions and Review Committee that determines if the evidence presented by the student indicates a level of achievement sufficient for promotion to the next year of the program (or graduation). Students are expected to choose not only their best examples of their work, but more importantly evidence demonstrating their growth across the year in specific competencies. We want to graduate students who recognize areas needing improvement, identify an approach to addressing them, and can show that they have now achieved that skill as well as those students who excel in specific areas throughout the year. Graduates of CCLCM will have not only achieved a defined level of achievement of each of the 9 competencies, they will also have developed their reflective ability to accurately assess their own strengths and areas needing improvement. The assessment process is designed to enhance student learning and the student portfolio enables students to document their progress in the achievement of defined competencies.

Graduation Requirements Summary for the College Track

A medical student who has satisfactorily completed all the required work in CCLCM may be granted the degree of Doctor of Medicine (MD) with Special Qualifications in Biomedical Research by Case Western Reserve University, provided that:

1. He/she has been registered at Case Western Reserve University School of Medicine for at least five academic years and not more than 6 years for CCLCM.
2. CCLCM Medical Student Promotions and Review Committee approve his/her record of performance including thesis, and the faculty recommends him/her to the School of Medicine’s Committee on Students for graduation.
3. He/she has discharged all financial obligations to Case Western Reserve University and to the program in which he/she is enrolled.
4. He/she has passed the U.S. Medical Licensing Examination (USMLE) Step 1, USMLE Step 2 Clinical Knowledge (CK) and Step 2 Clinical Skills (CS).
5. He/she has passed the CWRU School of Medicine Clinical Skills Examination.
6. The Research Thesis and Defense have been completed within 3 months after completing research or by February 15th of the 5th year, whichever is earlier.
7. In Years 3-5 every CCLCM student completes a total of 146 weeks in the following activities:
   - 56 weeks of required clinical experience:
   - 40 weeks: Basic Cores I, II, and III
   - 8 weeks: Two Advanced Cores
   - 8 weeks: Two Acting Internships
   - 48 weeks of research
   - 2 weeks of Capstone Course in Year 5
   - 34 weeks of electives (20 weeks minimum for clinical electives)
Dual Degree Programs

Dual Degree Programs with the MD

The degree programs listed in this section may require admission to another school at the university in addition to or instead of the School of Medicine. Each school may have different deadlines and requirements for admissions. Please contact the other schools separately using information provided under that school’s listing in this publication. Additional dual degree programs not including the MD are also offered through the medical school’s departments. Several certificate programs are also offered in General Medical Sciences.

MD/PhD (MSTP)

The Medical Scientist Training Program leading to the MD/PhD in various biomedical programs is listed in above grey tab.

MD/JD

This program, offered in conjunction with Case Western Reserve University School of Law, may be completed in six years. The JD portion requires the completion of 88 credit hours of study. Admission is through the School of Medicine and the School of Law. For more information about the JD portion of the program, visit the Law School section (p. 670), call the law school admissions office at 216.368.3600 or 800.756.0036, or e-mail lawadmissions@case.edu.

MD/MA in Bioethics

The 27-credit-hour Master of Arts in Bioethics program, including a 12-hour foundations course taken during the first year of medical school, emphasizes the interdisciplinary and interprofessional nature of the field. It is designed to provide advance training in bioethics for those who anticipate encountering ethical issues in the course of their primary careers. Medical school students complete the bioethics program while pursuing their medical degrees; no additional time is required. Admission for the master’s degree portion is through the Case Western Reserve University School of Graduate Studies. For more information about the MA requirements, visit the Bioethics section (p. 733), call 216.368.6196, or e-mail bioethics@case.edu.

MD/MS in Applied Anatomy

The core curriculum of this 30-hour, non-thesis master of science master of science in applied anatomy degree program integrates aspects of modern molecular biochemistry, cell biology and physiology with the traditional aspects of anatomical structure and nomenclature of cells, tissues and organs. Electives allow students to pursue individual interests in special areas of research and health care. The program is excellent preparation for those preparing for biomedical careers or those planning to pursue a PhD. Additional details and a sample course of study are described in the Anatomy section of the General Bulletin.

MD/MS Biomedical Investigation

The goal of the joint MD/ Masters of Science in Biomedical Investigation program at Case School of Medicine is to train medical students in basic or clinical research approaches so that the physician graduate may conduct research to advance health. Students will earn a plan B type MS from Graduate Studies, and the name of the joint degree will reflect the particular track pursued by the student (e.g. MD/MS Biochemistry). The tracks proposed in this joint MD/MS program are derived from existing type B MS programs at the School of Medicine into a joint program with the MD, using a common template.

The core activities for this degree include limited credit from the medical core curriculum, 3-6 graduate courses in specific tracks, participation in a common seminar series, scientific integrity training, and a requirement for a special problems project that reflects a full year of research (18 hours of 601 non-graded credits) culminating in a written report and examination. Students are anticipated to complete all graduate courses before entering the research year, allowing full focus on the research experience. Thus, this program will require 5 years overall to complete the requirements for both degrees. Students who wish to join the MD/MS program may apply to the Program after arriving at the University any time prior to Fall of their second year of medical school.

For students to receive graduate credit for medical coursework, they must register for IBIS credit (see below) in advance of the preclinical medical school semester. Students are likely to complete the required two semesters of research 601 after the pre-clinical years in medical school, although the research could occur in other years. Before initiating full time research, the trainee must submit a final Program plan to the Program Oversight Committee that summarizes the courses taken, the proposed thesis topic, and the names and credentials of the MS Thesis Committee. During the research period, the student is expected to participate in track-specific graduate activities including retreats, student talks, journal clubs and other program functions. Only under unusual circumstances will the student be allowed to satisfy the research requirement in non-contiguous semesters.

Each track within the joint MD/MS Program has specific course requirements, described in each graduate department MS section. Available tracks include: Biochemistry (p. 727), Clinical Research (CRSP) (p. 822), Epidemiology (p. 800), Nutrition (p. 754), Pathology (p. 759), Pharmacology (p. 767), Physiology & Biotechnology (p. 774). As a minimum, graduation requires successful completion of 9 graded credits of graduate courses, 6 graded credits of IBIS medical curriculum, 18 non graded credits of research, and additional non graded credits for departmental seminar and the exam and zero credits for scientific integrity training (IBMS 500 On Being a Professional Scientist: The Responsible Conduct of Research or CMED 500 Scientific Integrity in Biomedical Research) in the program. Students are required to pass an examination (IBIS 600 Exam in Biomedical Investigation) established for each student, generally reflecting the preparation and oral defense of a written report on the project.

For more information please contact the College Program Advisor, Dr. Dennis Stacey (http://bulletin.case.edu/schoolofmedicine/dualdegreeprograms/mailto:staceyd@ccf.org) or the University Program Advisor, Dr. William Merrick (http://bulletin.case.edu/schoolofmedicine/dualdegreeprograms/mailto:william.c.merrick@case.edu).

Typical Plan of Study

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On Being a Professional Scientist: The Responsible Conduct of Research (IBMS 500)
or Scientific Integrity in Biomedical Research (CMED 500)

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</tbody>
</table>

**Fifth Year**

<table>
<thead>
<tr>
<th>Units</th>
<th>Fall</th>
<th>Spring</th>
<th>Summer</th>
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<tbody>
<tr>
<td>Medical School Curriculum - no credit</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Medical School Curriculum - no credit</td>
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<tr>
<td>Year Total:</td>
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</tbody>
</table>

**Total Units in Sequence:** 33-36

Departmental Seminar is also taken for 1 credit hour - timing depends upon the track.

**MD/PhD in Health Policy and Health Services Research**

This program prepares students for careers in academic medicine, health policy, public health, and/or health care management. An important area of focus within this training program is methods and issues in study design that pertain to research examining the health and health care problems of urban and vulnerable populations.

Application to and acceptance in the PhD program in Health Policy/Health Services Research follows admission to the School of Medicine. Dual-degree students are fully integrated with graduate students in other tracks within the Department of Epidemiology and Biostatistics. Dual-degree students typically complete the PhD coursework and the dissertation requirement by their third year after matriculation, with the MD awarded at the end of the seventh year. Support for tuition and stipends is available for a limited number of students each year.

For more information, see Epidemiology and Biostatistics section (p. 803) or contact the departmental coordinator for Graduate Studies, Victor Courtney (http://bulletin.case.edu/schoolofmedicine/dualdegreeprograms/mailto:victor.courtney@case.edu), at 216.368.5957.

**Medical Scientist Training Program (MSTP)**

A combined MD/PhD program in biomedical sciences, the Medical Scientist Training Program (MSTP) is available for students desiring research careers in medicine and related biosciences. This program takes seven to eight years to complete, depending on the time needed to complete the PhD dissertation research. Financial support includes a stipend and full tuition support.

Candidates must meet established prerequisites for admission to both the School of Medicine and the School of Graduate Studies. Criteria include demonstrated capabilities in research and superior undergraduate academic credentials. Applicants must have either U.S. citizenship or permanent residency status to be considered for admission to the MSTP. Information can be obtained by contacting the MSTP program (http://bulletin.case.edu/schoolofmedicine/dualdegreeprograms/mailto:mstp@case.edu) or from the program website (http://bulletin.case.edu/schoolofmedicine/dualdegreeprograms/http://mstp.case.edu). Admissions are coordinated via the School of Medicine admissions program and the AMCAS application.

The first two years of the MSTP are centered on the University Program pre-clinical core medical school curriculum, which occupies five mornings each week. Afternoons include time for graduate courses and/or research rotations, as well as clinical training, thus integrating the medical school and graduate school experiences. The next three to four years are devoted to completion of graduate courses and PhD thesis research in one of the multiple MSTP-affiliated graduate programs. During the PhD phase, MSTP students participate in the MSTP Clinical Tutorial, a program designed to enhance clinical skills and allow students to develop connections between their research and clinical interests (this further addresses the goal of integrating medicine and science). After completion of the PhD program, students return to medical school for two years to complete clinical clerkships and finish the MD curriculum.

The program is administered by the MSTP Steering Committee, which consists of faculty from both basic science and clinical departments. Its functions include selecting candidates for admission, designing and administering the program curriculum, advising students and evaluating student progress.

Please see the Doctor of Medicine (MD) (p. 780) page  for information about the MD curriculum.

**MSTP Program by Year**

**Year 1**
- University Program MD curriculum
- Summer research rotation
- One graduate course or research rotation each semester (fall and spring)

**Year 2**
- University Program MD curriculum
- Summer research rotations (1 or 2)
- Graduate course or research rotation in the fall semester

**Year 3**
- PhD program

**Year 4**
- PhD program
- MSTP Clinical Tutorial

**Year 5**
- PhD program
- Optional MSTP Clinical Tutorial

**Year 6 (If Needed)**
• PhD program
• Optional MSTP Clinical Tutorial
• All PhD work, including dissertation defense and publications, to be completed before starting the 3rd year medical curriculum

Year 7
• Third year MD curriculum (core clinical clerkships)

Year 8
• Fourth year MD curriculum (completion of core clinical clerkships if necessary, clinical and research electives)

The Medical Scientist Training Program in detail

General Description
The Case Medical Scientist Training Program (MSTP) provides training for future physician-scientists by integrating well-developed curricula in science and medicine. Unique aspects of the program include the integration of graduate school and medical school in many phases of the program to optimize dual-degree training, and a high degree of student involvement in running the program.

The MSTP includes three major phases of training.

First phase: During the first two years, each student completes the first two years of the University Program medical school curriculum, including early clinical experiences, completes at least three research rotations, takes graduate courses, and chooses his or her PhD graduate program and thesis lab. During the summers before the first two years of medical school, students complete research rotations. During the fall and spring semesters of year one and the fall semester of year two, students take a graduate course or complete a research rotation.

Second phase: During the PhD phase, students complete all requirements of their PhD program. They also participate in the MSTP Clinical Tutorial for at least one year in a patient-based clinical specialty. A second year of MSTP Clinical Tutorial is optional.

Third phase: In the final phase, students complete years three and four of the University Program medical school curriculum. The focus is clinical training, but research electives can be taken for part of year four.

Although each of these three phases has a different focus, opportunities exist for students to pursue both research and clinical training in each phase. The philosophy of the Case MSTP is to integrate medicine and science throughout the program as much as possible.

The Case MSTP is run by faculty, students and staff. The MSTP Council is a body of students that plans and runs certain aspects of the program. The administrative director, program coordinator, and program assistant have many important roles and run the day-to-day management of the program. The co-director is involved in decisions at all levels of the program and is the primary advisor for students in the first two years of the program. The director is responsible for all aspects of the program and is available to students for advice at any stage. The MSTP Steering Committee makes decisions on MSTP policy, curriculum planning, student admissions, approval of mentors and evaluation of students.

Incoming MSTP students are expected to enter the program on July 1. The MSTP summer retreat, usually held in early July, provides an important orientation to the program and includes sessions and workshops for program and professional development.

Advising System
The program director provides advising to students in all phases of the program. The MSTP co-director advises students in the first two years on research rotations and course work. Students may also meet with an MSTP Steering Committee member representing an area of research interest or with the MSTP director. During the PhD training period, mentoring is provided by the thesis advisor and thesis committee, which includes a member of the MSTP Steering Committee and a member with an MD MSTP students are full members of the medical school class and enter one of the four societies of the University Program when they matriculate in the program. The society dean provides important advice for matters concerning the MD curriculum.

Classes and Research Rotations in Years One and Two
During years one and two of the University Program, MSTP students register for 9 credit hours of graduate course work each semester.

Plan of Study

First Year

| Integrated Biological Sciences I (IBIS 401) | 1 - 9 |
| Clinical Science I (IBIS 411) | 2 |
| Research Rotation in Medical Scientist Training Program (MSTP 400) | 0 - 9 |
| Integrated Biological Sciences II (IBIS 402) | 1 - 9 |
| Clinical Science II (IBIS 412) | 2 |
| Research Rotation in Medical Scientist Training Program (MSTP 400) | 0 - 9 |
| Total Year: | 3-20 |

Second Year

| Integrated Biological Sciences III (IBIS 403) | 1 - 9 |
| Clinical Science III (IBIS 413) | 2 |
| Research Rotation in Medical Scientist Training Program (MSTP 400) | 0 - 9 |
| Graduate School courses | 3-4 |
| IBIS 401 Research (in specific program) | 5-6 |
| Year Total: | 3-20 |

Total Units in Sequence: 17-70

- MSTP 400 Research Rotation in Medical Scientist Training Program or an appropriate graduate school course. If a 4-credit graduate course is taken, registration in IBIS 401 Integrated Biological Sciences I, IBIS 402 Integrated Biological Sciences II or IBIS 403 Integrated Biological Sciences III is reduced to 3 units.

IBIS 401 Integrated Biological Sciences I, IBIS 402 Integrated Biological Sciences II and IBIS 403 Integrated Biological Sciences III are 3-4 credits each. IBIS 411 Clinical Science I, IBIS 412 Clinical Science II, and IBIS 413 Clinical Science III are 2 credit hours each. In contrast to their fellow medical students, MSTP students are graded during years one and two of the medical school curriculum for these graduate courses, which provide graduate school credit for the medical school curriculum. These grades are for graduate school purposes and do not affect standing in the medical school.

In addition to the medical curriculum, students take MSTP 400 Research Rotation in Medical Scientist Training Program or one 3-4 credit graduate school course per semester in the first two years. Graduate courses
are scheduled in the afternoon in the fall and spring semesters to avoid conflict with the medical school curriculum. MSTP students will be registered for MSTP 400 during the summer terms before each of the first two years of medical school. Students also may complete a research rotation instead of a graduate school course during the fall or spring semester.

The PhD Phase

After completion of the second year of medical school, each student chooses a PhD thesis mentor, joins a specific PhD program, and completes any remaining graduate school course work and other requirements for the PhD degree. The following training programs are affiliated with the MSTP. (If the training program is not itself an independent PhD program, the program through which it is offered is indicated in parentheses.)

- Biochemistry
- Biomedical Engineering
- Cancer Biology (Pathology)
- Cell Biology
- Developmental Biology (Genetics and Neurosciences)
- Epidemiology
- Genetic and Molecular Epidemiology (Epidemiology)
- Genetics
- Immunology (Pathology)
- Molecular Biology and Microbiology
- Molecular Virology
- Pathology
- Neurosciences
- Nutrition
- Pharmacology
- Physiology and Biophysics
- Systems Biology and Bioinformatics

All MSTP students are required to take a one-week ethics course (IBMS 500 On Being a Professional Scientist: The Responsible Conduct of Research) during the spring semester of their second year in the program.

Clinical Tutorial, Clinical Refresher Course and Years Three and Four of Medical School

During the PhD thesis phase, MSTP students take the MSTP Clinical Tutorial, which provides a unique longitudinal part-time clinical experience. The MSTP Clinical Tutorial is a year-long course that enhances clinical skills for year three of medical school. It also serves a special career development objective by allowing students to balance medical and scientific interests and explore the connections between these areas. The MSTP Clinical Tutorial, offered during the PhD phase, is an example of the integration of science and medicine in the Case MSTP. An optional MSTP Clinical Refresher course may be taken before the start of year three. After completion of the PhD, MSTP students are enrolled in medical school to complete the requirements for the MD (see description provided for the University Program (p. 782)).

MSTP Activities

The MSTP supports several activities that enhance the scientific and professional development of students. These activities also foster a vibrant and collegial MSTP community with a strong sense of mission in the training of physician scientists.

Summer retreat: The annual MSTP summer retreat is a two-day event focusing on scientific presentations, professional development and program planning for the upcoming academic year.

Winter retreat: This retreat occurs in January or February. Students in their research years present their thesis work through an oral or poster presentation.

MSTP Council coordinates many activities of the Case MSTP. The Council meets once each month to discuss activities that are run by different student committees. The overall goals of the MSTP Council are to identify objectives for the program, to allow students to initiate programs to enhance the MSTP, to encourage increased student involvement in the operation of the MSTP, and to enhance development of leadership skills of MSTP students. The president, vice president and secretary are all elected for a one-year period. Committees are led by 1-3 committee chairs who take charge of committee activities and coordinate the involvement of other students in the committee activities. All students are welcome and encouraged to participate in the various committees and to attend the council meetings. Recent Council committees and other program activities have included the following:

1. Monthly Dinner Meeting Committee

This committee is responsible for planning monthly dinner meetings, selecting topics, speakers, and menus. The series is organized by students and is attended by students, Steering Committee members and research mentors. Invited speakers (students, faculty, alumni and outside speakers) address issues pertinent to research, professional issues, career development or other topics of interest. The informal environment at these gatherings promotes social and professional interactions.

2. Agre Society

The Agre Society at Case Western Reserve University serves to advance understanding of biomedical research by clinical residents, fellows and MSTP students. The society is sponsored and organized by the Department of Medicine, UHCMC, and its activities involve residents and fellows from clinical training programs at Case Western Reserve-affiliated hospitals. MSTP students in all phases of the program, and associated faculty. The main focus of the Agre Society is a series of informal monthly dinner meetings. The design of the Agre Society promotes interactions between MSTP students, residents and fellows with interests in biomedical research, allowing these groups to enrich each other with their different experiences and viewpoints. The program helps clinical residents and fellows to learn about research and identify potential mentors within the wider Case Western Reserve research community. It also helps MSTP students to understand the clinical context of their research and enables them to form contacts with people at more advanced stages of training. The society is named for Peter Agre, MD, a medicine resident in the University Hospitals of Cleveland/VA program in the mid 1970’s who won the Nobel Prize in Chemistry in 2003 for the discovery of aquaporins.

3. Communications and Webpage Committee

This committee organizes communications and the Case MSTP website content.

4. Summer Retreat Committee

This committee plans the summer retreat.

5. Intro to MSTP

This committee organizes events for first year MSTP students, to integrate them into the program and the community.

6. Community Service Committee
Plans events for involvement of MSTP students in community service.

7. Social Committee
This important committee plans fun events throughout the year!

8. Student Representative to Faculty Council
One student is selected to represent the MSTP on Faculty Council.

9. Student Representative to the Committee on Medical Education

10. Representative to the Graduate Student Senate

11. MSTP Women’s Committee
Women in the MSTP organize luncheons or other meetings to discuss issues that face women pursuing careers in science. Students may invite a successful woman scientist who provides a role model as a physician scientist.

Scientific meetings: The program strongly encourages students to present their research at national or international meetings and provides financial support to pay for part of meeting travel expenses (other funding is obtained from the research mentor). In addition to the general meeting support for all students, each year two students are offered the opportunity to attend the annual MD/PhD national student conference in Colorado or the American Physician Scientist Association annual meeting in Chicago, with all expenses paid by the MSTP.

Research symposia: MSTP students are encouraged to present their research at Case student symposia, including the annual graduate student symposium and the Irwin H. Lepow Student Research Day. These symposia feature a nationally recognized keynote speaker, and students have the opportunity to interact extensively with the noted scientist. A committee awards prizes for outstanding student presentations.

Assessment of MSTP Students

Students in the MSTP are assessed for the medical school component of the program in the same manner as students in the University Program, with the exception that grades are awarded for those courses in the MD curriculum in years one and two that receive graduate school credit and are used to satisfy requirements for the PhD degree. Students must satisfactorily complete all requirements for both the MD and the PhD.

IBIS Courses

IBIS 401. Integrated Biological Sciences I. 1 - 9 Unit.
A four-semester sequence encompassing anatomy, biochemistry, physiology, pharmacology, pathology, and microbiology.

IBIS 402. Integrated Biological Sciences II. 1 - 9 Unit.
A continuation of IBIS 401.

IBIS 403. Integrated Biological Sciences III. 1 - 9 Unit.
A continuation of IBIS 402.

IBIS 404. Integrated Biological Sciences IV. 0 - 9 Units.
A continuation of IBIS 403.

IBIS 405. Integrated Biological Sciences I. 1 - 9 Unit.

IBIS 406. Integrated Biological Sciences II. 1 - 9 Unit.

IBIS 407. Integrated Biological Sciences III. 1 - 9 Unit.

IBIS 408. Integrated Biological Sciences IV. 1 - 9 Unit.

IBIS 411. Clinical Science I. 2 Units.

IBIS 412. Clinical Science II. 2 Units.

IBIS 413. Clinical Science III. 2 Units.

IBIS 414. Clinical Science IV. 0 - 2 Units.

IBIS 415. Clinical Science I. 1 - 9 Unit.

IBIS 416. Clinical Science II. 1 - 9 Unit.

IBIS 417. Clinical Science III. 1 - 9 Unit.

IBIS 418. Clinical Science IV. 1 - 9 Unit.

IBIS 424. Integrated Biological Sciences in Medicine. 6 Units.
This course is open only to candidates enrolled in the M.D./M.S. program (University plan). Registration is for the Spring semester of the second year in medical school. The course will cover the areas of cardiology, pulmonary, hematology, renal physiology and gastroenterology. Assessment will be by examination (to include quizzes, multiple choice questions, and essays). Recommended preparation: First three semesters of medical school and currently a medical student in good standing.

IBIS 434. Integrated Biological Sciences in Medicine. 6 Units.
This course is open only to candidates enrolled in the M.D./M.S. program (College plan). Registration is for the Spring semester of the second year in medical school. The course content includes the areas of hematology, gastroenterology and renal physiology. Students will also be required to participate in Process of Discovery. Assessment of performance will be through reaching required levels of competency for the medical areas identified above and by the evaluation of a term paper. Recommended preparation: First three semesters of medical school and currently a medical student in good standing.

IBIS 435. Integrated Biological Science in Medicine-University. 6 Units.
This course is open only to candidates enrolled in the M.D./M.S. program (University Plan). Registration is typically for the Spring semester of the second year in medical school. The course content includes the areas of hematology, gastroenterology and renal physiology. (Students will also be required to participate in Process of Discovery.) Assessment of performance will be through reaching required levels of competency for the medical areas identified above and by the evaluation of a term paper. Recommended preparation: First three semesters of medical school and currently a medical student in good standing.


IBIS 461. Clinical Science (for M.P.H./M.D. Students). 1 - 6 Unit.

IBIS 466. Medical School Electives (for M.P.H./M.D. Students). 1 - 6 Unit.

IBIS 600. Exam in Biomedical Investigation. 0 Units.
Students are required to pass an examination established for each student, generally reflecting the preparation and oral defense of a written report on the project. Prereq: Must be enrolled in MD/MS Biomedical Investigation program.
MSTP Courses

MSTP 400. Research Rotation in Medical Scientist Training Program.  
0 - 9 Units.  
All students must complete research rotations in a minimum of three  
different MSTP-approved laboratories and submit rotation reports and  
rotation evaluations for each to the MSTP office. All three of the rotations  
must be completed before the beginning of each student’s third year of  
the program. The main purpose of research rotations is to aid the student  
in selecting a laboratory for their thesis work.
Environmental Health Sciences

Ariann Richner (http://bulletin.case.edu/schoolofmedicine/environmentalhealthsciences/mailto:ariani.duncan@case.edu), Department Assistant

The Department of Environmental Health Sciences is devoted to the study of the fundamental mechanisms responsible for disease processes initiated or aggravated by environmental agents. Indoor and outdoor environments consist of complex interacting systems. These systems require the development of new approaches to understanding the basis of their action. Current research interests of the faculty include chemical and environmental carcinogenesis, genetic and reproductive toxicology, cytogenetics, radiation biology, and clinical and forensic toxicology.

The Department of Environmental Health Sciences offers the MS degree and an MD/MS program for students who have received formal acceptance to the School of Medicine and are interested in expanding their training in the area of environmental health sciences. This program allows students to complete the requirements for both degrees within a four-year period.

MS Environmental Health Science

The Master of Science degree program is designed to increase the student's knowledge of environmental health science as well as to provide a firm foundation in the life sciences. The program is multidisciplinary and emphasizes cancer biology, environmental toxicology, and nutrition and toxicology. It is based on a core curriculum in the biological sciences, including biochemistry, biostatistics, microbiology, genetics, molecular biology, pharmacology, epidemiology, and toxicology.

Admissions

Applicants must complete a CWRU Graduate Application. Tuition or stipends will not be provided for the master of science program (no additional tuition is required for enrolled medical students).

Degree Requirements

Currently, a student can obtain a MS with a thesis based on an individual research project [Plan A] or may obtain a MS based solely on course work and a comprehensive exam [Plan B]. Both degrees require completion of 27 semester hours of credit. Under Plan A, up to 9 of the 27 semester hours can be obtained through research. Students also prepare a written thesis and complete an oral defense for a Plan A Degree. Completion of a Plan B, MS Degree, requires satisfactory performance on a written comprehensive exam taken after the student has finished their 27 hours of coursework. Also, for Plan B, it's recommended that the student take CBIO 453 Cell Biology I & CBIO 455 Molecular Biology I [8 Credits] or BIO 407 General Biochemistry [4 Credits] & BIO 408 Molecular Biology: Genes and Genetic Engineering [4 Credits].

Of the 27 semester hours of coursework required for the MS degree, 9 hours of credit are fulfilled by the EVHS Core Curriculum. This Core Curriculum is comprised of three 3 credit courses: EVHS 429 Introduction to Environmental Health, EVHS 401 Fundamentals of Environmental Health Sciences: Biochemical Toxicology and EVHS 402 Fundamentals of Environmental Health Sciences: Risk Assessment. Finally, as part of the 12 credits of Core Courses, a student must take a Statistics Course of their choosing (must be approved by the Department). Past examples include: EPBI 441 Theory of Linear Models, with Applications Biostatistics I [3 Credits], EPBI 414 Introduction to Statistical Computing [3 Credits] or EPBI 431 Statistical Methods I [3 credits].

The required course list is as follows:

**Course List**

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<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>EVHS 401</td>
<td>Fundamentals of Environmental Health Sciences: Biochemical Toxicology</td>
<td>3</td>
</tr>
<tr>
<td>EVHS 402</td>
<td>Fundamentals of Environmental Health Sciences: Risk Assessment</td>
<td>3</td>
</tr>
<tr>
<td>EVHS 405</td>
<td>Effects of Exposure to Env Toxins</td>
<td>3</td>
</tr>
<tr>
<td>EVHS 429</td>
<td>Introduction to Environmental Health</td>
<td>3</td>
</tr>
<tr>
<td>EVHS 435</td>
<td>Environmental Health Law and Policy</td>
<td>3</td>
</tr>
<tr>
<td>EVHS 502</td>
<td>Genetic Toxicology II: DNA Damage and Repair</td>
<td>3</td>
</tr>
<tr>
<td>EVHS 506</td>
<td>Independent Study in Environmental Health Sciences</td>
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<tr>
<td>EVHS 510</td>
<td>Molecular Oncology</td>
<td>3</td>
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<tr>
<td>EVHS 651</td>
<td>Master’s Thesis Research</td>
<td>1</td>
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**Courses**

**EVHS 401. Fundamentals of Environmental Health Sciences: Biochemical Toxicology. 3 Units.**

This course details the fundamentals of biochemical toxicology. Specific topics include oxidation-reduction reactions, Phase I and II xenobiotic metabolism and mechanisms of cellular toxicity. Also, this course focuses on pharmacology. General principles of pharmacology, drug transport and absorption, drug metabolism, neuropharmacology, immunopharmacology and pharmacokinetics are discussed.

**EVHS 402. Fundamentals of Environmental Health Sciences: Risk Assessment. 3 Units.**

This course presents an overview of the scientific approaches used to determine whether environmental agents are potentially dangerous to people. In this course, criteria utilized for establishing exposure limits is presented. A variety of assays which can be employed to assess the impact of environmental exposure on normal and genetically susceptible individuals are studied. These include: numerous animal tests, short term toxicity and mutagenicity tests, functional assays, molecular techniques to delineate mechanisms of action, epidemiology studies and controlled clinical trials. Recommended preparation: EVHS 429.

**EVHS 405. Effects of Exposure to Env Toxins. 3 Units.**

This course provides an introduction to toxic agents found in the environment and presents an overview of chemical and physical agents which have acute toxic and/or genotoxic effects on cells. Toxicity, mutagenicity, carcinogenicity, teratogenicity and the potential for exposure to these agents through environmental, occupational and medicinal routes are discussed. This topic will be covered at both the molecular and the clinical level. Discussion of clinical cases will be included. Prereq: EVHS 401 and EVHS 402.

**EVHS 429. Introduction to Environmental Health. 3 Units.**

This is a survey course of environmental health topics including individual, community, population, and global issues. Introduction to risk management, important biological mechanisms, and age and developmental impacts are covered in an overview fashion. A practical inner city home environment experience is included. Offered as EVHS 429 and MPHP 429.
EVHS 435. Environmental Health Law and Policy. 3 Units.
This course will introduce students to environmental law and policy, with a focus on federal environmental law. The goal of the course is to enable students to understand the distinctive characteristics of a regulatory agency, where scientific insights must be channeled through the paths set out by law. Students will consider how federal statutes are implemented through agency regulations, and the role of courts in overseeing the regulatory process. Substantive statutes we will consider include the Clean Air Act, the Clean Water Act, the Safe Drinking Water Act, the regulation of hazardous wastes and the cleanup of contaminated sites, and a range of federal statutes regulating chemical manufacturing/use and the workplace. The course includes an overview of the common law concepts of torts and nuisance. Prereq: EVHS 429 or permission of instructor.

EVHS 502. Genetic Toxicology II: DNA Damage and Repair. 3 Units.
This course provides an in-depth consideration of agents which alter DNA directly or indirectly through effects on its synthesis and examines the mechanisms and repair processes through which cells respond to this damage. The class consists of formal lectures which introduce each topic, and analysis of up-to-date literature on topics representative of major current areas of interest in this field. Topics covered include fidelity of DNA replication, excision repair, mismatch repair, transcription-linked repair, SOS repair and recombination repair. Other DNA damage responses controlling decision points between DNA repair and apoptosis are also considered. Agent-specific DNA damage, such as that caused by agents leading to bulky adducts, AP sites, base-base mismatches and damage to DNA bases, are considered in the context of specific repair processes responding to these DNA insults in procaryotes and eukaryotes. Recommended preparation: EVHS 401 and 402.

EVHS 506. Independent Study in Environmental Health Sciences. 1 - 6 Unit.

EVHS 510. Molecular Oncology. 3 Units.
This course explores the role of environmental factors in causing alterations in cellular mechanisms which lead to cancer. Emphasis is placed on genetic and other regulatory alterations leading to cell transformation. The possible role of oncogenes and suppressor genes in these processes and the mechanisms through which chemotherapy and immunotherapy manifest toxicity for cancer cells are considered.

EVHS 651. Master’s Thesis Research. 1 - 9 Unit.

EVHS 701. Dissertation Ph.D.. 1 - 9 Unit.
(Credit as arranged.) Prereq: Predoctoral research consent or advanced to Ph.D. candidacy milestone.
Epidemiology and Biostatistics

The Department of Epidemiology and Biostatistics (http://epbiwww.case.edu) draws on the core disciplines of Epidemiology, Biostatistics, and Public Health to help support students in developing the knowledge, skills and competencies needed to assume positions of leadership with the ultimate goal of advancing the public’s health. Through challenging coursework and both independent and collaborative research opportunities, students will develop a thorough understanding of the multiple determinants of population health outcomes; the individual and structural factors that may lead to disparities in those outcomes; and the way in which specific policies and interventions influence the nature and impacts of population health determinants.

The Department of Epidemiology and Biostatistics offers the following degrees:

- Doctor of Philosophy (PhD)
- Masters (MS)
- Master of Public Health (MPH)

Faculty and Research

Department faculty are nationally recognized and have more than $9.5 million in grants that support projects including HIV/TB research in Uganda, the search for genes that cause disease, cancer prevention and control, studies of interventions to change human behaviors that promote good health, design of clinical trials, studies to change high-risk behaviors related to AIDS, studies of public policies concerning the health of the elderly, and cost/benefit studies of medical interventions. Many research projects are performed in collaboration with the four affiliated hospitals; the University Hospitals, Metro Health, the Cleveland Clinic and the Veteran Administration. The department has offices in two locations at the university, (Wood Building and Wolestein Research Building) and in the Prevention Research Center for Healthy Neighborhoods (PRHCN). The department maintains two scientific computer centers comprised of 14 lab computers and over a dozen servers. Several very large national health care and demographic databases (including Medicare, Medicaid, and Vital Statistics databases) are stored on the servers and are used for faculty and student research and educational projects.

Masters Programs

MS Biostatistics

Statistics is a discipline that provides tools for making decisions under conditions of uncertainty. Biostatistics applies the discipline to medical and biological data, and it is an essential component of most medical research. The study of biostatistics includes design and analysis of experimental studies, such as clinical trials, and non-experimental studies, theory of probability and statistics, mathematical and statistical modeling, and knowledge of methodology used to evaluate the properties of statistical procedures. It also includes a competency in computers, which encompasses programming, statistical software use, and database management. Biostatistics is a dynamic field of study and an integral part of medical and public health research. Those who earn the MS in Biostatistics are equipped for careers in academia, government, and industry, or to enter doctoral programs in biostatistics.

The mission of the Masters Program in Biostatistics is to enroll and train outstanding students in the core discipline of biostatistics. The faculty and students in this program are committed to teaching and learning the theory and application of the essential and modern statistical methods used in the biomedical sciences.

Courses specific to this program include mathematical statistics, generalized linear models, multivariate statistics, survival analysis, categorical data analysis and non-parametric statistics, among others. In addition, the Department of Epidemiology and Biostatistics offers a wide array of courses in population health sciences, including global health epidemiology, genetic epidemiology and bioinformatics, health behavior and preventative science, and healthcare organization, outcomes, and policy. Plentiful research opportunities exist within the department and numerous research centers across the university, and ongoing research is discussed during seminars and frequent informal meetings with faculty.

Concurrently, students will master the rigorous scientific and analytic methods necessary to be at the forefront of efforts to not only describe, but effectively evaluate and improve the population’s health. Student- and faculty-led seminars provide an ongoing mechanism for keeping abreast of current literature and identifying important areas of research and collaborative opportunities. Students are considered junior colleagues of the faculty who will develop the capacity to work independently in a supportive environment. The Department operates within a strong interdisciplinary framework involving faculty within the department, the school of medicine, and across the entire university, as well as leaders in health care institutions and health oriented organizations and agencies throughout the wider community.

Graduates from accredited universities and colleges will be considered for admission to the department. All applicants must satisfy both CWRU and department requirements for graduate admission. The MS program in Biostatistics consists of a 21-credit core curriculum and 15 credits of electives.

General Requirements

Students must satisfy the requirements of the School of Graduate Studies as stated here (p. 656), as well as those outlined by the Biostatistics program. To complete the MS degree program, students must pass a written comprehensive examination (Master’s Plan B). Our MS program does not offer a MS Plan A, Master’s thesis option.

Minimum Program Requirements are as follows:

- Core curriculum (21 credits)
- Electives (15 credits)
- Active participation in Departmental and Biostatistics seminar series
- Written comprehensive exam

Course Requirements

A cumulative grade point average of at least 2.75 is required to obtain a master’s degree. A minimum of 36 credit hours is required and at most 3 credit hours of prerequisites. Where applicable, students are encouraged to design reading electives in their area of interest. To assure the appropriate background for the Biostatistics MS program each student must have completed or take three credit hours in one or more of the following scientific areas: biology, human behavior or social sciences. The advisor must confirm that this requirement is satisfied. No more than 3 credit hours of graduate level course work in these areas may count toward the minimum for the MS degree.

Required Non-Credit Seminar Courses

Attending the non-credit research seminars (EPBI 501 Research Seminar and EPBI 503 Seminar in Biostatistics) is integral to a biostatistics student’s professional development; thus they are required of every enrolled student. They provide an informal forum for students and faculty to discuss and often sharply debate important professional and scientific issues not typically covered in regular coursework.
Comprehensive Exam

The domain of coverage for the written comprehensive exam is the material contained in the core courses excluding the Practicum in Biostatistical Science (EPBI 602 Practicum). The exam is offered once per year and typically involves two days.

MS Biostatistics, Sample Plan of Study

<table>
<thead>
<tr>
<th>First Year</th>
<th>Units</th>
<th>Fall</th>
<th>Spring</th>
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</thead>
<tbody>
<tr>
<td>Statistical Methods I (EPBI 431)</td>
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<tr>
<td>Theoretical Statistics I (EPBI 481)</td>
<td>3</td>
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<tr>
<td>Epidemiology: Introduction to Theory and Methods (EPBI 490)</td>
<td>3</td>
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<tr>
<td>Research Seminar (EPBI 501)</td>
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<td></td>
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<td>Statistical Methods II (EPBI 432)</td>
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<td>Theoretical Statistics II (EPBI 482)</td>
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<td>Seminar in Biostatistics (EPBI 503)</td>
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<td>Year Total:</td>
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<th>Second Year</th>
<th>Units</th>
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<th>Spring</th>
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<tr>
<td>Survival Data Analysis (EPBI 435)</td>
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<tr>
<td>Biomedical Science Elective</td>
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<tr>
<td>Biostatistics Elective</td>
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<td>Categorical Data Analysis (EPBI 453)</td>
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<td>Practicum (EPBI 602)</td>
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<td>Biostatistics Elective</td>
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<tr>
<td>Year Total:</td>
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</tbody>
</table>

Total Units in Sequence: 36

*The following courses can be selected, upon advisor approval, as an Elective (15 credits):

- EPBI 441 Theory of Linear Models, with Applications | 3
- EPBI 443 Multivariate and High Dimensional Data | 3
- EPBI 442 Biostatistics II | 3
- EPBI 444 Communicating in Population Health Science Research | 2
- EPBI 445 Research Ethics in Population Health Sciences | 1
- EPBI 450 Clinical Trials and Intervention Studies | 3
- EPBI 451 Principles of Genetic Epidemiology | 3
- EPBI 452 Statistical Methods for Genetic Epidemiology | 3
- EPBI 453 Categorical Data Analysis | 3
- EPBI 458 Statistical Methods for Clinical Trials | 3
- EECS 458 Introduction to Bioinformatics | 3
- EECS 459 Bioinformatics for Systems Biology | 3

Master of Public Health (MPH)

Master of Public Health Program Administrative Director
Case Western Reserve University
10900 Euclid Avenue, W-G74
Cleveland, Ohio 44106-4945
216.368.3128 - phone

216.368.2286 - fax
info@casemph.org (http://bulletin.case.edu/schoolofmedicine/epidemiologyandbiostatistics/mailto:info@casemph.org)

A Master of Public Health degree is designed to prepare students to address the broad mission of public health, defined as “enhancing health in human populations, through organized community effort;” utilizing education, research and community service. Public health practitioners are prepared to identify and assess the health needs of different populations, and then to plan, implement and evaluate programs to meet those needs. It is the task of the public health practitioner to protect and promote the wellness of humankind. The master of public health program prepares students to enhance health in human populations through organized community effort. Graduates are qualified to work in local and state health departments, universities and colleges, hospitals, ambulatory medical centers, non-profit organizations, and the insurance and pharmaceutical industries. The program seeks to attract a rich mix of students, including those pursuing degrees in medicine, nursing, dentistry, law, social work, bioethics, management and other fields, as well as students holding undergraduate degrees.

The CWRU MPH Program has a two-year curriculum requiring 42 credit hours. Eighteen credits are accumulated in six core required courses, representing the fundamental domains of public health: biostatistics, epidemiology, environmental health sciences, health services administration, public health history and social and behavioral sciences. Students receive nine credits for three courses in the major of their choice, six credits for two elective courses, and nine credits for the “Capstone Experience,” a public health field practicum encompassing one semester of the MPH program. The MPH seminar program, a two-semester sequence, is taken for no credit. Previous experience or education pertaining to public health may increase the student’s flexibility in course selection. Students may also enroll part-time and take courses over a three to five year period.

NOTE: Students who matriculated prior to fall 2007 are still held to the 36 credit hour curriculum.

Requirements:

Core required courses (18 credits):

- MPH 405 Statistical Methods in Public Health | 3
- MPH 406 History and Philosophy of Public Health | 3
- MPH 411 Introduction to Health Behavior | 3
- MPH 429 Introduction to Environmental Health | 3
- MPH 439 Public Health Management and Policy | 3
- MPH 483 Introduction to Epidemiology for Public Health Practice | 3
- Capstone Experience: | 9
  - MPH 652 Public Health Capstone Experience

Major - choose one major and take 9 credits within that major

- Population Health Research Major | 9
- Global Health Major
- Health Policy & Management Major
- Health Promotion & Disease Prevention Major

Electives | 6

- MPH 506 The Future of Public Health
- MPH 507 Building a Public Health Project
Students in the Population Health Research major may take MPH 431 Statistical Methods I in place of MPH 405.

MPH Sample Plan of Study (full-time):

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<thead>
<tr>
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<th>Units</th>
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<tbody>
<tr>
<td></td>
<td>Fall</td>
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<td></td>
<td></td>
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<td>Statistical Methods in Public Health (MPHP 405)</td>
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<td>The Future of Public Health (MPHP 506)</td>
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<td>History and Philosophy of Public Health (MPHP 406)</td>
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<td>Introduction to Epidemiology for Public Health Practice (MPHP 483)</td>
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<td>Introduction to Health Behavior (MPHP 411)</td>
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<td>Introduction to Environmental Health (MPHP 429)</td>
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<td>Public Health Management and Policy (MPHP 439)</td>
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<td>Building a Public Health Project (MPHP 507)</td>
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<td>Year Total:</td>
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<table>
<thead>
<tr>
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<tr>
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<td>Major Course #3</td>
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<tr>
<td>Elective course</td>
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<td>Public Health Capstone Experience (MPHP 652)</td>
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<td>Year Total:</td>
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Total Units in Sequence: 42

Majors

Currently, four different majors (a.k.a. tracks) are offered by the CWRU MPH Program: Population Health Research, Global Health, Health Policy & Management, and Health Promotion & Disease Prevention. Each major has a required course or courses (in addition to the core required courses), plus selective offerings to be combined for a total of 9 credit hours in major coursework. Students develop a Capstone project relevant to the major area to expand and apply the knowledge of the subject. Individual emphasis will differ from student to student within each major.

MPH students can also choose to expand the emphasis and depth of their program of study by electing to do a double major plan of study. For the double major, the student chooses two areas (two majors) of equal emphasis and takes 3 courses in each area (this requires the student to take a minimum of 45 credit hours). The student’s Capstone project must embrace and integrate both emphasis., and no double-counting of credits can take place. Students choosing to do the double major plan of study should also work closely with an advisor to ensure optimal course selection and foster the evolution of a successful Capstone project.

Population Health Research Major

Coordinator - Mendel Singer, PhD

Learning Objectives:

- Working knowledge of epidemiologic principles, terminology, and tools
- Working knowledge of the primary analytic methods employed in both prospective and retrospective studies relating to population health
- Understand the most common study designs used in public health and/or clinical research
- Gain familiarity with some of the key advanced concepts in one of the subspecialties of population health (e.g. epidemiology, health services research, outcomes research)

Required major course:

<table>
<thead>
<tr>
<th>Code</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>MPH 491</td>
<td>Epidemiology: Case-Control Study Design and Analysis</td>
<td>3</td>
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</table>

Select other major courses from list below:

<table>
<thead>
<tr>
<th>Code</th>
<th>Course Title</th>
<th>Units</th>
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<tr>
<td>MPH 421</td>
<td>Health Economics and Strategy</td>
<td>3</td>
</tr>
<tr>
<td>MPH 432</td>
<td>Statistical Methods II</td>
<td>3</td>
</tr>
<tr>
<td>MPH 450</td>
<td>Clinical Trials and Intervention Studies</td>
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</tr>
<tr>
<td>MPH 458</td>
<td>Statistical Methods for Clinical Trials</td>
<td>3</td>
</tr>
<tr>
<td>MPH 460</td>
<td>Introduction to Health Services Research</td>
<td>3</td>
</tr>
<tr>
<td>MPH 467</td>
<td>Comparative and Cost Effectiveness Research</td>
<td>1</td>
</tr>
<tr>
<td>MPH 474</td>
<td>Principles of Practice-Based Network Research</td>
<td>3</td>
</tr>
<tr>
<td>MPH 484</td>
<td>Geographic Medicine and Epidemiology</td>
<td>1</td>
</tr>
<tr>
<td>MPH 492</td>
<td>Epidemiology: Cohort Study Design and Analysis</td>
<td>3</td>
</tr>
<tr>
<td>EPBI 414</td>
<td>Introduction to Statistical Computing</td>
<td>3</td>
</tr>
<tr>
<td>EPBI 451</td>
<td>Principles of Genetic Epidemiology</td>
<td>3</td>
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<tr>
<td>EPBI 452</td>
<td>Statistical Methods for Genetic Epidemiology</td>
<td>3</td>
</tr>
<tr>
<td>EPBI 459</td>
<td>Longitudinal Data Analysis</td>
<td>3</td>
</tr>
<tr>
<td>EPBI 461</td>
<td>Health Services Research Methods</td>
<td>3</td>
</tr>
<tr>
<td>EPBI 515</td>
<td>Secondary Analysis of Large Health Care Data Bases</td>
<td>3</td>
</tr>
<tr>
<td>NURS 631</td>
<td>Advanced Statistics: Multivariate Analysis</td>
<td>3</td>
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</table>

Global Health Major

Coordinator - Daniel Tisch, PhD, MPH

Learning Objectives:

- Develop a global perspective on health and diseases
- Learn to design, execute, analyze, and evaluate global health research or projects
- Acquire skills to understanding and communicate meaningfully with colleagues from distant fields of global health
- Learn to integrate multiple objectives in global health across academic and applied disciplines
- Understand ethical and regulatory issues for global health research

Select 2 of 3 as Required major courses:

<table>
<thead>
<tr>
<th>Code</th>
<th>Course Title</th>
<th>Units</th>
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<tbody>
<tr>
<td>INTH 401</td>
<td>Fundamentals of Global Health</td>
<td>3</td>
</tr>
<tr>
<td>MPH 447</td>
<td>Global Health: Outbreak Investigation in Real-Time</td>
<td>3</td>
</tr>
<tr>
<td>MPH 484</td>
<td>Geographic Medicine and Epidemiology</td>
<td>1</td>
</tr>
<tr>
<td>MPH 492</td>
<td>Epidemiology: Case-Control Study Design and Analysis</td>
<td>3</td>
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<tr>
<td>MPH 496</td>
<td>Epidemiology: Case-Control Study Design and Analysis</td>
<td>3</td>
</tr>
<tr>
<td>MPH 508</td>
<td>Ethics, Law, and Epidemiology</td>
<td>3</td>
</tr>
<tr>
<td>MPH 510</td>
<td>Health Disparities</td>
<td>3</td>
</tr>
<tr>
<td>ANTH 461</td>
<td>Urban Health</td>
<td>3</td>
</tr>
<tr>
<td>ANTH 480/481</td>
<td>Medical Anthropology and Global Health</td>
<td>3</td>
</tr>
<tr>
<td>ANTH 511</td>
<td>Seminar in Anthropology and Global Health: Topics</td>
<td>3</td>
</tr>
<tr>
<td>LAWS 4101</td>
<td>International Law</td>
<td>2</td>
</tr>
<tr>
<td>LAWS 5123</td>
<td>International Trade and Development</td>
<td>3</td>
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<tr>
<td>MGMT 460</td>
<td>Managing in a Global Economy</td>
<td>3</td>
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</tbody>
</table>

Health Care Policy & Administration Major

Coordinator - Jessica Berg, JD, MPH

Learning Objectives:
To improve population health through leadership by developing knowledge, ability and skills to lead care improvement, including:

- Knowledge of social science through theories and how they can be used to understand the organization of health care (health economics, sociology, organization theory, social psychology)
- To understand the role of the manager, organizational control and design, relationships with professional workers, adaptation to change and public accountability
- To understand and be able to use management techniques including quality improvement, small group leadership, budgeting, cost effectiveness, and decision supports
- Able to analyze a public health problem, recommend solutions, make a public presentation, and carry out improvements

Required major course:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MPHP 468</td>
<td>The Continual Improvement of Healthcare: An Interdisciplinary Course</td>
<td>3</td>
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</table>

Select remaining major courses from list below:

- MPHP 421 Health Economics and Strategy
- MPHP 456 Health Policy and Management Decisions
- MPHP 467 Comparative and Cost Effectiveness Research
- MPHP 475 Management of Disasters Due to Nature, War, or Terror
- MPHP 508 Ethics, Law, and Epidemiology
- MPHP 510 Health Disparities
- MPHP 532 Health Care Information Systems
- POSC 483 Health Policy and Politics in the United States
- HSMC 420 Health Finance
- EPBI 592 Special Topics in Epidemiology

Required major course:

<table>
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<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>LAWS 5205</td>
<td>Public Law</td>
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<tr>
<td>BETH 417</td>
<td>Introduction to Public Health Ethics</td>
<td>3</td>
</tr>
</tbody>
</table>

Health Promotion & Disease Prevention Major
Coordinator - Erika Trapl, PhD

Learning Objectives:

- Describe models and theories of health behavior as they relate to health promotion and disease prevention
- Identify multi-factorial causes of health behavior and disease
- Demonstrate knowledge and skills necessary to support behavior change
- Apply principles and practice of effective health communication
- Describe development, implementation, and evaluation of programs that promote healthy lifestyle and behaviors

Required major course:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MPHP 433</td>
<td>Community Interventions and Program Evaluation</td>
<td>3</td>
</tr>
</tbody>
</table>

Select remaining major courses from list below:

- MPHP 413 Health Education, Communication, and Advocacy
- MPHP 464 Obesity and Cancer: Views from Molecules to Health Policy
- MPHP 474 Principles of Practice-Based Network Research
- MPHP 475 Management of Disasters Due to Nature, War, or Terror
- MPHP 485 Adolescent Development
- MPHP 508 Ethics, Law, and Epidemiology
- ANTH 461 Urban Health

PhD Epidemiology and Biostatistics

The PhD Program in Epidemiology and Biostatistics draws on the core disciplines of biostatistics and epidemiology to support students in developing the knowledge, skills and competencies needed to assume positions of leadership with the ultimate goal of advancing the public’s health. Students accepted into the PhD program will master the rigorous scientific and analytic methods necessary to be at the forefront of efforts to not only describe, but effectively evaluate and improve the public’s health. The Department operates within a strong interdisciplinary framework involving faculty within the department, the school of medicine, and across the entire university, as well as leaders in health care institutions and health oriented organizations and agencies throughout the wider community.

Student- and faculty-led seminars provide an ongoing mechanism for keeping abreast of current literature and identifying important areas of research and collaborative opportunities. Students are considered junior colleagues of the faculty who will develop the capacity to work independently in a supportive environment. The Department operates within a strong interdisciplinary framework involving faculty within the department, the school of medicine, and across the entire university, as well as leaders in health care institutions and health oriented organizations and agencies throughout the wider community.

Graduates from accredited universities and colleges will be considered for admission to the department. All applicants must satisfy both CWRU and department requirements for graduate admission. Upon acceptance into the PhD program, each student will be assigned an academic advisor, who will guide the student through department and graduate school regulations, assist him or her in designing the initial planed program of study, and track the student’s progress toward degree completion.

All incoming PhD students take a required 36-credit core curriculum, which includes a 24-credit common core, 12-credit concentration core, and 6-credits of electives from one of four areas of concentration: Genetic Epidemiology and Bioinformatics, Global Health Epidemiology, Health Behavior and Prevention Science, and Health Care Organizations, Outcomes and Policy (see descriptions below).

On completion of all core requirements, students take a qualifying examination that leads to advancement to candidacy. When ready to embark upon the Doctoral dissertation, the student must choose a research advisor to have the major responsibility for facilitating, guiding, and advising the student in his or her research.

Curriculum

The Doctor of Philosophy degree in the Department of Epidemiology and Biostatistics is comprised of the following components:

- Basic Core Curriculum (24 credits)
- Specialization/Concentration Core Curriculum (12 credits)
- Electives (6 credits)
- Seminar Requirements (501 & 502, 503, 504, 505, or 506)
- Passing the Qualifying Exam
- Portfolio Presentation
- Dissertation (18 credits)

Basic Core Curriculum (24 credits)

The basic core curriculum is designed to provide PhD students with a strong foundation in epidemiology and biostatistics, together with
health service research - the fields that comprise population health sciences - and the methodological and analytic training to conduct a rigorous, high quality dissertation in the student’s selected specialization or concentration.

Specialization/Concentrations (12 credits)

The PhD coursework requirement also consists of concentrated studies within one of four substantive areas offered within the department: Genetic Epidemiology and Bioinformatics, Global Health Epidemiology, Health Behavior and Prevention Science, and Health Care Organizations, Outcomes and Policy.

Most PhD students will specify a concentration when they apply to the program; those who do so will have better chance of acceptance. Students who do not directly specify a concentration when applying for admission to the program, must do so no later than the end of the second semester (for full-time students) or 18 credit hours of core coursework, and meet all the requirements of the chosen concentration. Applying to a concentration after matriculation OR changing concentrations after initial admission does not guarantee acceptance into the concentration. Some concentrations may have additional prerequisites beyond those required for entrance into the PhD program (i.e., at least one course in calculus), or additional non-coursework requirements (i.e., applied research experience).

Electives (6 credits)

Electives are chosen in conjunction with consultation with the student’s academic advisor.

Seminars (0 credits)

Attending research seminars is integral to our graduate program and your professional development. Students are required to attend weekly research seminars. These seminars provide a forum for students to develop skills in scientific presentation, thought and communication, and balance general and concentration-specific speakers and topics. Meeting locations may vary from week to week depending upon the speaker.

Portfolio Presentation

The purpose of the portfolio presentation is to give the doctoral student, faculty and other doctoral students an opportunity to consider the progress, achievements and goals of the presenting student. However, it is neither an examination nor a formal checklist of activity. The presentation is an opportunity for the presenting student to review her/his study and career goals and for the faculty to offer feedback and advice to the student regarding progress toward her/his goals. One way for the student to think about the portfolio presentation is to imagine that (s)he is being interviewed for an academic or research position. In such a circumstance, the student would explain why (s)he has the background and skills that would qualify her/him for the position.

Generally, the Portfolio Presentation is given after Advancement to Candidacy but prior to the dissertation proposal defense.

Dissertation (18 credits)

After passing the qualifying examination and completing all course work, the student should choose a dissertation topic and find a faculty member with an appointment in the Department who is willing to be his/her research advisor.

PhD Epidemiology & Biostatistics Sample Plan of Study

§ Please also see Graduate Studies Academic Requirements for Doctoral Degrees. (p. 662)

<table>
<thead>
<tr>
<th>First Year</th>
<th>Units</th>
<th>Fall</th>
<th>Spring</th>
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<tr>
<td>Epidemiology: Introduction to Theory and Methods (EPBI 490)</td>
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<td>One of the following:</td>
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<td>Seminar in Health Care Organization, Outcomes and Policy (EPBI 504)</td>
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<td>Seminar in Global Health Epidemiology (EPBI 505)</td>
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<td>Seminar in Health Behavior and Prevention Research (EPBI 506)</td>
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<td>Statistical Methods I (EPBI 431)</td>
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<td>Introduction to Population Health (EPBI 440)</td>
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<td>Seminar in Genetic Epidemiology and Bioinformatics (EPBI 502)</td>
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<tr>
<td>Communicating in Population Health Science Research (EPBI 444)</td>
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<td>Research Ethics in Population Health Sciences (EPBI 445)</td>
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<td>Introduction to Health Services Research (EPBI 460)</td>
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<td>Research Seminar (EPBI 501)</td>
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<td>Essence of Multilevel Statistical Modeling, Including Repeated Measures Analysis (EPBI 436)</td>
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<td>Essence of Classical Multivariate Analysis (EPBI 437)</td>
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<td>Essence of Structural Equation Modeling (EPBI 438)</td>
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<td>Design and Measurement in Population Health Sciences (EPBI 465)</td>
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<td>After completing core curriculum, students take a qualifying exam to pass into candidacy. Concentration coursework</td>
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<td>Year Total:</td>
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| Total Units in Sequence: | 39 |

Year 3 + : Complete remaining hours of elective coursework, Portfolio, and 18 hours of Dissertation Research

Areas of Concentration

Genetic Epidemiology and Bioinformatics

Students enrolled in the Genetic Epidemiology and Bioinformatics Concentration will learn to design and conduct epidemiological studies investigating the genetic and environmental influences on disease. Genetic epidemiology combines genetics, epidemiology, and biostatistics.
Bioinformatics involves the use of sophisticated statistical and data mining tools to analyze genomic, epigenomic, and proteomic data. Special study designs and statistical methods are required to explore genetic influences in epidemiologic studies, and this field continues to evolve as molecular and computational technology evolves. Furthermore, studies have moved beyond associations strictly between trait and DNA sequence, and now incorporate gene-environment interaction, RNA/gene expression, copy number variants, epigenetics, and proteomics. Thus, today’s genetic epidemiologists must be able to take multidisciplinary approaches to the evaluation of genetics in disease pathogenesis.

Researchers in many diverse areas are interested in incorporating genetics into their studies of disease pathogenesis, so this field is in demand. Currently the field is moving towards the development of predictive models incorporating genetic polymorphisms, so this field is central to translational and personalized medicine. After finishing training in this area, students may become collaborators with other basic and clinical scientists who are interested in examining genetic effects on their respective phenotypes, may become methodologists and develop new statistical/bioinformatic approaches appropriate for obtaining genetic information, or may lead their own research related to the genetics of specific complex traits.

Global Health Epidemiology

The World Health Organization (WHO) and the US Institute of Medicine (IOM) defines Global Health as “health problems, issues, and concerns that transcend national boundaries, may be influenced by circumstances or experiences in other countries, and are best addressed by cooperative actions and solutions”. We believe that, at its core, Global Health (and more broadly, population health sciences) is built upon the disciplines of epidemiology and biostatistics. The unifying theme of this concentration is the relatedness of health across diverse geographic areas and communities and the application of epidemiology in the context of related disciplines to define, quantify, and address health determinants, measurements, and trends.

CWRU is a recognized leader in Global Health research and education. Academic opportunities in the field of Global Health are extensive and have been formally organized through the CWRU Framework for Global Health with nine departments, five schools and The Center for Global Health and Diseases at CWRU. Recognizing that Global Health is not limited to international settings or “developing countries”, the concentration also recognizes neglected diseases and vulnerable populations within the USA that transcend cultural boundaries.

The spirit of this concentration is advanced, innovative training to invite and strengthen the brightest new researchers in the field of global health. To accomplish this to the highest degree possible, we take advantage of our own connections within the University, our deep resources in Global Health professionals. Since the focus of this concentration is the development research of impact in a global perspective of health, prior or current experience in cultural settings from which these populations arise is strongly encouraged.

Health Behavior and Prevention Science

Health behavior and prevention research involves the systematic study of factors that modify behaviors related to disease risk and health promotion. This involves the development and testing of intervention programs designed to change behavior and reduce the onset and impact of various diseases and programs designed to improve quality of life. Students enrolled in a concentration in Health Behavior and Prevention Science will train and conduct research on the psychological, social and ecological influences of health-related behaviors linked to the prevention of chronic disease, focusing not only on individual-level health and health behavior change, but more broadly to include multi-level, socio-ecological influences from interpersonal relationships and families, to organizations (school, work, religion), neighborhoods and communities, and policy.

Research opportunities for HBPS students are plentiful across campus, both with EPBI faculty and through established research centers within the university, such as the Prevention Research Center for Healthy Neighborhoods, Center for Reducing Health Disparities, Practice-Based Research Networks, Swetland Center for Environmental Health, Case Comprehensive Cancer Center (Prevention and Control Program), and the Center on Urban Poverty and Community Development.

The Prevention Research Center for Healthy Neighborhoods, through its Training and Mentoring and Research Development Cores, have built-in opportunities for students to become part of research teams, attend seminars, brown-bag discussions and participate in collaborative exchanges with community research partners.

Health Care Organization, Outcomes, and Policy

Students in the Health Care Organization, Outcomes, and Policy concentration will be prepared to design and carry out research in alternative models for the organization and delivery of care; quality, cost-effectiveness and comparative effectiveness of care; disparities in receipt or outcomes of care; translation of evidence-based practice into guidelines and evaluation of their real-world applications; and health policy analysis and implementation. Students in this concentration will acquire a solid grounding in the conduct of rigorous multidisciplinary studies applying quantitative, qualitative and mixed methods, and specialized competencies in key areas, viz., large database analysis; cost-effectiveness and comparative effectiveness analysis; health economics; health policy and management; and other advanced methods such as hierarchical linear modeling; structural equation modeling; instrumental variable analysis; analysis of weighted survey data; and spatial analysis of data.

There is a nationally recognized need for researchers prepared to lead or collaborate on the types of studies students in this concentration would be prepared to conduct. Placements of past graduates of our department who focused their studies in this area indicate that a variety of employment opportunities exist in academia, industry, and government. This concentration is closely related to research in comparative effectiveness, disparities, and health care quality, all three of which reflect national funding priorities. For example, over one billion in federal research dollars has recently been devoted to the funding comparative effectiveness research.

EPBI Courses

EPBI 406. Public Policy and Aging. 3 Units.
Overview of aging and the aged. Concepts in the study of public policy. Policies on aging and conditions that they address. The politics of policies on aging. Emergent trends and issues. Offered as ANTH 498, BETH 496, EPBI 408, GERO 496, HSTY 480, MPHP 408, NURS 479, NURS 579, POSC 480, and SOCI 496.
EPBI 411. Introduction to Health Behavior. 3 Units.
Using a biopsychosocial perspective, an overview of the measurement and modeling of behavioral, social, psychological, and environmental factors related to disease prevention, disease management, and health promotion is provided. Offered as EPBI 411 and MPHP 411. Prereq: Enrollment limited to MPH students (Plan A or Plan B) and EPBI students or consent.

EPBI 414. Introduction to Statistical Computing. 3 Units.
This course introduces the use of computers in epidemiologic investigations and biostatistical applications. Topics covered include the use of the Internet to access and obtain publicly available databases, database and spreadsheet concepts, and developing a sound approach to analysis planning and implementation. The majority of the course will focus on instruction in the use of SAS software for advanced database management and manipulation and basic statistical analyses, with parallel applications in R to exploit its features. Primary emphasis is on developing the knowledge and familiarity required for running these particular programs in connection with data collection, analysis, and presentation of results in clinical studies. Students will be required to complete assignments using personal computers using Windows operating systems and/or computer systems maintained by the department. Students should expect weekly assignments to reinforce lecture concepts. Knowledge of basic statistics in beneficial, as this course does not teach inferential statistical analysis in detail; but it is not vital to learning the material in this course.

EPBI 415. Statistical Programming. 3 Units.
Programming with R and SAS, emphasizing sound practices and covering numerical methods commonly used in statistical science. R is a high-level, open-source platform now vital in statistical computing, especially for creating and sharing applications that implement new and customized methods. SAS is a comprehensive commercial software system that is widely used in biomedical research. Topics include effective programming style and structure, R for customized graphics, Monte Carlo simulation and bootstrapping, numerical optimization and root finding. Previous experience in R and SAS is advised, but students literate in other languages (e.g., Java, C++) are encouraged to enroll. Prereq: EPBI 431.

EPBI 419. Topics in Urban Health in the United States. 3 Units.
This course examines patterns of urban health and disease across the life course among marginalized populations and communities. We will examine the socio-environmental contexts that impact health status (i.e., racism, health disparities, neighborhood context, and environmental stressors). Readings from epidemiology, sociology, and public health literature will provide a foundation for the multiple factors and processes that impact health. Offered as EPBI 419 and MPHP 419.

EPBI 431. Statistical Methods I. 3 Units.
Application of statistical techniques with particular emphasis on problems in the biomedical sciences. Basic probability theory, random variables, and distribution functions. Point and interval estimation, regression, and correlation. Problems whose solution involves using packaged statistical programs. First part of year-long sequence. Offered as ANAT 431, BIOL 431, CRSP 431, EPBI 431, and MPHP 431.

EPBI 432. Statistical Methods II. 3 Units.
Methods of analysis of variance, regression and analysis of quantitative data. Emphasis on computer solution of problems drawn from the biomedical sciences. Design of experiments, power of tests, and adequacy of models. Offered as BIOL 432, CRSP 432, EPBI 432, and MPHP 432. Prereq: EPBI 431 or equivalent.

EPBI 433. Community Interventions and Program Evaluation. 3 Units.
This course prepares students to design, conduct, and assess community-based health interventions and program evaluation. Topics include assessment of need, evaluator/stakeholder relationship, process vs. outcome-based objectives, data collection, assessment of program objective achievement based on process and impact, cost-benefit analyses, and preparing the evaluation report to stakeholders. Recommended preparation: EPBI 490, EPBI 431, or MPHP 405. Offered as EPBI 433 and MPHP 433.

EPBI 434. Community Engaged Research: Principles, Methods and Applications. 3 Units.
Community-engaged research is a partnership approach to research that equitably involves community members, organization representatives, and academic researchers in all aspects of the research process. This course is designed to provide an overview of community-based participatory research (CBPR) and will familiarize students with the core principles, concepts and methods as it applies to health-related outcomes. Using a class format that includes lectures, discussion, case studies, small group exercises and fieldwork projects, we will examine and discuss key methodological considerations in each phase of the research process from partnering with communities to planning for research, data gathering, and dissemination of results. Examples of applications in both public health and clinical settings will be highlighted.

EPBI 435. Survival Data Analysis. 3 Units.
Basic concepts of survival analysis including hazard function, survival function, types of censoring; non-parametric models; extended Cox models: time dependent variables, piece-wise Cox model, etc; sample size requirements for survival studies. Prereq: EPBI 432.

EPBI 436. Essence of Multilevel Statistical Modeling, Including Repeated Measures Analysis. 1 Unit.
A brief introduction to statistical models to handle studies having observational units (cases) at multiple levels (hierarchies). In particular, cases are often nested within groups, such as distinct communities, healthcare centers, or schools. Because the cases are not independent, ordinary statistical models (EPBI 432) are not appropriate. In addition, some research questions suggest case-level analyses; others suggest group-level analyses. Longitudinal and other repeated measures analyses can be formed by taking the measurements to be nested within independent cases. Methods include the basic "summary measure" approach and mixed linear model methods, such as random coefficient regression models. Examples and wise use of software (R and SAS) are stressed in order to develop a strong conceptual understanding of the models. This course joins EPBI 437 and 438 as the three-step "essence" series in advanced statistical methods required for the PhD in Population Health Science. Prereq: EPBI 432 or requisites not met permission.
EPBI 437. Essence of Classical Multivariate Analysis. 1 Unit.
A brief introduction to classical multivariate analysis methods: data visualization, two-group discriminant analysis via Hotelling's test, principal components and exploratory factor analysis, cluster analysis. Examples and wise use of software R are stressed in order to develop a strong conceptual understanding of the methods. This course joins EPBI 436 and 438 as the three-step "essence" series in advanced statistical methods required for the PhD in Population Health Science. Prereq: EPBI 432 or requisites not met permission.

EPBI 438. Essence of Structural Equation Modeling. 1 Unit.
Brief introduction to classic "linear structural relations" (LISREL) formulation of structural equation models: Building them to address specific research aims. Fitting and assessing the goodness of the fit. Prudent interpretations. Examples and wise use of software are stressed in order to develop a strong conceptual understanding. This course joins EPBI 436 and 437 as the three-step "essence" series in advanced statistical methods required for the PhD in Population Health Science. Prereq: EPBI 432 or requisites not met permission.

EPBI 440. Introduction to Population Health. 3 Units.
Introduces graduate students to the multiple determinants of health including the social, economic and physical environment, health services, individual behavior, genetics and their interactions. It aims to provide students with the broad understanding of the research development and design for studying population health, the prevention and intervention strategies for improving population health and the disparities that exist in morbidity, mortality, functional and quality of life. Format is primarily group discussion around current readings in the field; significant reading is required.

EPBI 441. Theory of Linear Models, with Applications. 3 Units.

EPBI 442. Biostatistics II. 3 Units.
This course deals with the basic concepts and applications of nonparametric statistics. Topics will include distribution-free statistics, one sample rank test, the Mann-Whitney and Kruskal Wallis tests, one sample and two sample U-statistics, asymptotic relative efficiency of tests, distribution-free confidence intervals, point estimation and linear rank statistics. Recommended preparation: EPBI 441. Offered as EPBI 442 and MPH 442.

EPBI 443. Multivariate and High Dimensional Data. 3 Units.
Contemporary multivariate analysis, including statistical learning and inference methods when the number of measures far exceeds the number of subjects ("high-dimensional data"). Topics include (but not limited to) classical modeling and inference under multivariate normal theory, principal components, descriptive and confirmatory factor analysis, partial least squares, classification and supervised learning, cluster analysis, unsupervised learning methods, and next generation sequencing data analysis. This course stresses how the core modeling principles, computing tools, and visualization strategies are used to address complex scientific aims powerfully and efficiently, and to communicate those findings effectively to content researchers who may have little or no experience in these methods. Recommended preparation: Advanced graduate students in Biostatistics or other quantitative sciences with background and adequate preparation in graduate-level classical statistical theory and a course experience in regression analysis. Some programming experience. Knowledge in mathematical computing or statistical software package is helpful. We aim to use SAS, R, STATA, and JMP Genomics for analyzing data.

EPBI 444. Communicating in Population Health Science Research. 2 Units.
Doctoral seminar on writing journal articles to report original research, and preparing and making oral and poster presentations. The end products are ready-to-submit manuscripts and related slide and poster presentations for the required first-year research project in the PhD program in the Department of Epidemiology and Biostatistics. While this course provides a nucleus for this endeavor, students work intensively under the supervision of their research mentors, who guide all stages of the work including providing rigorous editorial support. Seminar sessions are devoted to rigorous peer critiques of every stage of the projects and to in-depth discussions of assigned readings. Recommended preparation: PhD students in the Department of Biostatistics and Epidemiology. Non-PhD EPBI students permitted if space available. Fluency in English writing (e.g., in accord with the Harbrace College Handbook). Prereq: EPBI 431 and EPBI 490. Coreq: EPBI 432.

EPBI 445. Research Ethics in Population Health Sciences. 1 Unit.
This one-credit hour course is designed to address key elements in research ethics as they apply to the Population Health Sciences. The course includes readings, lectures, discussions and peer presentations in the following areas: personal, professional and financial conflict of interest; policies regarding human subjects; safe laboratory practices; mentor/mentee responsibilities and relationships; collaborative research; peer review; data acquisition and laboratory tools; management, sharing and ownership of data; research misconduct; responsible authorship and publication; the role of the scientist in society; contemporary ethical issues in biomedical research; and the environmental and societal impacts of scientific research.

EPBI 446. Experimental Design for Biomedical Sciences. 3 Units.
This course deals with basic problems of the design and analysis of experiments with emphasis on experiments conducted in the biomedical sciences. Topics will include completely randomized and balanced incomplete block designs. Latin and Graeco-Latin squares, factorial experiments and response surface and mixture designs. In addition to analysis and interpretation of results from experiments, optimization of design parameters, using second-order models will be covered. The course is intended for graduate students and investigators who are engaged in biomedical research. Prereq: EPBI 432 or MPH 432 or BIOL 432 or consent of instructor.
EPBI 447. Global Health: Outbreak Investigation in Real-Time. 3 Units.
This course provides a trans-cultural, trans-disciplinary, multimedia learning experience by analyzing historical and real-time data from the annual dengue endemics and sporadic epidemics in Puerto Rico and Brazil. A rigorous problem-centered training in the epidemiology, prevention, treatment, and control of infectious diseases using real-time and historical surveillance data of endemic and epidemic Dengue in Bahia, Brazil. This is an advanced epidemiology course in which core material will be primarily taught through reading assignments, class discussion, group projects, and class presentations. The course will utilize the online web-based communication and learning technology to create a single classroom between the CWRU and international partners with unique and complementary skills. In addition to joint classroom lectures across sites, student groups will also perform smaller-scale videoconference meetings for assigned group projects, thus creating strong international connections for the students, faculty, and our institutions. Note: Due to the complexities of time zones for this international course, the course will begin at 8:00a.m. until the U.S.A. adjusts clocks for Daylight Savings Time (unlike Brazil). Therefore, classes after the second week of March will begin at 9:00a.m. Offered as: EPBI 447, INTH 447, and MPH 447. Prereq: EPBI 490.

EPBI 450. Clinical Trials and Intervention Studies. 3 Units.
Issues in the design, organization, and operation of randomized, controlled clinical trials and intervention studies. Emphasis on long-term multicenter trials. Topics include legal and ethical issues in the design; application of concepts of controls, masking, and randomization; steps required for quality data collection; monitoring for evidence of adverse or beneficial treatment effects; elements of organizational structure; sample size calculations and data analysis procedures; and common mistakes. Recommended preparation: EPBI 431 or consent of instructor. Offered as EPBI 450 and MPH 450.

EPBI 451. Principles of Genetic Epidemiology. 3 Units.
A survey of the basic principles, concepts and methods of the discipline of genetic epidemiology, which focuses on the role of genetic factors in human disease and their interaction with environmental and cultural factors. Many important human disorders appear to exhibit a genetic component; hence the integrated approaches of genetic epidemiology bring together epidemiologic and human genetic perspectives in order to answer critical questions about human disease. Methods of inference based upon data from individuals, pairs of relatives, and pedigrees will be considered. The last third of the course (1 credit) is more statistical in nature. Offered as EPBI 451, GENE 451, and MPH 451. Prereq: EPBI/MPH 431 and EPBI/MPH 450 or MPH 450.

EPBI 452. Statistical Methods for Genetic Epidemiology. 3 Units.
Analytic methods for evaluating the role of genetic factors in human disease, and their interactions with environmental factors. Statistical methods for the estimation of genetic parameters and testing of genetic hypotheses, emphasizing maximum likelihood methods. Models to be considered will include such components as genetic loci of major effect, polygenic inheritance, and environmental, cultural and developmental effects. Topics will include familial aggregation, segregation and linkage analysis, ascertainment, linkage disequilibrium, and disease marker association studies. Recommended preparation: EPBI 431 and EPBI 451.

EPBI 453. Categorical Data Analysis. 3 Units.
Descriptive and inferential methods for categorical data with applications: bivariate data; models for binary and multinomial response variables, with emphasis on logit models; loglinear models for multivariate data; model fitting using the maximum likelihood approach; model selection and diagnostics; and sample size and power considerations. Topics in repeated response data as time allows. Recommended preparation: EPBI 441.

EPBI 454. Population Genetics for Genetic Epidemiology. 3 Units.
This course will cover basics of population genetics (mutation, migration, natural selection) as well as topics such as random mating populations and inbred populations. Emphasis will be placed on migration studies and on linkage disequilibrium mapping. Measures on linkage disequilibrium, methods for linkage disequilibrium mapping of disease genes and the use of isolated versus outbred population in linkage of disequilibrium mapping will be discussed. Recommended preparation: EPBI 431.

EPBI 457. Genetic Linkage Analysis. 3 Units.
Methods of analyzing human data to detect genetic linkage between disease traits, discreet and continuous, and polymorphic markers. Both model-based maximum likelihood (lod score) and model-free robust methods will be discussed. Additional topics covered will include measures of informativeness, multipoint analysis, numerical methods and mod score analysis. Prereq: EPBI 432. Coreq: EPBI 451.

EPBI 458. Statistical Methods for Clinical Trials. 3 Units.
This course will focus on special statistical methods and philosophical issues in the design and analysis of clinical trials. The emphasis will be on practically important issues that are typically not covered in standard biostatistics courses. Topics will include: randomization techniques, intent-to-treat analysis, analysis of compliance data, equivalency testing, surrogate endpoints, multiple comparisons, sequential testing, and Bayesian methods. Offered as EPBI 458 and MPH 458. Prereq: EPBI 432 or MPH 432.

EPBI 459. Longitudinal Data Analysis. 3 Units.
This course will cover statistical methods for the analysis of longitudinal data with an emphasis on application in biological and health research. Topics include exploratory data analysis, response feature analysis, growth curve models, mixed-effects models, generalized estimating equations, and missing data. Prereq: EPBI 432.

EPBI 460. Introduction to Health Services Research. 3 Units.
This survey course provides an introduction to the field of Health Services Research and an overview of key health services research concepts and methods, including conceptual frameworks and models; outcomes research; risk adjustment; disparities in health care; policy/health care systems; cost and cost-effectiveness; quality of life, process improvement; patient satisfaction; patient safety; health economics; statistical modeling techniques; and qualitative research methods. Offered as EPBI 460 and MPH 460.
**EPBI 461. Health Services Research Methods. 3 Units.**
This is a course in research methods focusing on practical issues in the conduct of health services research studies. Topics include: an overview of health services research; ethics in health services research; proposal writing and funding; the relationship between theory and research; formulating research questions; specifying study design and study objectives; conceptualizing and defining variables; validity and reliability of measures; scale construction; operationalizing health research relevant variables using observation, self and other report, and secondary analysis; formatting questionnaires; developing analysis plans; choosing data collection methods; sampling techniques and sample size; carrying out studies; preparing data for analysis; and reporting of findings.

**EPBI 464. Obesity and Cancer: Views from Molecules to Health Policy. 3 Units.**
This course will provide an overview of the components of energy balance (diet, physical activity, resting metabolic rate, dietary induced thermogenesis) and obesity, a consequence of long term positive energy balance, and various types of cancer. Following an overview of energy balance and epidemiological evidence for the obesity epidemic, the course will proceed with an introduction to the cellular and molecular biology of energy metabolism. Then, emerging research on biologically plausible connections and epidemiological associations between obesity and various types of cancer (e.g., colon, breast) will be presented. Finally, interventions targeted at decreasing obesity and improving quality of life in cancer patients will be discussed. The course will be cooperatively-taught by a transdisciplinary team of scientists engaged in research in energy balance and/or cancer. Didactic lectures will be combined with classroom discussion of readings. The paper assignment will involve application of course principles, lectures and readings. Offered as EBPI 464, MPHP 464.

**EPBI 465. Design and Measurement in Population Health Sciences. 3 Units.**
This course focuses on common design and measurement approaches used in population health sciences research, building on introductions to these approaches provided in pre-requisite courses. Students will develop in-depth knowledge of these approaches through readings, lectures, discussions, class presentations, and hands-on applications. Applications will focus on primary data collection in multiple settings and across varying populations. Prereq: EPBI 440, EPBI 431, EPBI 490, EPBI 432, EPBI 460, EPBI 444 and EPBI 445.

**EPBI 466. Promoting Health Across Boundaries. 3 Units.**
This course examines the concepts of health and boundary spanning and how the synergy of the two can produce new, effective approaches to promoting health. Students will explore and analyze examples of individuals and organizations boundary spanning for health to identify practice features affecting health; compare and contrast practices and approaches, and evaluate features and context that promote or inhibit boundary spanning and promoting health. Offered as MPH 466, EPBI 466, and BETH 466. Prereq: Graduate student status or instructor consent.

**EPBI 467. Comparative and Cost Effectiveness Research. 1 Unit.**
Comparative effectiveness research is a cornerstone of healthcare reform. It holds the promise of improved health outcomes and cost containment. This course is presented in a convenient 5-day intensive format in June. There are reading assignments due prior to the 1st session. Module A, Days 1-2: Overview of comparative effectiveness research (CER) from a wide array of perspectives: individual provider, institution, insurer, patient, government, and society. Legal, ethical and social issues, as well as implications for population and public health, including health disparities will also be a component. Module B, Day 3: Introduction to the various methods, and their strengths, weaknesses and limitations. How to read and understand CER papers. Module C, Days 4-5: Cost-Effectiveness Analysis. This will cover costing, cost analysis, clinical decision analysis, quality of life and cost-effectiveness analysis for comparing alternative health care strategies. Trial version of TreeAge software will be used to create and analyze a simple cost-effectiveness model. The full 3-credit course is for taking all 3 modules. Modules A or C can be taken alone for 1 credit. Modules A and B or Modules B and C can be taken together for a total of 2 credits. Module B cannot be taken alone. If taking for 2 or 3 credits, some combination of term paper, project and/or exam will be due 30 days later. Offered as EPBI 467 and MPH 467.

**EPBI 468. The Continual Improvement of Healthcare: An Interdisciplinary Course. 3 Units.**
This course prepares students to be members of interprofessional teams to engage in the continual improvement in health care. The focus is on working together for the benefit of patients and communities to enhance quality and safety. Offered as EPBI 468, MPH 468, NURS 468.

**EPBI 471. Statistical Aspects of Data Mining. 3 Units.**

**EPBI 472. Special Topics in Statistical Genetics. 1 - 4 Unit.**
Various topics in statistical genetics will be discussed, depending on student interest and needs. Examples of topics are paternity and zygosity testing, path analysis for genetic epidemiology, the analysis of racial admixture and modeling such phenomena as imprinting and anticipation. The course will consist of four modules. A student may, in consultation with the instructor, elect to take 1 - 4 modules for the corresponding amount of credit. Recommended preparation: EPBI 452.

**EPBI 473. Integrative Cancer Biology. 3 Units.**
Nonlinear mathematical representations of cancer relevant processes will be analyzed and used to interpret data where available. Stochastic processes will be introduced for tumor cell numbers and DNA double strand breaks. SEER, A-bomb, omic and cytometry data will be analyzed.
EPBI 474. Principles of Practice-Based Network Research. 3 Units.
Practice-based research networks (PBRNs) are organizations of community-based healthcare practices that engage in clinical research and practice improvement. In the U.S., there are more than 100 of these dynamic, collaborative organizations that enable the translation of research into practice and practice into research. They also frequently engage in developing and refining methods to improve healthcare quality. This course is designed to provide students with a foundation in PBRN methods and principles, including: introduction to PBRNs, methods for collaborating with community practices, PBRN-building strategies, PBRN data collections methods, statistical issues in network research, community-based participatory research, human subjects' protection issues in PBRNs, quality improvement research in PBRNs, funding for PBRN research, and writing PBRN research findings for publication. Each 2.5 hour class session will feature a lecture followed by a discussion of readings from the literature. Students will develop a PBRN research or quality improvement proposal during the semester. Offered as EPBI 474 and MPH 474.

EPBI 476. Introduction to sequencing data analysis. 3 Units.
This is a 3 credit-hour cross-disciplinary course focusing on the analysis of high throughput sequencing data. In this course, the following will be covered: (1) basic genetics knowledge, (2) advanced next generation sequencing technology, (3) the use of R and perl, and (4) hands-on experience of analyzing different types of large sequencing data (e.g., SNP calling, chip-seq, RNA-seq, and methyl-seq). Upon completion of the course, the students are expected to (1) master basic knowledge and skills in several different disciplines: genetics, programming, and sequencing data analysis, and (2) be able to make significant contributions to collaborative projects by providing meaningful and accurate analysis for sequencing data. Graduate students from the following departments are encouraged to take this course: Department of Epidemiology and Biostatistics, Department of Electronic Engineering and Computer Science, Department of Genetics and Department of Biomedical Engineering. Prereq: EPBI 414 and EPBI 431. Coreq: EPBI 432.

EPBI 477. Internship at Health-Related Government Agencies. 3 Units.
This independent study course will incorporate a one-semester-long internship at health-related government agencies (Ohio Department of Health, Ohio Department of Job and Family Services, or Cleveland City Health Department). The choice of the agency will depend on the student's academic interests and research goals. The objective is to develop a level of familiarity with the organizational and operational aspects of such agencies, and to gain an understanding of agencies' and bureaucracies' interactions with the legislative body, as well as the processes of developing, implementing, managing, and monitoring health initiative. The instructor and the liaison persons at the agencies will be responsible for planning structured encounters of interns with key administrators and policy makers, and to select a research project, based on the intern's research interests and the agencies' research priorities. Interns will be required to submit a draft of the report to the instructor at the end of the semester. The approved, final report will be submitted to the agency. The project will be evaluated for its methodological soundness and rigor. Students will be required to be at the agency one day a week. Recommended preparation: EPBI 515. Offered as EPBI 477 and MPH 474.

EPBI 480. Introduction to Mathematical Statistics. 3 Units.
An introduction to statistical inference at an intermediate mathematical level. The concepts of random variables and distributions, discrete and continuous, are reviewed. Topics covered include: expectations, variance, moments, the moment generating function; Bernoulli, binomial, hypergeometric, Poisson, negative binomial, normal, gamma and beta distribution; the central limit theorem; Bayes estimation, maximum likelihood estimators, unbiased estimators, sufficient statistics; sampling distributions (chi-square, t) confidence intervals, Fisher information; hypothesis testing, uniformly most powerful tests and multi-decision problems. Prereq: MATH 122, MATH 124 or MATH 126.

EPBI 481. Theoretical Statistics I. 3 Units.
Topics provide the background for statistical inference. Random variables; distribution and density functions; transformations, expectation. Common univariate distributions. Multiple random variables; joint, marginal and conditional distributions; hierarchical models, covariance. Distributions of sample quantities, distributions of sums of random variables, distributions of order statistics. Methods of statistical inference. Offered as STAT 345, STAT 445, and EPBI 481. Prereq: MATH 122 or MATH 223 or Coreq: EPBI 431.

EPBI 482. Theoretical Statistics II. 3 Units.
Point estimation: maximum likelihood, moment estimators. Methods of evaluating estimators including mean squared error, consistency, "best" unbiased and sufficiency. Hypothesis testing; likelihood ratio and union-intersection tests. Properties of tests including power function, bias. Interval estimation by inversion of test statistics, use of pivotal quantities. Application to regression. Graduate students are responsible for mathematical derivations, and full proofs of principal theorems. Offered as STAT 346, STAT 446 and EPBI 482. Prereq: STAT 345 or STAT 445 or EPBI 481.

EPBI 483. Causal Inference. 3 Units.
This course covers concepts and methods for causal inference in health research. The ideas and approaches introduced in this course take us beyond standard statistical methods such as regression analysis, and have applications in both observational and randomized studies. Specific topics include potential outcomes, causal diagrams, confounding, propensity scores, instrumental variables, treatment noncompliance, mediation analysis, sensitivity analysis, and structural equations models. Prereq: EPBI/MPHP/BIOL 432 or equivalent.

EPBI 484. Geographic Medicine and Epidemiology. 1 - 3 Unit.
This course focuses on the epidemiology, prevention, treatment, and control of tropical and parasitic diseases. Emphasis will be placed on the triad of agent, host, and environment for infectious disease impacting global health. Three distinct modules will focus on specific examples such as malaria, helminths, bacteria, or viruses. Active class participation is required through discussions, case studies, and group projects. Recommended preparation: EPBI 490, EPBI 491 and a microbiology course or consent of instructor. Offered as EPBI 484, INTH 484, and MPH 484.
EPBI 485. Likelihood Theory & Applications. 3 Units.
This course introduces contemporary likelihood theory and its applications in solving statistical problems. The course will cover maximum likelihood theory; profile-, pseudo-, quasi-likelihood theory, and generalized estimating equations. We will use these likelihood theories in modeling and inference. Although we will rely on statistical theory and mathematics, the course is more about developing statistical thought process in addressing real-world statistical challenges. We will apply computational approaches in understanding estimation and making likelihood based inferences. There will be a midterm project in this course which will allow you to determine independent statistical research working in your own content area. The course is taught at the doctoral level, and much of the theory is illustrated through applications. Prereq: EPBI 482, STAT 446 or equivalent.

EPBI 490. Epidemiology: Introduction to Theory and Methods. 3 Units.
This course provides an introduction to the principles of epidemiology covering the basic methods necessary for population and clinic-based research. Students will be introduced to epidemiologic study designs, measures of disease occurrence, measures of risk estimation, and casual inference (bias, confounding, and interaction) with application of these principles to specific fields of epidemiology. Classes will be a combination of lectures, discussion, and in-class exercises. It is intended for students who have a basic understanding of the principals of human disease and statistics. Offered as EPBI 490 and MPHP 490. Prereq or Coreq: EPBI 431 or requisites not met permission.

EPBI 491. Epidemiology: Case-Control Study Design and Analysis. 3 Units.
This course builds upon EPBI 490 with a comprehensive study of the concepts, principles, and methods of epidemiologic research. The course content specifically focuses on the case-control study design and provides a framework for the design, analysis, and interpretation of case-control studies. Rigorous problem-centered training includes exposure measurement, subject selection, validity, reliability, sample size and power, effect modification, confounding, bias, risk assessment, matching, and logistic regression. Individual and group data projects will be analyzed using SAS statistical software. Offered as EPBI 491 and MPHP 491. Prereq: EPBI/MPHP 490.

EPBI 492. Epidemiology: Cohort Study Design and Analysis. 3 Units.
This course provides a comprehensive introduction to the cohort study. Particular emphasis is placed on cohort study design and cohort data analysis. The course will cover the conceptual framework underlying cohort studies, planning and conducting a cohort study, basic concepts of time, exposure, and outcome, and methods in the analysis of longitudinally collected data. Analytic methods covered in the class include, but are not limited to: analysis of age, period, and cohort effects, analysis of incidence rates, analysis of repeated measures, and analysis of time-to-event data. Students will have the opportunity to conduct analysis of data obtained from an actual cohort study using a statistical package of their choice. Offered as EPBI 492 and MPHP 492. Prereq: EPBI 431 and EPBI 490 or equivalents.

EPBI 494. Infectious Disease Epidemiology. 1 - 3 Unit.
This course is a follow-up to EPBI 484: Geographic Medicine and Epidemiology, and focuses on tuberculosis (TB), HIV, and dengue epidemiology. This is an advanced course, focusing on methods and approaches in epidemiology. It will be taught in three 1-credit modules, and students may take each module separately or all 3 together. Each module will have a separate project and/or exam. Module I: Tuberculosis epidemiology. Module II: HIV epidemiology. Module III: Dengue epidemiology. Offered as EPBI 494, INTH 494, and MPHP 494. Prereq: EPBI 490.

EPBI 497. Cancer Epidemiology. 1 - 3 Unit.
This is a 1-3 credit modular course in cancer epidemiology and is intended for graduate students in epidemiology and biostatistics, environment health, MPH students and MD or MD/PhD students. The course will consist of 3 five-week modules: 1) introduction to cancer epidemiology (study design, etiology and causal inference, cancer statistics and cancer biology); 2) site-specific discussions of various cancers involving natural history of disease and risk factors and etiology and 3) cancer prevention and screening and cancer survivorship. Each of the modules is worth 1 credit hour for a total of 3 credit hours. Offered as: EPBI 497 and MPHP 497.

EPBI 499. Independent Study. 1 - 18 Unit.

EPBI 500. Design and Analysis of Observational Studies. 3 Units.
An observational study investigates treatments, policies or exposures and the effects that they cause, but it differs from an experiment because the investigator cannot control assignment. We introduce appropriate design, data collection and analysis methods for such studies, to help students design and interpret their own studies, and those of others in their field. Technical formalities are minimized, and the presentations will focus on the practical application of the ideas. A course project involves the completion of an observational study, and substantial use of the R statistical software. Topics include randomized experiments and how they differ from observational studies, planning and design for observational studies, adjustments for overt bias, sensitivity analysis, methods for detecting hidden bias, and focus on propensity score methods for selection bias adjustment, including multivariate matching, stratification, weighting and regression adjustments. Recommended preparation: a working knowledge of multiple regression, some familiarity with logistic regression, with some exposure to fitting regression models in R. Offered as CRSP 500 and EPBI 500.

EPBI 501. Research Seminar. 0 Units.
This seminar series includes faculty and guest-lecturer presentations designed to introduce students to on-going research at the University and elsewhere. Seminars will emphasize the application of methods learned in class, as well as the introduction of new methods and tools useful in research.

EPBI 502. Seminar in Genetic Epidemiology and Bioinformatics. 0 Units.
Presentation of original research or recent journal publications by faculty and students.

EPBI 503. Seminar in Biostatistics. 0 Units.
Presentation of original research or recent journal publications by faculty and students in the area of Biostatistics.
EPBI 504. Seminar in Health Care Organization, Outcomes and Policy. 0 Units.
This seminar is designed to enhance the professional development of students in the Health Care Organization, Outcomes and Policy concentration of the Department of Epidemiology and Biostatistics and provide them with practical information, experiences and guidance to foster their academic success. Students will 1) develop the ability to critically appraise the health services research literature; 2) gain experience in organizing and delivering oral presentations based on published literature and their own research endeavors; 3) be exposed to role models and receive coaching on career development through lecture and discussion involving experienced faculty from within and outside the division; 4) receive didactic training and hands-on experience with career-related tasks and skills such as grant writing and proposal evaluation, article review, and effective participation in professional meetings; and hear faculty from within and outside the department describe their research. The specific content of the seminar for any given semester will be determined jointly by HCOOP students and faculty. Enrollment is limited to students in the HCOOP division of the Department of Epidemiology and Biostatistics.

EPBI 505. Seminar in Global Health Epidemiology. 0 Units.
This seminar explores a broad range of topics related to infectious disease research in international settings. Areas of interest are certain to include epidemiology, bioethics, medical anthropology, pathogenesis, drug resistance, vector biology, cell and molecular biology, vaccine development, diagnosis, and socio-cultural factors contributing to or compromising effective health care delivery in endemic countries. Speakers will include a diverse group of regional faculty and post-doctoral trainees, as well as visiting colleagues from around the world. Students will be asked to read a journal article written by the speaker and then discuss this article with the speaker after their seminar.

EPBI 506. Seminar in Health Behavior and Prevention Research. 0 Units.
This seminar is designed to enhance the academic and professional development of students in the Health Behavior & Prevention Research (HB&PR) concentration in the Department of Epidemiology and Biostatistics. The seminar is comprised of a journal club style in which current and classic research literature in health behavior and prevention research is critically evaluated. Also, talks are given by students, faculty, and invited guests. These activities give students the opportunity to improve their ability to: 1) critically evaluate research literature in HB&PR; 2) lead effectively a discussion of a research article; and 3) organize and deliver oral presentations based on published literature and their own research endeavors. Some sessions are devoted to didactic training and hands-on experience with career-related tasks and skills such as grant writing, proposal evaluation, and manuscript review. The specific content of the seminar for any given semester will be determined jointly by the students and faculty in HB&PR. Enrollment is required of all PhD students in the HB&PR concentration of the Department of Epidemiology and Biostatistics; however, it is open to all interested students.

EPBI 508. Ethics, Law, and Epidemiology. 3 Units.
This course is designed to provide epidemiology students with basic knowledge about the ethical and legal principles underlying epidemiological research. This is not a public health law class. Issue papers are assigned on a weekly basis. Each issue paper requires that the student analyze the situation depicted and apply the principles learned. Some issue papers may require that the student draft a proposed rule, a portion of legislation, or a document such as an informed consent form. Other exercises may require that students critique an existing agency rule or legislation. Offered as EPBI 508 and MPH 508. Prereq: EPBI 490 and EPBI 491 or equivalents.

EPBI 510. Health Disparities. 3 Units.
This course aims to provide theoretical and application tools for students from many disciplinary backgrounds to conduct research and develop interventions to reduce health disparities. The course will be situated contextually within the historical record of the United States, reviewing social, political, economic, cultural, legal, and ethical theories related to disparities in general, with a central focus on health disparities. Several frameworks regarding health disparities will be used for investigating and discussing the empirical evidence on disparities among other subgroups (e.g., the poor, women, uninsured, disabled, and non-English speaking populations) will also be included and discussed. Students will be expected to develop a research proposal (observational, clinical, and/or intervention) rooted in their disciplinary background that will incorporate materials from the various perspectives presented throughout the course, with the objective of developing and reinforcing a more comprehensive approach to current practices within their fields. Offered as CRSP 510, EPBI 510, MPH 510, NURS 510, and SASS 510.

EPBI 512. Reproductive and Perinatal Epidemiology. 1 - 3 Unit.
This course provides an overview of the biology, risk factors, and epidemiologic methods related to reproductive and perinatal outcomes. The course will be divided into three one-credit modules: 1) female reproductive health (e.g. puberty, menstrual cycle function, gynecological disorders, menopause); 2) pregnancy (e.g. fecundity, pregnancy complications, birth outcomes, congenital malformations, infant mortality); and 3) male reproductive health (e.g. fecundity, male reproductive malformations, testicular dysgenesis syndrome, erectile dysfunction). The course will be a combination of lectures and class discussions. Recommended preparation: EPBI 490 and EPBI 431 or the equivalent.

EPBI 515. Secondary Analysis of Large Health Care Data Bases. 3 Units.
Development of skills in working with the large-scale secondary data bases generated for research, health care administration/billing, or other purposes. Students will become familiar with the content, strength, and limitations of several data bases; with the logistics of obtaining access to data bases; the strengths and limitations of routinely collected variables; basic techniques for preparing and analyzing secondary data bases and how to apply the techniques to initiate and complete empirical analysis. Recommended preparation: EPBI 414 or equivalent; EPBI 431 or EPBI 460 and EPBI 461 (for HSR students).

EPBI 592. Special Topics in Epidemiology. 1 - 10 Unit.
Short, intensive courses on current research topics, statistical analyses, methodological issues or intervention approaches related to epidemiology, particularly infectious disease, chronic disease, behavioral and social epidemiology. Course hours and requirements vary by topic each semester.

EPBI 601. Master’s Project Research. 1 - 18 Unit.
EPBI 602. Practicum. 1 - 3 Unit.
This course focuses on the skills needed to become an effective statistical consultant. The course objectives are: to learn the role of the consulting statistician and the accompanying responsibilities and ethical considerations, to develop the ability to interact with clients and elicit the information required to provide consulting expertise, to learn general strategies for approaching consulting problems that can be applied to a wide range of problems in medical areas, and to develop expertise in areas needed by the consulting biostatistician. These include database architecture, data quality control, record keeping for potential audits, statistical techniques, and report generation.

EPBI 651. Thesis M.S.. 1 - 18 Unit.

Prereq: Predoctoral research consent or advanced to Ph.D. candidacy milestone.

MPHP Courses

MPHP 306. History and Philosophy of Public Health. 3 Units.
The purpose of this course is to introduce students to the science and art of public health through an understanding of the history and philosophies that represent its foundation. Students will learn about the essentials of public health and applications of those precepts throughout history and in the present. The course will examine public health case histories and controversies from the past and present, in order to better understand solutions for the future. Offered as MPHP 306 and MPHP 406. Prereq: Enrollment limited to juniors and seniors only.

MPHP 313. Health Education, Communication, and Advocacy. 3 Units.
Historical, sociological, and philosophical factors that have influenced definitions and the practice of health education and health promotion are studied. Advanced concepts in health communication theory will also be explored. This course is designed to education, motivate, and empower undergraduate and graduate students to become advocates for their own health, the health of their peers, and the health of the community. Offered as MPHP 313 and MPHP 413.

MPHP 405. Statistical Methods in Public Health. 3 Units.
This one-semester survey course for public health students is intended to provide the fundamental concepts and methods of biostatistics as applied predominantly to public health problems. The emphasis is on interpretation and concepts rather than calculations. Topics include descriptive statistics; vital statistics; sampling; estimation and significance testing; sample size and power; correlation and regression; spatial and temporal trends; small area analysis; statistical issues in policy development. Examples of statistical methods will be drawn from public health practice. Use of computer statistical packages will be introduced. Prereq: Enrollment limited to MPH students (Plan A or Plan B) and EPBI students only. All others require instructor consent.

MPHP 406. History and Philosophy of Public Health. 3 Units.
The purpose of this course is to introduce students to the science and art of public health through an understanding of the history and philosophies that represent its foundation. Students will learn about the essentials of public health and applications of those precepts throughout history and in the present. The course will examine public health case histories and controversies from the past and present, in order to better understand solutions for the future. Offered as MPHP 306 and MPHP 406. Prereq: Enrollment limited to MPH students (Plan A or Plan B) and EPBI students or instructor consent.

MPHP 408. Public Policy and Aging. 3 Units.
Overview of aging and the aged. Concepts in the study of public policy. Policies on aging and conditions that they address. The politics of policies on aging. Emergent trends and issues. Offered as ANTH 498, BETH 496, EPBI 408, GERO 496, HSTY 480, MPHP 408, NURS 479, NURS 579, POSC 480, and SOCI 496.

MPHP 411. Introduction to Health Behavior. 3 Units.
Using a biopsychosocial perspective, an overview of the measurement and modeling of behavioral, social, psychological, and environmental factors related to disease prevention, disease management, and health promotion is provided. Offered as EPBI 411 and MPHP 411. Prereq: Enrollment limited to MPH students (Plan A or Plan B) and EPBI students or consent.

MPHP 413. Health Education, Communication, and Advocacy. 3 Units.
Historical, sociological, and philosophical factors that have influenced definitions and the practice of health education and health promotion are studied. Advanced concepts in health communication theory will also be explored. This course is designed to education, motivate, and empower undergraduate and graduate students to become advocates for their own health, the health of their peers, and the health of the community. Offered as MPHP 313 and MPHP 413.

MPHP 419. Topics in Urban Health in the United States. 3 Units.
This course examines patterns of urban health and disease across the life course among marginalized populations and communities. We will examine the socio-environmental contexts that impact health status (i.e., racism, health disparities, neighborhood context, and environmental stressors). Readings from epidemiology, sociology, and public health literature will provide a foundation for the multiple factors and processes that impact health. Offered as EPBI 419 and MPHP 419.

MPHP 421. Health Economics and Strategy. 3 Units.
This course has evolved from a theory-oriented emphasis to a course that utilizes economic principles to explore such issues as health care pricing, anti-trust enforcement and hospital mergers, choices in adoption of managed care contracts by physician groups, and the like. Instruction style and in-class group project focus on making strategic decisions. The course is directed for a general audience, not just for students and concentration in health systems management. Offered as ECON 421, HSMC 421, and MPHP 421.

MPHP 429. Introduction to Environmental Health. 3 Units.
This is a survey course of environmental health topics including individual, community, population, and global issues. Introduction to risk management, important biological mechanisms, and age and developmental impacts are covered in an overview fashion. A practical inner city home environment experience is included. Offered as EVHS 429 and MPHP 429.
MPHP 431. Statistical Methods I. 3 Units.
Application of statistical techniques with particular emphasis on problems in the biomedical sciences. Basic probability theory, random variables, and distribution functions. Point and interval estimation, regression, and correlation. Problems whose solution involves using packaged statistical programs. First part of year-long sequence. Offered as ANAT 431, BIOL 431, CRSP 431, EPBI 431, and MPHP 431.

MPHP 432. Statistical Methods II. 3 Units.
Methods of analysis of variance, regression and analysis of quantitative data. Emphasis on computer solution of problems drawn from the biomedical sciences. Design of experiments, power of tests, and adequacy of models. Offered as BIOL 432, CRSP 432, EPBI 432, and MPHP 432. Prereq: EPBI 431 or equivalent.

MPHP 433. Community Interventions and Program Evaluation. 3 Units.
This course prepares students to design, conduct, and assess community-based health interventions and program evaluation. Topics include assessment of need, evaluator/stakeholder relationship, process vs. outcome-based objectives, data collection, assessment of program objective achievement based on process and impact, cost-benefit analyses, and preparing the evaluation report to stakeholders. Recommended preparation: EPBI 490, EPBI 431, or MPHP 405. Offered as EPBI 433 and MPHP 433.

MPHP 439. Public Health Management and Policy. 3 Units.
This course is designed to introduce students to the basics of health policy-making and includes a background on the basic structure and components of the US Health Care System (such as organization, delivery and financing). It will also cover introductory concepts in public health management, including the role of the manager, organizational design and control, and accountability. We will address relevant legal, political and ethical issues using case examples. At the end of the course, students will understand how health policy is developed and implemented in various contexts, and the challenges facing system-wide efforts at reform. This is a required course for the MPH degree. Grades will be based on a series of assignments. Prereq: Enrollment limited to MPH students (Plan A or Plan B) and EPBI Students or instructor consent.

MPHP 442. Biostatistics II. 3 Units.
This course deals with the basic concepts and applications of nonparametric statistics. Topics will include distribution-free statistics, one sample rank test, the Mann-Whitney and Kruskal Wallis tests, one sample and two sample U-statistics, asymptotic relative efficiency of tests, distribution-free confidence intervals, point estimation and linear rank statistics. Recommended preparation: EPBI 441. Offered as EPBI 442 and MPHP 442.

MPHP 447. Global Health: Outbreak Investigation in Real-Time. 3 Units.
This course provides a trans-cultural, trans-disciplinary, multimedia learning experience by analyzing historical and real-time data from the annual dengue endemics and sporadic epidemics in Puerto Rico and Brazil. A rigorous problem-centered training in the epidemiology, prevention, treatment, and control of infectious diseases using real-time and historical surveillance data of endemic and epidemic Dengue in Bahia, Brazil. This is an advanced epidemiology course in which core material will be primarily taught through reading assignments, class discussion, group projects, and class presentations. The course will utilize the online web-based communication and learning technology to create a single classroom between the CWRU and international partners with unique and complimentary skills. In addition to joint classroom lectures across sites, student groups will also perform smaller-scale videoconference meetings for assigned group projects, thus creating strong international connections for the students, faculty, and our institutions. Note: Due to the complexities of time zones for this international course, the course will begin at 8:00a.m. until the U.S.A. adjusts clocks for Daylight Savings Time (unlike Brazil). Therefore, classes after the second week of March will begin at 9:00a.m. Offered as: EPBI 447, INTH 447, and MPHP 447.

MPHP 450. Clinical Trials and Intervention Studies. 3 Units.
Issues in the design, organization, and operation of randomized, controlled clinical trials and intervention studies. Emphasis on long-term multicenter trials. Topics include legal and ethical issues in the design; application of concepts of controls, masking, and randomization; steps required for quality data collection; monitoring for evidence of adverse or beneficial treatment effects; elements of organizational structure; sample size calculations and data analysis procedures; and common mistakes. Recommended preparation: EPBI 431 or consent of instructor. Offered as EPBI 450 and MPHP 450.

MPHP 451. Principles of Genetic Epidemiology. 3 Units.
A survey of the basic principles, concepts and methods of the discipline of genetic epidemiology, which focuses on the role of genetic factors in human disease and their interaction with environmental and cultural factors. Many important human disorders appear to exhibit a genetic component; hence the integrated approaches of genetic epidemiology bring together epidemiologic and human genetic perspectives in order to answer critical questions about human disease. Methods of inference based upon data from individuals, pairs of relatives, and pedigrees will be considered. The last third of the course (1 credit) is more statistical in nature. Offered as EPBI 451, GENE 451, and MPHP 451.

MPHP 456. Health Policy and Management Decisions. 3 Units.
This seminar course combines broad health care policy issue analysis with study of the implications for specific management decisions in organizations. This course is intended as an applied, practical course where the policy context is made relevant to the individual manager. Offered as HSMC 456 and MPHP 456.

MPHP 458. Statistical Methods for Clinical Trials. 3 Units.
This course will focus on special statistical methods and philosophical issues in the design and analysis of clinical trials. The emphasis will be on practically important issues that are typically not covered in standard biostatistics courses. Topics will include: randomization techniques, intent-to-treat analysis, analysis of compliance data, equivalence testing, surrogate endpoints, multiple comparisons, sequential testing, and Bayesian methods. Offered as EPBI 458 and MPHP 458.
**MPHP 460. Introduction to Health Services Research. 3 Units.**
This survey course provides an introduction to the field of Health Services Research and an overview of key health services research concepts and methods, including conceptual frameworks and models; outcomes research; risk adjustment; disparities in health care; policy/healthcare systems; cost and cost-effectiveness; quality of life, process improvement; patient satisfaction; patient safety; health economics; statistical modeling techniques; and qualitative research methods. Offered as EPBI 460 and MPHP 460.

**MPHP 464. Obesity and Cancer: Views from Molecules to Health Policy. 3 Units.**
This course will provide an overview of the components of energy balance (diet, physical activity, resting metabolic rate, dietary induced thermogenesis) and obesity, a consequence of long term positive energy balance, and various types of cancer. Following an overview of energy balance and epidemiological evidence for the obesity epidemic, the course will proceed with an introduction to the cellular and molecular biology of energy metabolism. Then, emerging research on biologically plausible connections and epidemiological associations between obesity and various types of cancer (e.g., colon, breast) will be presented. Finally, interventions targeted at decreasing obesity and improving quality of life in cancer patients will be discussed. The course will be cooperatively-taught by a transdisciplinary team of scientists engaged in research in energy balance and/or cancer. Didactic lectures will be combined with classroom discussion of readings. The paper assignment will involve application of course principles, lectures and readings. Offered as EBPI 464, MPHP 464.

**MPHP 466. Promoting Health Across Boundaries. 3 Units.**
This course examines the concepts of health and boundary spanning and how the synergy of the two can produce new, effective approaches to promoting health. Students will explore and analyze examples of individuals and organizations boundary spanning for health to identify practice features affecting health, compare and contrast practices and approaches, and evaluate features and context that promote or inhibit boundary spanning and promoting health. Offered as MPHP 466, EPBI 466, and BETH 466. Prereq: Graduate student status or instructor consent.

**MPHP 467. Comparative and Cost Effectiveness Research. 1 Unit.**
Comparative effectiveness research is a cornerstone of healthcare reform. It holds the promise of improved health outcomes and cost containment. This course is presented in a convenient 5-day intensive format in June. There are reading assignments due prior to the 1st session. Module A, Days 1-2: Overview of comparative effectiveness research (CER) from a wide array of perspectives: individual provider, institution, insurer, patient, government, and society. Legal, ethical and social issues, as well as implications for population and public health, including health disparities will also be a component. Module B, Day 3: Introduction to the various methods, and their strengths, weaknesses and limitations. How to read and understand CER papers. Module C, Days 4-5: Cost-Effectiveness Analysis. This will cover costing, cost analysis, clinical decision analysis, quality of life and cost-effectiveness analysis for comparing alternative health care strategies. Trial version of TreeAge software will be used to create and analyze a simple cost-effectiveness model. The full 3-credit course is for taking all 3 modules. Modules A or C can be taken alone for 1 credit. Modules A and B or Modules B and C can be taken together for a total of 2 credits. Module B cannot be taken alone. If taking for 2 or 3 credits, some combination of term paper, project and/or exam will be due 30 days later. Offered as EPBI 467 and MPHP 467.

**MPHP 468. The Continual Improvement of Healthcare: An Interdisciplinary Course. 3 Units.**
This course prepares students to be members of interprofessional teams to engage in the continual improvement in health care. The focus is on working together for the benefit of patients and communities to enhance quality and safety. Offered as EPBI 468, MPHP 468, NURS 468.

**MPHP 474. Principles of Practice-Based Network Research. 3 Units.**
Practice-based research networks (PBRNs) are organizations of community-based healthcare practices that engage in clinical research and practice improvement. In the U.S., there are more than 100 of these dynamic, collaborative organizations that enable the translation of research into practice and practice into research. They also frequently engage in developing and refining methods to improve healthcare quality. This course is designed to provide students with a foundation in PBRN methods and principles, including: introduction to PBRNs, methods for collaborating with community practices, PBRN-building strategies, PBRN data collections methods, statistical issues in network research, community-based participatory research, human subjects’ protection issues in PBRNs, quality improvement research in PBRNs, funding for PBRN research, and writing PBRN research findings for publication. Each 2.5 hour class session will feature a lecture followed by a discussion of readings from the literature. Students will develop a PBRN research or quality improvement proposal during the semester. Offered as EBPI 474 and MPHP 474.
MPHP 475. Management of Disasters Due to Nature, War, or Terror. 3 Units.
The purpose of this course is to make participants aware of the special needs of children and families in disaster situations and understand public health approaches to address these needs. The learning objectives for this course are: 1) Identify the most important problems and priorities for children in disaster situations, 2) Identify the organizations most frequently involved in providing assistance in disaster situations and define their roles and strengths, 3) Describe the reasons why children are among the most vulnerable in disaster events, 4) Conduct emergency nutritional assessments for children, 5) Develop health profiles on displaced children and plan interventions based on results, 6) Define common psychosocial issues of children and the means to address them, 7) List basic points of international law including the Geneva Convention that relate to all persons involved in disaster situations, 8) List important security issues, 9) Appreciate ethical issues involved in disaster situations and employ skills of cross cultural communication, 10) Recognize and respond to special issues for children involved in biological and chemical terrorist attacks.

MPHP 477. Internship at Health-Related Government Agencies. 3 Units.
This independent study course will incorporate a one-semester-long internship at health-related government agencies (Ohio Department of Health, Ohio Department of Job and Family Services, or Cleveland City Health Department). The choice of the agency will depend on the student’s academic interests and research goals. The objective is to develop a level of familiarity with the organizational and operational aspects of such agencies, and to gain an understanding of agencies’ and bureaus’ interactions with the legislative body, as well as the processes of developing, implementing, managing, and monitoring health initiative. The instructor and the liaison persons at the agencies will be responsible for planning structured encounters of interns with key administrators and policy makers, and to select a research project, based on the intern’s research interests and the agencies’ research priorities. Interns will be required to submit a draft of the report to the instructor at the end of the semester. The approved, final report will be submitted to the agency. The project will be evaluated for its methodological soundness and rigor. Students will be required to be at the agency one day a week. Recommended preparation: EPBI 515. Offered as EPBI 477 and MPHP 477.

MPHP 478. Assessment and Application of Health Behavior Principles to Clinical Prevention. 3 Units.
To develop an understanding of the basic principles of health behavior and related theory in an effort to better inform the assessment and delivery of clinical prevention and health promotion to both individuals and populations.

MPHP 479. Teaching Population Health and Community Assessment. 3 Units.
This course allows students to function in a teaching and leadership role in population health education and conduct of a multilevel community assessment of underserved neighborhoods in Cleveland. During the course, students will function as facilitators of small groups (8 to 9 students) of first year medical students during the Population Health block of their medical curriculum. Community assessment, also known as the “Extensive Care Unit” project will include 1) semi-structured interviews with Key Community Contacts; 2) an environmental scan of the assigned neighborhood; 3) analysis of publicly available data; and 4) analysis of youth risk behavior survey data. All data analysis will be mentored by course faculty. In addition, students will be involved with facilitation of a pandemic influenza tabletop exercise. Students will participate in an intensive training prior to facilitation responsibilities; and each week will both debrief the community assessment sessions and plan for the next weekly session.

MPHP 480. Health Systems Management in Primary Care. 1 Unit.
Goal - To develop a deeper understanding of components of the health system that influence and provide shape to the environment in which health care is delivered and about the implementation of systems-based strategies that foster better processes and/or outcomes of health care delivery.

MPHP 481. A Primer of Dental Public Health. 3 Units.
This course introduces students to principles and issues in dental public health. In addition to the principles, students will learn about contemporary issues impacting dental public health, oral epidemiology, dental health care systems, and oral health promotion. To facilitate the understanding of oral health promotion, students will gain a basic understanding of the common oral diseases. Prereq: MPHP 306 or MPHP 406 and MPHP 490 or EPBI 490.

MPHP 482. Qualitative and Mixed Methods in Public Health. 3 Units.
The purpose of this course is three-fold - 1) to provide students with an understanding of the fundamentals of qualitative and mixed methods, including the history and philosophy of these methods, 2) to provide students with an understanding of and skill set associated with the use of qualitative and mixed methods in public health research, and 3) to provide students with an introduction to local professionals engaged in qualitative and mixed methods public health research. Prerequisites include MPHP 405 and 483 (or equivalents) and current status as an MPH student. Prereq: MPHP 405, MPHP 483 and current MPH student.

MPHP 483. Introduction to Epidemiology for Public Health Practice. 3 Units.
This course is designed to introduce the basic principles and methods of epidemiology. Epidemiology has been referred to as the basic science for public health. Application of epidemiologic principles is critical to disease prevention, as well as in the development and evaluation of public policy. The course will emphasize basic methods (study design, measures of disease occurrence, measures of association, and causality) necessary for epidemiologic research. It is intended for students who have a basic understanding of the principals of human disease as well as statistics. Prereq: Must be an MPH Plan A or MPH Plan B, or EPBI student in order to enroll in the course.
**MPHP 484. Geographic Medicine and Epidemiology. 1 - 3 Unit.**

This course focuses on the epidemiology, prevention, treatment, and control of tropical and parasitic diseases. Emphasis will be placed on the triad of agent, host, and environment for infectious disease impacting global health. Three distinct modules will focus on specific examples such as malaria, helminths, bacteria, or viruses. Active class participation is required through discussions, case studies, and group projects. Recommended preparation: EPBI 490, EPBI 491 and a microbiology course or consent of instructor. Offered as EPBI 484, INTH 484, and MPHP 484.

**MPHP 485. Adolescent Development. 3 Units.**

Adolescent Development can be viewed as the overriding framework for approaching disease prevention and health promotion for this age group. This course will review the developmental tasks of adolescence and identify the impact of adolescent development on youth risk behaviors. It will build a conceptual and theoretical framework through which to address and change adolescent behavior to promote health.

**MPHP 490. Epidemiology: Introduction to Theory and Methods. 3 Units.**

This course provides an introduction to the principles of epidemiology covering the basic methods necessary for population and clinic-based research. Students will be introduced to epidemiologic study designs, measures of disease occurrence, measures of risk estimation, and casual inference (bias, confounding, and interaction) with application of these principles to specific fields of epidemiology. Classes will be a combination of lectures, discussion, and in-class exercises. It is intended for students who have a basic understanding of the principals of human disease and statistics. Offered as EPBI 490 and MPHP 490. Prereq or Coreq: EPBI 431 or requisites not met permission.

**MPHP 491. Epidemiology: Case-Control Study Design and Analysis. 3 Units.**

This course builds upon EPBI 490 with a comprehensive study of the concepts, principles, and methods of epidemiologic research. The course content specifically focuses on the case-control study design and provides a framework for the design, analysis, and interpretation of case-control studies. Rigorous problem-centered training includes exposure measurement, subject selection, validity, reliability, sample size and power, effect modification, confounding, bias, risk assessment, matching, and logistic regression. Individual and group data projects will be analyzed using SAS statistical software. Offered as EPBI 491 and MPHP 491. Prereq: EPBI/MPHP 490.

**MPHP 492. Epidemiology: Cohort Study Design and Analysis. 3 Units.**

This course provides a comprehensive introduction to the cohort study. Particular emphasis is placed on cohort study design and cohort data analysis. The course will cover the conceptual framework underlying cohort studies, planning and conducting a cohort study, basic concepts of time, exposure and outcome, and methods in the analysis of longitudinally collected data. Analytic methods covered in the class include, but are not limited to: analysis of age, period, and cohort effects, analysis of incidence rates, analysis of repeated measures, and analysis of time-to-event data. Students will have the opportunity to conduct analysis of data obtained from an actual cohort study using a statistical package of their choice. Offered as EPBI 492 and MPHP 492. Prereq: EPBI 431 and EPBI 490 or equivalent.

**MPHP 494. Infectious Disease Epidemiology. 1 - 3 Unit.**

This course is a follow-up to EPBI 484: Geographic Medicine and Epidemiology, and focuses on tuberculosis (TB), HIV, and dengue epidemiology. This is an advanced course, focusing on methods and approaches in epidemiology. It will be taught in three 1-credit modules, and students may take each module separately or all 3 together. Each module will have a separate project and/or exam. Module I: Tuberculosis epidemiology. Module II: HIV epidemiology. Module III: Dengue epidemiology. Offered as EPBI 494, INTH 494, and MPHP 494. Prereq: EPBI 490.

**MPHP 497. Cancer Epidemiology. 1 - 3 Unit.**

This is a 1-3 credit modular course in cancer epidemiology and is intended for graduate students in epidemiology and biostatistics, environment health, MPH students and MD or MD/PhD students. The course will consist of 3 five-week modules: 1) introduction to cancer epidemiology (study design, etiology and causal inference, cancer statistics and cancer biology); 2) site-specific discussions of various cancers involving natural history of disease and risk factors and etiology and 3) cancer prevention and screening and cancer survivorship. Each of the modules is worth 1 credit hour for a total of 3 credit hours. Offered as: EPBI 497 and MPHP 497.

**MPHP 499. Independent Study. 1 - 18 Unit.**

**MPHP 506. The Future of Public Health. 0 - 3 Units.**

This seminar course is meant to provide an orientation to the Master of Public Health (MPH) Program at Case Western Reserve University's (CWRU) School of Medicine, essential topics related to the future of public health as a professional field, and local public health efforts in the broader campus and Cleveland communities. This seminar is designed for first year MPH students. Prereq: MPH Plan A or Plan B student status.

**MPHP 507. Building a Public Health Project. 0 - 3 Units.**

This course is designed to walk students through the process of creating a Capstone Project, form "idea to field." Specific topics to be covered include: identifying a project, creating a project plan, how to effectively work in the community, program design, evaluation, ethical issues in community research, creating an analytic plan, survey design, and writing results. Major class projects include completing an IRB application or completing a grant application for your own project. The last two weeks of class center around attending and discussing the Capstone Presentations of graduating students. Prereq: MPH Plan A or Plan B student status.

**MPHP 508. Ethics, Law, and Epidemiology. 3 Units.**

This course is designed to provide epidemiology students with basic knowledge about the ethical and legal principles underlying epidemiological research. This is not a public health law class. Issue papers are assigned on a weekly basis. Each issue paper requires that the student analyze the situation depicted and apply the principles learned. Some issue papers may require that the student draft a proposed rule, a portion of legislation, or a document such as an informed consent form. Other exercises may require that students critique an existing agency rule or legislation. Offered as EPBI 508 and MPHP 508. Prereq: EPBI 490 and EPBI 491 or equivalent.
MPHP 510. Health Disparities. 3 Units.
This course aims to provide theoretical and application tools for students from many disciplinary backgrounds to conduct research and develop interventions to reduce health disparities. The course will be situated contextually within the historical record of the United States, reviewing social, political, economic, cultural, legal, and ethical theories related to disparities in general, with a central focus on health disparities. Several frameworks regarding health disparities will be used for investigating and discussing the empirical evidence on disparities among other subgroups (e.g., the poor, women, uninsured, disabled, and non-English speaking populations) will also be included and discussed. Students will be expected to develop a research proposal (observational, clinical, and/or intervention) rooted in their disciplinary background that will incorporate materials from the various perspectives presented throughout the course, with the objective of developing and reinforcing a more comprehensive approach to current practices within their fields. Offered as CRSP 510, EPBI 510, MPHP 510, NURS 510, and SASS 510.

MPHP 532. Health Care Information Systems. 3 Units.
This course covers concepts, techniques and technologies for providing information systems to enhance the effectiveness and efficiency of health care organizations. Offered as HSMC 432, MIDS 432, MPHP 532 and NUNI 432.

Public health field practicum, involving a placement at a community-based field site, and a Master’s essay. The field placement will provide students with the opportunity to apply the knowledge and skills acquired through their Master of Public Health academic program to a problem involving the health of the community. Students will learn to communicate with target groups in an effective manner; to identify ethical, social, and cultural issues relating to public health policies, research, and interventions; to identify the process by which decisions are made within the agency or organization; and to identify and coordinate use of resources at the placement site. The Master’s essay represents the culminating experience required for the degree program and may take the form of a research thesis, an evaluation study, or an intervention study. Each student is required to formally present the experience and research findings. In any semester in which a student is registered for MPHP 652 credit, it is required that the student attend the Community Health Research and Practice (CHRP) group at a minimum of two sessions per 3 credits. CHRP is held once a week for approximately an hour and a half for the duration of fall, spring, and summer semesters. MPHP 652 credit is available only to Master of Public Health students.
General Medical Sciences

The Division of General Medical Sciences was established in 1986 to provide an organizational home for units pursuing interdisciplinary research and education objectives. The division is the equivalent of an academic department, and its constituent units are characterized as Centers. The Dean of the School of Medicine serves as the Chair of the division; each Center is led by a director. The unique nature of each of the General Medical Sciences centers is described in the paragraphs below. (Centers are listed in alphabetical order by full title, and associated academic programs including certificate, MS and PhD programs described in top navigation tabs).

Case Comprehensive Cancer Center

Phone: 216.844.8797
http://cancer.case.edu

Stanton L. Gerson, MD, Director, Case Comprehensive Cancer Center
Anne M. Duli, MPA, Associate Director, Research Administration and Finance

The Case Comprehensive Cancer Center (Case CCC) is one of only 41 National Cancer Institute-designated Comprehensive Cancer Centers in the country. The Case CCC integrates the cancer research activities of the largest biomedical research and health care institutions in Ohio - Case Western Reserve University (CWRU), University Hospitals Case Medical Center and Cleveland Clinic - under a single leadership structure. The Center is internationally recognized for its discoveries in cancer cell signaling; cancer genetics in colon cancer, Barrett’s Esophagitis, leukemias and brain tumors; drug discovery and innovative therapeutics; stem cell research; GU malignancies; and cancer prevention and early detection.

The Case CCC has over 300 collaborating scientists and physicians who have successfully competed for over $119 million in annual funding. These investigators are organized into eight interdisciplinary scientific programs and have access to 14 Scientific Core Facilities. A unified clinical research effort consisting of 11 multidisciplinary clinical disease teams develop and prioritize clinical trials among the partner institutions. A certificate in clinical oncology for K12 participants is available (see Certificates).

Research programs extend to CWRU affiliates MetroHealth Medical Center (the region’s county hospital) and Louis Stokes Veterans Affairs Hospital and to 13 community medical centers operated by University Hospitals and Cleveland Clinic. As a consortium cancer center, the Case CCC has become a powerful example of the potential generated by complementary institutions coming together for the benefit of research and discovery, patient treatments and community impact. Through its partners, Case CCC programs extend throughout northern Ohio to offer residents access to cancer care and a wide range of clinical trials, and participation in community outreach, cancer prevention and cancer survivorship initiatives.

Center for Clinical Investigation

Phone: 216.368.3286
http://cci.case.edu/cci/index.php/Main_Page

Pamela Davis, MD, PhD, Director
James Spilsbury, PhD, Academic Development Core Director
Denise Babineau, PhD, Statistical Sciences Core Director
Guo-Qiang Zhang, PhD, Medical Informatics Division Chief

The Center for Clinical Investigation (CCI) was founded in 2007 and is part of Case Western Reserve University School of Medicine’s Division of General Medical Sciences. The CCI serves as the academic home of Cleveland’s Clinical & Translational Science Collaborative, a partnership of 4 local institutions (Case Western Reserve University, the Cleveland Clinic Foundation, the MetroHealth System, and University Hospitals) and member of a national consortium of approximately 60 institutions funded by the National Institutes of Health to increase the efficiency and speed of clinical and translational research across the country.

The CCI’s mission is to enhance clinical and translational research efforts across the Cleveland area by: (1) spurring advances in knowledge of risk factors, outcomes and treatment effectiveness in the population; (2) facilitating the transfer of scientific advances to the community; and (3) developing a new generation of clinical researchers equipped with the skills needed to efficiently design, implement and interpret novel studies that address important public health questions. To accomplish its mission, the CCI provides computer systems and applications support for basic science and clinical research activities and works closely with basic science and clinical investigators in the CWRU Schools of Medicine, Nursing, and Dental Medicine, as well as the University Hospitals Case Medical Center, Cleveland Clinic Foundation, and MetroHealth System.

The CCI has supported hundreds of clinical research and epidemiology projects, including local and national multicenter, longitudinal studies. The CCI has three cores that work together to provide fully integrated research support to all investigators: Academic Development Core, Division of Medical Informatics, and Statistical Sciences Core.

The Academic Development Core manages the Master’s Degree Program in Clinical Research (Clinical Research Scholars Program - see “Clinical Research MS” tab above) as well as a newly created Certificate Program in Clinical Research. The Academic Development Core also delivers seminars and short courses in clinical research and works to coordinate educational activities in interdisciplinary clinical research across the CTSC’s institutional members. The programs target investigators and other key members of the research team, including data managers and study coordinators. Training efforts in research design, research data management, statistical sciences, statistical software, and scientific communication are emphasized.

The Division of Medical Informatics is primarily charged with developing informatics solutions to many of the barriers clinical investigators face in efficiently processing, storing and sharing research data; and with providing informatics tools and infrastructure for the CCI and the larger research community. In order to meet these goals, the Division of Medical Informatics develops data standards for research database development and data management that aim to maximize the value (accuracy, completeness, availability, security) of research data, develops technological solutions and tools in support of the other CCI cores, develops tools and systems to facilitate understanding of research data (including data dictionaries, data sharing tools, and repositories for biological data) and conducts research in new methodologies for clinical research informatics, clinical and health informatics, comparative effectiveness research, information discovery, data integration, data mining, and translational research. The Division of Medical Informatics staff consists of research programmers and systems analysts with not only a wide range of technical expertise, but with experience using semantic web technology in support of clinical research.

The Statistical Sciences Core provides data management and statistical support on study design and data analysis. Members who provide data management consist of skilled data managers and programmers who consult and collaborate with investigators on data collection instrument development and coding, database development and administration, data cleaning and quality assurance, statistical programming, and dataset preparation. Members providing statistical support collaborate and consult with clinical investigators on proposal development, study
design, study monitoring, and data analysis. The Statistical Sciences Core currently consists of 1 PhD biostatistician, 2 MS biostatisticians, and 1 data manager, each with several years of collaborative experience in an academic medical center. Statistical software packages that are supported by the CCI Statistical Sciences Core include SAS, SPSS, R/S-Plus, JMP, NCSS PASS, MINITAB, and Stata.

**Center for Global Health and Diseases**

Phone: 216.368.6321  
http://www.case.edu/orgs/cghd/index.html  
James W. Kazura, MD, Director

The Center for Global Health and Diseases links the numerous international health resources of the University, its affiliated institutions, and the northern Ohio community in transdisciplinary programs of research and education related to global health. The scope of the Center's activities also includes education and service as these are related to molecular, clinical and population studies of human health and disease.

The Center is currently a national leader in National Institutes of Health-supported studies of the major infectious diseases of developing countries. Cutting-edge approaches are implemented in order to examine the molecular, genetic and immunologic basis of susceptibility to infectious diseases of public health significance - malaria, river blindness, lymphatic filariasis, schistosomiasis, HIV and other viral diseases such as Rift Valley fever. Clinical research in endemic countries is concerned with testing and implementing cost-effective public health interventions that are aimed at the control of malaria and Neglected Tropical Diseases (worm infections of children, elimination of lymphatic filariasis). The Center has ongoing research and educational collaborations with academic and governmental institutions in Papua New Guinea, Brazil, Kenya, Uganda, and several other countries in Sub-Saharan Africa. Educational programs sponsored by the Center include electives in international health, population biology, and genetics of infectious diseases (available to undergraduate, graduate and professional school students), a weekly World Health Interest Group (WHIG) seminar series, overseas rotations for graduate and professional school students, and training programs at the university and abroad for scholars from developing countries (with support from the Fogarty International Center at NIH).

A certificate in Global Health is available (see Certificates).

**Center for Medical Education**

Phone: 216.368.6986  
Terry Wolpaw, MD, MHPE, Interim Director  
Megan McNamara, MD, Director, CAML

The Center for Medical Education, established in 2010, is currently being reorganized to better align with the needs of learners across the educational continuum – from students to residents to graduate students to faculty. The Center for Medical Education (CMEd) provides an organizational home for teaching and learning programs in the School of Medicine and a supportive environment for those who want to develop special skills in medical education.

The Center for the Advancement of Medical Learning ("CAML") operates its programs under the auspices of the CMEd. CAML supports and promotes the development of teaching and lifelong-learning skills among students, faculty, staff, residents, and alumni. CAML pursues research into educational innovations to advance our knowledge of medical learning and teaching. The Center offers workshops to faculty locally, regionally, and nationally to enhance faculty teaching, research and evaluation skills.

The Center also sponsors faculty appointments, both full- and part-time, for some faculty whose roles are predominantly focused on teaching medical students. These include community clinicians who welcome medical students into their clinics and practices.

**Center for Proteomics and Bioinformatics**

Phone: 216.368.1490  
http://proteomics.case.edu/default.aspx  
Biomedical Research Building, Ninth Floor  
Mark R. Chance, PhD, Director

The Case Center for Proteomics and Bioinformatics (CPB) in the School of Medicine was established in 2005. The CPB was created, in part, to strengthen Cleveland’s presence in modern proteomics, bioinformatics, systems biology, structural biology and mass spectrometry research. One of the primary goals of the CPB is to develop an infrastructure of sophisticated equipment that facilitates and maximizes shared equipment usage, as well as to offer a wide array of proteomics services including 2D gel and mass spectrometry analyses.

The CPB has expanded its vision to include education of graduate students in systems biology and bioinformatics. The Center for Proteomics and Bioinformatics developed a graduate program in Systems Biology and Bioinformatics in collaboration with Schools and Departments across the campus. For more information regarding the SYBB graduate program please see "Systems/Bioinformatics" tab above. You may also visit http://bioinformatics.case.edu/.

Proteomics entails the in depth structural analysis of individual proteins in human and animal cells. In studying proteins and their changes, bioinformatics enables researchers to take an integrated -omics approach for discovering networks involved in human disease. The School of Medicine established the Center for Proteomics and Bioinformatics to perform research to better understand the genetic and environmental bases of disease as well as provide new technologies to diagnose diseases such as cancer, heart disease, and diabetes. The CPB has three divisions: Proteomics and Bioinformatics, Bioinformatics, and Macromolecular Structure to enhance the capabilities of the CPB.

The Division of Proteomics and Genomics was established to support research in protein and gene expression analysis, protein and gene modifications, and protein interactions in a wide variety of biological contexts and develop new tools in proteomics and genomics research. The Division of Bioinformatics was established to support interdisciplinary research and training in many areas of bioinformatics including analysis of DNA and protein sequences, protein interaction networks, linkage and association studies for simple and complex traits, and gene and protein expression profiles. The Division of Macromolecular Structure was established to support interdisciplinary research in new methods of structure determination, the combination of computational and experimental structural biology approaches, and developing and maintaining infrastructure for macromolecular structure determination. This Division works closely and coordinates their activities with faculty and Departments across the University who use structural information to understand function as well as other centers that provide leadership in Structural Biology and Biophysics.

The CPB has 9000 sq. feet of laser, spectroscopy, spectrometry, cell culture, and biochemistry laboratory space, residing on the 9th floor of the Biomedical Research Building at CWRU School of Medicine. The CPB has a full complement of mass spectrometry and proteomics facilities including 6 mass spectrometry instruments from Thermo Fisher. The CPB
has a full suite of available computational resources including: Proteus Module Software from Genologics for automated data acquisition and analysis, Rosetta Elucidator, Ingenity and Metacore protein annotation databases, and BioWorks and Mascot MS for mass spectrometry (MS) database searches.

The CPB also offers a wide range of seminars, workshops, and possibilities for individual training. These activities are posted on the CPB Web site. For a list of services and to explore opportunities to collaborate, please visit the Web site: http://proteomics.case.edu/default.aspx or e-mail: proteomics@case.edu.

**Center for Psychoanalytic Child Development**

The Center for Psychoanalytic Child Development is to be led by a child psychoanalyst affiliated with the Hanna Perkins Center for Child Development, located in Shaker Heights, Ohio. The Center’s goals include the development of courses, practica, and supervisory experiences appropriate for medical students, residents, and fellows.

**The Center for RNA Molecular Biology**

Phone: 216.368.1852  
http://www.case.edu/med/rnacenter/home.htm  
Timothy W. Nilsen, PhD, Director

The Center for RNA Molecular Biology is a free standing academic unit in the basic sciences within the School of Medicine at Case Western Reserve University. The RNA Center was established in the mid-nineties as a core entity in recognition of the strong cadre of research laboratories devoted to studying post-transcriptional mechanisms of gene expression focusing on various aspects of RNA Biology. The RNA Center is composed of 11 primary faculty members and 10 secondary members.

The RNA Center contains the largest concentration of RNA molecular biologists in the nation. Collectively, the faculty of the RNA Center cover almost every aspect of RNA research. Current research in the Center focuses on several of these problems ranging from extremely basic questions such as the mechanism of RNA catalysis and how proteins interact with RNA to the roles of RNA processing in disease. Specific research interests include splicing and its regulation, RNA editing, RNA maturation, mechanisms of translation regulation, RNA degradation, RNA trafficking, RNA interference and regulation of gene expression by microRNAs and non-coding RNAs.

Collectively, the RNA Center provides a valuable resource for collaborative efforts within the University and its affiliated institutions the Cleveland Clinic Foundation, and University Hospitals System. In addition, the official journal of the RNA Society “RNA” was founded and continues to be housed in the RNA Center. The RNA Center has also recently launched the “Core Facility for RNA Technology” which provides the CWRU community with the ability to incorporate RNA research into their programs. This includes the technical expertise associated with next-generation sequencing and subsequent bioinformatic analysis.

The members of the RNA Center have an excellent funding record and the research performed is regularly published in highly visible journals such as Science, Nature, Molecular Cell, NSMB, Molecular Cell, etc. In addition, a comprehensive laboratory manual on RNA technology has been co-authored by the Center’s director, Dr. Nilsen.

**Center for Science, Health and Society**

Phone: 216.368.2059  
http://casemed.case.edu/cshs/  
Nathan A. Berger, MD, Director

Recognizing that the successful futures of Case Western Reserve University, the City of Cleveland, and Cuyahoga County are integrally related, the Center for Science, Health and Society (C SHS) was created in 2002 to focus the efforts of the University and the community in a significant new collaboration to impact the areas of health and healthcare delivery systems through community outreach, education, and health policy. The Center, based in the School of Medicine, with university wide associations is engaging the many strengths of the University and the community to improve the health of the community.

The Center has engaged the community at the level of the individual and the neighborhood, in public and private schools, at civic and faith-based organizations, and at the level of governmental agencies and community leadership to identify community problems, perceptions, assets and resources; advise the community of faculty skills, assets and expertise; and, catalyze that community service based scholarship that benefits community interests and promotes mutual enhancement. The Center coordinates the Scientific Enrichment Opportunity outreach program that brings Cleveland high school students on to the medical school campus in the summer to work along with our distinguished faculty in their research labs, to introduce and stimulate the students and help prepare them to enter careers in the health care professions and biomedical workforce. The Center also coordinates the Mini Medical School Program presented every Spring and Fall to educate the community in the latest developments in healthcare, particularly those developed at CWRU. The overall goal of these programs is to educate and empower the community to become better consumers of healthcare and more informed and stronger advocates for healthcare policy and legislation in their own interests.

**Center for the Study of Kidney Biology and Disease**

Phone: 216.778.4993  
John R. Sedor, MD, co-director  
Tyler Miller, MD, co-director  
Donald E. Hricik, MD, co-director  
Walter Boron, MD, PhD, co-director

Kidney disease is the ninth leading cause of death according to the Centers for Disease Control data. Health care costs for approximately 500,000 patients, who are being treated with dialysis [artificial kidney machine] or who received a kidney transplant, consumed almost 1% of the federal budget in 2008. Up to 26 million U.S. residents have evidence of serious kidney disease

The Center’s mission is to accelerate discovery and its translation for treatment and cure of kidney diseases in an interdisciplinary environment within the rich, research environment of the CWRU School of Medicine. The faculty is an accomplished and highly interactive group of investigators, based in the adult or pediatric Divisions of Nephrology in CWRU-affiliated hospitals and the Department of Physiology and other clinical and basic departments. Research interests of the faculty include glomerular development and disease, epithelial cell biology and ion transport, tubular physiology, genetic epidemiology, health services research, renal transplantation, health disparities research and clinical trials. Research faculty applies cellular, molecular biological, genetic, genomic and epidemiological methods to in vitro models, animal models and/or patients. Many projects by Center investigators use health data, culled from robust electronic health records, and biological samples from patients with kidney diseases in order to generate novel hypotheses, which can then tested with animal models and cell lines.
Training opportunities are available for undergraduate, pre- and post-doctoral students.

National Center for Regenerative Medicine
Phone: 216.368.3614
http://stemcellcenter.case.edu
Stanton L. Gerson, MD, Director
Jeremy Rich, MD, PhD, Co-Director
Mariasja Malinowski, Executive Director

The Center for Regenerative Medicine is a multi-institutional center composed of investigators from Case Western Reserve University, University Hospitals Case Medical Center, the Cleveland Clinic, Athersys, Inc., and The Ohio State University. Building on over 30 years of experience in adult stem cell research in northeast Ohio, the Center was created in 2003 with a $19.4 million award from the State of Ohio as a Wright Center of Innovation. An additional $8M award in 2006 from the State of Ohio’s Biomedical Research and Commercialization Program (BRCP) was successfully completed and enabled 3 new clinical trials to enroll patients. In 2009, $5M was awarded by the Ohio Third Frontier (OTF) Research Commercialization Program (RCP) which further validated the Center’s ability to achieve its mission to utilize human stem cell and tissue engineering technologies to treat human disease. In 2010, $1M was awarded to the NCRM by the OTF Biomedical Program (OTFBP) to advance the clinical treatment of spinal cord injury, and a $2.1M OTF Wright Program Project (WPP) award was made to create a consortium of quantitative analysis imaging systems for stem cells.

Clinical Research Scholars Program (CRSP) (http://casemed.case.edu/CRSP)
The Clinical Research program is designed for individuals with an existing degree in medicine, dentistry, nursing, or an allied science such as pharmacy or biomedical engineering. Moreover, a track has also been established for medical students interested in obtaining dual MD/MS degree. The program seeks individuals committed to a career in clinical investigation in an academic or related environment. The program consists of a total of 36 credits: 27 credit hours of coursework, 9 credit hours of mentored research and a formal oral thesis defense. The curriculum offers both focus and flexibility. Focus is provided through a core curriculum (13 credit hours) highlighting clinical research methods, the ethical conduct of research, and a seminar series that introduces the skills necessary for scholarly success. Students typically have special interests in a particular area of clinical research, both clinically and methodologically. This program facilitates pursuit of different methodological interests guided by seasoned CWRU research faculty and addressed partly with choice of appropriate electives (14 credit hours). Requirements for the dual MD/MS degree differ to reflect integration with the medical school curriculum. Most graduates of this program are currently working in academic medical settings, with smaller numbers located in research positions in the private sector or private practice.

CRSP Curriculum
36 credit hours are required for completion of this Master of Science in Clinical Research degree.

Core Courses and Thesis Requirement
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<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
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<tbody>
<tr>
<td>CRSP 401</td>
<td>Introduction to Clinical Research Summer Series</td>
<td>3</td>
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<tr>
<td>CRSP 402</td>
<td>Study Design and Epidemiologic Methods</td>
<td>3</td>
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<tr>
<td>CRSP 412</td>
<td>Communication in Clinical Research (Part 1)</td>
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<tr>
<td>NURS 630</td>
<td>Advanced Statistics: Linear Models</td>
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<td>CRSP 413</td>
<td>Communication in Clinical Research (Part 2)</td>
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<td>CRSP 603</td>
<td>Research Ethics and Regulation</td>
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<td>CRSP 651</td>
<td>Clinical Research Scholars Thesis</td>
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Recommended Courses
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<tr>
<td>CRSP 406</td>
<td>Introduction to R Programming</td>
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<tr>
<td>CRSP 407</td>
<td>Logistic Regression and Survival Analysis</td>
<td>3</td>
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<tr>
<td>CRSP 500</td>
<td>Design and Analysis of Observational Studies</td>
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Each scholar is encouraged to develop his/her own area of concentration based on personal interests and needs. Typical areas of concentration include: Clinical Research Trials, Health Services Research and Outcomes, and Multidisciplinary/Translational Clinical Research. Please consult with CRSP faculty and your Research Mentor on which electives will best suit your needs.

The choices of electives include but are not limited to:

CRSP 410 Independent Study in Clinical Research 1
- 3
CRSP 501 Working in Interdisciplinary Research Teams 1
CRSP 502 Leadership Development 2
CRSP 503 Innovation and Entrepreneurship 1
CRSP 504 Managing Research Records - A System’s Approach 2
- 3
CRSP 505 Investigating Social Determinants of Health 2
- 3
CRSP 510 Health Disparities 3
EPBI 411 Introduction to Health Behavior 3
EPBI 450 Clinical Trials and Intervention Studies 3
EPBI 458 Statistical Methods for Clinical Trials 3
EPBI 467 Comparative and Cost Effectiveness Research 1

MS Clinical Research, Plan of Study

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<th>Summer</th>
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Year Total: 9-10 10 5

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<tr>
<th>Second Year</th>
<th>Units</th>
<th>Fall</th>
<th>Spring</th>
<th>Summer</th>
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<tr>
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<tr>
<td>Clinical Research Scholars Thesis (CRSP 651)</td>
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Total Units in Sequence: 38-39

MD/MS Biomedical Investigation-Clinical Research Track

For information about Program Admission and MD requirements, please see MD Dual Degrees section (p. 792). The Clinical Research track includes formal instruction in methods common to all fields of clinical investigation along with mentored research. In addition to medical school credits, students must complete the track-specific courses and electives listed below.

All students in this track must complete the CRSP Core Curriculum or equivalents:

- IBIS 434 Integrated Biological Sciences in Medicine (**or IBIS 401 and 402) 6
- CMED 401 Intro to Clinical Research and Scientific Writing 3
- or CRSP 401 Introduction to Clinical Research Summer Series
- CMED 402 Statistical Science for Medical Research 3
- or CRSP 431 Statistical Methods I
- CMED 403 Introduction to Clinical Epidemiology 3
- or CRSP 402 Study Design and Epidemiologic Methods
- CMED 404 Clinical Research Seminars (*) 1
- or CRSP 412 Communication in Clinical Research (Part 1)
- CMED 405 Clinical Research Seminars (Part 2) 1
- or CRSP 413 Communication in Clinical Research (Part 2)
- CMED 450 Clinical Trials 3
- or EPBI 450 Clinical Trials and Intervention Studies
- CMED 458 Statistical Modeling with Applications in Clinical Research 3
- or EPBI 458 Statistical Methods for Clinical Trials
- CMED 500 Scientific Integrity in Biomedical Research 0
- or IBMS 500 On Being a Professional Scientist: The Responsible Conduct of Research
- CMED 601 Clinical Research Project 18
- IBIS 600 Exam in Biomedical Investigation 0

Program Advisors: Dr. Dennis Stacey (College students) and Dr. William Merrick (University students).

Registration permits for all CMED courses can be obtained from Dr. Ticknor’s office.

Certificate in Global Health

Ronald Blanton, MD  
216.368.4814

The Certificate is the centerpiece of the Framework for Global Health Curricula comprised of faculty from across the Case Western Reserve University campus, whose objective is to promote education in global health issues. Nearly every department at CWRU offers multiple educational activities in global health. Rather than attempt to own all of these activities, the group at CWRU (representing Anthropology, Bioethics, Biology, Biostatistics/Epidemiology, Mathematics, Medicine, Nursing, Engineering) elected to develop a structure within which each department could develop independently while taking advantage of what the others had to offer. The organizing structure for this became the certificate program rather than a separate degree. This approach recognizes that student’s need to graduate within a recognized discipline as well as recognition of a student’s focus, time and effort in training. Each student in the Certificate program will be grounded in global health by a core course (INTH 301 Fundamentals of Global Health/INTH 401 Fundamentals of Global Health) that will allow them to understand concepts and vocabulary across disciplines and that will facilitate meaningful communication with others based in a different discipline. In addition to the Certificate, the Framework for Global Health Curricula had identified and is annotating all global health related courses at CWRU. It has supported the recent revival of Medical Spanish and new courses and electives in Global Health.

Requirements for Certificate in Global Health:

**Anthropology**

**Undergraduate:**

- INTH 301 Fundamentals of Global Health 3
- ANTH 215 Health, Culture, and Disease: An Introduction to Medical Anthropology 3
- ANTH 359 Introduction to International Health 3
- And one elective selected from list of approved electives in the Anthropology Department

**Graduate:**

- INTH 401 Fundamentals of Global Health 3
- ANTH 459 Introduction to International Health 3
- ANTH 511 Seminar in Anthropology and Global Health: Topics 3
- And one elective selected from list of approved electives in the Anthropology Department

Contact: Janet McGrath (http://bulletin.case.edu/schoolofmedicine/generalmedicalsciences/mailto:janet.mcgrath@case.edu), 216.368.2287

**Bioethics**

- INTH 401 Fundamentals of Global Health 3
- BETH 414 International Health Research Ethics 3
- And complete one elective selected from list of approved electives in the Bioethics Department

Contact: Insoo Hyun (http://bulletin.case.edu/schoolofmedicine/generalmedicalsciences/mailto:insoo.hyun@case.edu), 216.368.8658

**Epidemiology/Biostatistics**

- INTH 401 Fundamentals of Global Health 3
- EPBI 484 Geographic Medicine and Epidemiology 1
- EPBI 494 Infectious Disease Epidemiology 1
- And complete an epidemiology research project with global perspective (may be substituted with other course work).

Contact: Daniel Tisch (http://bulletin.case.edu/schoolofmedicine/generalmedicalsciences/mailto:daniel.tisch@case.edu), 216.368.0875

**Math/Applied Math specialization:**

- INTH 301 Fundamentals of Global Health 3
- or INTH 401 Fundamentals of Global Health 3
- EPBI/ANAT/BIOL 431 Statistical Methods I (A basic course in Epidemiology or Biostatistics) 3
- or EPBI 490 Epidemiology: Introduction to Theory and Methods
- or EPBI 491 Epidemiology: Case-Control Study Design and Analysis
- MATH 449 Dynamical Models for Biology and Medicine 3
Case Comprehensive Cancer Center
http://cancer.case.edu/training

The Clinical Oncology Research Career Development Program (CORP) provides interdisciplinary training in clinical and translational oncology research for clinical oncology junior faculty physicians who are interested in pursuing academic research careers as physician scientists. This training addresses the need for clinician investigators to translate fundamental cancer research discoveries into medical care of cancer patients. Eligible candidates are physicians (MD, DO or MD/PhD) with a clinical training background in one of a number of oncology disciplines, including medical, surgical, pediatric, dermatological, gynecological and radiation oncology. Scholars select one of three areas of concentration:

- Mechanism Based Therapeutics and Clinical Trials
- Stem Cell Biology and Hematopoietic Malignancy Clinical Trials
- Prevention, Aging and Cancer Genetics and Clinical Trials

The Scholars' individual training plan consists of a 2-year certificate program which includes a didactic curriculum designed to provide basic background and highly individualized advanced training in both clinical and methodological components of clinical and translational cancer research.

Each Scholar is co-mentored by both a basic or behavioral scientist and a clinical investigator. A mentoring committee comprised of faculty in the Scholar's focus of oncology research provides additional guidance and support. During the period of mentored laboratory training, the Scholars develop original hypothesis-based experiments related to disease mechanisms at a molecular or cellular level. As the Scholars build on their laboratory conclusions to create and implement clinical trials, they are mentored by clinical investigators. Clinical trials are aimed at developing new methods for diagnosis and testing promising ideas for novel therapeutic interventions. These components come together with the Scholar's presentations at a national conference, publications in peer review journals and application for independent funding as a physician scientist.

This two-year certificate program is administered through the Case Comprehensive Cancer Center. The overall goal of the K12 CORP certificate program is to foster interdisciplinary training in clinical and translational oncology research for clinical oncology junior faculty physicians who are interested in pursuing academic research careers as physician scientists. This training addresses the need for clinician investigators to translate fundamental cancer research discoveries into medical care of cancer patients. Eligible candidates are physicians (MD, DO or MD/PhD) with a clinical training background in one of a number of oncology disciplines, including medical, surgical, pediatric, dermatological, gynecological and radiation oncology. Scholars select one of three areas of concentration:

- Mechanism Based Therapeutics and Clinical Trials
- Stem Cell Biology and Hematopoietic Malignancy Clinical Trials
- Prevention, Aging and Cancer Genetics and Clinical Trials

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This two-year certificate program is administered through the Case Comprehensive Cancer Center. The overall goal of the K12 CORP certificate program is to foster interdisciplinary training in clinical and translational oncology research for physicians. Upon completion of this 15-19 hour two year training, scholars will earn the K12 CORP Certificate.

The formal didactic program includes a course in responsible conduct IBMS 500 On Being a Professional Scientist: The Responsible Conduct of Research (0) or CRSP 603 Research Ethics and Regulation (2 hr); CNCR 501 Translational Cancer Research A (Translational Cancer Research Course (1 hr/semester); and one elective (1-3). Additional required activities include Clinical Protocol Tutorials, Intensive Mentored Research Project, Ongoing seminars, Meetings and Presentations; and applications for independent funding.

Formal Didactic Curriculum Coursework *:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>IBMS 500</td>
<td>On Being a Professional Scientist: The Responsible Conduct of Research</td>
<td>0-2</td>
</tr>
<tr>
<td>or CRSP 603</td>
<td>Research Ethics and Regulation</td>
<td>2</td>
</tr>
<tr>
<td>CNCR 501</td>
<td>Translational Cancer Research A (All four modules required, one each semester of the program (501-1, 501-2, 501-3, 501-4))</td>
<td>1</td>
</tr>
</tbody>
</table>

*Additionally, choose one course from following core courses for credit towards certificate:
Certificate in Clinical Research

James Spilsbury, PhD, Director
Natalie Milone, Education Manager, natalya.cheprakova-milone@case.edu
Center for Clinical Investigation
http://casemed.case.edu/CRSP
216.368.2601

The Clinical Research Certificate program is a four course, 11 credit hour program. Students who successfully complete the required coursework will receive a Certificate in Clinical Research issued by the Center for Clinical Investigation. Coursework includes: Introduction to Clinical and Translational Research; Study Design and Epidemiologic Methods; Advanced Statistics: Linear Models; and a course on Research Ethics and Regulation.

Admissions will be administered by the Center for Clinical Investigation. Individuals who want to participate in the program will complete an application form that includes a brief personal statement describing the reason(s) for seeking clinical research training and a recent CV or resume. Per CWRU School of Graduate Studies requirements, individuals who are not already graduate-degree-seeking students at CWRU must submit to the School of Graduate Studies a completed non-degree application form. Individuals who are not faculty, staff, or employees of CWRU must also submit a transcript or copy of their diploma, documenting completion of a baccalaureate degree. Once accepted into the Certificate program, participants will register for the courses through the Student Information System. The program will have rolling admissions, and students will be able to start taking courses in the summer or fall semester. The coursework for the Certificate will be listed on the official CWRU transcript. However, the Certificate in Clinical Research will be issued by the Center for Clinical Investigation, not the University, and will not appear on the official CWRU transcript.

Performance Standards: A grade of B or higher in each graded course will be required for successful completion of the Certificate program. Enrollees will be responsible for keeping track of the courses they take.

Required Courses:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>CRSP 401</td>
<td>Introduction to Clinical Research Summer Series</td>
<td>3</td>
</tr>
<tr>
<td>CRSP 402</td>
<td>Study Design and Epidemiologic Methods</td>
<td>3</td>
</tr>
<tr>
<td>EPBI 630</td>
<td>Advanced Statistics: Linear Models</td>
<td>3</td>
</tr>
<tr>
<td>EPBI 603</td>
<td>Research Ethics and Regulation</td>
<td>2</td>
</tr>
</tbody>
</table>

Exit Standards: Students who complete all required coursework will submit a checklist to the Center for Clinical Investigation notifying the Center for Clinical Investigation’s Education Administrator/Manager that all coursework is completed. This administrator will verify with the registrar’s office that all requirements have been met and will then issue a certificate to the enrollee, documenting completion of the program.
proteins, bioinformatics, and quantitative modeling and analysis. At least 18 semester hours of course work, in addition to thesis hours, must be at the 400-level or higher.

Each student must prepare an individual thesis that must conform to regulations concerning format, quality, and time of submission as established by the dean of graduate studies. For completion of master’s degrees under Plan A, an oral examination (defense) of the master’s thesis is required, where the examination is conducted by a committee of at least three members of the university faculty.

**Masters Degree Plan B Summary**

The minimum requirements for the master’s degree under Plan B are 30 semester hours of course work (with at least 18 semester hours of course work at the 400 level or higher) and a written comprehensive examination or major project with report to be administered and evaluated by the program steering committee. The coursework must include SYBB 459 Bioinformatics for Systems Biology, SYBB 555 Current Proteomics, and SYBB 501 Biomedical Informatics and Systems Biology Journal Club. The curriculum plan must be approved by the program steering committee and include appropriate coverage of the core competencies in genes and proteins, bioinformatics, and quantitative modeling and analysis.

**Sample Plan of Study for MS Degree**

Plan of Study includes required courses as well as electives.

### Plan of Study Grid

<table>
<thead>
<tr>
<th>First Year</th>
<th>Units</th>
<th>Fall</th>
<th>Spring</th>
</tr>
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<tbody>
<tr>
<td>Cell Structure and Function (PHOL 432)</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Proteins and Nucleic Acids (PHOL 456)</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Introduction to Bioinformatics (EECS 458)</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Biomedical Informatics and Systems Biology Journal Club (SYBB 501)</td>
<td>0</td>
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<tr>
<td>Bioinformatics for Systems Biology (SYBB 459)</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current Proteomics (SYBB 555)</td>
<td>3</td>
<td></td>
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</tr>
<tr>
<td>Thesis MS (SYBB 651)</td>
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<td>Year Total:</td>
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<th>Second Year</th>
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<th>Spring</th>
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<tbody>
<tr>
<td>Statistical Methods I (EPBI 431)</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Applied Probability and Stochastic Processes for Biology (BIOL 419)</td>
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<tr>
<td>Biomedical Informatics and Systems Biology Journal Club (SYBB 501)</td>
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<td>Thesis MS (SYBB 651)</td>
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<tr>
<td>Biomedical Informatics and Systems Biology Journal Club (SYBB 501)</td>
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<td>Year Total:</td>
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</table>

**Total Units in Sequence:** 30

**PhD Program Summary**

The Systems Biology and Bioinformatics program differs from current CWRU programs in the comprehensive requirement for an understanding of biological systems, bioinformatics, and quantitative analysis & modeling. The program includes a set of required core courses including (SYBB 459 Bioinformatics for Systems Biology) and (SYBB 555 Current Proteomics), (SYBB 501 Biomedical Informatics and Systems Biology Journal Club), and an individualized course of study that includes at least six additional courses, a course in the Responsible Conduct of research (IBMS 500 On Being a Professional Scientist: The Responsible Conduct of Research), a qualifier exam, a PhD Thesis, and oral defense consistent with CWRU requirements. The total credits required for the PhD is at least 54 credits (24 grade graduate courses, 12 pre-dissertation research credits, and at least 18 dissertation research credits) and is consistent with a traditional graduate program. Admissions to this program may be obtained through the integrated Biomedical Sciences Training Program, by direct admission to the department or via the Medical Scientist Training Program.

### Sample Plan of Study for PhD Degree

§ Please also see Graduate Studies Academic Requirements for Doctoral Degrees (p. 662)

#### Plan of Study Grid

<table>
<thead>
<tr>
<th>First Year</th>
<th>Units</th>
<th>Fall</th>
<th>Spring</th>
<th>Summer</th>
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<tr>
<td>Cell Structure and Function (PHOL 432)</td>
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<td>Proteins and Nucleic Acids (PHOL 456)</td>
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<td>Systems Biology and Bioinformatics Research (SYBB 601)</td>
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<td>Current Proteomics (SYBB 555)</td>
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<tr>
<td>Systems Biology and Bioinformatics Research (SYBB 601/651)</td>
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<tr>
<td>Systems Biology and Bioinformatics Research (SYBB 601)</td>
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<tr>
<td>On Being a Professional Scientist: The Responsible Conduct of Research (IBMS 500)</td>
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<tr>
<td>Structural Biology (BIOL 434)</td>
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<td>Protein Biophysics (PHOL 475)</td>
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<tr>
<td>Systems Biology and Bioinformatics Research (SYBB 601)</td>
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<td>Advanced Methods in Structural Biology (BIOC 430)</td>
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<td>Systems Biology and Bioinformatics Research (SYBB 601)</td>
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<tbody>
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<td>1-9</td>
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</tbody>
</table>
## Footnotes

* Students admitted into program via BSTP would take BSTP 400 for research rotations; students admitted via MSTP would take MSTP 400 for research rotations.

## Required Core Courses for MS and PhD programs

### Course List

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<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>SYBB 459</td>
<td>Bioinformatics for Systems Biology</td>
</tr>
<tr>
<td>SYBB 555</td>
<td>Current Proteomics</td>
</tr>
<tr>
<td>SYBB 501</td>
<td>Biomedical Informatics and Systems Biology Journal Club</td>
</tr>
<tr>
<td>SYBB 601</td>
<td>Systems Biology and Bioinformatics Research</td>
</tr>
<tr>
<td>SYBB 651</td>
<td>Thesis MS (For MS Students only)</td>
</tr>
<tr>
<td>SYBB 701</td>
<td>Dissertation PhD (For PhD students only)</td>
</tr>
</tbody>
</table>

**Total Units in Sequence:** 44-108

### Elective Courses for MS and PhD programs

#### Genes and Proteins Courses

### Course List

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<thead>
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<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>EPBI/GENE/MPHP 451</td>
<td>Principles of Genetic Epidemiology</td>
</tr>
<tr>
<td>CLBY 555/BIOC 555/PATH 555</td>
<td>Biomedical Informatics</td>
</tr>
<tr>
<td>PHOL/PHRM CHEM 475</td>
<td>Protein Biophysics</td>
</tr>
<tr>
<td>PHOL 432</td>
<td>Cell Structure and Function</td>
</tr>
<tr>
<td>PHOL 456</td>
<td>Proteins and Nucleic Acids</td>
</tr>
<tr>
<td>PHOL 480</td>
<td>Physiology of Organ Systems</td>
</tr>
<tr>
<td>CBIO 453</td>
<td>Cell Biology I</td>
</tr>
<tr>
<td>CBIO 455</td>
<td>Molecular Biology I</td>
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#### Bioinformatics and Computational Biology Courses

### Course List

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<th>Course Title</th>
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<td>EPBI 415</td>
<td>Statistical Programming</td>
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<tr>
<td>BIOLEEC 419</td>
<td>Applied Probability and Stochastic Processes for Biology</td>
</tr>
<tr>
<td>PHRM/PHOL CHEM 475</td>
<td>Advanced Methods in Structural Biology</td>
</tr>
<tr>
<td>BIOC 430</td>
<td>Computer Science</td>
</tr>
<tr>
<td>EECS 458</td>
<td>Introduction to Bioinformatics</td>
</tr>
<tr>
<td>NEUR 478/BIOL 378/CAGS/MATH 378/BIOL 478/EBME 478</td>
<td>Computational Neuroscience</td>
</tr>
<tr>
<td>GENE 508</td>
<td>Bioinformatics and Computational Genomics</td>
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</table>

#### Quantitative Analysis and Modeling

### Course List

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<th>Course Title</th>
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</thead>
<tbody>
<tr>
<td>EPBI 431</td>
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</tr>
<tr>
<td>EPBI 432</td>
<td>Statistical Methods II</td>
</tr>
<tr>
<td>EPBI 471</td>
<td>Statistical Aspects of Data Mining</td>
</tr>
<tr>
<td>EPBI 473</td>
<td>Integrative Cancer Biology</td>
</tr>
<tr>
<td>MATH 441</td>
<td>Mathematical Modeling</td>
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</table>

## CMED Courses

### CMED 401. Intro to Clinical Research and Scientific Writing. 3 Units.

This seminar brings in numerous experts to cover a variety of essential issues and concepts in clinical research and scientific writing. The overarching goal is for students to produce a short but well-crafted research proposal. Topics for reading and discussion include general principles of research design and proposal development; key concepts and issues in biostatistical science for study planning, data management, analysis, interpretation, and presentation; modern medical library informatics; ethical issues in clinical research and necessary rigmarole; technical writing emphasizing research proposals; designing studies of diagnostic tests; outcomes research and medical decision making; clinical genomics research.

### CMED 402. Statistical Science for Medical Research. 3 Units.

A rigorous, practical introduction to core concepts and methods in statistical planning, managing, and analyzing data, and interpreting and communicating biostatistical information. Seminar sessions: discuss readings, work through realistic examples using popular commercial software. Project sessions: individuals in small groups discuss their own examples and receive on-the-spot feedback. Topics: types of data and common distributions; database and statistical software; understanding and describing data with simple statistics and effective tables and graphics; statistical transforms (log, logit) and what they imply, basic inference tests, confidence intervals, and related sample-size analyses involving categorical data (analyzing proportions), ordinal data (analyzing ranks), continuous data (analyzing means), and time-to-event data with censoring. A substantial introduction to statistical modeling unifies seemingly diverse methods to induce a cohesive, flexible, and broad understanding of biostatistics. Medical students enrolled in CRSP must complete CCLCM Introduction to Clinical Research, IBIS 431 and IBIS 490 to satisfy the CRSP 401, 402 and 403 series. Prereq: Must be enrolled in School of Medicine.

### CMED 403. Introduction to Clinical Epidemiology. 3 Units.

Using multiple learning modalities, including case-based seminars, computer-based interactive learning, journal club, and readings from texts as well as contemporary clinical literature, students will receive a rigorous introduction to methods of research in clinical epidemiology. Topics to be covered include human subjects protections; legal and ethical components of clinical research; measures of disease frequency; basics of clinical study design; nature of and analysis of risk factors; cohort study design and analysis; case-control study design and analysis; confounding; interaction; bias; survey research; diagnostic tests; disease screening; design, analysis, and reporting of clinical trials; meta-analysis; decision analysis; cost-effectiveness analysis; and a brief introduction to health services research. Medical students enrolled in CRSP must complete CCLCM Introduction to Clinical Research, IBIS 431, and IBIS 490 to satisfy the CRSP 401, 402, and 403 series. Prereq: Must be enrolled in School of Medicine.
CMED 404. Clinical Research Seminars. 1 Unit.
The Clinical Research Seminars series is intended to give students a broad exposure to issues unique to clinical research as well as career development. Students attend seminars on relevant clinical research topics offered either on the Case or CCF campuses, and will write a short summary of each seminar attended. A total of 12-14 one-hour seminars per semester is required for successful completion of the course. Students are expected to take two semesters. Prereq: Must be enrolled in School of Medicine and consent of CCLCM Office.

CMED 405. Clinical Research Seminars. 1 Unit.
The Clinical Research Seminars series is intended to give students a broad exposure to issues unique to clinical research as well as career development. Students attend seminars on relevant clinical research topics offered either on the Case or CCF campuses, and will write a short summary of each seminar attended. A total of 12-14 one-hour seminars per semester is required for successful completion of the course. Students are expected to take two semesters. Prereq: Must be enrolled in School of Medicine and consent of CCLCM Office.

CMED 406. Introduction to Database Programming Base SAS. 0 Units.
Using the SAS Data Step as a programming language. Creating temporary and permanent SAS datasets, exchanging datasets with other software (e.g. Excel, Jmp, R), checking and manipulating data, sorting and merging, producing reports, Effective programming style. This is not a course in statistical analysis. Prereq: Must be enrolled in School of Medicine and consent of CCLCM Office.

CMED 407. Basic Research Ethics. 3 Units.
Examine the ethical issues of clinical research involving human subjects. Topics include research versus clinical practice, informed consent, therapeutic misconception, risk reduction, vulnerability and subject selection, recruitment and inducement.

CMED 408. Clinical Trials. 3 Units.
Design, organization and operation of randomized controlled clinical trials and intervention studies. Topics include legal and ethical issues in design; application of concepts of controls; masking and randomization; steps required for quality data collection; monitoring for evidence of adverse or beneficial treatment effects; elements of organizational structure; sample size calculations and data analysis procedures and mistakes. Prereq: Must be enrolled in School of Medicine.

CMED 409. Statistical Modeling with Applications in Clinical Research. 3 Units.
Statistical modeling methods and strategies for analyzing data in clinical research, including randomized and non-randomized clinical trials. Standard Normal-theory, logistic, and Cox proportional hazard regression methods, emphasizing that these tools provide a unified schema to use linear models for continuous and categorical predictors of outcomes that are continuous, binary, or time-to-event with censoring. Repeated measures analysis using summary measures versus modern mixed models. Spline models for non-linear relationships. Extending the logistic model for ordinal outcomes. Propensity analysis. Software: R. Prereq: Must be enrolled in School of Medicine and consent of CCLCM Office.

CMED 410. Foundations of Clinical Medicine. 3 Units.
Students meet weekly to learn, examine, and discuss issues related to their future societal and professional roles as physicians. Topics covered include population health, medical errors and patient safety, cultural competence, health care disparities, quality improvement, pain management, ethical and legal issues in medicine, leadership, and professionalism. Prereq: Must be enrolled in School of Medicine and consent of CCLCM Office.

CMED 499. Independent Study in Clinical Trials. 3 Units.
A survey of the various aspects of clinical trial investigation to provide the student a first-hand perspective on the day-to-day conduct of clinical investigation from the perspective of investigating physicians, clinical trial coordinators, compliance and regulatory officers, and core laboratory personnel. Students will develop a specific plan with the course directors that will total 40-50 hours of discussion and direct participation. Prereq: CMED 450. Must be enrolled in the School of Medicine and consent of CCLCM Office.

CMED 500. Scientific Integrity in Biomedical Research. 0 Units.
This course covers a wide variety of topics in ethics for biomedical researchers including Institutional Review Boards for human and animal experimentation, requirements of the Health Insurance Portability and Accountability Act (HIPAA), informed consent, and de-identification of patient data in research databases. Issues of data ownership, responsibilities of authorship, and conflicts of interest are also discussed. Prereq: Enrolled in School of Medicine. Must have completed 1.5 years.

CMED 601. Clinical Research Project. 1 - 18 Unit.
Clinical research project leading toward the completion of a type B Masters of Science in Biomedical Investigation - CRSP.

CNCR Courses

CNCR 460. Introduction to Microarrays. 3 Units.
Microarray technology is an exciting new technique that is used to analyze gene expression in a wide variety of organisms. The goal of this course is to give participants a hands-on introduction to this technology. The course is intended for individuals who are preparing to use this technique, including students, fellows, and other investigators. This is a hands-on computer-based course, which will enable participants to conduct meaningful analyses of microarray data. Participants will gain an understanding of the principles underlying microarray technologies, including: theory of sample preparation, sample processing on microarrays, familiarity with the use of Affymetrix Microarray Suite software and generation of data sets. Transferring data among software packages to manipulate data will also be discussed. Importation of data into other software (GeneSpring and DecisionSite) will enable participants to mine the data for higher-order patterns. Participants will learn about the rationale behind the choice of normalization and data filtering strategies, distance metrics, use of appropriate clustering choices such as K-means, Hierarchical, and Self Organizing Maps. Course Offered as BIOC 460, PATH 460, CNCR 460.
CNCR 501. Translational Cancer Research A. 1 Unit.
In this course Case K12 Paul Calabresi Scholars will learn about the steps to receive an IRB approval for their research proposal and clinical trials; how to design and conduct clinical trials by developing a protocol, a research question, the purpose of the LOI, funding and budget issues, working with pharmaceutical companies; essential writing skills for successfully submitting a manuscript for publication in a peer reviewed journal. The class will discuss Social Intelligence and the Biology of Leadership by Goleman and Boyatzis; the scholars will learn about the Case Cancer Center Core Facilities and resources which are available for their research projects. Topics also include the expectations of the K12 CORP program and essential elements for advancing their academic and research career. Recommended preparation: Acceptance to Case K12 Clinical Oncology Career Development Training Program as Paul Calabresi Research Scholar.

CNCR 502. Translational Cancer Research B. 1 Unit.
In this course Case K12 Paul Calabresi Scholars will learn how to manage clinical trials; including staffing, multi or single site, contracting issues, translation and incorporation of laboratory research/correlative science into clinical trials design, getting involved with ECOG. The scholars will learn about mentored and independent funding resources, how to select the appropriate mechanism, and strategies for successful grant submissions and resubmissions. They will learn how to present research and clinical trials progress orally and written to peers/faculty for evaluation my making two PowerPoint presentations: one to the class and their two K12 mentors and a second to the K12 CORP Advisory Committee for written evaluation. Both of these sections will be video taped and a copy of the tape will be reviewed with the scholar. Each scholar will also provide a written summary of their research to date along with their goals for the next 12 months on April 1. Recommended preparation: Acceptance to Case K12 Clinical Oncology Career Development Training Program as Paul Calabresi Research Scholar.

CNCR 503. Translational Cancer Research C. 1 Unit.
In this course each Case K12 Paul Calabresi Scholar will present a summary of their experience from attending either the ASCO/AACR or ASH Clinical Trial Protocol Writing Workshop; two sessions will cover how to write a research proposal-hypothesis, specific aims, methods, and study design. Each scholar will write a sample research proposal which will be critiqued by the other members of the class; two sessions will cover the organization and analysis of biostatistic data used in research. One of these sessions will be a working session based on the scholar’s own data. The scholars will learn about the essential components and issues in developing a successful career in clinical and translational research. Recommended preparation: Acceptance to Case K12 Clinical Oncology Career Development Training Program as Paul Calabresi Research Scholars.

CNCR 504. Translational Cancer Research D. 1 Unit.
In this course Case K12 Paul Calabresi Scholars will discuss an article on essential components of leadership in an academic and clinical setting; how to advance their clinical research career to the level that they can present at the ASCO national conference; learn how to present research and clinical trials progress orally and written to peers/faculty for evaluation by making two PowerPoint presentations: one to the class and their two K12 mentors and a second to the K12 CORP Advisory Committee for written evaluation. Both of these sessions will be video taped and a copy of the tape will be reviewed with the scholar. Each scholar will also provide a written summary of their research and date along with their goals for the next 12 months on April 1. Recommended preparation: Acceptance to Case K12 Clinical Oncology Career Development Training Program as Paul Calabresi Research Scholar.

CRSP Courses

CRSP 401. Introduction to Clinical Research Summer Series. 1 - 3 Unit.
This course is designed to familiarize one with the language and concepts of clinical investigation and statistical computing, as well as provide opportunities for problem-solving, and practical application of the information derived from the lectures. The material is organized along the internal logic of the research process, beginning with mechanisms of choosing a research question and moving into the information needed to design the protocol, implement it, analyze the findings, and draw and disseminate the conclusion(s). Prereq: M.D., R.N., Ph.D., D.D.S., health professionals.

CRSP 402. Study Design and Epidemiologic Methods. 3 Units.
This course will cover the methods used in the conduct of epidemiologic and health services research and considers how epidemiologic studies may be designed to maximize etiologic inferences. Topics include: measures of disease frequency, measures of effect, cross-sectional studies, case-control studies, cohort studies, randomized controlled trials, confounding, bias, effect modification, and select topics. Recommended preparation: CRSP 401 or permission of instructor.

CRSP 406. Introduction to R Programming. 2 Units.
This course will introduce students to programming with R. Major topics will include session management, R data structures, indexing and conditional selection, combining and restructuring data frames, data aggregation, reading and writing data, basic statistical functions, and R traditional graphics. Students will also learn R programming conventions as they relate to preparing data for statistical analysis. Small research datasets will be used in class examples and in homework assignments. Each class will include a demonstration of new concepts followed by a computer lab with exercises designed to reinforce the concepts introduced.
CRSP 407. Logistic Regression and Survival Analysis. 3 Units.
This course introduces two commonly used statistical modeling techniques found in the medical, epidemiologic, and public health research fields; logistic regression and survival analysis. The course emphasizes summarizing and analyzing binary and time-to-event outcomes. The focus is on establishing a foundation for when and how to use these modeling techniques as well as an understanding of interpreting results from analyses. Two course projects will involve problem specification, data collection, analysis, and presentation. Students will use R statistical software extensively. Planned topics include contingency tables, logistic regression models and diagnostic measures, analyzing ordinal outcomes, estimating of the survival curve, Cox proportional hazard regression models and diagnostic measures, and sample size estimation. Software: R version 2.9.1 installed on the student’s lap top. Prereq: CRSP 403 and CRSP 406.

CRSP 410. Independent Study in Clinical Research. 1 - 3 Unit.
Independent Study in Clinical Research enables the student to undertake study of advanced topics in clinical research that are not offered as standing courses at Case Western Reserve University. The student(s) and a member of the Clinical Research Scholars Program faculty, or another faculty member at CWRU, submit a 1-2 page proposal for independent study to the CRSP Program Director. The proposal should include a descriptive title (e.g., research method or clinical topic area) to be studied; a list of up to 5 student-centered objectives of the study; how the subject matter will be learned; and how success in achieving the objectives will be measured (e.g., manuscript, essay, grant proposal, or other written product; examination, etc.). It is expected that there will be at least one contact hour per week for each credit hour requested.

CRSP 412. Communication in Clinical Research (Part 1). 1 Unit.
Sound research only has strong impact when communicated effectively to various types of readers, listeners, and viewers. This requires knowing what receivers need and expect. CRSP 412 focuses on writing. CRSP 413 deals with preparing and delivering oral, poster, and online presentations, mock grant reviewing (to learn what reviewers expect), and modern statistical graphics and tables. Prereq: CRSP 401 or equivalent.

CRSP 413. Communication in Clinical Research (Part 2). 1 Unit.
Sound research only has strong impact when communicated effectively to various types of readers, listeners, and viewers. This requires knowing what receivers need and expect. CRSP 412 focuses on writing. CRSP 413 deals with preparing and delivering oral, poster, and online presentations, mock grant reviewing (to learn what reviewers expect), and modern statistical graphics and tables. Prereq: CRSP 401 or equivalent.

CRSP 431. Statistical Methods I. 3 Units.
Application of statistical techniques with particular emphasis on problems in the biomedical sciences. Basic probability theory, random variables, and distribution functions. Point and interval estimation, regression, and correlation. Problems whose solution involves using packaged statistical programs. First part of year-long sequence. Offered as ANAT 431, BIOL 431, CRSP 431, EPBI 431, and MPHP 431.

CRSP 432. Statistical Methods II. 3 Units.
Methods of analysis of variance, regression and analysis of quantitative data. Emphasis on computer solution of problems drawn from the biomedical sciences. Design of experiments, power of tests, and adequacy of models. Offered as BIOL 432, CRSP 432, EPBI 432, and MPHP 432.

CRSP 500. Design and Analysis of Observational Studies. 3 Units.
An observational study investigates treatments, policies or exposures and the effects that they cause, but it differs from an experiment because the investigator cannot control assignment. We introduce appropriate design, data collection and analysis methods for such studies, to help students design and interpret their own studies, and those of others in their field. Technical formalities are minimized, and the presentations will focus on the practical application of the ideas. A course project involves the completion of an observational study, and substantial use of the R statistical software. Topics include randomized experiments and how they differ from observational studies, planning and design for observational studies, adjustments for overt bias, sensitivity analysis, methods for detecting hidden bias, and focus on propensity score methods for selection bias adjustment, including multivariate matching, stratification, weighting and regression adjustments. Recommended preparation: a working knowledge of multiple regression, some familiarity with logistic regression, with some exposure to fitting regression models in R. Offered as CRSP 500 and EPBI 500.

CRSP 501. Working in Interdisciplinary Research Teams. 1 Unit.
This course will assist learners to understand why and how different professional disciplines, each representing a body of scientific knowledge, must work together to develop and disseminate knowledge. Learners will develop a set of skills specific to being an effective member and leader of an interdisciplinary research team, including working with different value and knowledge sets across disciplines, running effective meetings, managing conflict, giving and receiving feedback, and group decision-making techniques. Using the small group seminar approach and case studies, learners will practice individual and group communication, reflective and self-assessment techniques, and engage in experiential learning activities regarding effective teamwork in interdisciplinary research teams. Techniques to increase group creativity and frame new insights will be discussed. Recommended preparation: K grant Appointment or permission of instructor.

CRSP 502. Leadership Development. 2 Units.
Leadership Assessment and Development is for participants to learn a method for assessing their knowledge, abilities, and values relevant to management; and for developing and implementing plans for acquiring new management related knowledge and abilities. The major goals of this course include generating data through a variety of assessment methods designed to reveal your interests, abilities, values, and knowledge related to leadership effectiveness; learning how to interpret this assessment data and use it to design/plan developmental activities; small group sharing of insights from the various assessments. Recommended preparation: K grant appointment or consent of instructor.
CRSP 503. Innovation and Entrepreneurship. 1 Unit.
The purpose of this module is to acquaint and ultimately engage clinical researchers with the business of innovation and entrepreneurship. Goals include: (1) to provide researchers with many of the skills that they would need to translate academic research into commercial uses; (2) to sensitize clinical researchers to the goals of the business community and facilitate their ability to work with the private sector on technology development; and (3) to make clinical researchers aware of the processes of academic technology development and transfer. Sessions consist of lectures and case discussion facilitated by the instructor. Some sessions include members of the business community as guest lecturers. As an example, students will discuss the financing of new companies with local venture capitalists. Student products include the evaluation of the commercial potential of a university technology in which they apply their new knowledge about commercialization of scientific discoveries.

CRSP 504. Managing Research Records - A System’s Approach. 2 - 3 Units.
This course will provide an approach to managing data for research studies. Major topics include a discussion of a research study system including database design and development, data management, and clinical data management; how to evaluate the data needs of a study including the impact of required regulations; summary of key regulations; the role of the data manager including protocol review, development of a data management plan, CRF design, data cleaning, locking studies and ensuring best practices. Each session will include a lecture, class discussion, and student presentation.

CRSP 505. Investigating Social Determinants of Health. 2 - 3 Units.
The biopsychosocial model highlights the inter-related roles that biological, psychological, and social factors play in health and illness. This course is geared towards clinical research scholars who would like to incorporate aspects of the “social context” in their research. The course will examine the conceptualization, measurement, and effects of several key socio-cultural determinants of health and illness. Sample studies that incorporate social determinants of health will be reviewed. The course will also consider strategies and techniques to conduct clinical research involving social factors in socially and ethnically diverse settings. Students will be encouraged to develop a prototypical study design to incorporate social determinants in their research. To earn an optional third credit hour for this course, students will be required to complete additional assignments tailored to the students’ research needs and interests upon mutual agreement with the instructor at the beginning of the course. Recommended preparation: CRSP 401.

CRSP 510. Health Disparities. 3 Units.
This course aims to provide theoretical and application tools for students from many disciplinary backgrounds to conduct research and develop interventions to reduce health disparities. The course will be situated contextually within the historical record of the United States, reviewing social, political, economic, cultural, legal, and ethical theories related to disparities in general, with a central focus on health disparities. Several frameworks regarding health disparities will be used for investigating and discussing the empirical evidence on disparities among other subgroups (e.g., the poor, women, uninsured, disabled, and non-English speaking populations) will also be included and discussed. Students will be expected to develop a research proposal (observational, clinical, and/or intervention) rooted in their disciplinary background that will incorporate materials from the various perspectives presented throughout the course, with the objective of developing and reinforcing a more comprehensive approach to current practices within their fields. Offered as CRSP 510, EPBI 510, MPHP 510, NURS 510, and SASS 510.

CRSP 603. Research Ethics and Regulation. 2 Units.
This course is designed to introduce students to the ethical, policy, and legal issues raised by research involving human subjects. It is intended for law students, post-doctoral trainees in health-related disciplines and other students in relevant fields. Topics include (among others): regulation and monitoring of research; research in third-world nations; research with special populations; stem cell and genetic research; research to combat bioterrorism; scientific misconduct; conflicts of interest; commercialization and intellectual property; and the use of deception and placebos. Course will meet once per week for 2 hours throughout the semester. Grades will be given based on class participation and a series of group projects and individual short writing assignments. Offered as BETH 503, CRSP 603 and LAWS 603.

CRSP 651. Clinical Research Scholars Thesis. 1 - 18 Unit.
CRSP Thesis M.S.

INTH Courses

INTH 301. Fundamentals of Global Health. 3 Units.
This course seeks to integrate the multiple perspectives and objectives in global health by investigating how the disciplines of Biology, Medicine, Anthropology, Nursing, Mathematics, Engineering analyze and approach the same set of international health problems. Students will develop a shared vocabulary with which to understand these various perspectives from within their own discipline. The focus sites will emphasize issues related to the health consequences of development projects, emergency response to a health care crisis and diseases of development in presence of underdevelopment. Offered as INTH 301 and INTH 401. Prereq: Junior or senior.

INTH 401. Fundamentals of Global Health. 3 Units.
This course seeks to integrate the multiple perspectives and objectives in global health by investigating how the disciplines of Biology, Medicine, Anthropology, Nursing, Mathematics, Engineering analyze and approach the same set of international health problems. Students will develop a shared vocabulary with which to understand these various perspectives from within their own discipline. The focus sites will emphasize issues related to the health consequences of development projects, emergency response to a health care crisis and diseases of development in presence of underdevelopment. Offered as INTH 301 and INTH 401. Prereq: Graduate student.
INTH 447. Global Health: Outbreak Investigation in Real-Time. 3 Units.
This course provides a trans-cultural, trans-disciplinary, multimedia learning experience by analyzing historical and real-time data from the annual dengue endemics and sporadic epidemics in Puerto Rico and Brazil. A rigorous problem-centered training in the epidemiology, prevention, treatment, and control of infectious diseases using real-time and historical surveillance data of endemic and epidemic Dengue in Bahia, Brazil. This is an advanced epidemiology course in which core material will be primarily taught through reading assignments, class discussion, group projects, and class presentations. The course will utilize the online web-based communication and learning technology to create a single classroom between the CWRU and international partners with unique and complementary skills. In addition to joint classroom lectures across sites, student groups will also perform smaller-scale videoconference meetings for assigned group projects, thus creating strong international connections for the students, faculty, and our institutions. Note: Due to the complexities of time zones for this international course, the course will begin at 8:00a.m. until the U.S.A. adjusts clocks for Daylight Savings Time (unlike Brazil). Therefore, classes after the second week of March will begin at 9:00a.m. Offered as: EPBI 447, INTH 447, and MPHP 447.

INTH 484. Geographic Medicine and Epidemiology. 1 - 3 Unit.
This course focuses on the epidemiology, prevention, treatment, and control of tropical and parasitic diseases. Emphasis will be placed on the triad of agent, host, and environment for infectious disease impacting global health. Three distinct modules will focus on specific examples such as malaria, helminths, bacteria, or viruses. Active class participation is required through discussions, case studies, and group projects. Recommended preparation: EPBI 490, EPBI 491 and a microbiology course or consent of instructor. Offered as EPBI 484, INTH 484, and MPHP 484.

INTH 494. Infectious Disease Epidemiology. 1 - 3 Unit.
This course is a follow-up to EPBI 484: Geographic Medicine and Epidemiology, and focuses on tuberculosis (TB), HIV, and dengue epidemiology. This is an advanced course, focusing on methods and approaches in epidemiology. It will be taught in three 1-credit modules, and students may take each module separately or all 3 together. Each module will have a separate project and/or exam. Module I: Tuberculosis epidemiology. Module II: HIV epidemiology. Module III: Dengue epidemiology. Offered as EPBI 494, INTH 494, and MPHP 494. Prereq: EPBI 490.

INTH 551. World Health Seminar. 1 Unit.
This seminar (also called the World Health Interest Group) examines a broad range of topics related to infectious disease research in international settings. Areas of interest are certain to include epidemiology, bioethics, medical anthropology, pathogenesis, drug resistance, vector biology, cell and molecular biology, vaccine development, diagnosis, and socio-cultural factors contributing to or compromising effective health care delivery in endemic countries. Speakers will include a diverse group of local faculty, post-doctoral and graduate student trainees, as well as visiting colleagues from around the world.

SYBB Courses

SYBB 459. Bioinformatics for Systems Biology. 3 Units.

SYBB 501. Biomedical Informatics and Systems Biology Journal Club. 0 Units.
The purpose of this journal club is to provide an opportunity for students to critically discuss a wide variety of informatics and systems biology topics and to present their works in progress. A wide range of informatics and systems theory approaches to conducting biomedical research will be accomplished through the guided selection of articles to be discussed during the club. Potential articles will be chosen from scientific journals including: Nature, Science, BMC Bioinformatics, BMC Systems Biology, the Journal of Bioinformatics and Computational Biology, and the Journal for Biomedical Informatics. During journal presentations, trainees will be expected to lead a discussion of the article that leads to the critical evaluation of the merit of the article and its implication for biomedical informatics and systems biology. The Journal Club will also provide a forum for trainees to present proposed, on-going, and completed research. Trainees will attend and participate in the Journal Club throughout their tenure in the program. The Journal Club will meet twice a month and each trainee will be required to present one journal article and one research in progress presentation yearly. The Journal Club will also include sessions where issues related to the responsible conduct of research are reviewed and extended.

SYBB 555. Current Proteomics. 3 Units.
This course is designed for graduate students across the university who wish to acquire a better understanding of fundamental concepts of proteomics and hands-on experience with techniques used in current proteomics. Lectures will cover protein/peptide separation techniques, protein mass spectrometry, bioinformatics tools, and biological applications which include quantitative proteomics, protein modification proteomics, interaction proteomics, structural genomics and structural proteomics. Laboratory portion will involve practice on the separation of proteins by two-dimensional gel electrophoresis, molecular weight measurement of proteins by mass spectrometry, peptide structural characterization by tandem mass spectrometry and protein identification using computational tools. The instructors’ research topics will also be discussed. Recommended preparation: CBIO 453 and CBIO 455. Offered as PHRM 555 and SYBB 555.

SYBB 600. Special Topics. 1 - 18 Unit.
Offered as EECS 600 and SYBB 600.

SYBB 601. Systems Biology and Bioinformatics Research. 1 - 18 Unit.
(Credit as arranged.)
SYBB 651. Thesis MS. 1 - 18 Unit.
(Credit as arranged.)

SYBB 701. Dissertation PhD. 1 - 18 Unit.
(Credit as arranged.) Prereq: Predoctoral research consent or advanced to Ph.D. candidacy milestone.
Graduate Programs in the Biomedical Sciences

Malana Bey (http://bulletin.case.edu/schoolofmedicine/graduateprograms/malitno:malana.bey@case.edu), Administrator 216.368.5655

The School of Medicine is proud to administer doctoral, master’s, professional and certificate graduate programs in the biomedical sciences, described fully in this bulletin under their departmental or center affiliations. The Office of Graduate Education provides support and information on the graduate and postdoctoral training programs in the School of Medicine, as well as professional skill development and training grant proposal support. Resources for proposal development as well as current training information are available in Graduate Education (http://casemed.case.edu/gradprog).

Case Western Reserve University School of Medicine has a strong commitment to the importance of diversity in its research and educational programs. The CWRU community celebrates how our individual diversity in race, ethnicity, gender, country of origin, sexual orientation or gender identity enhances our work together. CWRU programs welcome diverse individuals, including those individuals of racial and ethnic groups underrepresented in biomedical science, those with physical disabilities, and those with disadvantaged backgrounds.

Common Academic Requirements

Each graduate program follows the overall regulations established and described in Graduate Studies Academic Requirements pages (http://bulletin.case.edu/schoolofmedicine/graduateprograms/http://schoolofgraduatesudiesacademicrequirements) and documented to the Regents of the State of Ohio. In particular, students and faculty are directed to sections regarding Academic Requirements for Master’s and Doctoral Degrees regarding total and graded course requirements, dissertation advisory committees, maintenance of quality-point average, and other general aspects of graduate study at CWRU. Within those overall expectations, a specific course of study for each graduate program is required and described in each degree plan of study.

Graduate Admissions to School of Medicine Programs

Graduate students are admitted to our programs through several streams, including the Biomedical Sciences Training Program (http://www.case.edu/med/BSTP), the Medical Scientist Training Program (http://mstp.cwru.edu), dual-degree initiatives, and direct admission to specific programs (please see individual program entries under their affiliated department pages).

Student Affinity Groups

Graduate students interact in vibrant groups in the School of Medicine including the Biomedical Graduate Student Organization (http://casemed.case.edu/gradprog/bgso.cfm) and the Minority Graduate Student Organization (http://casemed.case.edu/gradprog/mgso.cfm), as well as university-wide student organizations such as the Graduate Student Senate (http://gss.case.edu). In addition, doctoral students in the School of Medicine organize the annual Biomedical Graduate Student Symposium (http://filer.case.edu/org/bgss/site/Home.html).

Postdoctoral Fellows and Postdoctoral Scholars are appointed through the Office of Postdoctoral Affairs (http://postdoc.case.edu). The Office of Graduate Education provides monthly Professional Skills Programs directed toward trainees.

Biomedical Sciences Training Program (BSTP)

Phone: 216.368.3347
http://www.case.edu/med/BSTP/
Martin Snider, PhD, Director
Debbie Noureddine, Coordinator

The Biomedical Sciences Training Program (BSTP) offers a common admission portal to most biomedical PhD degree programs at CWRU School of Medicine. The BSTP includes eleven doctoral programs in the School of Medicine with more than 200 faculty based in both basic science and clinical departments. Students in the BSTP have the opportunity to study within any research discipline represented in the training programs. This opportunity gives students a tremendous range of research choices. It also provides a distinct advantage over traditional programs, which restrict choices of research area and faculty advisors.

Admissions

Students usually apply in the fall or winter and begin their studies the following summer. The application deadline is January 15th, but applications will be considered by the Admissions Committee as soon as they are complete. In general a year of biology, organic chemistry and mathematics through calculus are required, and biochemistry and molecular biology are strongly recommended. We also seek students with strong quantitative training who may have majored in physics or math who may be interested in our Structural Biology track (p. 774) or Systems Biology and Bioinformatics (p. 825) programs. Depending on preparation, we may suggest additional biology coursework once graduate training begins. This background prepares most students for success in our programs.

Research Experience and Recommendations

Experience performing original research is essential. This might stem from an undergraduate honors thesis, summer research internships, or a technical position after graduation. Letters of recommendation from research mentors that describe creativity, hardwork and promise in science are very important.

Exams

The GRE general test is required. Recent classes have earned an average of 70th percentile in each area. A GRE subject test is desirable, but is not required. The Test of English as a Foreign Language (TOEFL) is required for foreign students unless they are from an English-speaking country or have a degree from University program where the instruction is primarily in English. Students may be eligible to apply for the transfer of some graduate credit from their previous institution. Please go here (http://gradstudies.case.edu) for more information. Transfer credit must be requested prior to beginning coursework at CWRU.

The First Year

Coursework

Students take integrated courses in Cell and Molecular Biology (CBIO 453 Cell Biology 1, CBIO 455 Molecular Biology 1). These two courses offered in the fall semester emphasize the molecular approaches that form the basis of modern biology. We also seek students with strong quantitative training who may have majored in physics or math, and offer alternative courses for these students to acquire foundations in biology. Qualified students also may take more specialized elective courses. All students complete the IBMS 500: On Being a Professional Scientist course introduction to responsible conduct.
Research Rotations
The research rotations allow students to explore research areas and become familiar with faculty members and their laboratories. The main purpose of these rotations is to aid students in selecting a laboratory for their thesis work. Students are encouraged to begin their rotations in July. Doing so gives them the opportunity to complete one rotation during the summer before classes begin at the end of August. A minimum of three rotations must be completed during the year.

Choosing a Thesis Advisor
During the first year, students select an advisor for the dissertation research. Each student also joins the doctoral training program with which the advisor is affiliated. Once a student has chosen a PhD program, the specific requirements of that program are followed to obtain the PhD. The emphasis of the PhD work is on research, culminating in the completion of an original, independent research thesis.

Participating Training Programs
- Biochemistry
- Cell Biology
- Molecular Biology and Microbiology
- Molecular Virology
- Molecular and Cellular Basis of Disease and Immunology
- Molecular, Developmental, and Human Genetics
- Neurosciences
- Nutritional Sciences
- Pharmacological Sciences
- Physiology and Biophysics
- Systems Biology and Bioinformatics

Training faculty, course offerings and individual degree requirements are described in detail in the separate listings for each of these programs.

Once an advisor is selected, the student becomes a member of a PhD Program and fulfills the specific requirements of that program. All PhD programs have similar requirements, including an original thesis, coursework, examinations, publications in scientific journals with lead authorship, seminars and journal clubs and other activities.

BSTP Courses
BSTP 400. Research Rotation in Biomedical Sciences Training Program. 0 - 9 Units.

CBIO Courses
CBIO 453. Cell Biology I. 4 Units.
Part of the first semester curriculum for first year graduate students along with CBIO 455. This course is designed to give students an intensive introduction to prokaryotic and eukaryotic cell structure and function. Topics include membrane structure and function, mechanisms of protein localization in cells, secretion and endocytosis, the cytoskeleton, cell adhesion, cell signaling and the regulation of cell growth. Important methods in cell biology are also presented. This course is suitable for graduate students entering most areas of basic biomedical research. Undergraduate courses in biochemistry, cell and molecular biology are excellent preparation for this course. Recommended preparation: Undergraduate biochemistry or molecular biology.

CBIO 455. Molecular Biology I. 4 Units.
Part of the first semester curriculum for first year graduate students along with CBIO 453. This course is designed to give students an intensive introduction to prokaryotic and eukaryotic molecular biology. Topics include protein structure and function, DNA and chromosome structure, DNA replication, RNA transcription and its regulation, RNA processing, and protein synthesis. Important methods in molecular biology are also presented. This course is suitable for graduate students entering most areas of basic biomedical research. Undergraduate courses in biochemistry, cell and molecular biology are excellent preparation for this course. Recommended preparation: Undergraduate biochemistry or molecular biology.

IBMS Courses
IBMS 500. On Being a Professional Scientist: The Responsible Conduct of Research. 0 Units.
The goal of this course is to provide graduate students with an opportunity to think through their professional ethical commitments before they are tested, on the basis of the scientific community’s accumulated experience with the issues. Students will be brought up to date on the current state of professional policy and federal regulation in this area, and, through case studies, will discuss practical strategies for preventing and resolving ethical problems in their own work. The course is designed to meet the requirements for "instruction about responsible conduct in research" for BSTP and MSTP students supported through NIH/ADAMHA institutional training grant programs at Case. Attendance is required.
Molecular Biology and Microbiology

Ms. Brinn Omabegho (http://bulletin.case.edu/schoolofmedicine/molecularbiologyandmicrobiology@mailto:brinn.omabegho@case.edu), Manager

The Department of Molecular Biology and Microbiology provides a focus within the School of Medicine for the study of the growth and development of microorganisms at the molecular level. The Department is home to three PhD programs: Cell Biology, Molecular Biology and Microbiology, and Molecular Virology.

Faculty have nationally-funded research programs. Many faculty serve on study sections of national agencies, publish in the most prestigious journals, serve as editors of journals, and take leadership positions in throughout Case School of Medicine. The department also enjoys numerous collaborations with faculty in the Departments of Biochemistry, Neuroscience, and Genetics, the Case Comprehensive Cancer Center, the Visual Sciences Research Center, the Center for AIDS Research, and the Center for RNA Molecular Biology, and the Department of Cell Biology at the Lerner Research Center at CCF, because of shared research interests. All these activities create a vibrant scientific environment.

Research areas include the study of normal cell functions, microbial systems, viruses, and infectious diseases. It is only by developing a thorough understanding of the fundamental biology of cells and pathogenic microbes, their host organisms, and how the two interact during infection that improved strategies for prevention and treatment of infectious diseases can be achieved.

PhD in Cell Biology, Molecular Biology and Microbiology, Molecular Virology

The Department of Molecular Biology and Microbiology is home to three PhD programs: Cell Biology, Molecular Biology and Microbiology, and Molecular Virology. Admissions for all three of these programs occurs through the common PhD admissions program, the Biomedical Sciences Training Program (p. 834). In addition, students in the Medical Scientist Training Program (p. 793) (MSTP) can also pursue these three PhD programs.

PhD Requirements

Students entering through BSTP begin the first of three research rotations during the summer and participate in the Core Curriculum in Cell and Molecular Biology (C3MB), two integrated courses which provides formal instruction in modern cell and molecular biology. Some exceptional students with strong backgrounds, such as a previous Master’s Degree, may be eligible to be exempted from part of the Core Curriculum, and instead enroll in one or more advanced courses during the fall semester. Some students may be eligible to apply for the transfer of credit from their previous institution (please visit here (http://gradstudies.case.edu) for more information). Transfer credit must be requested prior to beginning coursework at CWRU.

A student who chooses a thesis advisor from Cell Biology, Molecular Biology Microbiology or Molecular Virology can become a member of one of these three PhD programs. To earn a PhD a student must complete 400-level graduate Core and Elective coursework including responsible conduct of research as described in the course of study.

Students in each program are expected to attend the joint student seminars (MBIO 435 Seminar in Molecular Biology/Microbiology/MVIR 435 Seminar in Molecular Biology/Microbiology/CLBY 435 Seminar in Molecular Biology/Microbiology) for at least 3 semesters (3 credit hours). Continued participation in the seminars after completion of this requirement is encouraged. Up to 4 credit hours can be allocated to the seminar course (one credit per semester).

Molecular Biology and Microbiology/ Molecular Virology and Cell Biology students should take the MBIO 450 Cells and Pathogens/MVIR 450 Cells and Pathogens/CLBY 450 Cells and Pathogens.

In addition, Cell Biology Students entering in 2009 or later must take two of the three following fundamental courses: (CLBY 422 Topics in Cell Biology); (CLBY 526 Cell Biology and Human Disease/MBIO 526 Cell Biology and Human Disease); or (CLBY 488 Yeast Genetics and Cell Biology).

Beyond that, any combination of graduate courses from within or outside the department can be used to fulfill the requirement as long as the planned program of study has the approval of the student’s advisor and committee.

In addition, each PhD student must successfully complete a qualifier examination for advancement to candidacy in the form of a short grant proposal with oral defense. The qualifier is generally completed in the summer after year two. During the dissertation period, students are expected to meet twice a year with the thesis committee, present seminars in the department, and fulfill journal publication requirements. Throughout the doctoral training, students are expected to be enthusiastic participants in seminars, journal clubs, and research meetings in the lab and program.

Plan of Study

Please also see Graduate Studies Academic Requirements for Doctoral Degrees (p. 662)

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<tr>
<th>First Year</th>
<th>Units</th>
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<tr>
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<td>Fall</td>
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<td>Cell Biology I (CBIO 453)</td>
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<tr>
<td>Molecular Biology I (CBIO 455)</td>
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<td>Seminar in Molecular Biology/Microbiology (MBIO 435) ((optional))</td>
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<td>Research Rotation in Biomedical Sciences Training Program (BSTP 400)</td>
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<td>or Research Rotation in Medical Scientist Training Program (MSTP 400)</td>
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<td>Seminar in Molecular Biology/Microbiology (MBIO 435)</td>
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<td>Research in Molecular Biology and Microbiology (MBIO 601)</td>
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<td>or Special Problems (CLBY 601)</td>
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<td>or Research (MVIR 601)</td>
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<td>On Being a Professional Scientist: The Responsible Conduct of Research (IBMS 500)</td>
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<td>Year Total:</td>
<td>9-18</td>
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CLBY 416. Fundamental Immunology. 4 Units.
Introductory immunology providing an overview of the immune system, including activation, effector mechanisms, and regulation. Topics include antigen-antibody reactions, immunologically important cell surface receptors, cell-cell interactions, cell-mediated immunity, innate versus adaptive immunity, cytokines, and basic molecular biology and signal transduction in B and T lymphocytes, and immunopathology. Three weekly lectures emphasize experimental findings leading to the concepts of modern immunology. An additional recitation hour is required to integrate the core material with experimental data and known immune mediated diseases. Five mandatory 90 minute group problem sets per semester will be administered outside of lecture and recitation meeting times. Graduate students will be graded separately from undergraduates, and 22 percent of the grade will be based on a critical analysis of a recently published, landmark scientific article. Offered as BIOL 316, BIOL 416, CLBY 416, and PATH 416. Prereq: Graduate standing.

CLBY 417. Cytokines: Function, Structure, and Signaling. 3 Units.
Regulation of immune responses and differentiation of leukocytes is modulated by proteins (cytokines) secreted and/or expressed by both immune and non-immune cells. Course examines the function, expression, gene organization, structure, receptors, and intracellular signaling of cytokines. Topic include regulatory and inflammatory cytokines, colony stimulating factors, chemokines, cytokine and cytokine receptor gene families, intracellular signaling through STAT proteins and tyrosine phosphorylation, clinical potential, and genetic defects. Lecture format using texts, scientific reviews and research articles. Recommended preparation: PATH 416 or equivalent. Offered as BIOL 417, CLBY 417, and PATH 417.

CLBY 422. Topics in Cell Biology. 3 Units.
This team-taught seminar course focuses on 3-4 distinct areas of contemporary cell biology. Faculty will present context and overview, but most time will be devoted to a close reading of the literature and discussion by students in a round table format. Recommended preparation: CBIO 453 and CBIO 455.

CLBY 435. Seminar in Molecular Biology/Microbiology. 1 Unit.
Graduate students will attend the departmental seminar given by all graduate students in the Department of Molecular Biology and Microbiology, in the Molecular Virology Program, and in the Cell Biology Program, as well as give a seminar on their own thesis research. Students will be evaluated by the faculty member in charge of that student’s seminar with input from the students’ own thesis committee. After each seminar, the student presenter will meet with other graduate students for peer-review of the content, delivery, and style of the seminar. Peer reviewers will also be evaluated for the quality of their input. Offered as CLBY 435 and MBIO 435 and MVIR 435.

CLBY 450. Cells and Pathogens. 3 Units.
Modern molecular cell biology owes a great debt to viral and bacterial pathogens as model systems. In some instances pathogens operate by faithful mimicry of host proteins, and other cases represent the result of extensive molecular tinkering and convergent evolution. This course will also explore numerous mechanisms utilized by pathogens to subvert the host and enhance their own survival. Topics covered include nuclear regulatory mechanisms, protein synthesis and stability, membrane-bound organelles, endocytosis and phagocytosis, and factors that influence cell behavior such as cytoskeleton rearrangements, cell-cell interactions, and cell migration. Additional topics include cell signaling and co-evolution of pathogens and host cell functions. Students are expected to come to class prepared to discuss pre-assigned readings consisting of brief reviews and seminal papers from the literature. Student assessment will be based on effective class participation (approximately 80%) and successful presentation of an independent research topic (approximately 20%). Offered as CLBY 450, MBIO 450, and MVIR 450. Prereq: CBIO 453 and CBIO 455 or permission of instructor.

CLBY 466. Cell Signaling. 3 Units.
This is an advanced lecture/journal/discussion format course that covers cell signaling mechanisms. Included are discussions of neurotransmitter-gated ion channels, growth factor receptor kinases, cytokine receptors, G protein-coupled receptors, steroid receptors, heterotrimeric G proteins, ras family GTPases, second messenger cascades, protein kinase cascades, second messenger regulation of transcription factors, microtubule-based motility, actin/myosin-based motility, signals for regulation of cell cycle, signals for regulation of apoptosis. Offered as CLBY 466 and PHOL 466 and PHRM 466.
CLBY 468. Membrane Physiology. 3 Units.
This student-guided discussion/journal course focuses on biological membranes. Topics discussed include thermodynamics and kinetics of membrane transport, oxidative phosphorylation and bioenergetics, electro-physiology of excitable membranes, and whole and single channel electrophysiology, homeostasis and pH regulation, volume and calcium regulation. Offered as CLBY 468 and PHOL 468.

CLBY 487. Cell Biology of the Nucleus. 3 Units.
Discussion of current cell biology research on the structure and functions of the nuclear envelope, the matrix and chromatin. Recommended preparation: CBIO 453 and CBIO 454 or consent of instructor. Offered as CLBY 487 and PATH 487.

CLBY 488. Yeast Genetics and Cell Biology. 3 Units.
This seminar course provides an introduction to the genetics and molecular biology of the yeasts S. cerevisiae and S. pombe by a discussion of current literature focusing primarily on topics in yeast cell biology. Students are first introduced to the tools of molecular genetics and special features of yeasts that make them important model eukaryotic organisms. Some selected topics include cell polarity, cell cycle, secretory pathways, vesicular and nuclear/cytoplasmic transport, mitochondrial import and biogenesis, chromosome segregation, cytoskeleton, mating response and signal transduction. Offered as CLBY 488, GENE 488, MBIO 488, and PATH 488.

CLBY 511. Cell Biology Seminar. 1 Unit.
The Cell Biology Seminar provides a forum for presentation and discussion of contemporary issues in Cell Biology. Students, fellows, local faculty and guest speakers present both research talks and journal clubs.

CLBY 512. Cell Biology Seminar. 1 Unit.
The Cell Biology Seminar provides a forum for presentation and discussion of contemporary issues in Cell Biology. Students, fellows, local faculty and guest speakers present both research talks and journal clubs.

CLBY 519. Molecular Biology of RNA. 3 Units.
Selected topics regarding editing, enzymatic function, splicing, and structure of RNA. Offered as BIOC 519, CLBY 519, and MBIO 519.

CLBY 525. Transport and Targeting of Macromolecules in Health and Disease. 3 Units.
Each class includes introductory lecture, followed by student participation in interactive discussion of 3 to 5 research publications. At the end of the course, the students are expected to submit a paper or a short research proposal on any of the topics discussed during the course. Recommended preparation: CBIO 453, CBIO 454, CBIO 455, and CBIO 456. Offered as CLBY 525 and PATH 525.

CLBY 526. Cell Biology and Human Disease. 3 Units.
This course is designed to provide broad base of knowledge regarding cell structure and function. The basic structure of the cell will be discussed, as will the various functional systems that are superimposed upon and interact with this structure. The course will discuss organelle biogenesis, materials movement inside cells, cell interaction with the external environment, cell cycle and cell death regulation, cytoskeleton dynamics, quality control mechanisms, and basic signal transduction concepts. The course will also discuss how abnormal cell function may lead to human disease, and how basic cell function may be harnessed by intracellular pathogens to provide favorable intracellular environments for replication. The major goals of this course are to provide students with a working knowledge of the cell to facilitate understanding of the scientific literature, and to familiarize students with modern experimental approaches in cell biology. The course will rely heavily on student participation. Students will be provided with study guides with the expectation they will come to class prepared to lead interactive group discussions with minimal input from instructors. Offered as: CLBY 526, MBIO 526, MVIR 526.

CLBY 599. RNA Structure and Function. 3 Units.
This course will cover fundamental aspects of modern RNA biology with emphasis on the interplay of three dimensional structure of nucleic acids and their function. The main focus of the course is on the recent discoveries that indicate a prominent role of RNA as a major regulator of cellular function. Topics discussed will include an introduction to RNA structure, folding and dynamics, RNA/RNA and RNA-protein interactions, and role of RNA in catalysis of biological reactions in ribosome and the role of other catalytic RNAs in tRNA biogenesis, pre-mRNA splicing, and viral replication. The course also covers the recently discovered RNA regulatory switches, large noncoding regulatory RNAs, and the role of RNA in human diseases and novel, RNA-based therapeutics. Offered as BIOC 599, CLBY 599, and MBIO 599.

CLBY 601. Special Problems. 1 - 18 Unit.
This is the listing for independent research. Students should enroll in this course once they have selected their laboratory for Ph.D. research. The number of credit hours depends on how many didactic courses students are following at the same time. Once they have passed their qualifying examination they should register for CLBY 701.

This is the listing for independent research toward the Ph.D. The number of credit hours depends on how many didactic courses students are following at the same time. Students may register for this course only once they have passed their qualifying examination. Prereq: Predoctoral research consent or advanced to Ph.D. candidacy milestone.

MBIO Courses

MBIO 399. Undergraduate Research. 1 - 3 Unit.
Permits qualified undergraduates to work in a faculty member’s laboratory.
MBIO 413. Advanced Topics in Molecular and Biochemical Research Ethics. 0 Units.
This course offers continuing education in responsible conduct of research for advanced graduate students. The course will cover the nine federally defined responsible conduct of research (RCR) areas through a combination of lectures, on-line course material and small group discussions. Six 2-hour meetings per semester are planned. Maximum enrollment of 15 students with preference to graduate students in the Department of Molecular Biology and Microbiology, the Department of Biochemistry, and trainees of the Cell and Molecular Biology Training Grant. Offered as: BIOC 413, MBIO 413.

MBIO 420. Molecular Genetics of Cancer. 3 Units.
Cancer is a genetic disease, not only in the Mendelian sense of inheritance, but also in the sense that it is caused by somatic mutation. The targets of mutation are a set of proto-oncogenes and tumor suppressor genes whose products govern cellular proliferation, death and differentiation. The objectives of this course are to examine the types of genes that are the targets of mutational activation or inactivation and the mechanistic outcome of mutational changes that lead to oncogenesis. The course will also probe viral mechanisms of oncogenesis related to the products of cellular proto-oncogenes or tumor suppressor genes. In the course of these examinations we will explore the genetic and molecular genetic approaches used to identify and study oncogenes and tumor suppressor genes. Students should be prepared to present and discuss experimental design, data and conclusions from assigned publications. There will be no exams or papers but the course will end with a full-day, student-run symposium on topics to be decided jointly by students and instructors. Grades will be based on class participation and symposium presentation. Offered as BIOC 420, MBIO 420, MVIR 420, PATH 422, and PHRM 420. Prereq: CBIO 453 and CBIO 455.

MBIO 434. Mechanisms of Drug Resistance. 3 Units.
Resistance to drugs is an important health concern in the new millennium. Over the past century, modern medicine has developed and prescribed drugs for various ailments and diseases with known therapeutic benefit. Since the discovery of antibiotics by Dr. Fleming, we have struggled with a new complication in infectious diseases, development of drug resistance. This course will focus on and compare the drug resistant mechanisms selected by viruses, bacteria, parasites, fungi, and tumor cells. Topics to be covered include antiretroviral resistance (e.g., AZT and protease inhibitors), antibiotic resistance (e.g., B-lactams), resistance to chemotherapeutic agents, and resistance to anti-malarial drugs (e.g., chloroquine). Offered as MBIO 434, MVIR 434, and PHRM 434.

MBIO 435. Seminar in Molecular Biology/Microbiology. 1 Unit.
Graduate students will attend the departmental seminar given by all graduate students in the Department of Molecular Biology and Microbiology, in the Molecular Virology Program, and in the Cell Biology Program, as well as give a seminar on their own thesis research. Students will be evaluated by the faculty member in charge of that student’s seminar with input from the students’ own thesis committee. After each seminar, the student presenter will meet with other graduate students for peer-review of the content, delivery, and style of the seminar. Peer reviewers will also be evaluated for the quality of their input. Offered as CLBY 435 and MBIO 435 and MVIR 435. Prereq: CBIO 453 and CBIO 455.

MBIO 445. Molecular Biology and Pathogenesis of RNA and DNA Viruses. 3 Units.
Through a combination of lectures by Case faculty and guest lecturers, along with student discussion of current literature, this course emphasizes mechanisms of viral gene expression and pathogenesis. RNA viruses to be discussed include positive, negative, and retroviruses. DNA viruses include SV40, adenovirus, herpes, papilloma, and others. Important aspects of host defense mechanisms, antiviral agents, and viral vectors will also be covered. Students will be evaluated based on their quality of presentation of course papers assigned to them and their overall participation in class discussions. Offered as MBIO 445 and MVIR 445.

MBIO 446. Virus-Host Interactions. 3 Units.
Viruses and their hosts have co-evolved for millions of years and, as a result, viruses have evolved intricate and fascinating mechanisms for evading host defenses. Understanding how viruses interact with the host is fundamental to counteracting or preventing viral infections. For example, viruses that fail to block host defenses are avirulent and candidates for vaccines. Emerging viral infections are a major public health concern and a subject of this course. The course consists of lectures and in-depth analysis of published studies on virus-host interactions. Outstanding local and external lecturers from across the U.S. will participate in teaching this course. In addition, students will deliver one presentation to the class during the course. Offered as MBIO 446 and MVIR 446.

MBIO 450. Cells and Pathogens. 3 Units.
Modern molecular cell biology owes a great debt to viral and bacterial pathogens as model systems. In some instances pathogens operate by faithful mimicry of host proteins, and other cases represent the result of extensive molecular tinkering and convergent evolution. This course will also explore numerous mechanisms utilized by pathogens to subvert the host and enhance their own survival. Topics covered include nuclear regulatory mechanisms, protein synthesis and stability, membrane-bound organelles, endocytosis and phagocytosis, and factors that influence cell behavior such as cytoskeleton rearrangements, cell-cell interactions, and cell migration. Additional topics include cell signaling and co-evolution of pathogens and host cell functions. Students are expected to come to class prepared to discuss pre-assigned readings consisting of brief reviews and seminal papers from the literature. Student assessment will be based on effective class participation (approximately 80%) and successful presentation of an independent research topic (approximately 20%). Offered as CLBY 450, MBIO 450, and MVIR 450. Prereq: CBIO 453 and CBIO 455 or permission of instructor.

MBIO 486. HIV Immunology. 3 Units.
This course will examine the unique immunology of HIV disease. The course content will include the study of HIV pathogenesis, immune control, immune dysfunctions, HIV prevention and immune restoration. Students will be expected to attend lectures and participate in class discussions. A strong emphasis will be placed on reviewing scientific literature. Students will be asked to help organize and to administer an HIV immunology journal club and will be asked to prepare a written proposal in the area of HIV immunology. Offered as PATH 486 and MBIO 486.
MBIO 488. Yeast Genetics and Cell Biology. 3 Units.
This seminar course provides an introduction to the genetics and molecular biology of the yeasts S. cerevisiae and S. pombe by a discussion of current literature focusing primarily on topics in yeast cell biology. Students are first introduced to the tools of molecular genetics and special features of yeasts that make them important model eukaryotic organisms. Some selected topics include cell polarity, cell cycle, secretory pathways, vesicular and nuclear/cytoplasmic transport, mitochondrial import and biogenesis, chromosome segregation, cytoskeleton, mating response and signal transduction. Offered as CLBY 488, GENE 488, MBIO 488, and PATH 488.

MBIO 513. Bacterial Virulence and Host Interactions. 3 Units.
The goal of this seminar course is to familiarize students with bacterial virulence mechanisms and how they interact with the host. The focus will be on current literature pertaining to this field. While the molecular basis of bacterial virulence mechanisms will be the main focus, some time will be spent on the host immune response. Topics covered will include adhesins/pili, secretion mechanisms, AB toxins, bacterial invasion and intracellular survival, regulation of virulence gene expression. Prereq: CBIO 453 and CBIO 455 or equivalent courses.

MBIO 519. Molecular Biology of RNA. 3 Units.
Selected topics regarding editing, enzymatic function, splicing, and structure of RNA. Offered as BIOL 519, CLBY 519, and MBIO 519.

MBIO 520. Principles of Microbiology. 3 Units.
This course provides lectures and small group discussions of the cellular and molecular mechanisms by which certain bacteria, viruses, and parasites execute normal and pathologic conditions in human hosts. The biology, genetics, and physiological properties of these infectious agents are considered in light of the mechanisms by which they induce pathogenic conditions in their human hosts. The course is intended for graduate students advanced beyond the core curriculum of course work in molecular biology and microbiology areas of specialization. Prereq: CBIO 453 and CBIO 455.

MBIO 524. Trends in Prokaryotic Cell and Developmental Biology. 3 Units.
Did you know the (i) all building blocks for the eukaryotic cytoskeleton are also present in prokaryotes, that (ii) bacteria rely on dynamic actin-like structures to segregate chromosomes/plasmids and regulate cell polarity, that (iii) oscillating waves of cyclin-like regulators control progression of the bacterial cell cycle, that (iv) a novel secondary messenger, cyclic di-GMP, has been identified that triggers a physiological and morphological transition in bacteria and (v) that bacterial cell-cell interactions can elicit morphological changes that bear remarkable similarities to organogenesis in flies, worms, and vertebrates? In this advanced graduate course, recent insights on the cell and developmental biology of prokaryotes will be discussed and analogies drawn to those that exist in eukaryotes. Studies on the bacterial model organisms Escherichia coli, Bacillus subtilis, Caulobacter crescentus, Vibrio spp, Myxococcus xanthus and Streptomyces coelicolor have altered our view of the bacterial cell, demonstrating that at the most fundamental level cells operate in a remarkable similar way, regardless of whether they contain a nucleus or not.

MBIO 526. Cell Biology and Human Disease. 3 Units.
This course is designed to provide broad base of knowledge regarding cell structure and function. The basic structure of the cell will be discussed, as will the various functional systems that are superimposed upon and interact with this structure. The course will discuss organogenesis, materials movement inside cells, cell interaction with the external environment, cell cycle and cell death regulation, cytoskeleton dynamics, quality control mechanisms, and basic signal transduction concepts. The course will also discuss how abnormal cell function may lead to human disease, and how basic cell function may be harnessed by intracellular pathogens to provide favorable intracellular environments for replication. The major goals of this course are to provide students with a working knowledge of the cell to facilitate understanding of the scientific literature, and to familiarize students with modern experimental approaches in cell biology. The course will rely heavily on student participation. Students will be provided with study guides with the expectation they will come to class prepared to lead interactive group discussions with minimal input from instructors. Offered as: CLBY 526, MBIO 526, MVIR 526.

MBIO 537. Microscopy-Principles and Applications. 3 Units.
This course provides an introduction to various types of light microscopy, digital and video imaging techniques, and their applications to biological and biomedical sciences via lectures and hands-on experience. Topics covered include geometrical and physical optics; brightfield, darkfield, phase contrast, DIC, fluorescence and confocal microscopes; and digital image processing. Offered as GENE 537, MBIO 537, and PHOL 537.

MBIO 599. RNA Structure and Function. 3 Units.
This course will cover fundamental aspects of modern RNA biology with emphasis on the interplay of three dimensional structure of nucleic acids and their function. The main focus of the course is on the recent discoveries that indicate a prominent role of RNA as a major regulator of cellular function. Topics discussed will include an introduction to RNA structure, folding and dynamics, RNA/RNA and RNA-protein interactions, and role of RNA in catalysis of biological reactions in ribosome and the role of other catalytic RNAs in RNA biogenesis, pre-mRNA splicing, and viral replication. The course also covers the recently discovered RNA regulatory switches, large noncoding regulatory RNAs, and the role of RNA in human diseases and novel, RNA-based therapeutics. Offered as BIOL 599, CLBY 599, and MBIO 599.

MBIO 601. Research in Molecular Biology and Microbiology. 1 - 18 Unit.

MBIO 620. Transcription and Gene Regulation. 3 Units.
This course covers mechanisms of transcription that play critical roles in biological processes. It is designed to develop scientific thinking in designing experiments and evaluating the merits of research papers. Students will be able to present two to three 30-minute talks. Topics include: 1) structure and function of RNA polymerases; 2) accessory factors involved in initiation, elongation, and termination; 3) regulation transcription; 4) transcriptional coactivators and corepressors; 5) regulation of transcription factor activity. A take-home exam will be conducted at the final week. Grades will be based on presentations and take-home exam. Offered as BIOL 620 and MBIO 620. Prereq: CBIO 453 and CBIO 455.

Prereq: Predoctoral research consent or advanced to Ph.D. candidacy milestone.
MVIR Courses

MVIR 434. Mechanisms of Drug Resistance. 3 Units.
Resistance to drugs is an important health concern in the new millennium. Over the past century, modern medicine has developed and prescribed drugs for various ailments and diseases with known therapeutic benefit. Since the discovery of antibiotics by Dr. Fleming, we have struggled with a new complication in infectious diseases, development of drug resistance. This course will focus on and compare the drug resistant mechanisms selected by viruses, bacteria, parasites, fungi, and tumor cells. Topics to be covered include antiviral resistance (e.g., AZT and protease inhibitors), antibiotic resistance (e.g., β-lactams), resistance to chemotherapeutic agents, and resistance to anti-malarial drugs (e.g., chloroquine). Offered as MBIO 434, MVIR 434, and PHRM 434.

MVIR 435. Seminar in Molecular Biology/Microbiology. 1 Unit.
Graduate students will attend the departmental seminar given by all graduate students in the Department of Molecular Biology and Microbiology, in the Molecular Virology Program, and in the Cell Biology Program, as well as give a seminar on their own thesis research. Students will be evaluated by the faculty member in charge of that student's seminar with input from the students' own thesis committee. After each seminar, the student presenter will meet with other graduate students for peer-review of the content, delivery, and style of the seminar. Peer reviewers will also be evaluated for the quality of their input. Offered as CLBY 435 and MBIO 435 and MVIR 435.

MVIR 445. Molecular Biology and Pathogenesis of RNA and DNA Viruses. 3 Units.
Through a combination of lectures by Case faculty and guest lecturers, along with student discussion of current literature, this course emphasizes mechanisms of viral gene expression and pathogenesis. RNA viruses to be discussed include positive, negative, and retroviruses. DNA viruses include SV40, adenovirus, herpes, papilloma, and others. Important aspects of host defense mechanisms, antiviral agents, and viral vectors will also be covered. Students will be evaluated based on their quality of presentation of course papers assigned to them and their overall participation in class discussions. Offered as MBIO 445 and MVIR 445. Prereq: CBIO 453 and CBIO 454 and CBIO 455 and CBIO 456.

MVIR 446. Virus-Host Interactions. 3 Units.
Viruses and their hosts have co-evolved for millions of years and, as a result, viruses have evolved intricate and fascinating mechanisms for evading host defenses. Understanding how viruses interact with the host is fundamental to counteracting or preventing viral infections. For example, viruses that fail to block host defenses are avirulent and candidates for vaccines. Emerging viral infections are a major public health concern and a subject of this course. The course consists of lectures and in-depth analysis of published studies on virus-host interactions. Outstanding local and external lecturers from across the U.S. will participate in teaching this course. In addition, students will deliver one presentation to the class during the course. Offered as MBIO 446 and MVIR 446. Prereq: MVIR 445

MVIR 450. Cells and Pathogens. 3 Units.
Modern molecular cell biology owes a great debt to viral and bacterial pathogens as model systems. In some instances pathogens operate by faithful mimicry of host proteins, and other cases represent the result of extensive molecular tinkering and convergent evolution. This course will also explore numerous mechanisms utilized by pathogens to subvert the host and enhance their own survival. Topics covered include nuclear regulatory mechanisms, protein synthesis and stability, membrane-bound organelles, endocytosis and phagocytosis, and factors that influence cell behavior such as cytoskeleton rearrangements, cell-cell interactions, and cell migration. Additional topics include cell signaling and co-evolution of pathogens and host cell functions. Students are expected to come to class prepared to discuss pre-assigned readings consisting of brief reviews and seminal papers from the literature. Student assessment will be based on effective class participation (approximately 80%) and successful presentation of an independent research topic (approximately 20%). Offered as CLBY 450, MBIO 450, and MVIR 450. Prereq: CBIO 453 and CBIO 455 or permission of instructor.

MVIR 481. Immunology of Infectious Diseases. 3 Units.
Lectures and discussion on the immune response to infectious organisms, including bacteria, viruses and parasites. Emphasis on human responses but includes discussions of animal models. Other topics include vaccines and infections in immuno-compromised hosts. Recommended preparation: PATH 416 or consent of instructor. Offered as MVIR 481 and PATH 481.

MVIR 526. Cell Biology and Human Disease. 3 Units.
This course is designed to provide broad base of knowledge regarding cell structure and function. The basic structure of the cell will be discussed, as will the various functional systems that are superimposed upon and interact with this structure. The course will discuss organelle biogenesis, materials movement inside cells, cell interaction with the external environment, cell cycle and cell death regulation, cytoskeleton dynamics, quality control mechanisms, and basic signal transduction concepts. The course will also discuss how abnormal cell function may lead to human disease, and how basic cell function may be harnessed by intracellular pathogens to provide favorable intracellular environments for replication. The major goals of this course are to provide students with a working knowledge of the cell to facilitate understanding of the scientific literature, and to familiarize students with modern experimental approaches in cell biology. The course will rely heavily on student participation. Students will be provided with study guides with the expectation they will come to class prepared to lead interactive group discussions with minimal input from instructors. Offered as: CLBY 526, MBIO 526, MVIR 526.

MVIR 601. Research. 1 - 18 Unit.
Grade of S/U only.

MVIR 701. Dissertation Ph.D.. 1 - 18 Unit.
Grade of S/U only. Prereq: Predoctoral research consent or advanced to Ph.D. candidacy milestone.
Molecular Medicine Program

Robin Crotty (http://bulletin.case.edu/schooolofmedicine/molecularmedicine/mailto:crottyr@cfs.org), Recruiting Coordinator

The Molecular Medicine PhD Program is a unique collaborative graduate training opportunity that integrates medical knowledge into graduate training. The goal of this program is to produce scientists trained in translational research: basic or applied research relevant to human health and disease that can lead to new understanding of disease, clinical and diagnostic tools, medications, and therapies.

This program is funded by the Howard Hughes Medical Institute "Med Into Grad" initiative and is consistent with National Institutes of Health Roadmap directives.

Students train rigorously to apply basic science discoveries to human health and to the causes and treatments of human disease. The mastery of competencies necessary to translate scientific observations from the research bench to clinical care is the focus of this PhD program. Graduates will be well prepared to collaborate with physicians and for the challenge of using molecular and cellular biology to advance human health.

PhD in Molecular Medicine

Admission into the Molecular Medicine PhD program is obtained through application directly to the program. Graduate students complete didactic coursework, independent research, and other doctoral requirements to earn the PhD. Students complete three laboratory rotations (starting mid-July) among the laboratories of training faculty, and are exposed to trainer research projects during the Frontiers of Molecular Medicine seminar and journal club series taken the first summer and each semester thereafter.

During subsequent years, students will devote the majority of their time to thesis research, while attending advanced graduate courses, seminars, and journal clubs. Advanced elective courses may be chosen from any department or program on campus, with the approval of the graduate program director and the student’s thesis committee. Students must take a total of 36 semester hours of courses and maintain a B average.

The qualifying exam will be comprised of preparing and defending a grant application in the NIH/NRSA format. The topic of the grant can be in a related area of investigation to the student’s research but cannot resemble projects that are ongoing in the laboratory of the Research Advisor. At least one aim of this proposal will consist of a specific translational or clinical aim.

All efforts should be made to complete the Ph.D. within four years. All students are expected to submit two or more first-authored primary research publications in peer-reviewed scientific journals. At least one manuscript should be accepted for publication prior to the thesis defense.

PhD Program Requirements

Coursework

Students begin in July by first taking MMED 410 Introduction to Human Physiology and Disease. The student will follow a progressive curriculum including Cell Biology; Metabolism and Pharmacology; Nucleic Acids, Gene Expression and Gene Regulation; Infection and Immunity; and Mammalian Genetics. The core series concludes with a course in Principles of Clinical Research for the Ph.D. Investigator, and a mentored Clinical Experience.

Research Rotations

The research rotations allow the student to sample areas of research and become familiar with faculty members and their laboratories. The main purpose of these rotations is to aid the student in selecting a laboratory for the thesis work. Students will begin their rotations in July. A minimum of three rotations must be completed during the year.

Choosing a Thesis Advisor

After the second semester of the first year students select an advisor for the dissertation research. The emphasis of the Ph.D. work is on research, culminating in the completion of an original, independent research thesis.

Plan of Study

§ Please also see Graduate Studies Academic Requirements for Doctoral Degrees (p. 662)

* All required coursework is listed in this plan

First Year

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<th>Units</th>
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<tr>
<td>Principles of Clinical and Translational Research (MMED 501)</td>
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<tr>
<td>Molecular Aspects of the Diagnosis, Pathology, and Treatment of Selected Human Diseases (MMED 521)</td>
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<td>Seminars in Advanced Research in Medicine (MMED 504)</td>
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<tr>
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Third Year

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<td>Advanced Electives (if necessary)**</td>
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Total Units in Sequence: 33-65

* Starts in July
** Credits vary

Third Year: Complete elective coursework so that total graded courses = 24 credits; Research credits switch from 601 to 701 once passed
into candidacy. Minimum of 1 credit of 701 is required each semester thereafter for a total of 18 credits to graduate. Total of 6 graded credits of advanced electives are required to graduate.

Fourth Year and beyond: Full-time Thesis Research (701)

Courses

MMED 400. Research Rotations. 0 Units.
Research rotations are conducted to expose the student to several laboratory environments, a variety of research problems and numerous laboratory techniques as well as to assist them in the selection of their Research Advisor. Rotations will begin immediately upon enrollment and continue through the second semester of the first year. Usually rotations will last 12 weeks, however if a student decides that he/she is not interested in the assigned laboratory a shorter rotation is appropriate. The student is responsible for arranging each rotation with an approved trainer with the consultation of the Graduate Program Director. To assist in this endeavor, the Graduate Program Director will provide a list of approved trainers who have space, time and money to support a graduate student. During the rotation, students are expected to participate in all lab and departmental activities, e.g., lab meetings and seminars. At the completion of a rotation the student is required to submit a written Rotation Report including an outline of the problem being studied, a description of the experimental approaches, a discussion of the results of performed experiments as well as future directions.

MMED 404. Frontiers in Molecular Medicine Seminar. 1 Unit.
In the Frontiers in Molecular Medicine Seminar series, faculty from the department of Molecular Medicine and guest lecturers will discuss ongoing translational research.

MMED 410. Introduction to Human Physiology and Disease. 4 Units.
The purpose of this course is to give an introduction to the physiology of the major human organ systems, as well as selected associated pathophysiologies. The course will provide a physiological basis for subsequent study and research in Molecular Medicine. The integration of clinical faculty into the course will emphasize the importance of bringing scientific knowledge to bear on clinical problems, a theme which will be stressed throughout the Molecular Medicine curriculum. The course will also acquaint students with medical terminology.

MMED 412. Metabolism and Introduction to Principles of Pharmacology. 2 Units.
The course will include a combination of interactive lectures and problem-based interactive seminars. Each week will conclude with at least one clinical correlation where the weekly topic is presented in the context of a clinical problem. Topics to be covered include: carbohydrate metabolism; amino acid and nucleotide metabolism; lipid metabolism and lipoproteins; regulation of metabolism; and principals of pharmacology.

MMED 413. Nucleic Acids, Gene Expression, and Gene Regulation. 3 Units.
The course will include a combination of interactive lectures and problem-based learning. Each week will conclude with at least one clinical correlation where the weekly topic is presented in the context of a clinical problem. Topics to be covered include: DNA structure, chromosome structure, replication and repair; RNA synthesis and RNA processing, the organization of eukaryotic genes and the genetic code and translation; and gene regulation.

MMED 414. Mammalian Genetics. 2 Units.
The course focuses on genetics, genomics, and bioinformatics, and it will include a combination of interactive lectures, problem-based learning and a week-long group project. Topics to be covered include: genetic variation; linkage studies; association studies; complex traits, linkage disequilibrium, the Hap Map, pharmacogenetics; genome-wide expression studies, and mouse models of human disease, and bioinformatics.

MMED 415. Cell Biology. 2 Units.
The course will include a combination of interactive lectures and problem-based learning. Each week will conclude with at least one clinical correlation where the weekly topic is presented in the context of a clinical problem. Topics to be covered include: cell structure and organelles, prokaryotes/eukaryotes; intracellular compartments and protein sorting; receptors/endocytosis/rafts; the nucleus; cell communication; and mechanics of cell division.

MMED 416. Host Defense: Infection and Immunity. 3 Units.
The course will include a reading program, lectures, and weekly problem-based student-led presentations. Weeks 1 and 2 are dedicated to establishing the scope of the field and forming vocabulary. Week 3 and part of Week 4 will cover immune mechanisms. The remainder of the course will deal with clinical aspects of immunobiology. On a regular basis Clinical Correlations, relevant to weekly topics, are integrated into the material. Topics to be covered include: biology and molecular biology of infectious agents; fundamentals of immunology; innate and adaptive responses to infection, immune effector mechanisms; and clinical aspects of immunobiology.

MMED 501. Principles of Clinical and Translational Research. 4 Units.
To give an introduction to the ethical, statistical, methodologic and informatics basis of clinical and translational research. Topics will include the history of clinical and translational research, regulatory aspects of human subjects research, clinical trials study design, conflicts of interest, human subjects recruitment, research and publication ethics, technology transfer, biobank construction and utilization, and clinical and research database construction and utilization. In addition, students will be introduced to principles of biostatistics and clinical epidemiology relevant to clinical and translational research and gain expertise in statistical tool using problem based learning sets.

MMED 504. Seminars in Advanced Research in Medicine. 1 Unit.
The goal of Advanced Research in Medicine 2, Friday Research Seminars (ARM2), is to facilitate student understanding of the bidirectional nature of research and to instill excitement about the way in which novel research results in advances in clinical medicine. A series of 18 accomplished, well-respected researchers will interact with students for 60 minutes per week, challenging the students to think about novel research questions and their relationships to current clinical challenges linked thematically to the theme of the week. The emphases of ARM2 Friday Research Seminar is on the content of the research and how this research may impact and change clinical practice in the future. Each week, a student from the class will be assigned to moderate the session. The student moderator will introduce the speaker and will be responsible for assuring that adequate interactive discussion occurs. In addition, four sets of 2-week sessions each will be devoted to small group sessions. The goal of the 2-week sessions is for the students to develop a research plan directly related to the organ system featured in the presentations.
MMED 521. Molecular aspects of the diagnosis, pathology, and treatment of selected human diseases. 3 Units.
The goal of this course is to integrate medical knowledge into PhD training. This team-taught seminar course focuses on a top-down examination of selected human diseases starting with clinical presentations of the manifestations, diagnoses, and treatment of disease. This is followed by study of the pathology, cell biology, and molecular biology of the disease. This information forms the foundation of a final discussion of current treatment strategies and ongoing research to identify new strategies. Three to four separate disease areas will be discussed during each semester, such as neurodegenerative diseases, cancer, cardiovascular diseases and others. The specific areas of discussion are selected to demonstrate the strength of an integrated team of clinical and basic scientists; and to provide a model for students to follow in future studies in their own area of expertise. Emphasis will be given to the basic scientific observations that formed the basis of successful clinical practice, and how this was utilized by integrated teams of basic and clinical investigators to provide better patient care. Students will prepare for discussions with close reading of the literature. Faculty will present an overview in a discussion format. It is anticipated that each disease area will be presented by an integrated team of clinical and basic scientists. The final weeks of the semester will be devoted to student preparation of a research proposal based upon the information discussed during the course. The specific topic of this proposal will be of the students choosing. Grading will be based both upon preparation for and participation in discussions, and upon the research proposal. Recommended Preparation: Introductory Graduate or Medical School courses in Cell Biology, Molecular Biology, and Physiology

MMED 601. Dissertation Research. 1 - 9 Unit.
Research leading toward the Ph.D. dissertation in Molecular Medicine.

MMED 612. Clinical Experience. 2 Units.
Each student will be assigned a Clinical Mentor who will co-advice the student and serve on both the Qualifying Examination Committee and Thesis Committee. The Clinical Mentor will develop an individualized curriculum for the student in consultation with the Thesis Research Mentor and Program Director. The curriculum will be organized around the integrated, multidisciplinary disease groups at the Clinic. The students will attend and actively participate in the regularly scheduled multidisciplinary clinical conference organized by their disease group (most meet for one hour every week or every other week), usually involving a combination of case presentations and research presentations. At the conclusion of the semester the student will make a presentation to the group focused on a relevant translational research problem. The Clinical Mentor will also organize a series of supervised clinical experiences (with a Mentor) to various locations where students will observe clinician interactions with patients to better understand the disease from the patient perspective and to disease-related diagnostic and research laboratories.

MMED 701. Dissertation Ph.D.. 1 - 9 Unit.
Research leading toward the Ph.D. dissertation in Molecular Medicine. Recommended preparation: Advancement to candidacy in MMED. Prereq: Predoctoral research consent or advanced to Ph.D. candidacy milestone.
School of Medicine Faculty

Anatomy
Amanda Almon, MS
Adjunct Instructor
Darin Croft, PhD
Associate Professor
Robin Dhillon, MD
Clinical Senior Instructor
John Fredieu, PhD
Assistant Professor
Barbara Freeman, PhD
Assistant Professor
Betty Gatliff, BA
Adjunct Instructor
Christopher Hernandez, PhD
Adjunct Assistant Professor
Kathleen Jung, MS
Adjunct Assistant Professor
Ita KaisermanAbramof, PhD
Professor
Michael Katz, MD, PhD
Associate Professor
Hue-Lee Kaung, PhD
Associate Professor
Bruce Latimer, PhD
Adjunct Associate Professor
Charles Maier, PhD
Assistant Professor
Joseph Miller, PhD
Associate Professor
Ronald Przybylski, PhD
Associate Professor
Scott Simpson, PhD
Professor
Kenneth Spano, MD
Adjunct Instructor
Susanne Wish-Baratz, PhD
Assistant Professor

Anesthesiology
Basem Abdemalak, MD
Associate Professor
Maged Argalious, MD
Associate Professor
Harendra Arora, MD
Clinical Associate Professor
Brendan Astley, MD
Assistant Professor
Mohamed Attala, MD
Professor
Rafi Avitsian, MD
Associate Professor
Sabri Barsoum, MD
Assistant Professor
Michael Bassett, MD
Assistant Professor
Norman Bolden, MD
Assistant Professor
David Brown, MD
Professor
Michelle Capdeville, MD
Associate Professor
Anthony Chang, MD
Assistant Professor
Jianguo Cheng, MD, PhD
Professor
Kenneth Cummings, MD
Assistant Professor
Jacek Cywinski, MD
Assistant Professor
Samuel DeJoy, MD
Assistant Professor
Teresa Dews, MD
Clinical Associate Professor
Jose Diaz-Gomez, MD
Assistant Professor
Cynthia Dietrich, MD
Assistant Professor
D. Doyle, MD, PhD
Professor
Andra Duncan, MD
Assistant Professor
Jennifer Eisman, MD
Senior Instructor
Wael Esa, MD, PhD
Assistant Professor
Ehab Farag, MD
Associate Professor
Ursula Galway, MD
Assistant Professor
Alexandru Gottlieb, MD
Associate Professor
Maureen Harders, MD
Assistant Professor
Michael Howkins, MD
Senior Instructor
Samuel Irefin, MD
Associate Professor
Anil Jagetia, MD
Assistant Professor
Matthew Joy, MD
Assistant Professor
Pete Kaluszyk, M, ED
Adjunct Instructor
Colleen Koch, MD
Professor
Priya Kumar, MD
Clinical Assistant Professor
Andrea Kurz, MD
Professor
Saebo Lee, MD
Clinical Senior Instructor
Daniel Leizman, MD
Clinical Senior Instructor
Michael Licina, MD
Professor
Charles Lind, MD
Assistant Professor
Jessica Lovich-Sapola, MD
Assistant Professor
Maria Loy, MD
Assistant Professor
Negmeldeen Mamoun, MD
Assistant Professor
Donn Marciniak, MD
Assistant Professor
Marco Maurtua, MD
Assistant Professor
Douglas Mayers, MD, PhD
Clinical Associate Professor
Nagy Mekhail, MD
Professor
Arnold Morscher, MD
Assistant Professor
Paul Murray, PhD
Professor
Jerome O’Hara, MD
Associate Professor
Brian Parker, MD
Associate Professor
Alfred Pinchak, MD, PhD
Assistant Professor
Cristian Prada, MD
Senior Instructor
Aditya Reddy, MD
Clinical Senior Instructor
Michael Roizen, MD
Professor
Kathleen Rosen, MD
Professor
Leif Saager, MD
Assistant Professor
Peter Schoenwald, MD
Associate Professor
Daniel Sessler, MD
Professor
Kanwaljit Sidhu, MD
Assistant Professor
Tejjbir Sidhu, MD
Assistant Professor
Charles Smith, MD
Professor
Sara Spagnuolo, MD
Clinical Associate Professor
Michael Stanton-Hicks, MD
Professor
Norman Starr, MD
Professor
Kutaiba Tabbaa, MD
Clinical Assistant Professor
John Tetzlaff, MD
Professor
Augusto Torres, MD
Senior Instructor
Alparslan Turan, MD
Associate Professor
Donald Voltz, MD
Assistant Professor
Karl Wagner, MD
Assistant Professor
Sherif Zaky, MD, PhD
Assistant Professor
Anesthesiology and Perioperative Medicine
Mohamed Abdalla, MD
Clinical Assistant Professor
Soozan Abouhassan, MD
Instructor
Peter Adamek, MD
Assistant Professor
Anjali Adur, MD
Assistant Professor
Surendra Adusumulli, MD
Clinical Instructor
Jafer Ali, MD
Assistant Professor
Jafar Ali, MD
Clinical Instructor
Michael Altose, MD, PhD
Assistant Professor
Shane Angus, MS
Professor
Maggie Green, MS
Clinical Instructor

Adam Haas, MD
Assistant Professor

Roy Haber, MS
Clinical Instructor

Gina Haber, MS
Clinical Instructor

Rudy Hamad, MS
Clinical Instructor

Sue Han, MD, PhD
Clinical Instructor

Joseph Harp, MS
Clinical Instructor

Brian Haskins, MS
Clinical Instructor

Brooks Hawley, MS
Clinical Instructor

Salim Hayek, MD, PhD
Professor

Heather Hill, MS
Clinical Instructor

Irving Hirsch, MD
Assistant Professor

Dan Hladky, BS
Clinical Instructor

Alma Hoxha, MD
Clinical Assistant Professor

Grace Hwang, MS
Clinical Instructor

Megan Isbell, MS
Clinical Instructor

Randa Jaafar, MD
Clinical Instructor

Camille Jansen, MS
Clinical Instructor

Leclerc Jermaine, MS
Clinical Instructor

Allison Johns, MS
Clinical Instructor

Gary Jones, MS
Instructor

Abdallah Kabbara, MD
Assistant Professor

Sabena Kachwalla, MS
Clinical Instructor

Gareth Kantor, MD
Clinical Assistant Professor

Kellye Kaufman, MS

Clinical Instructor
David Kazdan, MD
Assistant Professor

Matthew Kellems, MD
Instructor

Al-Amin Khalil, MD
Assistant Professor

Scott Klein, MD
Assistant Professor

John Klick, MD
Assistant Professor

Mark Kopel, MS
Clinical Instructor

Anthony Koury, MS
Clinical Instructor

Gregory Kychun, BS
Clinical Assistant Professor

Ann Lawrence, MD
Assistant Professor

Deborah Lawson, BS
Clinical Assistant Professor

Jermaine Leclerc, MS
Clinical Instructor

E. Leon-ruiz, MD
Assistant Professor

Lora Levin, MD
Assistant Professor

Todd Lewis, MD
Clinical Instructor

Michael Lilly, MS
Clinical Instructor

Agnes Lina, MD
Assistant Professor

Jennifer Loomis, MS
Clinical Instructor

Joseph Mader, MS
Clinical Instructor

Marin Mannix, MD
Instructor

Gregg Mastropolo, MS
Clinical Instructor

Peter Matgouranis, MD
Assistant Professor

Elenora Mazover, MD
Clinical Instructor

Scott McAndrew, MS
Clinical Instructor

Katherine McClain, MS
Clinical Instructor

Michael McDermott, MS
Clinical Instructor
Heather McFarland, MD
Assistant Professor
Patrick McIntyre, MD
Assistant Professor
Matthew McKinney, MS
Clinical Instructor
Ali Mchaourab, MD
Associate Professor
Gholam Medhi, MS
Clinical Instructor
Gregory Menendez, MS
Clinical Instructor
Sheryl Modlin, MD
Assistant Professor
Natalie Morello, MS
Clinical Instructor
Kenneth Moss, MD
Clinical Assistant Professor
Girish Mulgaokar, MD
Assistant Professor
Howard Nearman, MD
Professor
Priya Neti, MS
Clinical Instructor
Michael Nichols, MS
Instructor
Angela Nichols, MS
Clinical Instructor
Edward Noguera, MD
Clinical Assistant Professor
Matthew Norcia, MD
Assistant Professor
Annemarie Norenberg, MD
Assistant Professor
Omar Omar, MD
Clinical Assistant Professor
Ashish Patel, MS
Clinical Instructor
Michael Patrick, MS
Clinical Assistant Professor
Layne Paviol, MS
Clinical Instructor
Joseph Peachman, MS
Clinical Instructor
Patrick Pickett, MD
Clinical Instructor
Rodnina Pinto, MD
Instructor
Daniel Pistone, MS
Clinical Instructor
Andrew Plante, MD
Instructor
Stephanie Polutnik, MS
Clinical Instructor
Dan Rankin, BS
Clinical Instructor
Susan Raphaely, MD
Assistant Professor
David Rapkin, MD
Clinical Assistant Professor
Fares Raslan, MD
Clinical Assistant Professor
Jeffrey Ratino, MS
Clinical Instructor
Leslie Ray, MS
Clinical Instructor
William Redwood, MD
Clinical Instructor
James Reynolds, PhD
Associate Professor
Joseph Rifici, M, ED
Assistant Professor
Eliot Ro, MD
Assistant Professor
Romni Ross, MS
Clinical Instructor
James Rowbottom, MD
Associate Professor
Kasia Rubin, MD
Assistant Professor
Sarah Russell, M, PH
Clinical Instructor
Vinod Sahgal, MD
Professor
Rachel Schlesinger, MD
Assistant Professor
Angelique Scott, MS
Clinical Instructor
Chirag Shah, MD
Clinical Instructor
Pankaj Shah, MD
Clinical Instructor
Aaron Sikowitz, MS
Clinical Instructor
Antonio Silva, MD
Clinical Instructor
Subhalakshmi Sivashankaran, MD
Assistant Professor
John Stork, MD
Assistant Professor
Paul Tripi, MD
Associate Professor
Carie Twichell, MS
Clinical Instructor
Alison Umina, MPH
Clinical Instructor
Judith Van Antwerp, MD
Clinical Assistant Professor
Ranga Venna, MD
Clinical Assistant Professor
Valeriu Vlasie, MD
Clinical Instructor
Bich Vuong, MS
Clinical Instructor
David Wallace, MD
Assistant Professor
Mi Wang, MS
Clinical Instructor
Mark Wheeler, BA
Clinical Instructor
Judith Wolkoff, BS
Clinical Instructor
Donald Woods, MD
Instructor
George Yung, MD
Clinical Instructor
David Zagorski, MS
Clinical Assistant Professor
Mark Zahniser, MD
Assistant Professor

Biochemistry
Ifeanyi Arinze, PhD
Adjunct Professor
Amiya Banerjee, PhD
Professor
Barbara Bedogni, PhD
Assistant Professor
Paul Carey, PhD
Professor
Richard Hanson, PhD
Professor
Michael Harris, PhD
Associate Professor
Marian Harter, PhD
Associate Professor
Hung-Ying Kao, PhD
Professor
Anton Komar, PhD
Adjunct Assistant Professor

William Merrick, PhD
Professor
Natasha Mesinkovska, MD, PhD
Adjunct Instructor
Nelson Phillips, PhD
Associate Professor
Marianne Pusztai-Carey, PhD
Associate Professor
David Samols, PhD
Professor
Menachem Shoham, PhD
Associate Professor
Martin Snider, PhD
Associate Professor
Focco Van den Akker, PhD
Associate Professor
Zhu-li Wan, PhD
Instructor
Michael Weiss, MD, PhD
Professor
Jonathan Whittaker, MD
Associate Professor
Yu-Chung Yang, PhD
Professor
Yanwu Yang, PhD
Assistant Professor
Vivien Yee, PhD
Associate Professor

Bioethics
Mark Aulisio, PhD
Associate Professor
Sherri Broder, PhD
Adjunct Instructor
Dena Davis, PhD
Adjunct Professor
Nicole Deming, Other
Assistant Professor
Jennifer Fishman, PhD
Adjunct Assistant Professor
Jason Gatiff, PhD
Adjunct Instructor
Monica Gerrek, PhD
Adjunct Instructor
Aaron Goldenberg, PhD
Assistant Professor
Thomas Harter, PhD
Adjunct Instructor
John Huss, PhD
Adjunct Assistant Professor
Insoo Hyun, PhD
Associate Professor
Eric Juengst, PhD
Adjunct Professor
Nicholas King, PhD
Adjunct Assistant Professor
Maria Lopez de la Vieja, PhD
Adjunct Professor
Patricia Marshall, PhD
Professor
Michelle McGowan, PhD
Assistant Professor
Thomas Murray, PhD
Adjunct Professor
Suzanne Rivera, PhD
Assistant Professor
Kathryn Weise, MD
Adjunct Assistant Professor
Stuart Youngner, MD
Professor
Richard Zellner, JD
Adjunct Instructor

Biomedical Engineering
A. Ajiboye, PhD
Assistant Professor
Eben Alsberg, PhD
Associate Professor
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Richard Creger, PhD
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<td>Frederick Creighton, MA</td>
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<td>Timothy Crone, MD</td>
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<table>
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<tr>
<th>Clinical Assistant Professor</th>
<th>Clinical Instructor</th>
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<tr>
<td>Prasun Mishra, MD</td>
<td>Simone Nader, MD</td>
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<td>Anita Misra-Hebert, MD</td>
<td>Vijaiganesht Nagarajan, MD</td>
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<td>Mohammad Moayeri, MD</td>
<td>Dileep Nair, MD</td>
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<td>Sri Krishna Mohan, MD</td>
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<td>Ravi Nair, MD</td>
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<td>Arabi Naso, MD</td>
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Lynn Schoenfield, MD
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David Sell, PhD
Assistant Professor
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<tr>
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<td>Samar Bashour, MD</td>
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Susannah Briskin, MD
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Reinaldo Garcia-Naveiro, MD
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<tr>
<th>Assistant Professor</th>
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<tbody>
<tr>
<td>Andrew Garner, MD, PhD</td>
<td>Anna Grinberg, MD</td>
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<td>G. Gascoigne, MD</td>
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<td>Maureen Hack, MD</td>
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Nancy Wollam-Huhn, MD
Clinical Instructor
C.K. Woo, MD
Clinical Instructor
Kristine Zanotti, MD
Assistant Professor
Vivian von Gruenigen, MD
Adjunct Associate Professor

Surgery
Mujjahid Abbas, MD
Assistant Professor
Tom Abelson, MD
Clinical Associate Professor
Dominick Adornato, MD
Clinical Instructor
Mark Aeder, MD
Associate Professor
Ashok Agarwal, PhD
Professor
Diya Alaedeen, MD
Assistant Professor
Daniel Alam, MD
Associate Professor
John Alexander, MD
Associate Professor
Warren Alilain, PhD
Assistant Professor
Benito Alvarez, MD
Assistant Professor
John Ammori, MD
Assistant Professor
Michael E. Anderson, MD
Clinical Assistant Professor
James Anderson, MD
Associate Professor
Kenneth Angermeier, MD
Associate Professor
William Annable, MD
Clinical Associate Professor
Samantha Anne, MD
Assistant Professor
Kathleen Ashton, PhD
Clinical Assistant Professor
Medhat Askar, MD, PhD
Associate Professor
Vikram Attaluri, MD
Clinical Instructor
Federico Aucejo, MD
Assistant Professor
Cynthia Austin, MD
Associate Professor
Anthony Avallone, MD
Assistant Professor
Bruce Averbook, MD
Associate Professor
Henry Baele, MD
Assistant Professor
Robert Ballock, MD
Professor
Matthew Barber, MD
Professor
Edward Barksdale, MD
Professor
Gene Barnett, MD
Professor
Wael Barsoum, MD
Associate Professor
Jennifer Bennett, MD
Clinical Assistant Professor
Michael Benninger, MD
Professor
Edward Benzel, MD
Professor
Eren Berber, MD
Associate Professor
Ryan Berglund, MD
Assistant Professor
Stanley Berman, PhD
Clinical Instructor
Steven Bernard, MD
Assistant Professor
William Bingaman, MD
Professor
Eugene Blackstone, MD
Professor
Arie Blitz, MD
Assistant Professor
Michael Bloomfield, MD
Clinical Assistant Professor
Michael Bloomfield, MD
Clinical Instructor
Robert Boova, MD
Clinical Associate Professor
John Bottros, MD
Clinical Instructor
Scott Boulanger, MD
Assistant Professor
Natalie Bowersox, MD
Clinical Assistant Professor
Jonathan Boyd, MD
Clinical Assistant Professor
Jeffrey Boyko, MD
Clinical Assistant Professor
Linda Bradley, MD
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Christopher Brandt, MD
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Stacy Brethauer, MD
Assistant Professor
Diane Brown-Young, MD
Clinical Assistant Professor
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Frederick Cason, MD
Associate Professor
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Assistant Professor
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Associate Professor
Ronald Charles, MD
Clinical Instructor
Christina Ching, MD
Clinical Instructor
Louisa Chiu, MD
Clinical Instructor
Shih-Chieh Chueh, MD, PhD
Clinical Professor
Kimberly Cingle, MD
Senior Instructor
Daniel Clair, MD
Professor
Jeffrey Claridge, MD
Associate Professor
Brian Cmolik, MD
Assistant Professor
Adnan Cobanoglu, MD
Professor
John Como, MD
Associate Professor
George Coseriu, MD
Clinical Assistant Professor
Joseph Crowe, MD
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Clinical Instructor
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Ihor Danko, MD
Clinical Instructor
Howard Darvin, MD
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Carly Day, MD
Clinical Assistant Professor
Russell DeMicco, MD
Clinical Assistant Professor
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Assistant Professor
Conor Delaney, MD, PhD
Professor
Achilles Demetriou, MD, PhD
Professor
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Associate Professor
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Edward Diaz, MD
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Clinical Assistant Professor
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David Ebenezer, MD
Clinical Instructor
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Clinical Instructor
Kevin El-Hayek, MD
Clinical Instructor
Yakov Elgudin, MD, PhD
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Jonathan Emery, MD
Assistant Professor
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Anthony Forde, PhD
Clinical Assistant Professor
William Forsythe, MD
Clinical Assistant Professor
Nicole Fowler, MD
Clinical Instructor
Richard Freeman, MD, PhD
Clinical Associate Professor
Charlotte Frires, MSN
Adjunct Instructor
Mark Froimson, MD
Clinical Assistant Professor
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Professor
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Clinical Instructor
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Habibeh Gitiforooz, MD
Clinical Assistant Professor
Amitabh Goel, MD
Clinical Associate Professor
Mark Goldberg, MD
Clinical Assistant Professor
Jeffrey Goldberg, MD
Professor
David Goldfarb, MD
Professor
Howard Goldman, MD
Associate Professor
Jerry Goldstone, MD
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Clinical Assistant Professor
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Koji Hashimoto, MD
Assistant Professor
John Henderson, MD
Professor
Robert Hermann, MD
Clinical Professor
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Senior Instructor
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Clinical Instructor
Tracy Hull, MD
Professor
John Iafelice, MD
Adjunct Instructor
Joseph Iannotti, MD, PhD
Professor
Scott Jamerson, MD
Clinical Instructor
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John Jasper, MD
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Majida Jassani, MD
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Jessie Jean-Claude, MD
Associate Professor
John Jelovsek, MD
Associate Professor
Douglas Johnston, MD
Clinical Instructor
J. Jones, MD
Professor
Roderick Jordan, MD
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Natalie Joseph, MD
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Michael Joyce, MD
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David Joyce, MD
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Jihad Kaouk, MD
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Vikram Kashyap, MD
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Howard Kimmel, MD
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John Klein, MD
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Philip Knott, MD
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Assistant Professor
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Associate Professor
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Associate Professor
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Assistant Professor
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Clinical Assistant Professor
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Robert Stein, MD
Assistant Professor
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R. Walsh, MD
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Clinical Assistant Professor
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Diana Whittlesey, MD
Assistant Professor
Scott Wilhelm, MD
Associate Professor
Virginia Wong, MD
Assistant Professor
Hadley Wood, MD
Assistant Professor
Kenneth Woods, MD
Assistant Professor
Charles Yowler, MD
Professor
James Zins, MD
Professor

Urology
Robert Abouassaly, MD
Assistant Professor
Cengiz Altuntas, PhD
Instructor
Kevin Banks, MD
Clinical Assistant Professor
Michael Barkoukis, MD
Clinical Assistant Professor
Michael Berte, MD
Clinical Assistant Professor
Donald Bodner, MD
Professor
Edward Cherullo, MD
Associate Professor
Marc Cymes, MS
Clinical Instructor
Firouz Daneshgari, MD
Professor
Lawrence Gervasi, MD
Clinical Assistant Professor
Julian Gordon, MD
Clinical Assistant Professor
Sanjay Gupta, PhD
Professor
Nehemia Hampel, MD
Professor
Adonis Hijaz, MD
Associate Professor
Gregory Kondray, MD
Clinical Assistant Professor
Milton Lakin, MD
Associate Professor
Frederic Levine, MD
Clinical Assistant Professor
Guiming Liu, MD, PhD
Assistant Professor
S. Mahoney III, MD
Clinical Assistant Professor
Mani Menon, MD
Clinical Professor
Lee Ponsky, MD
Associate Professor
Jonathan Ross, MD
Professor
Sanjeev Shukla, PhD
Instructor
Tim Sidor, MD
Clinical Assistant Professor
Mark Stovsky, MD
Associate Professor
David Turk, MD
Clinical Assistant Professor
Lawrence Wolkoff, MD
Clinical Assistant Professor
Lynn Woo, MD
Assistant Professor
Hui Zhu, MD
Assistant Professor
Craig Zippe, MD
Clinical Professor
## University Degree Programs

<table>
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<tr>
<th>Field of Study</th>
<th>Undergraduate</th>
<th>Professional Graduate</th>
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<tbody>
<tr>
<td>Management</td>
<td>Bachelor of Science in Management</td>
<td>Master of Business Administration</td>
<td>Master of Business Administration/ Master of Science in Social Administration</td>
</tr>
<tr>
<td>Doctor of Philosophy</td>
<td>Doctor of Philosophy</td>
<td>Doctor of Business Administration</td>
<td>Master of Business Administration/ Master of Science in Social Administration</td>
</tr>
<tr>
<td>&quot;Designing Sustainable Systems, *Information Systems, Business Administration&quot;</td>
<td>Doctor of Business Administration</td>
<td>Doctor of Business Administration/ Master of Science in Social Administration</td>
<td></td>
</tr>
<tr>
<td>&quot;Master of Business Administration&quot;</td>
<td>Doctor of Business Administration</td>
<td>Doctor of Business Administration/ Master of Science in Social Administration</td>
<td></td>
</tr>
<tr>
<td>&quot;Master of Public Health&quot;</td>
<td>Doctor of Business Administration</td>
<td>Doctor of Business Administration/ Master of Science in Social Administration</td>
<td></td>
</tr>
<tr>
<td>&quot;Master of Business Administration&quot;</td>
<td>Doctor of Business Administration</td>
<td>Doctor of Business Administration/ Master of Science in Social Administration</td>
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</tr>
<tr>
<td>&quot;Master of Science in Nursing&quot;</td>
<td>Doctor of Business Administration</td>
<td>Doctor of Business Administration/ Master of Science in Social Administration</td>
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<tr>
<td>Materials Science and Engineering</td>
<td>Bachelor of Science in Engineering</td>
<td>Master of Science in Bioinformatics</td>
<td>Bachelor of Science in Engineering/ Master of Science</td>
</tr>
<tr>
<td>Mathematics</td>
<td>Bachelor of Arts</td>
<td>Bachelor of Science in Mathematics</td>
<td>Master of Science in Mathematics</td>
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<tr>
<td>Doctor of Philosophy in Mathematics</td>
<td>Doctor of Philosophy in Mathematics</td>
<td>Doctor of Philosophy in Mathematics</td>
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<tr>
<td>&quot;Bachelor of Science in Applied Mathematics&quot;</td>
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<td>Doctor of Philosophy in Mathematics</td>
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</tr>
<tr>
<td>&quot;Bachelor of Science in Mathematics and Physics&quot;</td>
<td>Doctor of Philosophy in Mathematics</td>
<td>Doctor of Philosophy in Mathematics</td>
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<tr>
<td>Mechanical Engineering</td>
<td>Bachelor of Science in Engineering</td>
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<td>Bachelor of Science in Engineering/ Master of Science</td>
</tr>
<tr>
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<td>Doctor of Philosophy</td>
<td>Doctor of Philosophy</td>
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<tr>
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<td>Master of Science in Bioinformatics</td>
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<td>Doctor of Medicine</td>
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<td>Master of Science in Bioinformatics</td>
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<tr>
<td>&quot;Master of Science in Applied Anatomy/Doctor of Medicine&quot;</td>
<td>Master of Science in Bioinformatics</td>
<td>Master of Science in Bioinformatics</td>
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</tr>
<tr>
<td>&quot;Doctor of Medicine/Doctor of Philosophy (Biochemistry, Biology, Biomedical Engineering, Cell Biology, Chemistry, Epidemiology and Biostatistics, Genetics, Mechanical Engineering, Molecular Biology and Microbiology, Molecular Virology, Neurosciences, Nutrition, Pathology, Pharmacology, Physiology and Biophysics) (3)&quot;</td>
<td>Doctor of Medicine/Doctor of Philosophy (Biochemistry, Biology, Biomedical Engineering, Cell Biology, Chemistry, Epidemiology and Biostatistics, Genetics, Mechanical Engineering, Molecular Biology and Microbiology, Molecular Virology, Neurosciences, Nutrition, Pathology, Pharmacology, Physiology and Biophysics) (3)</td>
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<tr>
<td>&quot;Doctor of Medicine/Doctor of Philosophy (Biochemistry, Clinical Research, Epidemiology, Nutrition, Pathology, Pharmacology, Physiology and Biotechnology)&quot;</td>
<td>Doctor of Medicine/Doctor of Philosophy (Biochemistry, Clinical Research, Epidemiology, Nutrition, Pathology, Pharmacology, Physiology and Biotechnology)</td>
<td>Doctor of Medicine/Doctor of Philosophy (Biochemistry, Clinical Research, Epidemiology, Nutrition, Pathology, Pharmacology, Physiology and Biotechnology)</td>
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<tr>
<td>Molecular Biology and Microbiology</td>
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<td>Doctor of Philosophy (3)</td>
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*Designing Sustainable Systems, *Information Systems, Business Administration"
<table>
<thead>
<tr>
<th>Field</th>
<th>Degree(s)</th>
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<tbody>
<tr>
<td>Molecular Medicine</td>
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</tr>
<tr>
<td>Molecular Virology</td>
<td>Doctor of Philosophy, Doctor of Medicine/Doctor of Philosophy (3)</td>
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<tr>
<td>Music</td>
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</tr>
<tr>
<td>Early Music</td>
<td>Master of Arts, Doctor of Musical Arts, Doctor of Philosophy</td>
</tr>
<tr>
<td>Music Education</td>
<td>Bachelor of Arts, Master of Arts, Master of Arts for Teacher Licensure, Doctor of Philosophy</td>
</tr>
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<td>Musicology</td>
<td>Doctor of Philosophy</td>
</tr>
<tr>
<td>Music History</td>
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<tr>
<td>Natural Sciences</td>
<td>Bachelor of Arts</td>
</tr>
<tr>
<td>Neurosciences</td>
<td>Doctor of Philosophy, Doctor of Medicine/Doctor of Philosophy (3)</td>
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<tr>
<td>Nonprofit Organizations</td>
<td>Master of Nonprofit Organizations (5), Master of Nonprofit Organizations/ Juris Doctor (5), Master of Nonprofit Organizations/ Master of Science in Social Administration (5), Master of Nonprofit Organizations/ Master of Arts (5)</td>
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<tr>
<td>Nutrition Biochemistry and Metabolism</td>
<td>Bachelor of Arts, Bachelor of Science in Nutritional Biochemistry and Metabolism</td>
</tr>
<tr>
<td>Operations and Supply Chain Management</td>
<td>Master of Science in Management</td>
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<td>Operations</td>
<td>Doctor of Philosophy (10)</td>
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<td>Organizational Behavior</td>
<td>Master in Positive Organizational Development and Change, Doctor of Philosophy</td>
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<td>Pathology</td>
<td>Doctor of Philosophy, Doctor of Medicine/Doctor of Philosophy (9)</td>
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<td>Field</td>
<td>Bachelor or Master</td>
</tr>
<tr>
<td>------------------------------</td>
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<tr>
<td>Pharmacology</td>
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<td></td>
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<td>Master of Arts/Doctor of Arts</td>
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<td></td>
<td>Doctor of Philosophy</td>
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<td>Physiology</td>
<td>Master of Science</td>
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<td>Master of Arts/Juris Doctor</td>
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<td>Political Science</td>
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<td></td>
<td>Doctor of Philosophy</td>
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<td></td>
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<tr>
<td>Polymer Science and Engineering</td>
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<td>Pre-Architecture</td>
<td>Bachelor of Arts</td>
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<td>Psychological Science</td>
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<td>Master of Arts</td>
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<td>Doctor of Philosophy</td>
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<td>Public Health</td>
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<td></td>
<td>Master of Public Health</td>
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<tr>
<td></td>
<td>Master of Public Health/Master of Science in Nursing (Infection Control)</td>
</tr>
<tr>
<td></td>
<td>Master of Public Health/Master of Arts (Anthropology)</td>
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<td></td>
<td>Master of Public Health/Master of Arts (Bioethics)</td>
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<td></td>
<td>Master of Public Health/Doctor of Philosophy (Anthropology)</td>
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<td>Public Health Nutrition</td>
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<td>Religious Studies</td>
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<td>Social Welfare</td>
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<tr>
<td>Social Work</td>
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<tr>
<td></td>
<td>Master of Science in Social Administration/ Master of Business Administration</td>
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<td></td>
<td>Master of Science in Social Administration/Master of Arts (Bioethics)</td>
</tr>
<tr>
<td></td>
<td>Master of Science in Social Administration/Master in Nonprofit Organizations</td>
</tr>
<tr>
<td>Sociology</td>
<td>Master of Arts</td>
</tr>
<tr>
<td></td>
<td>Doctor of Philosophy</td>
</tr>
</tbody>
</table>

- a. Available only as a second major.
- b. Includes dietetics.
- c. The Medical Scientist Training Program.
- d. Combined degree by special arrangement for selected students who hold acceptances in the School of Medicine.
- e. Degrees conferred jointly by the Mandel School of Applied Social Sciences and the Weatherhead School of Management in association with the Mandel Center for Nonprofit Organizations.
- f. Available as the undergraduate portion of the Bachelor of Science in Engineering/Master of Science program.
- g. Available as the graduate portion of the Bachelor of Science in Engineering/Master of Science program.
- h. Joint five-year Doctor of Medicine/Master of Science
- i. The Biomedical Investigation Program
- j. Program currently not accepting applications
- k. Masters offered only to current doctoral students or through the Integrated Graduate Studies program (IGS)
University Registrar

Registration
Students register at the time indicated by the University Registrar, (http://www.case.edu/registrar) as shown in the Student Information System (sis.case.edu/psp/saprd/EMPLOYEE/PSFT_HR/c/CW_SR_MENU.CW_CONFID_AGREEMNT.GBL?) (SIS) or as indicated by individual graduate/professional schools. Undergraduate student registration for fall begins in April and continues through the beginning of classes in August; undergraduate student registration for spring begins in November and continues through the beginning of classes in January. Only those students who have no outstanding financial obligations to the university are eligible to register. The Bursar bills those who register early for the next semester, with payment due by the specified deadline before the start of the next semester. At registration just prior to the beginning of classes, students must have paid all previous charges and be able to pay or have financial aid equal to one-half of that semester’s tuition and fees. The schedule of classes (sis.case.edu/psp/saprd/EMPLOYEE/HRMS/c/COMMUNITY_ACCESS.CLASS_SEARCH.GBL & is available electronically and can be accessed through the SIS. (sis.case.edu/psp/saprd/EMPLOYEE/PSFT_HR/c/CW_SR_MENU.CW_CONFID_AGREEMNT.GBL)

The University Registrar’s website includes the academic calendar (http://www.case.edu/registrar/calendar.html) and the dates for late registration and drop/add (http://www.case.edu/registrar/lastday.html). The SIS includes a complete real time listing of courses offered. Students use SIS to register for classes; refer to the listing of registration start dates for each school (http://www.case.edu/registrar/online/when.html) to determine registration eligibility. No zero-credit only registrations (e.g., zero-credit physical education courses) are allowed, unless approved as part of ongoing degree programs.

Registration deadlines will be strictly enforced. Only students officially registered, according to the official SIS class roster, are permitted to attend that class. Instructors may permit students to sit in on occasional classes at their discretion, but students who wish to attend class regularly without receiving credit should register as auditors. Unregistered students are not permitted to take part in laboratory activities.

Courses of Instruction
All courses at the university, except courses in the Medical School, Law School, School of Dental Medicine, and School of Nursing are numbered according to the following plan:

• 100-199 Elementary courses
• 200-299 Intermediate courses
• 300-399 Advanced undergraduate courses
• 400-499 Lower level graduate courses (some are open to undergraduates; consult with the appropriate department)
• 500 and above Advanced graduate courses

Roman numerals (I, II, etc.) after course titles indicate segments of a multicourse sequence. Arabic numerals in parentheses after course titles indicate the semester credit hours for each course.

Veterans’ Coordinator
The Veterans’ Coordinator, housed in the Office of the University Registrar, 110 Yost Hall, administers the regulations governing the educational benefits and opportunities open to veterans under various federal laws. The office maintains close contact with the Veterans Administration and is the only office authorized to verify veterans’ attendance. For information call 216.368.4310 or email registrar@case.edu.

Exceptions to Policies
Requests for exceptions to any academic or administrative policy must be submitted within three months of the end of the semester for which the exception is sought.

Course Audit Program for Senior Citizens
Case Western Reserve University’s Course Audit Program for Senior Citizens (http://www.case.edu/provost/seniorauditprogram) (CAPSC) allows senior citizens (age 65 and older) to take on campus courses at a reduced tuition rate.

Student Records
The Family Educational Rights and Privacy Act of 1974 (FERPA) contains several provisions that are important to students. First, the university may not release personally identifiable student records to a third party, with certain specific exceptions, unless the third party has requested the information in writing and the student has consented, again in writing, to its release. The university may release directory information about a student, however, unless the student submits a written request that any or all such information not be released. Second, a student may request, in writing, an opportunity to inspect and review the student’s official files and records maintained by the university and may, if appropriate, challenge the accuracy of those records. The university is permitted a reasonable time, not to exceed 45 days, to respond to such a request. Third, a student may file with the Family Policy and Regulations Office of the U.S. Department of Education a complaint concerning what he or she believes to be the university’s failure to comply with FERPA. Finally, a student may obtain from the Registrar a copy of this policy, which the university has adopted to meet the requirements of FERPA. The information below is presented in compliance with the provisions of FERPA, which require the university to notify students annually of their rights and the university’s policies and procedures. Specific procedures may vary slightly among the schools and colleges of the university, and each student is encouraged to inquire at his or her own dean’s office if any question arises.

Access to Files
A student may request, in writing, an opportunity to review the contents of the student’s educational file. Certain materials are excluded from review as specified in FERPA. Among these are:

• Records kept in the sole possession of faculty, staff, and other personnel, used only as a personal memory aid, and not accessible to any other person except a temporary substitute for the maker of the record.
• Records created and maintained by law enforcement units solely for law enforcement purposes that are not maintained by persons other than law enforcement officials.
• Records created and maintained by a physician, psychiatrist, psychologist, or other professional or paraprofessional acting in that capacity in connection with the provision of treatment to a student. Such records can, of course, be reviewed by a physician or other appropriate professional of the student’s choice.
FERPA affords students certain rights with respect to their educational records. Students may ask the university to amend a record that the student believes is inaccurate or misleading. The student should write to the university official responsible for the record, clearly identifying the part of the record the student wants changed, and specify why it is inaccurate or misleading. If the university decides not to amend the record as requested by the student, the university will notify the student of the decision and advise the student of his or her right to a hearing regarding the request for amendment. Additional information regarding the hearing procedures will be provided to the student when notified of the right to a hearing.

The student may request copies of those records to which he or she has access under the terms of FERPA. The student will be charged a nominal fee per page for these copies.

Release of Personally Identifiable Records

FERPA affords the student the right to consent to disclosures of personally identifiable information contained in the student’s educational records, except to the extent that FERPA authorizes disclosure without consent. One exception, which permits disclosure without consent, is disclosure to school officials with legitimate educational interests. A school official is defined as a person employed by the university in an administrative, supervisory, academic, or support staff position (including law enforcement unit and health staff); a person or company with whom the university has contracted (such as an attorney, auditor, or collection agent); a person serving on the Board of Trustees; or assisting another school official in performing his or her tasks. A school official has a legitimate educational interest if the official needs to review an education record in order to fulfill his or her professional responsibility.

Upon request, the university discloses education records without consent to officials of another school in which a student seeks or intends to enroll. The university also discloses education records to organizations conducting studies for educational agencies or institutions under certain circumstances.

Directory Information

For the convenience of faculty and fellow students, FERPA provides for a category known as directory information, which may be released without requesting the eligible student’s specific prior consent. Rather, the act requires that students be notified annually of the types of information included in this category and be given an appropriate period in which to express, in writing, any preference that such information about themselves not be released. For this purpose, directory information is defined to include:

- Name (including both maiden name and married name, where applicable)
- Address, telephone listing, and electronic mail address
- Date and place of birth
- Major field of study
- Anticipated graduation date
- Enrollment Status (undergraduate or graduate, full-time or part-time)
- Dates of attendance
- Degrees and awards received
- Participation in officially recognized sports and activities
- Weight and height (members of athletic teams)

Any student who would prefer that the university not release such information about himself or herself should so notify the Office of the University Registrar, in writing, prior to the first week of classes in the fall semester. Students entering the university at midyear may submit such notice during the first week of classes of the spring semester.

Transcripts

A transcript of grades will be released only upon written (or electronically authenticated) request of the student, either in person, by mail or by online request through our transcript servicing partner. A fee is charged for each transcript copy. Neither transcripts nor diplomas will not be issued to, or on behalf of, students who have not discharged delinquent obligations to the university.

Student Right to Know

The Student Right to Know and Campus Security Act requires that universities throughout the country produce statistics and/or information on the following subjects: 1) retention and graduation rates (http://bulletin.case.edu/universityregistrar/www.case.edu/registrar/gradrate.html); 2) financial assistance available to students and requirements and restrictions imposed on Title IV aid; 3) crime statistics on campus (http://www.case.edu/finadmin/security/protserv/protserv.htm); 4) athletic program participation rates and financial support; and 5) other institutional information including: the cost of attendance, accreditation and academic program data, facilities and services available to disabled students, and withdrawal and refund policies.

Data on retention and graduation rates is available in the Office of the Provost in Adelbert Hall (216-368-4389) and from the Office of the Registrar (http://www.case.edu/registrar). Information on financial assistance, including descriptions of application procedures and forms, may be obtained from the Office of University Financial Aid (http://finaid.case.edu). Yost Hall (216.368.4530). Information concerning athletic program participation and financial support may be obtained from the Physical Education and Athletics Department (http://studentaffairs.case.edu/athletics), Veale Center (216.368.2867). Other institutional information, such as that listed in number 5, above, may be obtained from the Office of the Provost and in the various undergraduate, graduate, and professional schools’ registrars’ offices. Case Western Reserve University’s annual security report (available online (http://case.edu/finadmin/security/protserv/protserv.htm)) includes statistics for the previous three years concerning certain reported crimes, including hate crimes, that occurred on campus, in or on campus buildings or property owned or controlled by the university, and on public property within or immediately adjacent to and accessible from campus. The report is available from the Office of the Provost in Adelbert Hall (216-368-4389) and from the Office of the Registrar (http://www.case.edu/registrar). Information on campus security policies and other information concerning the university's efforts to maintain a safe campus environment is available in the Office of the Provost in Adelbert Hall (216-368-4389).
also contains summaries of institutional policies regarding safety and security, reporting of crimes, sexual assault, drug and alcohol use, timely warnings and missing persons investigations. The university maintains a daily crime log that can be accessed here (http://police.case.edu/log.html). The Case Western Reserve University annual security report also includes information on emergency notification, emergency response and evacuation procedures. Emergency procedures for students, faculty, staff and visitors can also be reviewed here (http://case.edu/emergencymanagement).

The annual security report is updated Oct. 1 of every year. A full print copy of the report can be obtained by contacting the crime prevention office at 216.368.1243 (http://bulletin.case.edu/universityregistrar/tel:216-368-1243). Case Western Reserve University also produces an annual fire safety report that includes fire statistics for on-campus housing, summaries of fire policies and evacuation procedures. The report is available online (https://www.case.edu/ehs/FireSafety/2011report.pdf).

**Grading System**

The following grading system is used at Case Western Reserve University:

<table>
<thead>
<tr>
<th>Letter Grade</th>
<th>Meaning</th>
<th>Quality Points</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Excellent</td>
<td>4.000</td>
<td></td>
</tr>
<tr>
<td>A-</td>
<td>Good</td>
<td>3.666</td>
<td>1</td>
</tr>
<tr>
<td>B+</td>
<td>Fair</td>
<td>3.333</td>
<td>1</td>
</tr>
<tr>
<td>B</td>
<td>Good</td>
<td>3.000</td>
<td></td>
</tr>
<tr>
<td>B-</td>
<td>Fair</td>
<td>2.666</td>
<td>1</td>
</tr>
<tr>
<td>C+</td>
<td>Fair</td>
<td>2.333</td>
<td>1</td>
</tr>
<tr>
<td>C</td>
<td>Fair</td>
<td>2.000</td>
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</tr>
<tr>
<td>C-</td>
<td>Fair</td>
<td>1.666</td>
<td>1</td>
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<tr>
<td>D+</td>
<td>Fair</td>
<td>1.333</td>
<td>2</td>
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<tr>
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<td>Passing</td>
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<td>Failure</td>
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<td>Successful audit</td>
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<tr>
<td>AE</td>
<td>Achieves or exceeds competencies</td>
<td>n/a</td>
<td>5</td>
</tr>
<tr>
<td>AP</td>
<td>Advanced placement</td>
<td>n/a</td>
<td>4</td>
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<tr>
<td>AS</td>
<td>Advanced subsidiary</td>
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<td>COM</td>
<td>Commendable</td>
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<td>CR</td>
<td>Earns credit, credit/no credit course</td>
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<td>H</td>
<td>Honors</td>
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<tr>
<td>I</td>
<td>Incomplete</td>
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<td>IB</td>
<td>International baccalaureate</td>
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<tr>
<td>M</td>
<td>Meets or exceeds expectations</td>
<td>n/a</td>
<td>5</td>
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<tr>
<td>NC</td>
<td>No credit, credit/no credit course</td>
<td>n/a</td>
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<td>NG</td>
<td>Unsuccessful audit</td>
<td>n/a</td>
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<tr>
<td>NOG</td>
<td>Non-graded course</td>
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<td>NP</td>
<td>No pass</td>
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<td>P</td>
<td>Pass</td>
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<td>PR</td>
<td>Proficiency</td>
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<td>R</td>
<td>In progress or extends &gt; one term</td>
<td>n/a</td>
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<tr>
<td>RPT</td>
<td>Repeated course (until Summer 2006)</td>
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<tr>
<td>S</td>
<td>Satisfactory</td>
<td>n/a</td>
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<tr>
<td>SA</td>
<td>Special audit or alumni/senior audit</td>
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<td>TR</td>
<td>Transfer</td>
<td>n/a</td>
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<td>Unsatisfactory</td>
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<tr>
<td>W</td>
<td>Withdrawal from a class</td>
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<tr>
<td>WD</td>
<td>Withdrawal from all classes</td>
<td>n/a</td>
<td></td>
</tr>
<tr>
<td>WF</td>
<td>Withdrawn under Acad Regs 5 &amp; 6</td>
<td>n/a</td>
<td>7</td>
</tr>
<tr>
<td>1 - 69</td>
<td>Nonpassing grade</td>
<td>n/a</td>
<td>10</td>
</tr>
<tr>
<td>70 - 100</td>
<td>Passing grade</td>
<td>n/a</td>
<td>10</td>
</tr>
</tbody>
</table>
In order to receive credit for a course marked Incomplete, the student must complete the work by the date specified by the instructor and in no event later than the end of the next regular semester (fall or spring). If the student fails to remove the Incomplete within the specified time, he or she forfeits the privilege of completing the course for credit, and the grade becomes a permanent Incomplete unless the instructor elects to give a grade of F.

Graduate and Professional Students

Graduate and Professional Students

The grade of S given graduate students in the School of Graduate Studies indicates satisfactory progress in evaluating exclusively thesis and dissertation research. The grade S is not counted in determining quality averages. The alternative to a grade of S is U (Unsatisfactory). The grade of I (Incomplete) may not be used in evaluating thesis and dissertation research. In other graduate/professional schools, the grade of S may indicate passing performance in designated courses and advanced seminars.

Conditional (R)

The grade of R is used for work, such as undergraduate thesis and project laboratories, that extends more than one semester and, upon completion of the thesis or project, will be changed to the letter grade awarded for the completed work. The R grade assigned in ENGL 148 Introduction to Composition indicates that a student must re-enroll in ENGL 148 Introduction to Composition. In the following semester; the R grade in ENGL 148 Introduction to Composition remains on the student’s record and is not subject to replacement by the final grade earned in ENGL 148.

Audit (AD) and Unsuccessful Audit (NG)

The grade of AD (audit) will be given when a student has officially registered to audit a course and has satisfied the requirements specified by the instructor for this grade. The grade of NG (unsuccessful audit, graduate, and professional schools only) will be given when a student has officially registered to audit a course and has not satisfied the requirements specified by the instructor.

Undergraduate Students

A student may audit a course with the dean’s or advisor’s approval and the consent of the instructor of the course. An auditor receives no credit for the course.

Registration in a course cannot be changed from audit to credit or the reverse after the end of the drop/add period. At the beginning of the course, the student and instructor should reach agreement regarding the requirements to be met for a grade of AD. The grade of AD is entered on the student’s transcript if approved by the instructor of the course. If the instructor does not approve the grade AD, the enrollment is not posted on the transcript. A student may take for credit a course he or she audited in an earlier semester.

Graduate/Professional Students

Dental students: Courses toward degree programs in the School of Dental Medicine may not be audited.

The following statements apply to the Schools of Graduate Studies and Management: The instructor may designate that the student has not completed all requirements for auditing the course and that NG (Unsuccessful Audit) be recorded on the student’s transcript. A course
once audited may not be repeated for credit, nor may any course for which credit has been given be repeated for credit toward degree requirements. Students will be permitted to change their registration in a course from credit to audit (AD), or the reverse, with written consent of their advisor and the instructor only if the change is officially made on or before the date specified in the academic calendar for the given term.

Other graduate and professional schools: Please refer to individual school sections of this publication, or to individual school student handbooks.

**Partial Withdrawal (W)**

The grade of W will be given if a student officially withdraws from a course on or before the date specified in the academic calendar for the given term. After this date, the grade as determined by the instructor will be posted.

**Complete Withdrawal (WD)**

The grade WD is assigned by the University Registrar for complete withdrawal from all course work for the semester. All withdrawal requests are to be submitted to the University Registrar prior to the last day of class.

**Grade Point Averages**

Grade-point averages are calculated by multiplying the number equivalent of the letter grade by the number of credit hours for the course. The semester grade-point average is computed by dividing the total number of grade points earned at the university during a given semester by the sum of the credit hours for all courses in which the student received letter grades of A, B, C, D, or F taken at the university during that same semester. (Not all of these grades are given by all schools.)

For the purpose of semester grade calculations, grade points earned when a grade of Incomplete is replaced by the appropriate course grade are credited to the semester in which the incomplete grade was received, but status action (separation, probation, or restoration to good standing) taken at the end of that semester is not affected unless the grade change occurs by the first day of classes of the following semester. Qualification for honors is based on the same terms.

The cumulative grade-point average is computed by dividing the total grade points earned at the university by the sum of the credit hours for all courses included in the grade-point calculation.

**Pass-No Pass**

See specific colleges and schools for information about courses that may be taken on a pass-no pass basis and similar options.

**Definition of a Credit-Hour**

Program Integrity Rules issued by the U.S. Department of Education require institutions to establish a definition of "credit hour." CWRU’s definition was approved by the Faculty Senate on 4/25/12 and applies to all degree programs (undergraduate through graduate/professional):

1. The assignment of credit-hours to a course occurs through a formal review process conducted at the appropriate levels of faculty governance.

2. For courses in lecture format, one credit-hour represents the subject content that can be delivered in one academic hour of contact time each week for the full duration of one academic semester, typically fourteen weeks along with a final examination period. For undergraduate courses, one credit-hour also includes associated work that can be completed by a typical student in 2-3 hours of effort outside the classroom. For graduate and professional courses taught in lecture format, 3-4 hours of outside work is expected for each academic hour of contact time.

3. For courses taught in other than lecture format (e.g., seminars, laboratories, independent study, clinical work, research, etc.), one credit-hour represents an amount of content and/or student effort that in aggregate is no less than that described in (2) above.
Weatherhead School of Management

The Weatherhead School of Management (http://weatherhead.case.edu) is different from other business schools. Weatherhead is bold in its ideas, creative in its approach, and adaptive in its interactions within a changing business environment. Weatherhead has enhanced traditional management education by integrating the fundamentals of business with ideas and practices that change individuals, organizations, and societies. Weatherhead graduates are ready to add immediate value to their organizations, their communities, and the world.

Weatherhead is home to seven academic departments comprising 69 full-time faculty members and 71 full-time members of staff. It offers programs at the undergraduate, master’s, and doctoral levels in the Peter B. Lewis Building and executive programming in the George S. Di-Vely Building on the campus of Case Western Reserve University. Located within University Circle, a square mile of educational, scientific, medical, and cultural institutions, Weatherhead counts among its neighbors the Cleveland Orchestra, the Cleveland Museum of Art, the Cleveland Botanical Garden, the Cleveland Museum of Natural History, the Cleveland Institute of Art, and University Hospitals. Weatherhead is a business school that attracts interest from every corner of the globe while maintaining its roots in the Cleveland community.

Mission Statement
Developing transformational ideas and outstanding leaders for the advancement of business and society.

Values
• Weatherhead believes that management is a noble profession committed to the advancement of human life.
• Weatherhead values its strong ethical foundation and strives to promote a culture rich in ideas and reflection.
• Weatherhead is committed to increasing individual creative and critical capacities, nurturing new and expansive patterns of thought.
• Weatherhead values research of enduring consequence and judges its significance by the impact it has on management thought, management action, and public policy.
• Weatherhead values learning that is active and collaborative. Students, faculty, and staff together engage important management problems with an innovative, knowledge-creating approach.
• Weatherhead is responsive to the needs of its students.
• Weatherhead considers alumni its important partners and strives to add value to their personal and professional lives.
• Weatherhead values partnerships with the business community and other organizations.
• Weatherhead values meaningful service to society and strives for outcomes that influence and positively change the way people and organizations conduct themselves.
• Weatherhead is a cohesive learning organization with an international outlook.
• Weatherhead values diversity, characterized by open dialogue and mutual respect among individuals with different specializations, backgrounds, cultures, and perspectives.
• Weatherhead is results-oriented and judges its contributions by actions taken and outcomes achieved.

Vision
Weatherhead is respected locally and globally for research of enduring consequence. The school is recognized for attracting and educating managers to design novel solutions to the most complex issues facing business and society. Weatherhead’s learning environment is a hub of creative thinking, innovative teaching, and trans-disciplinary research, filled with excitement and a strong sense of community.

Distinguishing Focus
It matters to the Weatherhead School of Management that its education and research efforts help people improve organizations and society. To that end, Weatherhead educates and develops managers of private and public, corporate and nonprofit institutions to combine rigorous analytic skills, design competence, and a bias for execution.

At Weatherhead, students are taught to Manage by Designing and to build the Sustainable Enterprise. These teachings infuse the MBA curriculum; so does the emphasis on responsible commercial practices. Weatherhead confronts today’s most important global issues from a business perspective, and Weatherhead students leave ready to lead that charge, wherever they go.

Specifically, Weatherhead’s work is known for instilling in its students:
• Use of disciplined methods to explore, frame, and resolve complex problems and issues
• Ability to use design techniques to generate alternatives that improve on familiar solutions in surprising and valuable ways
• Awareness of the importance of taking into account entire systems when proposing new ways of doing things

Effective execution requires leadership. Weatherhead’s learning environments are also known for promoting:
• Change management skills that are required to effectively implement novel solutions
• Attention to the value of designing solutions that are sustainable from economic, ecological, and social points of view
• Ability to actively engage all relevant stakeholders in positive change

Weatherhead School of Management’s distinguishing focus on design and sustainability in management integrates and builds upon investments that it has made over the past decade to align with growing interests in organizations and society at large.

Brief History
In 1952, Western Reserve University established the School of Business by combining the Cleveland College Division of Business Administration and the Graduate School Division of Business Administration, and from its founding until 1988, the activities of the School of Business were divided among a number of buildings both in downtown Cleveland and in University Circle. In 1967, the merger of Case Institute of Technology and Western Reserve University created Case Western Reserve University, and the Western Reserve University School of Business absorbed Case’s Division of Organizational Sciences to become the School of Management in 1970. Just six years later, the School of Management launched its Full-Time MBA.

It was in 1980 that the School of Management was renamed in honor of Albert J. Weatherhead III, a Cleveland businessman and industrialist who represented the fourth generation of his family to carry on the Weatherhead name and values, including cultural and educational leadership. By 1999, the Weatherhead School of Management had developed a strong identity, growing out of its space in Nord Hall and requiring new construction. Funded by the philanthropist and
entrepreneur whose name it bears, the Peter B. Lewis building, designed by renowned contemporary architect Frank Gehry and completed in 2002, was the answer. Located across the street from the George S. Dively Building, which houses Weatherhead Executive Education programs, the Lewis Building, featuring Gehry’s unmistakable sculptural profile and gleaming stainless steel roof, both sets the school apart from its surroundings and, quite literally, reflects the prestigious neighborhood of the school. Gehry redefined the way a business school should look, just as Weatherhead redefines the way management education should take place.

Accreditation

The programs of the Weatherhead School of Management have been fully accredited by the Association to Advance Collegiate Schools of Business (AACSB) International since 1958.

Administration

J.B. Silvers, PhD
(Stanford University)
Interim Dean; John R. Mannix Medical Mutual of Ohio Professor in Health Care Finance; Professor, Banking and Finance

Fred Collopy, PhD
(University of Pennsylvania)
Senior Associate Dean; Professor, Information Systems

Laura Desmond, BA
(University of Michigan)
Associate Dean, External Relations

Michael Devlin, MBA
(Case Western Reserve University)
Associate Dean, Executive Education

Jennifer Johnson, MBA
(Case Western Reserve University)
Associate Dean, Undergraduate and Integrated Studies; Associate Professor, Marketing and Policy Studies

Sharon Martin, MBA
(Baldwin-Wallace College)
Associate Dean, Finance and Administration

Department Chairs

Richard J. Boland Jr., PhD
(Case Western Reserve University)
Elizabeth M. and William C. Treuhaft Professor of Management; Chair and Professor, Information Systems

Ronald Fry, PhD
(Massachusetts Institute of Technology)
Chair and Professor, Organizational Behavior

Anurag Gupta, PhD
(New York University)
Chair and Professor, Banking and Finance; Director, International Programs

Kamlesh Mathur, PhD
(Case Western Reserve University)
Chair and Professor, Operations; Faculty Director, Master of Science in Operations Research and Supply Chain; Faculty Director, Executive MBA

Gary J. Previts, PhD, CPA
(University of Florida)
Distinguished University Professor, E. Mandell de Windt Professor in Leadership and Enterprise Development; Chair and Professor, Accountancy

Jagdip Singh, PhD
(Texas Tech University)
ATT Professor; Chair and Professor, Marketing and Policy Studies

Matthew Sobel, PhD
(Stanford University)
Chair, Department of Economics; William E. Umstattd Professor in Industrial Economics; Professor, Operations
Certificate in Nonprofit Management

Certificate in Nonprofit Management (CNM)

This program is not currently accepting new students.

Policies

Satisfactory completion of an approved set of five courses (15 credits) in residence, along with payment of all tuition and fees, is required for graduation. Participants who complete all requirements will be awarded the Mandel Center Certificate in Nonprofit Management.

Retention Requirements

A CNM student who earns a final grade below a B in any course may no longer continue in the program. There is no academic probation period for the CNM, due to the short duration of the program.

Graduation Requirements

A candidate for the CNM program must file an application to graduate not later than two months before the expected graduation date. The filing of this application is the responsibility of the CNM candidate. Contact the Weatherhead School of Management at 216.368.8566 for more information. Eligibility of the candidate to graduate at the time requested will be verified upon receipt of the application.

All requirements for the CNM program must be completed within two years from the date of the student’s initial registration.
Doctoral Programs

Doctor of Management (DM) and PhD in Management: Designing Sustainable Systems

Business leadership is increasingly required to integrate multiple sources of knowledge, understand the perceptions of diverse parties, and put human values into action. Executives are challenged to create social, intellectual, and economic value for their organizations and for society at large based on rigorous and sound evidence. Recognizing these challenges, Weatherhead offers two doctoral degrees in management for working professionals: the DM and the PhD in management: Designing Sustainable Systems.

The DM is based on the expectation that the practitioner-scholar will develop the ability to think intensely and critically about problems confronting an organization, a community, a nation, and the world. Through conceptually modeling these problems, assessing and modifying the assumptions underlying the models, testing assumptions empirically, and applying modes of thought drawn from many disciplines, students draw conclusions and propose solutions based on the results their models produce.

The PhD in management: Designing Sustainable Systems is focused in preparing interdisciplinary scholar-practitioners for successful research and academic careers. Students develop the ability to approach problems rigorously from multiple disciplinary angles and to produce sound evidence and theoretical frames to address those problems.

Curricula and coursework in these programs provide a foundation for conducting rigorous research and practicing evidence-based management. Courses are interrelated theoretically and methodologically and prepare students to bring academic, theoretical, and empirical perspectives to bear on problems that they face in their organizations or in public policy advocacy.

DM

The DM is a 54-credit-hour, three-year lock-step program. DM students' research projects are evaluated by a faculty review committee over the course of the program at critical research milestones.

Curriculum

First Year

<table>
<thead>
<tr>
<th>Course</th>
<th>Units</th>
<th>Fall</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theory and Practice of Collective Action (EDMP 611)</td>
<td>3</td>
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<td></td>
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<tr>
<td>Leading Change (EDMP 613)</td>
<td>3</td>
<td></td>
<td></td>
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<tr>
<td>Introduction to Research Inquiry (EDMP 665)</td>
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<td></td>
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<tr>
<td>Qualitative Inquiry I (EDMP 638)</td>
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<td></td>
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<tr>
<td>Understanding, Designing, Managing Complex Systems (EDMP 673)</td>
<td>3</td>
<td></td>
<td></td>
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<tr>
<td>Effectiveness of Institutional, Individual and Organizational Decision Making (EDMP 678)</td>
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Second Year

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<tr>
<th>Course</th>
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<th>Spring</th>
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<tr>
<td>Culture and World Politics (EDMP 610)</td>
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<td></td>
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<tr>
<td>Qualitative Inquiry II (EDMP 641)</td>
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<tr>
<td>Causal Analysis of Business Problems I (EDMP 648)</td>
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<tr>
<td>Measuring Business Behaviors and Structures (EDMP 643)</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Social Ethics: Contemporary Issues (EDMP 640)</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Causal Analysis of Business Problems II (EDMP 649)</td>
<td>3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Year Total: 54

Research Requirements and Deliverables

The DM dissertation consists of the Qualitative Research Paper and Quantitative Research Paper and an Integrative Paper that organizes the research into a coherent thesis.

Research Proposal Paper

The first research requirement is a qualitative research proposal that frames the student’s research problem and question and specifies a design for the fieldwork portion of the qualitative research project. The student develops a written research proposal that synthesizes a substantial body of scholarly literature (theoretical and empirical) in a fashion that creates a conceptual framework and model providing insight into a significant problem of practice reflecting the lived worlds of a specified body of practitioners. The Research Proposal Paper produces a “grand tour” research question to guide the qualitative research project and includes a design for the fieldwork to be carried out in the course of the research project. Students develop individual skills of conceptualizing (including modeling), creating ethnographic/phenomenological interview protocols, conducting phenomenological interviews, and interpretively analyzing qualitative interview data.

Qualitative Research Paper

The Qualitative Research Paper presents findings and explanatory concepts from the student’s qualitative fieldwork project. It identifies and frames a potent “phenomenological practice gap” wherein current practitioner and academic knowledge is lacking in guiding effective practice. The research synthesizes significant scholarly literature into a coherent conceptual framework and an understandable model of relationships among theoretical constructs. Students learn to frame effective questions for practitioner-scholarship research that embodies inquiry and openness, aligning the conceptual framework and research question to the chosen problem of practice, and to write scholarly papers that are clear and present a logical flow of well-supported arguments. By understanding the development of grounded theory and understanding ethnographic observation and field notes, students formally and rigorously analyze qualitative data in an interpretive fashion.

Capstone

The Capstone integrates the analytical approaches the student has learned in EDMP 643 Measuring Business Behaviors and Structures and EDMP 649 Causal Analysis of Business Problems II. The Capstone exercise is intended to allow students to demonstrate their independent competence in quantitative inquiry skills and, based on a satisfactory assessment, to progress toward the completion of the quantitative
inquiry project which is a requirement for both the DM and the PhD in management: Designing Sustainable Systems track.

**Quantitative Research Paper**

The objective of the Quantitative Research Paper is to generate a rigorous and valid quantitative empirical study that is guided by a sound conceptual model of the student’s phenomenon of interest. The study must position itself with respect to the theoretical and research literature of the topic, utilize a robust research design to collect credible data that mitigates biases, reflect systematic and rigorous quantitative analysis indicative of material covered in the quantitative inquiry courses, and meet high scholarly standards to merit publication in top-rated journals and outlets.

**DM Dissertation**

The DM dissertation consists of the Qualitative Research Paper and Quantitative Research Paper and an Integrative Paper that organizes the study into a coherent thesis.

**Integrative Paper**

As a final requirement for the DM dissertation, each student writes an overview statement introducing his or her Qualitative and Quantitative Research Papers, making substantive observations and conclusions about each project, and presenting a personal reflective statement about each project’s significance to the author. The Research Proposal frames the dissertation overview in a preliminary way, but in light of the student’s experience in conducting qualitative and quantitative studies, the synthesis is rewritten, revised, and critically evaluated to become the Integrative Paper. The Integrative Paper and the approved Qualitative Research Paper and Quantitative Research Paper serve as the dissertation requirement of the DM program.

### Fourth Year:

<table>
<thead>
<tr>
<th>Units</th>
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<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dissertation Ph.D. (MGMT 701) (includes participating in two research workshops/seminars)</td>
<td>1-18</td>
<td></td>
</tr>
<tr>
<td>Manuscript presented and defended in the research workshop</td>
<td></td>
<td></td>
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<tr>
<td>Dissertation Ph.D. (MGMT 701) (includes participating in two research workshops/seminars)</td>
<td>1-18</td>
<td></td>
</tr>
<tr>
<td>Summary of thesis or a specific paper presented and defended in a research workshop</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PhD dissertation submitted and defended</td>
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<td></td>
</tr>
<tr>
<td>Year Total:</td>
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<td>1-18</td>
</tr>
<tr>
<td>Total Units in Sequence:</td>
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</tbody>
</table>

**PhD in Management: Designing Sustainable Systems**

Weatherhead’s PhD in Management: Designing Sustainable Systems is a 72-credit-hour program. The students in this program are selected from first-year DM students who wish to reorient their careers to formally pursue positions as academic researchers and scholars.

**Research Requirements and Deliverables for the PhD in Management: Designing Sustainable Systems Track**

Although trans-disciplinary research is the main focus of the PhD in Management: Designing Sustainable Systems track, candidates must be grounded in a disciplinary field. Therefore, throughout their course of study, candidates will read seminal works and acquire knowledge that leads to a grounding in their chosen discipline(s) (for example marketing, strategy, accounting, information systems, organizational behavior, finance, or economics). Students are required to take a comprehensive exam demonstrating adequate knowledge of the field’s theories, research methods, and results. Upon passing the comprehensive exam, students are advanced to candidacy for the PhD. Candidates defend their PhD thesis proposal and the final thesis during their course of study.

Doctoral candidates in the PhD in Management: Designing Sustainable Systems track will undertake full dissertation research during their fourth year of study to extend their contributions to managerial knowledge. Informed by courses in design thinking, sustainability thinking, and complex systems thinking, candidates incorporate human values and appropriate mixed methods of analysis into their research. An original and significant endeavor, the dissertation includes a detailed review of the chosen topic, relevant research questions, methods of inquiry used, and findings obtained, as well as the implications of these findings.

For more information, contact Sue Nartker (http://bulletin.case.edu/weatherheadschoolofmanagement/doctoralprograms/mailto:sue.nartker@case.edu), Managing Director of the DM program, at 216.368.1943; or Marilyn Chorman (http://bulletin.case.edu/weatherheadschoolofmanagement/doctoralprograms/mailto:marilyn.chorman@case.edu), Associate Director of the program, at 216.368.3638.

**PhD in Management**

A PhD in Management offers students the opportunity to develop theory-driven scholarship that is grounded in practice and explores various dimensions of value creation, and to prepare for a career as university faculty member.

Candidates may specialize in one of five areas:

- Accountancy
- Designing Sustainable Systems
- Information Systems
- Labor and Human Resource Policy
- Marketing

**Accountancy**

The PhD in Accountancy program is structured and a student study plan is developed to support high-quality research and effective teaching based upon knowledge and skill levels appropriate to a student’s goals. Doctoral students work with faculty whose research investigates matters of importance to academics, practitioners, and policy makers, in order to influence practice and standard setting in both the private and public sectors.

**Curriculum**

The first two academic years are directed toward the study of the literature, methods, and recent research appropriate to a student’s identified interests. Summer periods are available for individual reading, development, and writing along project lines to be determined by the student’s chair and program committee. This two-year period is expected to provide the foundation for preparing well-developed research papers that exhibit knowledge and skill levels appropriate to an individual’s goals as he or she approaches candidacy.

The third year is devoted to writing focused individual papers leading to a dissertation proposal under the supervision of a study program committee. Based upon one of these high-quality research papers, a suitable dissertation proposal will be prepared by the end of the third year of study. This research and writing activity will not only help to determine the student’s dissertation topic, but will also be considered equivalent to field examinations. The series of papers leading up to the dissertation
proposal, the proposal itself, and an oral presentation to the student’s study program committee will be taken into account as the committee determines whether to grant doctoral candidate status to the student.

The fourth year is focused upon completion of the dissertation. Throughout the program, the student will develop competencies related to classroom and teaching activities as well.

For more information, visit our website (http://weatherhead.case.edu/degrees/phd-management/accountancy) or contact Elaine Iannicelli (http://bulletin.case.edu/weatherheadschoolofmanagement/doctoralprograms/mailto:elaine.iannicelli@case.edu), Department Administrator, at 216.368.4141.

Designing Sustainable Systems

Please refer to the Doctor of Management (p. 948) section of the Bulletin for more information on the PhD in Management: Designing Sustainable Systems.

Information Systems (IS)

The IS Department is a center for learning about the ways in which information is generated and used in organizations. The department believes that a broad, theoretical study of information that includes human, social, and technical aspects will best enable people in organizations to achieve their operational and strategic missions. Design is a central theme of the work in IS because it connotes the critical evaluation of existing practice, the creation of better alternatives, and the changes needed to make new ideas a reality. Some design issues of special importance to the department include information systems that amplify human and organizational intelligence, that enable new forms of knowledge work, and that expand the capability of teams.

The IS faculty ask fundamental questions about how information shapes our social and economic environment. The faculty cares about the design and use of technology and about information as a uniquely human accomplishment. The faculty believes that information systems are an essential driver in creating a better world, and are committed to making that better world happen.

A management discipline engaged in design- and information-based inquiry, IS is influenced by a broad set of concepts from the humanities, social sciences, and engineering. The department studies and designs information-rich socio-technical systems that satisfy human and social needs. The department seeks intellectually curious students whose research interests intersect with the department’s and who possess a solid background in IS or computer science; industrial, service, or interaction design; or related academic areas. Doctoral study of IS at Weatherhead attracts rigorous lateral thinkers who want to shape their environments and build a strong scholarly track record in the Manage by Designing arena.

The PhD program prepares students for a career in research and teaching, primarily in academic institutions. Students work with faculty from IS and other areas of the school and university to tailor the program to their specific interests and previous study, and develop the skills to become competent researchers in their chosen areas of specialization. IS provides a hands-on education, broad exposure to technique, close association with industry, and intensive workshops with senior faculty. The department unites qualitative and quantitative approaches in order for doctoral candidates to derive better practice from theory and better theory from practice.

Weatherhead approaches IS as a global phenomenon and believe that international collaboration is a necessity. The faculty is well known internationally with substantial experience as visiting scholars or consultants in India, Sweden, the United Kingdom, Canada, Finland, Hong Kong, and Denmark.

The PhD program consists of coursework in three areas and a dissertation. Coursework in the following areas is required: management research and methods, IS research, and a specialized area of study. Following the completion of all required coursework, students take a comprehensive qualifying examination, generally during the second Summer Semester or early in the Fall Semester of the third year.

Upon successful completion of the comprehensive qualifying examination, the student is admitted to candidacy and formally begins the dissertation phase of the program. The dissertation proposal and the dissertation itself are generally completed in one and a half to two years. Students making normal progress should expect to finish all degree requirements within four years. Students must remain in residence throughout the coursework portion of the program, and the faculty strongly discourages any student from relocating prior to completion of the dissertation as doing so dramatically reduces the likelihood of completing the degree.

For more information, contact Gail Stringer (http://bulletin.case.edu/weatherheadschoolofmanagement/doctoralprograms/mailto:gailstringer@case.edu), Department Administrator, at 216.368.5326.

Labor and Human Resource Policy

A specialization in labor and human resource policy involves inquiry into the employment relationship and effective use of human assists at the level of work groups, organizations, markets, and societies.

For more information, contact Radhika Easwaran (http://bulletin.case.edu/weatherheadschoolofmanagement/doctoralprograms/mailto:radhika.easwaran@case.edu), Department Administrator, at 216.368.2144.

Marketing

Marketing is fundamentally an organizing logic for creating, communicating, and delivering value to customers. The marketing faculty’s research is primarily around themes of value creation and customer relationship management that address managerially relevant problems in a socially networked service economy. Working closely with faculty, PhD students in marketing develop a plan of study that is tailored to their goals within a structured program. Students build skills for high quality, theory-driven scholarship including rigorous empirical work that influences academics, practitioners, and policy makers. The program emphasizes outcomes and expects doctoral students to develop research papers of publishable quality during each year of the program.

Curriculum

The coursework usually spans five semesters. Students normally carry three courses per semester. Except in extraordinary circumstances, students will only be permitted to commence their programs in the Fall Semester. Following completion of all required course work, students will take a comprehensive qualifying examination. Students in good standing will usually sit for the qualifying exam by the end of the second year or early in the third year of their program, thereby completing all course requirements, except the dissertation proposal and dissertation, in about three years.

Upon successful completion of the comprehensive qualifying examination, the PhD student is admitted to candidacy and formally begins the dissertation phase of the program. Students are required to enroll in a minimum of 18 credit hours of dissertation research while the
dissertation is in progress. The minimum number of total credit hours (dissertation and course credits) is 57. Students are required to complete both their course work and dissertation at the Case Western Reserve campus.

Student Profile
Typical doctoral students have strong quantitative skills, a master’s degree with more than two years’ work experience, and a GMAT score over 650. Student dissertation topics include market-driven innovations, relationship marketing, sales management, service marketing, marketing strategy, frontline marketing, and marketing value chains, among others.

Interested students are encouraged to visit our website (http://weatherhead.case.edu/departments/marketing) and to contact individual faculty to explore mutual interests.

For more information, contact Tedda Nathan (http://bulletin.case.edu/weatherheadschooolofmanagement/doctoralprograms/mailto:tedda.nathan@case.edu), Department Administrator, at 216.368.2144.

PhD in Operations
The intrinsic complexity of supply chain organizations and the coordination of operational and financial decisions throughout the supply chain are at the heart of the PhD in operations research. Weatherhead’s Operations Department has a rich history as a center of education and scholarship—it was here that the world’s first doctorate in operations research was granted. Candidates learn a unique combination of mathematics, statistics, and computer modeling to assist in decision-making for complex organizational problems.

Please note that the Operations Department is not accepting new PhD candidates for academic year 2012-2013. For more information, contact Radhika Easwaran (http://bulletin.case.edu/weatherheadschooolofmanagement/doctoralprograms/mailto:radhika.easwaran@case.edu), Department Administrator, at 216.368.2144.

PhD in Organizational Behavior
Weatherhead’s doctoral program in organizational behavior was the first of its kind. Created in 1964, it continues to set the standard for universities worldwide in this discipline. United by a passion for generating new knowledge of enduring consequence through scholarly inquiry, writing, and research, and deeply reflective practice, doctoral candidates study in a department that the Financial Times ranked among the three best in the world.

Recipients of the PhD in organizational behavior have taken positions throughout the globe in leading business schools, think tanks, and research-oriented nongovernmental organizations, including such prestigious organizations as the London School of Business, Columbia University, Stanford University, the Naval Postgraduate School, Notre Dame University, the World Bank, and the White House.

Organizational behavior is a vital and growing field of knowledge that is concerned with relational and developmental processes across levels of analysis, ranging from individuals and groups, through organizations and inter-organizational systems, to societal change and development. The academic roots of the field span the disciplines of individual and social psychology, sociology, anthropology, political science, and social philosophy. Organizational behavior situates the knowledge and tools of those disciplines in the context of the human dimensions of organizational life.

We approach the study of organizational behavior from the perspectives of human diversity and possibility, with a special concern for the dynamics and processes of adult development and for creating new knowledge and methods for individual, group, and organizational processes of learning, innovation, performance, and transformation.

Educational Goals
• Obtain a doctoral-level foundation in academic areas pertinent to organizational behavior, from the micro to the macro. This interdisciplinary course of study covers key social science domains including developmental psychology, sociology, learning theory, group dynamics, organization theory, living systems theory, and the organizational dimensions of global change.
• Master and blend qualitative, quantitative, and action-research methodologies in the quest for comprehensive and penetrating understanding
• Develop a high level of professional creativity, interpersonal competence, and a foundation of professional values enabling the pursuit of research and action in the field, including the facilitation and design of contexts for human development and self-reflective learning, organization development, and larger-system transformative change

Curriculum
The doctoral program is structured to align with the department’s mission of developing world-class researchers interested in doing high-quality work of enduring consequence. Hence, course requirements encourage continual development of reading, writing, relational, and research skills to help students effectively explore and seamlessly communicate their ideas.

Sample Course Schedule

<table>
<thead>
<tr>
<th>First Year</th>
<th>Units Fall</th>
<th>Units Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>ORBH Dynamic Modules (3 each semester)</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>ORBH Dynamic Modules (3 each semester)</td>
<td>3</td>
<td></td>
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<tr>
<td>Research Methods I (ORBH 560)</td>
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<tr>
<td>Organizational Behavior Department Seminar (ORBH 510)</td>
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<tr>
<td>ORBH Dynamic Modules (3 each semester)</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Statistics I</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Organizational Behavior Department Seminar (ORBH 510)</td>
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<td></td>
</tr>
<tr>
<td>ORBH Dynamic Modules (3 each semester)</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Statistics II</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Elective (recommended)</td>
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<tr>
<td>Year Total:</td>
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<td>12</td>
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</table>

<table>
<thead>
<tr>
<th>Second Year</th>
<th>Units Fall</th>
<th>Units Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>ORBH Dynamic Modules (3 each semester)</td>
<td>3</td>
<td></td>
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<tr>
<td>ORBH Dynamic Modules (3 each semester)</td>
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<tr>
<td>ORBH Dynamic Modules (3 each semester)</td>
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</tr>
<tr>
<td>Elective (recommended)</td>
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<td></td>
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<tr>
<td>Organizational Behavior Department Seminar (ORBH 510)</td>
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<td></td>
</tr>
<tr>
<td>ORBH Dynamic Modules (3 each semester)</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Statistics Multivariate Analysis</td>
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<tr>
<td>Year Total:</td>
<td>12</td>
<td>12</td>
</tr>
</tbody>
</table>

Total Units in Sequence: 48

The program is designed for full-time, year-round engagement for four years. Although some students choose not to maintain local residence in
latter stages of the dissertation and to complete it more slowly, the PhD in organizational behavior is designed and supported as a four-and-a-half to five-year journey.

For the first two years, in addition to the methods courses and departmental "modules" (worth one credit hour each), there is a weekly Organizational Behavior Department Seminar designed to create and sustain an appreciative, intellectually nourishing learning space for the organizational behavior community. The Organizational Behavior Department Seminar is organized and managed by the first- and second-year PhD students in close relationship with the course instructors, and is required for both the first- and second-year cohort groups. Seminar sessions alternate between first- and second-year student meetings and gatherings of the organizational behavior community of students and faculty from within and outside the department. The seminar provides a forum for sharing the ongoing research and scholarship of the department through preparation and presentation of Integrative Scholarship Papers, Qualifying Papers, dissertation proposals, and dissertation defenses. It is also a platform for developing productive and collaborative research relationships and for increasing collective knowledge of the current state of the art in organizational behavior and related fields.

Research Requirements and Deliverables
The first two years of the PhD are devoted to coursework. This provides a strong theoretical foundation for conducting research throughout the remainder of the program.

Integrative Scholarship Paper
At the end of the first year, each doctoral student is required to have completed an Integrative Scholarship Paper. This is a critical review and integration of the literature about a topic or problem of interest. It can be thought of as a report on the current state of the scholarly conversation about the topic, encompassing historical perspectives on the evolution of the scholarly conversation to date, an examination of how the topic is approached by different disciplines or schools of thought, theoretical propositions, and suggestions for future research. Students are expected to work with a faculty advisor with support from other faculty and doctoral students to submit their Integrative Scholarship Papers for journal publication during the second year of the doctoral program.

Qualifying Paper
By the conclusion of their second year or the beginning of their third year in the doctoral program, students complete a Qualifying Paper. Generally, this is an initial empirical investigation or meta-analysis of a topic of choice. The student is expected to form a committee, headed by a faculty advisor of the student’s own choosing, and two other departmental faculty members who guide the research. Often understood as a "mini-thesis," the student is expected to produce an in-depth analysis of the research question explored through a relevant method of inquiry. Students are expected to submit their Qualifying Papers for journal publication during the third year of the doctoral program.

Dissertation
Doctoral students undertake dissertation research during their third and fourth years in the program. Each student forms a committee consisting of three departmental faculty members (one of whom will be the committee chair) and one faculty member from outside the department, but within the university, to guide the research conducted. An original and significant endeavor, the dissertation includes a detailed review of the chosen topic, relevant research questions, methods of inquiry used, findings obtained, and an analysis of their implications.

Though all three deliverables (the Integrative Scholarship Paper, Qualifying Paper, and dissertation) may optimally flow within a single stream of inquiry, the student is free to choose a different topic of interest for each.

For more information, contact Lila Robinson (http://bulletin.case.edu/weatherheadschoolofmanagement/doctoralprograms/mailto:lila.robinson@case.edu), Department Administrator, at 216.368.2055.
Dual Degree Programs

MBA/Juris Doctor (JD) Dual-Degree Program

Weatherhead has a formal full-time dual-degree program with the School of Law. Students enrolled in the program who fulfill the requirements set for graduation by both schools will receive both a JD and an MBA degree. The MBA/JD dual-degree program is designed for individuals who want to specialize in the legal, contractual, and governmental aspects of management. After completion of both degree programs, two separate diplomas are awarded. Coursework for both programs must be completed within six years of the date of initial enrollment in either program.

To learn more, contact Weatherhead at 216.368.2030 or bizadmission@case.edu, or the School of Law at 216.368.3600 or msadmit@case.edu.

MBA/MD Dual-Degree Program

The School of Medicine and Weatherhead collaborate to offer the dual MBA/MD degree program. The MBA/MD provides physicians with the management knowledge and skills necessary to deal with rapid changes in the healthcare industry and the economy. Students are expected to take one full year of study in one program followed by one full year of study in the other. The completion of the remaining MBA credit requirements will be determined in partnership with the student’s society dean and the Full-Time MBA Program Director. Throughout the dual-degree program, MBA/MD students continue to register in the first school they attended. After completion of both degree programs, two separate diplomas are awarded. Coursework for both programs must be completed within six years of the date of initial enrollment in either program.

To learn more, contact Weatherhead at 216.368.2030 or bizadmission@case.edu, or the School of Medicine at 216.368.3450 or msadmit@case.edu.

MBA/Master of Global Management (MGM) Dual-Degree Program

Weatherhead and the American Graduate School of International Management (the Thunderbird School) jointly offer a graduate-level program in both management and international studies. Prospective students who are interested in applying to the dual MBA/MGM program offered by Weatherhead and the Thunderbird School should apply separately to each school. (Applicants to Weatherhead should indicate their interest in the MBA/MGM in the appropriate area under “Intended Program” at the bottom of the first page of the Weatherhead MBA application.) The admissions committees of each institution will maintain independent control over their admissions criteria and procedures. Students must be admitted separately to each of the programs. Admission to one school does not guarantee admission to the other.

To learn more, contact Weatherhead at 216.368.2030 or bizadmission@case.edu, and contact Thunderbird at 602.978.7131 or admissions@t-bird.edu (http://bulletin.case.edu/weatherheadschoolofmanagement/dualequals/mailto:admissions@t-bird.edu).

Master of Science in Social Administration (MSSA)/MBA Dual-Degree Program

The MSSA/MBA joint program is offered in partnership with the Mandel School of Applied Social Sciences (MSASS) and Weatherhead. The MSSA/MBA is designed for candidates who wish to prepare for advanced social work practice in a variety of direct practice and community and social development settings, while developing the skills to assume management responsibility within those settings. Candidates must apply separately to each program.

To learn more, contact Weatherhead at 216.368.2030 or bizadmission@case.edu, or MSASS at 216.368.2280 or msassadmit@case.edu.

MBA/Master in Public Health (MPH) Dual-Degree Program

The dual MBA/MPH degree was developed by the School of Medicine, the School of Graduate Studies and Weatherhead to provide the skills and knowledge necessary for those who wish to attain the following goals:

- A career working with communities to improve the health of their members by identifying and assessing the health needs of the population and planning and implementing programs to meet those needs
- Management and leadership ability to ensure continued economic viability, human development, and effective communication for the public health organization and community in which they practice

MBA/MPH candidates must complete separate applications, participate in the required admission tests, and be admitted separately to each program. Students will continue to register throughout the program in the school where they first registered.

To learn more, contact Weatherhead at 216.368.2030 or bizadmission@case.edu, or the School of Medicine at 216.368.3725 or info@casemph.org (http://bulletin.case.edu/weatherheadschoolofmanagement/dualequals/mailto:info@casemph.org).

Weatherhead MSM-Finance and Tongji University MBA Double-Degree Program

Weatherhead and the School of Economics and Management at Tongji University (SEM-Tongji) have jointly developed a double-degree program. This is the first master’s degree in finance offered by a world-class U.S. university in mainland China. This innovative program, taught in Shanghai and Cleveland, provides students with both broad general management skills and depth of knowledge in finance. Graduates come away with a global way of thinking and the latest insights on the Asian financial market.

Upon graduation from the program, students will obtain both the MSM-Finance degree from Weatherhead and the MBA degree from SEM-Tongji. Students take 10 SEM-Tongji MBA courses and 13 Weatherhead MSM-Finance courses.

Program Features

- Obtain the first MSM-Finance degree offered from a highly ranked U.S. university in mainland China
- Gain cutting-edge knowledge and skills in global finance
- Take advantage of the opportunity to prepare for CFA, FRM, and other certifications
- Specialize in corporate finance, risk management, and capital markets
- Network with financial sector players in the U.S.; intern in Shanghai’s Lujiazui/Pudong international finance and trade area
To learn more, contact Yuan Wu (http://bulletin.case.edu/weatherheadschoolormanagement/dualdegrees/mailto:yuan.wu@case.edu) at 216.368.2077.
Honors and Awards

Graduate Student Leadership Awards

All Weatherhead graduate students, faculty, and staff may nominate graduating students for the student awards. Finalists are chosen from among the nominees, and recipients are elected by graduating students.

The **Rita Kicher Award** is presented to a graduating part-time student at Weatherhead. The award recipient is recognized as an outstanding colleague in Cleveland’s professional community by his or her peers and supervisors, is an active member of community nonprofit organizations, contributes to one or more professional societies or organizations, demonstrates leadership qualities, and promotes Weatherhead in a positive way.

The **Scott S. Cowen Student Leadership Award** is presented to a Weatherhead graduate student who serves as a leader and role model for all students. The recipient promotes the Weatherhead image in a positive way, contributes to the total community, and stimulates the classroom experience.

The **Student Life Award** is presented to a Weatherhead graduate student who actively participates in and supports Weatherhead student activities and events; encourages and supports student participation in student life activities; and creates, revitalizes, or provides added value to Weatherhead student organizations, activities, or programs.

The **Theodore M. Alfred Distinguished Service Award** is presented to a Weatherhead graduate student who participates in community service inside and outside of Weatherhead, brings community service opportunities to Weatherhead, and promotes external service opportunities.

Awards presented independent of nominations are:

- The Dean’s Academic Achievement Award to those students attaining the highest GPA in their respective programs

- Beta Gamma Sigma - Master’s students graduating in the Spring, who are in the top 20 percent of their graduating class (Summer, Fall and Spring graduates), are invited to join the semester they complete their program. Master’s students graduating in the Summer and Fall, who are in the top 20 percent of their graduating class (Summer, Fall and Spring graduates), are invited to join the Spring semester following completion of their program. Doctoral students graduating in the Spring are invited to join the semester they complete their program. Doctoral students graduating in the Summer and Fall are invited to join the Spring semester following completion of their program.
Master of Business Administration (MBA)

Full-Time MBA

The Full-Time MBA is a four-semester, 69-credit program. The Weatherhead experience starts where many MBA programs end up: in conversation with top executives. Weatherhead’s first-year Management Perspectives and Dialogues course brings business leaders into the classroom, where they work on real management issues with the help of students. Students also complete a leadership development course that puts them in touch with their strengths and identifies areas that can be improved through a personal learning and career plan. And during their second year, candidates are immersed in studio-based design or sustainability courses; the MBA Institute in Sustainable Value was touted in Forbes as one of the 10 most innovative business school courses, while Businessweek named the Weatherhead School of Management MBA as one of the 30 best design programs in the world.

Electives

The second year of the program allows students to customize their academic program by selecting eight electives.

Independent Study

MBA students are limited to six credit hours of elective credit as independent study. Any student wishing to take more than six credit hours of independent study must petition the Faculty Director of the Full-Time MBA.

Other courses at the university may be eligible for MBA elective credit. Contact the Faculty Director of the Full-Time MBA for additional information.

Curriculum

All of the core courses in the following tables are required.

<table>
<thead>
<tr>
<th>First Year</th>
<th>Units</th>
<th>Fall</th>
<th>Spring</th>
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</thead>
<tbody>
<tr>
<td>Financial Accounting (MBAC 502)</td>
<td>3</td>
<td></td>
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<tr>
<td>Corporate Finance I (MBAC 504)</td>
<td>3</td>
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<tr>
<td>Leadership Assessment and Development (MBAC 509)</td>
<td>3</td>
<td></td>
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<tr>
<td>Statistics and Decision Modeling (MBAC 511)</td>
<td>3</td>
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<td>Economics (MBAC 512)</td>
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<td>Management Perspectives and Dialogues (MBAC 517A)</td>
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<td>Managerial Accounting (MBAC 503)</td>
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<tr>
<td>Corporate Finance II (MBAC 505)</td>
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<tr>
<td>Marketing and Supply Chain Management (MBAC 506)</td>
<td>3</td>
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<tr>
<td>Operations and Supply Chain Management (MBAC 507)</td>
<td>3</td>
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<tr>
<td>Strategic Issues and Applications (MBAC 508)</td>
<td>3</td>
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<tr>
<td>Managing People and Organizations (MBAC 510)</td>
<td>3</td>
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<tr>
<td>Management Perspectives and Dialogues (MBAC 517B)</td>
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<tr>
<td>MBA Institute in Sustainable Value and Social Entrepreneurship I (ORBH 430A) or Design in Management: Concept and Practices (MIDS 420A)</td>
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<tr>
<td>Electives</td>
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<tr>
<td>MBA Practicum in Sustainable Value and Social Entrepreneurship II (ORBH 430B) or Design in Management: Concept and Practices (MIDS 420B)</td>
<td>3</td>
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</tr>
</tbody>
</table>

| Electives | 12 |
| Leadership Assessment and Development II (MGMT 440) | 0 |
| Year Total: | 15 | 15 |

Total Units in Sequence: 69

Either the year-long course Design in Management: Concept & Practices or the year-long course MBA Institute in Sustainable Value and Social Entrepreneurship is required. Students must take both semesters of either Design in Management: Concept & Practices or MBA Institute in Sustainable Value and Social Entrepreneurship. Students may take both semesters of both courses, but they may not change courses mid-year, taking Design in Management: Concept & Practices in the fall followed by MBA Institute in Sustainable Value and Social Entrepreneurship in the spring, for example.

Cleveland Clinic Health Management Scholars Program

Cleveland Clinic has joined forces with Weatherhead to create the Health Management Scholars Program. This innovative partnership gives four students the unique opportunity to participate in Weatherhead’s Full-Time MBA program and in a specialized Experiential Learning assignment at the Cleveland Clinic. Qualifying scholars will also receive the following benefits:

• Partial tuition scholarship
• Prestigious paid summer internships at Cleveland Clinic

For additional information about this program, contact Deborah Bibb (http://bulletin.case.edu/weatherheadschoolofmanagement/mbaprograms/mailto:deborah.bibb@case.edu), Senior Director of Admissions, at 216.368.6702.

Part-Time MBA

The Weatherhead Part-Time MBA is a 48-credit-hour, three-year cohort-based program that combines a core of fundamental business classes with elective options to create an integrated experience focused on honing general management skills. Students develop a personalized learning plan through the MBAP 401 Leadership Assessment and Development (LEAD) course.

A Leadership Speaker Series provides an opportunity to hear from a variety of executives who bring current business experience to the classroom. Classes meet one evening a week and one Saturday a month in the Fall and Spring Semesters. Summer Semesters may include more intensive formats.

The Part-Time MBA program also features cutting-edge classes in applying design ideas to management issues and in understanding sustainable business practices. These classes will help students break from the norm of viewing every challenge through the standard spreadsheet-based prisms common to so many MBA programs.

The first Summer Semester begins with the intensive offering of LEAD and moves through the rest of the core offerings within the first two years of the program. The majority of the third year is devoted to electives.

Curriculum

<table>
<thead>
<tr>
<th>First Year</th>
<th>Units</th>
<th>Fall</th>
<th>Summer</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leadership Assessment and Development (MBAP 401)</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Accounting for Decision Making (MBAP 402)</td>
<td>3</td>
<td></td>
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</tr>
</tbody>
</table>
Curriculum

Students attracted to the Weatherhead EMBA aspire to senior leadership roles within organizations. The curriculum opens horizons, fusing that aspiration with Weatherhead’s expertise in turning good leaders into great ones. At every stage in the program, students build their knowledge of how business works while strengthening their personal leadership capacity. Each course is taught in the format that best facilitates learning its content. For instance, each of the four levels of leadership (individual, team, organization, and society) is explored in a one-week immersive format, while some quantitative courses extend over two semesters.

requiring only 12 total residencies on campus, the 57-credit-hour Weatherhead EMBA program is designed to be manageable for busy executives, allowing students from around the world to participate in a one-of-a-kind leadership program. The curriculum is delivered over five semesters, or 21 months. Both Fall and Spring Semesters are comprised of a one-week immersion and two 3-day residencies. The Summer Semester is delivered abroad through the EMBA 475 International Tour. The EMBA requires a serious time commitment from each participant. Although individual study habits vary, students should anticipate devoting a minimum of 20 hours per week to study outside of classes.

The Weatherhead EMBA is a lock-step cohort program. Participants self-select learning teams which represent essential study partnerships over the course of the program as well as invaluable resources for networking and organizational support. Learning teams meet weekly outside of the classroom, either face-to-face or remotely, to achieve course objectives and enhance the learning experience. In addition, faculty often host optional study and review sessions, which are also recorded for virtual access.

Executive MBA (EMBA)

For candidates with 10 years of experience and the endorsement of their organization, the Executive MBA (EMBA) is tailored to those poised to move into a more prominent leadership role. Indeed, the Organizational Behavior Department (which the Financial Times named as one of the three best worldwide) structured the EMBA around an exploration of the four levels of leadership, amplifying students’ ability to effect change at the personal, team, organization, and societal levels. The program is based around periodic residencies in the company of intimate cohort groups.

Open Electives

Students in the Part-Time MBA program have the opportunity to choose four electives. Students determine their own focus areas and, with the help of our Career Management Office, learn how to best position themselves for post-MBA career advancement.

Non-cohort Students

Non-cohort part-time students are those who entered the Part-Time MBA program in Fall Semester 2009 or prior, transferred in during Summer Semester 2010 or prior, or transitioned from non-degree to degree-seeking status prior to Fall Semester 2010. Non-cohort students must complete 48 credit hours, consisting of 10 core required courses and 6 electives. The 48 hours must be completed within six years of starting the program.

For additional information about this program, contact Tony Lingham (http://bulletin.case.edu/weatherheadschoolofmanagement/mbaprograms/mailto:tony.lingham@case.edu), Faculty Director of the Part-Time MBA, at 216.368.2138.

Wealth climate EMBA program is designed to be manageable for busy executives, allowing students from around the world to participate in a one-of-a-kind leadership program. The curriculum is delivered over five semesters, or 21 months. Both Fall and Spring Semesters are comprised of a one-week immersion and two 3-day residencies. The Summer Semester is delivered abroad through the EMBA 475 International Tour. The EMBA requires a serious time commitment from each participant. Although individual study habits vary, students should anticipate devoting a minimum of 20 hours per week to study outside of classes.

The Weatherhead EMBA is a lock-step cohort program. Participants self-select learning teams which represent essential study partnerships over the course of the program as well as invaluable resources for networking and organizational support. Learning teams meet weekly outside of the classroom, either face-to-face or remotely, to achieve course objectives and enhance the learning experience. In addition, faculty often host optional study and review sessions, which are also recorded for virtual access.

### First Year

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<thead>
<tr>
<th>Course (EMBA 441A)</th>
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<td>Leading Change: Self</td>
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<tr>
<td>Business Model Design (EMBA 451)</td>
<td>3</td>
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<td>Accounting for Business Executives (EMBA 436)</td>
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<td>Managerial Marketing (EMBA 450)</td>
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<td>Economic Analysis for Managers (EMBA 437)</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Expanding Boundaries (EMBA 445)</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Business Statistics and Quantitative Analysis (EMBA 438B)</td>
<td>1.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corporate Finance (EMBA 439)</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leading Change: Teams (EMBA 473)</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>International Tour (EMBA 475)</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Year Total:</td>
<td>12.5</td>
<td>14.5</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

### Second Year

<table>
<thead>
<tr>
<th>Course (EMBA 442)</th>
<th>Units</th>
<th>Fall</th>
<th>Spring</th>
<th>Summer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Innovation (EMBA 442)</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corporate Governance (EMBA 476)</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leading Change: Society (EMBA 479)</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leading Design in Organizations (EMBA 478B)</td>
<td>1.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contemporary Issues in Management (EMBA 449)</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Third Year

<p>| Course (EMBA 410) | Units | Summer | Fall | Spring | |
|-------------------|-------|--------|------|--------| |
| Strategic Issues and Applications | 3 | | | |
| Identifying Design Opportunities (EMBA 411) | 3 | | | |
| Dialogues in Leadership (MBAP 412A) | 1.5 | | | |
| Elective Option | 3 | | | |
| Dialogues in Leadership (MBAP 412B) | 1.5 | | | |
| Elective Option | 3 | | | |
| Elective Option | 3 | | | |
| Year Total: | 3 | 7.5 | 7.5 | |</p>
<table>
<thead>
<tr>
<th>Total Units in Sequence</th>
<th>57</th>
</tr>
</thead>
</table>

For more information, contact Michelle Wilson ([http://bulletin.case.edu/weatherheadschoolofmanagement/mbaprogam/mailto:michelle.j.wilson@case.edu](http://bulletin.case.edu/weatherheadschoolofmanagement/mbaprogam/mailto:michelle.j.wilson@case.edu)), Program Manager of the EMBA, at 216.368.6411.
Master's Programs

Master of Accountancy (MAcc)
The MAcc program at Weatherhead is designed for individuals who seek to obtain an advanced degree which builds upon the skills and knowledge acquired in an undergraduate degree in accountancy. The program is fully accredited and provides professional education by very highly qualified faculty members. In an increasingly competitive business environment, the MAcc program provides students with an important foundation for long-term success and sets graduates apart from their colleagues.

Undergraduate accounting students at Case Western Reserve are strongly advised to enter and complete the MAcc program in their fifth year. University policies permit such students an opportunity to complete their master's degree in 30 credit hours, rather than 36, if course selection is properly planned. Also, certain highly qualified students in accounting may be eligible to accelerate their completion of the Bachelor of Science (BS) in Accounting and the MAcc through an Integrated Study (p. 970) program. This program allows such students to enroll as both an undergraduate and a graduate student during the senior year. Because of the necessity for proper planning of course work and programs, undergraduate students are strongly encouraged to begin planning early and apply for the MAcc in the junior year.

Most candidates for the MAcc program have an academic background in accountancy, but this is not required for admission. If not completed during a candidate's undergraduate coursework, an admitted student must complete specific accounting and general business coursework before or during the MAcc program.

Prerequisites
Because the program builds upon skills and knowledge developed in an undergraduate accountancy program, all admitted candidates must complete certain prerequisite courses in accounting and business before or during the MAcc program. Prerequisites include:

- An undergraduate degree from an accredited institution or the equivalent. Please note that an undergraduate degree in accountancy is not required.
- A grade of B or better in prerequisite business and accounting courses completed at an accredited four-year educational institution or the equivalent. Prerequisites may be completed before or during the MAcc program.

General Business Prerequisites
- Corporate Finance
- U.S. Business Law
- Operations Management
- Marketing
- Principles of Economics (Micro and Macro)
- Statistics

Accountancy Prerequisites
- Principles I and II (must include a semester of managerial accounting)
- Intermediate Financial Reporting I and II
- Advanced Financial Reporting
- Auditing
- U.S. Taxation

Curriculum
The 36-credit-hour MAcc program offers the flexibility of beginning in the Fall or Spring Semester. Upon completion of the program, graduates will have satisfied all educational requirements to sit for the CPA examination in the state of Ohio.

Core Courses
These courses build a foundation for the program.

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACCT 405</td>
<td>Advanced Federal Taxes</td>
<td>3</td>
</tr>
<tr>
<td>ACCT 406</td>
<td>Accounting Information Systems</td>
<td>3</td>
</tr>
<tr>
<td>ACCT 431</td>
<td>Tax Practice: Analysis, Planning and Communications</td>
<td>3</td>
</tr>
<tr>
<td>ACCT 444</td>
<td>Advanced Auditing Theory and Practice</td>
<td>3</td>
</tr>
<tr>
<td>ACCT 520</td>
<td>Advanced Accounting Theory</td>
<td>3</td>
</tr>
<tr>
<td>ACCT 540</td>
<td>Contemporary Accountancy Policy</td>
<td>3</td>
</tr>
<tr>
<td>Total Units</td>
<td></td>
<td>18</td>
</tr>
</tbody>
</table>

Concentration Courses
Students must complete a concentration in either Financial Reporting and Attestation Services or U.S. Taxation by completing six credit hours in the selected area.

Financial Reporting and Attestation Services Concentration

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACCT 414</td>
<td>Corporate Reporting and Analysis</td>
<td>3</td>
</tr>
<tr>
<td>ACCT 418</td>
<td>Fraud, Governance and Reporting</td>
<td>3</td>
</tr>
<tr>
<td>Total Units</td>
<td></td>
<td>6</td>
</tr>
</tbody>
</table>

U.S. Taxation Concentration

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACCT 437</td>
<td>Principles of Personal Financial Planning and Taxation</td>
<td>3</td>
</tr>
<tr>
<td>ACCT 480</td>
<td>International Tax</td>
<td>3</td>
</tr>
<tr>
<td>Total Units</td>
<td></td>
<td>6</td>
</tr>
</tbody>
</table>

Supporting Electives
In consultation with the graduate program advisor, MAcc students select four electives (12 credit hours) in areas that complement a professional accountancy career. As an option to fulfill a portion of the supporting elective courses, students are encouraged to consider completing a second accounting concentration. Supporting elective courses must be selected from graduate management courses other than MBA core courses and prerequisite-level courses.

Total: 36 credit hours

For more information about the MAcc, contact Tiffany Welch (http://bulletin.case.edu/weatherheadschoolofmanagement/masterprograms/mailto:tiffany.welch@case.edu), Assistant Dean of Curriculum and Administration, at 216.368.2058.

Master of Science in Management-Finance (MSM-Finance)
The Master of Science in Management-Finance (MSM-Finance) degree is an intensive program designed to equip students to meet the needs of financial-sector companies in today’s intense and competitive business climate. Upon completion of the program, students will be prepared to pursue a number of exciting career opportunities in the fields of investment banking, private equity, corporate finance, risk management, commercial banking, investment management, corporate development, and financial advising.

Weatherhead’s distinctive program prepares students to make immediate and skilled contributions to corporate finance, financial modeling, valuation, derivatives, risk management, and financial econometrics. Candidates learn from and work directly with A-list
faculty whose hands-on involvement with students is a point of pride at Weatherhead; meanwhile, Weatherhead’s Cleveland location is home to the Federal Reserve Bank of Cleveland and to a number of corporate headquarters. The program can be completed in 15 months, and internship opportunities are available on a competitive basis.

Upon completion of the MSM-Finance program, students will:

- Be prepared to add expected and immediate industry value
- Speak and understand the languages of business
- Have a working knowledge of focused financial theory
- Have a network of regional, national, and international business contacts

Curriculum

The 39-credit-hour MSM-Finance program is a three-semester, full-time curriculum beginning in the Fall Semester.

The curriculum is comprised of the following four components:

Finance Core

The Finance Core provides students with advanced tools and techniques to serve as a strong foundation for a career in finance.

<table>
<thead>
<tr>
<th>Course</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSFI 403</td>
<td>3</td>
</tr>
<tr>
<td>MSFI 404</td>
<td>3</td>
</tr>
<tr>
<td>MSFI 421</td>
<td>3</td>
</tr>
<tr>
<td>MSFI 429</td>
<td>3</td>
</tr>
<tr>
<td>MSFI 430</td>
<td>3</td>
</tr>
<tr>
<td>MSFI 434</td>
<td>3</td>
</tr>
<tr>
<td>MSFI 435</td>
<td>3</td>
</tr>
<tr>
<td>MSFI 436A</td>
<td>1.5</td>
</tr>
<tr>
<td>MSFI 436B</td>
<td>1.5</td>
</tr>
<tr>
<td>Total Units</td>
<td>24</td>
</tr>
</tbody>
</table>

Specialty Core

In the Specialty Core, students have the opportunity to choose courses to build expertise in a particular area of interest. Students choose three of the following four courses:

<table>
<thead>
<tr>
<th>Course</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSFI 428 Financial Strategy</td>
<td>3</td>
</tr>
<tr>
<td>MSFI 431 Fixed Income Markets</td>
<td>3</td>
</tr>
<tr>
<td>MSFI 432 Corporate Risk</td>
<td>3</td>
</tr>
<tr>
<td>MSFI 440 Advanced Corporate</td>
<td>3</td>
</tr>
<tr>
<td>Total: 9 credit hours</td>
<td></td>
</tr>
</tbody>
</table>

Electives

Students can choose one of the following courses to fulfill the elective requirement of their curriculum plan, or they make take any other elective with permission from the program’s faculty director.

<table>
<thead>
<tr>
<th>Course</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>BAFI 420 Health Finance</td>
<td>3</td>
</tr>
<tr>
<td>BAFI 444 Entrepreneurial Finance</td>
<td>3</td>
</tr>
<tr>
<td>MSFI 450 Mergers and Acquisitions</td>
<td>3</td>
</tr>
<tr>
<td>BAFI 480 International Financial Management</td>
<td>3</td>
</tr>
<tr>
<td>Total: 3 credit hours</td>
<td></td>
</tr>
</tbody>
</table>

Capstone Course

Students will take one final course at the end of their program to build upon the knowledge of their previous coursework. Capstone experiences include a choice of one of the following:

<table>
<thead>
<tr>
<th>Course</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSFI 490</td>
<td>3</td>
</tr>
<tr>
<td>MSFI 491</td>
<td>3</td>
</tr>
<tr>
<td>Total: 3 credit hours</td>
<td></td>
</tr>
</tbody>
</table>

Total: 3 credit hours

First Year

<table>
<thead>
<tr>
<th>Course</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corporate Finance (MSFI 403)</td>
<td>3</td>
</tr>
<tr>
<td>Financial Modeling (MSFI 404)</td>
<td>3</td>
</tr>
<tr>
<td>Fundamental Analysis of Companies and Industries (MSFI 421)</td>
<td>3</td>
</tr>
<tr>
<td>Derivatives and Risk Management (MSFI 430)</td>
<td>3</td>
</tr>
<tr>
<td>Financial Econometrics (MSFI 434)</td>
<td>3</td>
</tr>
<tr>
<td>Individual, Team and Career Development (MSFI 436A)</td>
<td>1.5</td>
</tr>
<tr>
<td>Investment Management (MSFI 429)</td>
<td>3</td>
</tr>
<tr>
<td>Empirical Finance (MSFI 435)</td>
<td>3</td>
</tr>
<tr>
<td>Individual, Team and Career Development (MSFI 436B)</td>
<td>1.5</td>
</tr>
<tr>
<td>3 courses from the following:</td>
<td></td>
</tr>
<tr>
<td>Financial Strategy and Value Creation (MSFI 428)</td>
<td>Offered in both fall and spring semesters</td>
</tr>
<tr>
<td>Fixed Income Markets and Their Derivatives (MSFI 431)</td>
<td></td>
</tr>
<tr>
<td>Corporate Risk Management (MSFI 432)</td>
<td></td>
</tr>
<tr>
<td>Advanced Corporate Finance (MSFI 440)</td>
<td></td>
</tr>
<tr>
<td>Year Total:</td>
<td>16.5</td>
</tr>
</tbody>
</table>

Second Year

<table>
<thead>
<tr>
<th>Course</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capstone class:</td>
<td>3</td>
</tr>
<tr>
<td>Projects in Corporate Finance (MSFI 490)</td>
<td></td>
</tr>
<tr>
<td>or Projects in Risk Management (MSFI 491)</td>
<td></td>
</tr>
<tr>
<td>1 elective from a large class; examples include: BAFI 420, BAFI 444, MSFI 450, BAFI 480, etc.</td>
<td>3</td>
</tr>
<tr>
<td>Year Total:</td>
<td>6</td>
</tr>
</tbody>
</table>

Total Units in Sequence: 39

Total for degree: 39 credit hours

For more information, contact CNV Krishnan (http://bulletin.case.edu/weatherheadschoolofmanagement/masterprograms/mailto:cnk2@case.edu), PhD, Deborah and David Daberko Faculty Fellow, Associate Professor of Banking and Finance, and Faculty Director of the MSM-Finance program, at 216.368.2116.

Master of Science in Management in Operations Research and Supply Chain Management (MSM-OR/SC)

The MSM-OR/SC degree is designed for individuals with quantitative training who seek to obtain a position in operations management or a management position in manufacturing, service, or consulting firms that are part of sophisticated national or global supply chains. The MSM-OR/SC curriculum provides students with the fundamentals of business as well as depth and focus in the principles and concepts of operations and supply chain management. This unique program produces highly knowledgeable professionals well prepared to make organizations more efficient and competitive.

The MSM-OR/SC degree attracts individuals with a quantitative undergraduate degree who have an interest in gaining expertise in the field of operations research or supply chain management. Typical undergraduate majors include:

- Engineering
- Statistics
- Computer science
- Economics
• Mathematics
• Business

Students beginning this program must have a working knowledge of undergraduate calculus, including differentiation and integration, and one semester of undergraduate linear algebra. Work experience is beneficial but not required for admission; many students pursue the MSM-OR/SC immediately following the completion of their undergraduate degree.

Outcomes

Upon completion of the MSM-OR/SC program, students will:

• Be equipped with analytical and supply chain skills to become an agent of positive change at their organization within the first few years of work
• Speak and understand the languages of business
• Have a working knowledge of all functional areas of an organization and the ability to communicate effectively with colleagues in these areas
• Have a network of regional, national, and international business contacts

Curriculum

The 39-credit-hour MSM-OR/SC is a three-semester, full-time program beginning in the Fall Semester of each year. The curriculum comprises the following three components:

Business Core (9 credit hours)

The Business Core introduces students to business fundamentals and includes a professional development course, a unique feature of the Weatherhead MSM-OR/SC not found in most competitors’ programs.

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSOR 410</td>
<td>Financial Management for Supply Chain</td>
<td>3</td>
</tr>
<tr>
<td>MSOR 419</td>
<td>Market Space Management</td>
<td>3</td>
</tr>
<tr>
<td>MSOR 485A</td>
<td>Individual Development</td>
<td>1.5</td>
</tr>
<tr>
<td>MSOR 485B</td>
<td>Team Development</td>
<td>1.5</td>
</tr>
<tr>
<td></td>
<td><strong>Total Units</strong></td>
<td><strong>9</strong></td>
</tr>
</tbody>
</table>

Operations Research Core (12 credit hours)

The Operations Research Core provides the mathematical, statistical, and computational skills needed by analysts in research and development groups in manufacturing and service companies and consulting firms.

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>OPRE 402</td>
<td>Stochastic Models with Applications</td>
<td>1.5</td>
</tr>
<tr>
<td>OPRE 411</td>
<td>Optimization Modeling</td>
<td>3</td>
</tr>
<tr>
<td>OPRE 432</td>
<td>Computer Simulation</td>
<td>3</td>
</tr>
<tr>
<td>OPRE 433</td>
<td>Probability, Statistics, and Forecasting</td>
<td>3</td>
</tr>
<tr>
<td>OPRE 435B</td>
<td>Integrated Problem Solving in OR and OM</td>
<td>1.5</td>
</tr>
<tr>
<td></td>
<td><strong>Total Units</strong></td>
<td><strong>12</strong></td>
</tr>
</tbody>
</table>

Supply Chain Courses (18 credit hours)

Supply chain courses build upon the business and quantitative foundation to provide advanced knowledge in operations and supply chain management.

Required:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSOR 406</td>
<td>Operations Management for MSM OR</td>
<td>3</td>
</tr>
<tr>
<td>OPMT 420</td>
<td>Six Sigma and Quality Management</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td><strong>Total Units</strong></td>
<td><strong>6</strong></td>
</tr>
</tbody>
</table>

Elective Options:

Students must choose four of the courses below, based on their availability, to fulfill elective requirements for the degree.

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>OPMT 430</td>
<td>Sustainable Operations</td>
<td>3</td>
</tr>
<tr>
<td>OPMT 450</td>
<td>Project Management</td>
<td>3</td>
</tr>
<tr>
<td>OPMT 475</td>
<td>Supply Chain Logistics</td>
<td>3</td>
</tr>
<tr>
<td>OPMT 476</td>
<td>Strategic Sourcing</td>
<td>3</td>
</tr>
<tr>
<td>OPMT 477</td>
<td>Enterprise Resource Planning in the Supply Chain</td>
<td>3</td>
</tr>
</tbody>
</table>

For more information, contact Kamlesh Mathur (http://bulletin.case.edu/weatherheadschoolofmanagement/masterprograms/mailto:kamlesh.mathur@case.edu), PhD, Chair and Professor of Operations and Faculty Director of the MSM-OR/SC, at 216.368.3857.

Master of Science in Positive Organization Development and Change (MPOD)

The Master of Science in Positive Organization Development and Change (MPOD) is a relatively new program created and offered by the Department of Organizational Behavior at the Weatherhead School of Management. It is specifically geared toward the needs of managers and change agents from a wide variety of organizations that face a torrent of continual change, increasing complexity, and growing interconnectedness in multi-cultural contexts, and must respond in ways that will yield economic value while being environmentally sustainable and socially responsible.

Toward these ends, the MPOD program emphasizes strength-based and positive approaches to managing change, designing sustainable institutions, formulating effective strategy, creating high engagement work cultures, leading through Emotional Intelligence, coaching for high performance, and deep personal and professional development. It will be of value to organizations with aspiring managers who wish to:

• Build new capabilities in strategic-level change management for value creation with customers and communities
• Broaden their knowledge of leading-edge theory and practice in Appreciative Inquiry, strength-based human resource development, and positive organizational change research
• Develop the competencies and the Emotional Intelligence to coach and foster leadership skills and personal character in oneself and others
• Form extraordinary teams and Sustainable Enterprises—ones that enable human flourishing, are economically prosperous and ecologically advanced, and unite strengths with aspirations
• Engage in lifelong Experiential Learning to realize, develop, and model themselves as agents for positive change

The MPOD program is grounded in the basic belief that a person can be a powerful instrument for change, and that personal and professional development go hand in hand. The learning experience will involve experiential opportunities for participants to become more self-aware, to practice and experiment with new skills, and to give and receive coaching that can be life-changing.

Curriculum:

The MPOD program is conducted in five 7-day residencies and one 10-day international tour spread over 18 months. The modules are conveniently spaced 10-12 weeks apart—thereby making the program flexible enough to accommodate the busy schedules of leaders, managers, and staff professionals. This design will enable students to attend school without leaving their employment. The intervening periods...
(between program residencies) will involve project and group work, self-study, assignments, reading, and on-line guidance done in collaboration with the faculty at CWRU.

One of the uniquely rewarding aspects of the MPOD program is the 10-day international study tour. Students will travel as a cohort to Katholieke University in Leuven, Belgium, to learn with students from their Certificate of Continuing Education program in Consultancy in Groups and Organizations (CIGO), and to Ashridge University Business School, Berkhamsted, U.K., to study alongside peers in the Ashridge Masters in Organisation Consulting (AMOC) program.

**Major Course Topics:**
- Foundations of Positive Organization Development and Change
- Organization Design for a Knowledge World
- Leadership and Executive Assessment and Development
- Sustainability for Strategic Advantage
- Building the Sustainable Enterprise
- Experiential Learning for Individuals, Teams, and Organizations
- Practicum in Appreciative Inquiry and Positive OD
- Individual Field Project
- Foundations of Strategic Thinking
- The Dynamics of Effective Consulting and Implementation
- Global Citizenship and Multi-Cultural OD: International Study Tour

**International Study Tour**

For more information, please contact Patricia Petty (http://bulletin.case.edu/weatherheadschoolofmanagement/masterprograms/mailto:patricia.petty@case.edu), Program Manager of the MPOD, at 216.368.4642.

**Master of Nonprofit Organizations (MNO)**

This program is not currently accepting new students.

**Master of Engineering and Management (MEM)**

In industry, the work of engineering and business management cannot be done independently. That is why the Case School of Engineering and the Weatherhead School of Management have pooled resources via The Institute for Management and Engineering (TiME) to offer a fully integrated master’s degree that can be completed in three semesters. Graduates of the MEM program possess skills critical to success in a leadership role, require less management training, and contribute effectively to engineering organizations within their first year on the job.

Additional information regarding the MEM program (p. 9) is available in the Case School of Engineering section of the Bulletin.
Policies

Registration and Academic Standards for Graduate Students

Class Attendance

Students are expected to attend all scheduled class meetings for the courses in which they are registered. Students should notify faculty when they are forced to miss a class because of extenuating circumstances. Faculty should report excessive absences to the program's faculty director. Students who are not on the class roster for a course are not permitted to attend the course.

Course Loads

The university requires students to be registered for a minimum of 9 credit hours to maintain full-time student status. Weatherhead requires students to register for and complete courses as specified in their cohort program curriculum plan to continue in their program and maintain any scholarship granted. Failure to adhere to the program curriculum plan may result in separation from the program.

Part-Time MBA cohort students register for between 3 and 7.5 credit hours per semester. Non-cohort part-time students are those who entered the Part-Time MBA program in the 2009 Fall Semester or prior, transferred in during the 2010 Summer Semester or prior, or transitioned from non-degree to degree-seeking status prior to the 2010 Fall Semester. Non-cohort students must complete 48 credit hours, consisting of 10 required courses and 6 electives. The 48 hours must be completed within six years of starting the program.

MNO students are required to follow the completion plan as signed with the program director. All requirements for the MNO degree must be completed within six years from the day of the student’s initial registration.

Course Registration

A student may enroll during each registration period through the last day of late registration, as set by the official university calendar (http://www.case.edu/provost/registrar/calendars/5year.html). Exceptions will be granted only upon the recommendation of the dean of Weatherhead. A fee of $25 is charged during the late registration period.

To register, students must have a clear balance unless they are participating in the Bridge Loan Program. In this case, a company tuition reimbursement letter must be submitted. Students register online using the Student Information System (SIS). Students who wish to apply for federal loans should visit the FAFSA website (http://www.fafsa.ed.gov).

During any semester, a student may not register in more than one career in SIS, unless the student is in a dual-degree program.

If at any time a student fails to register in two consecutive semesters, excluding the summer session, the student must reapply for admission to Weatherhead, unless prior approval was granted by the Weatherhead Registrar.

Degrees Conferred

Case Western Reserve grants degrees to qualified candidates three times per year: in August, for students who complete their programs during the Summer Semester; in January, for students who complete their programs during the Fall Semester; and in May, for students who complete their programs during the Spring Semester.

There is only one diploma (http://case.edu/commencement) exercise each year, in May, and all candidates are invited to march at this ceremony, regardless of the month in which their degree was awarded. May degree candidates receive their diplomas the day of the ceremony. May degree candidates who do not participate in the ceremony can choose to have their diploma mailed to them or collect it at the Weatherhead registrar’s office. January and August degree recipients can have diplomas mailed or held for pick up. Students may not receive diplomas prior to the date on which the degree is to be granted.

Extra Assignments

No student is permitted to do extra assignments beyond the work assigned to all students in a course, in order to obtain a higher grade. This policy applies to changing an I grade to a regular grade, or to changing one regular grade to another. However, faculty may replace or substitute assignments for individual students in a course, based on extenuating circumstances.

Grades

<table>
<thead>
<tr>
<th>Letter Grade</th>
<th>Meaning</th>
<th>Quality Points</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Excellent</td>
<td>4</td>
<td>No degree credit awarded</td>
</tr>
<tr>
<td>B</td>
<td>Good</td>
<td>3</td>
<td>No degree credit awarded</td>
</tr>
<tr>
<td>C</td>
<td>Fair</td>
<td>2</td>
<td>No degree credit awarded</td>
</tr>
<tr>
<td>D</td>
<td>Passing</td>
<td>1</td>
<td>No degree credit awarded</td>
</tr>
<tr>
<td>F</td>
<td>Failure</td>
<td>0</td>
<td>No degree credit awarded</td>
</tr>
<tr>
<td>R</td>
<td>Completion of the first semester of a two-semester course</td>
<td>No degree credit awarded</td>
<td></td>
</tr>
<tr>
<td>P</td>
<td>Pass</td>
<td>0</td>
<td>Degree credit awarded</td>
</tr>
<tr>
<td>NP</td>
<td>No pass</td>
<td></td>
<td>No degree credit awarded</td>
</tr>
<tr>
<td>I</td>
<td>Incomplete</td>
<td></td>
<td>No degree credit awarded</td>
</tr>
<tr>
<td>AD</td>
<td>Successful audit</td>
<td></td>
<td>No degree credit awarded</td>
</tr>
<tr>
<td>NG</td>
<td>No grade, unsatisfactory audit</td>
<td></td>
<td></td>
</tr>
<tr>
<td>W</td>
<td>Withdrawal from a class</td>
<td></td>
<td>No degree credit awarded</td>
</tr>
<tr>
<td>WD</td>
<td>Withdrawal from all courses in a semester</td>
<td></td>
<td>No degree credit awarded</td>
</tr>
</tbody>
</table>

Midterm Grades

<table>
<thead>
<tr>
<th>Letter Grade</th>
<th>Meaning</th>
<th>Quality Points</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>S</td>
<td>Satisfactory</td>
<td>0</td>
<td>No degree credit awarded</td>
</tr>
<tr>
<td>U</td>
<td>Unsatisfactory</td>
<td>0</td>
<td>No degree credit awarded</td>
</tr>
</tbody>
</table>

Grade of Incomplete (I)

The grade I is assigned at the discretion of an instructor, provided that two criteria are met:

- There are extenuating circumstances, explained to the instructor before the assignment of the grade, which clearly justify an extension of time beyond the requirements established for other students in the class. It is the student’s responsibility to notify the instructor of the circumstances which prevent completion of the course.
• The student has been passing the course and only a small segment of the course, such as a term paper, remains to be completed, for which the extenuating circumstances justify a special exception.

In order to receive credit for an I, the student must complete the work by the date specified by the instructor, and no later than the end of the next regular semester (Fall or Spring Semester).

In the absence of notification or adequate justification, the I will automatically change to F or NP (depending on the grading basis for the course) on the stated deadline.

If the student wishes to petition to extend a grade of I beyond the stated deadline, the student must obtain approval from the faculty member who assigned the I, and from the program’s faculty director, before the deadline. A request must be made in writing, preferably via email, and convey (a) the extenuating circumstances justifying the extension and (b) the expected date of completion of the work. If approved, the request should be initiated by the faculty member and delivered by the student to the faculty director for approval and then to the Weatherhead registrar. Failure to complete course requirements by the extended date will result in a grade of F or NP, depending on the grading basis for the course.

Graduation Requirements

A cumulative GPA of 2.5 in all graduate courses taken for credit in the MBA, EMBA, MSM-Finance, MPOD, MSM-OR/SC, or MAcc degree programs is required for graduation. Candidates must submit an application for graduation in SIS no later than two months before the graduation date at which their degree is expected to be awarded. The candidate is responsible for filing the application. Upon receipt of the student’s application, the Weatherhead registrar will verify the student’s eligibility for graduation at the anticipated date. Students are advised to contact the Weatherhead Registrar’s Office (mailto:wsomregistrar@case.edu) if they have any questions regarding requirements for graduation.

Leave of Absence

If a student will not be taking classes for more than one semester, the student should request a one-year leave of absence. Approval for any leave of absence from a degree program must be requested in writing by the student. This request for approval should be submitted to the faculty director of the program and the Weatherhead registrar. Unapproved interruption in the program sequence constitutes separation from the program.

Retroactive leaves of absence are not permitted. Students who fail to return upon completion of a leave of absence need to re-apply to the degree program. Students must graduate within six years from the start of their first semester at Weatherhead. A leave of absence does not extend the maximum time permitted for the completion of degree requirements. A leave of absence cannot be taken if students are on an approved extension of the time limit to complete their degree.

Registration

Students generally register for classes and make changes to their schedule using SIS. Step by step information on registering for classes is available online (http://www.case.edu/registrar/sisuserguides/SIS_SC_Enroll.pdf). For assistance with this process, students must contact the Weatherhead Registrar (http://bulletin.case.edu/weatherheadschoolofmanagement/policies/mailto:wsomregistrar@case.edu) at 216.368.5900 before the last day of the drop/add period.

Residency

For the EMBA program:

In-person presence at each residency is critical for success in the EMBA program. Students are expected to attend each residency and each class. If unavoidable absences arise, these should be approved in advance, and accommodation should be reached with the faculty member(s) in question to make up the content. In addition to regularly-scheduled classes, students can expect to attend frequent meetings with small groups formed at the outset of the program.

For the MPOD program:

In-person presence at each residency is critical for success in the MPOD program. Students are expected to attend each residency and each class, and to participate throughout the program with classmates in small groups, team projects, and practicums. If unavoidable absences arise, these should be approved in advance, and accommodation should be reached with the faculty member(s) in question to make up the content.

Retention Requirements

All students are required to follow their curriculum plan and graduate with their cohort. If at any time a student fails to register in two consecutive semesters, excluding the summer session, the student must reapply for admission to Weatherhead, unless prior approval was granted by the Weatherhead Registrar.

For the MBA, EMBA, MSM-Finance, and MSM-OR/SC degree programs:

• A cumulative GPA of 2.5 is needed to maintain good standing.
• A cumulative GPA below 2.5 will result in probation.
• A cumulative GPA below 2.5 in two different semesters will result in separation from the program.
• An earned F received in any class will result in separation from the program.
• If a student receives a grade of D in a required class, the student must pass a proficiency exam in order to continue and graduate. The student must take and pass the proficiency exam before the start of the next semester. If the student passes the proficiency exam, a grade of C will appear on the transcript. Failure to obtain a C will lead to separation from the program. If the GPA of a student on probation is low enough to remain below 2.5 regardless of a C grade earned in a proficiency exam, the student will not be allowed to take the exam and will be separated from the program.

For MAcc and MPOD degree programs:

• A cumulative GPA of 2.5 is needed to maintain good standing.
• A cumulative GPA below 2.5 will result in probation.
• A cumulative GPA below 2.5 in two different semesters will result in separation from the program.
• An earned F received in any class will result in separation from the program.

For the MEM program:

• Students must maintain an overall GPA of 2.75 to remain in the program.
• Any student admitted to the program on a conditional basis must demonstrate a minimum GPA of 2.75 in the first semester (the Summer Semester) to continue.
A student will be placed on academic probation after any semester in which the minimum GPA is not attained. A student who is on academic probation in a particular semester will be allowed one additional semester to attain the minimum GPA in order to continue in the MNO program.

Transcripts
Case Western Reserve considers grades and other information about a student’s performance at the university to be a private matter and will release such information to the student only upon written request. Transcripts will not be issued to or on behalf of a student who has not discharged all financial obligations to the university. Transcripts are issued by the University Registrar’s Office. Requests can be made online (http://www.case.edu/registrar/transcripts.html) or in person or by mail using this form (http://www.case.edu/registrar/forms/transreq.pdf).

Transcripts of work completed at other institutions will not be released to the student or other third parties.

Transfers and Waivers
No transfers, waivers, or substitutions are accepted for Full-Time MBA, EMBA, MPOD or MAcc. For the MSM-Finance and MSM-OR/SC:

Upon approval of the Faculty Program Director, MSM-Finance and MSM-OR/SC students may substitute up to 9 credit hours of coursework if comparable CWRU courses have been completed.

For the Part-Time MBA:

Students who entered the program in Fall 2011 and after may transfer 6 credit hours of prior course work from an AACSB-accredited university to replace elective classes only with approval from the faculty director and the Weatherhead Registrar. No course in which the student received a grade lower than a B will be accepted.

Non-cohort part-time students who entered the Part-Time MBA program in the 2009 Fall Semester or prior, transferred in during the 2010 Summer Semester or prior, or transitioned from non-degree to degree-seeking status prior to the 2010 Fall Semester must complete the Petition for Transfer Credit Form and required accompanying documents (a current course description and the course syllabus). Core courses are not eligible for transfer credit. Transfer course approval is required from the Weatherhead Registrar, the Faculty Program Director, the Department Chair and the Dean’s Office. Contact the Weatherhead Registrar’s Office for the Petition for Transfer Credit Form. (Online courses are not eligible for transfer credit to Weatherhead.) If a transfer credit request is approved, upon completion of the course, it is the student’s responsibility to provide the Weatherhead Registrar’s Office with an official transfer transcript. Official transcripts are transcripts received in a sealed envelope directly from the transfer institution. Only courses with a “B” or higher are transferred to Weatherhead. Weatherhead does not transfer in courses from non-AACSB accredited schools. Quarter hours convert to semester hours with a conversion of 0.67 semester hours for every 1.0 quarter hours.

For the MNO program:

A total of 6 credit hours are eligible for a waiver, subject to the following requirements:

• Courses must have been taken at an accredited institution within five years of the date of application to the MNO program
• A grade of at least a B must have been earned
• A Mandel Center faculty member must make written approval of the waived course
• Courses will not be waived based upon work experience
• A student must register for and complete at least 54 credits toward the MNO degree in residence at the university in addition to courses waived. A waived course may reduce degree requirements

Transfer Credit
Courses granted transfer credit must be approved as applicable to the MNO program. Courses must have been taken at an accredited institution and must be approved prior to enrollment. A grade of at least a B must have been earned. Grades in transfer credit courses are not counted in the cumulative grade point average. Transfer credit is limited to 6 credits.

Substitution
An additional 9 credits may be approved for substitute credit. Substitute courses replace required MNO courses but do not reduce the total number of credits required to complete the program. Substitute courses must be selected and approved in accordance with a clearly defined written proposal consistent with student interests and needs and the MNO program mission.

Withdrawals
To withdraw from courses during a semester, the student may either initiate a request to withdraw in SIS or contact the Weatherhead Registrar (http://bulletin.case.edu/weatherheadschoolofmanagement/policies/mailto:wsomregistrar@case.edu) before the last day of classes. All withdrawals after the official drop/add periods will result in a grade of W (WD if withdrawing from all classes) on the student’s transcript. A student withdrawing after the last day of classes will receive the grade of F unless, in the judgment of the program’s faculty director, there are valid reasons for recording the grade of W.

Failure to attend class, giving notice to the instructor, or nonpayment of fees will not be regarded as official notice of withdrawal. A grade of F will be assigned in each course from which the student has not officially withdrawn.

Note: A student is not entitled to any tuition adjustment for a single course dropped after the drop/add deadline. However, if a student is forced to withdraw from all coursework for the semester due to unavoidable and unforeseen circumstances, he or she may petition (in writing to the Weatherhead registrar) for a partial tuition refund. Tuition charges for withdrawals after the drop/add deadline are prorated based upon the week of withdrawal and according to the schedule (http://www.case.edu/finadmin/controller/pdf/bill_sch12-13.pdf) published in the semester registration materials.

Academic Integrity Policy
This Policy comprises the standards of academic integrity in the graduate programs of the Weatherhead School of Management at Case Western Reserve University and sets forth the procedures to be followed by the
Dean, Faculty, and Staff in cases in which students are alleged to have violated the Academic Integrity Policy. This policy does not address alleged violations and disciplinary actions in the undergraduate programs. Such matters are addressed at the university level.

Academic integrity is vital to the Weatherhead School of Management’s (WSOM) graduate programs learner-centered approach to management education. Learning flourishes where the free flow of ideas is unimpeded by concerns over the origins of those ideas and the process by which they are created. Thus, a deep commitment to learning and honesty on the part of every student is crucial. Every student is expected to respect the learning process, to enhance it, to strenuously avoid any activity that might corrupt it, and to report observed violations of the WSOM code of academic conduct. Faculty, the Dean and Administration also have a crucial role in upholding Academic Integrity in WSOM and ensuring adherence to general principles of academic integrity and this policy.

To foster a well-informed commitment to academic integrity, the following policies govern the WSOM learning environment:

1. All forms of dishonesty including cheating, plagiarism, or knowingly furnishing false information to WSOM faculty or administrators are prohibited. This standard is to be interpreted strictly. Examples of violations of the code of academic conduct include, but are not limited to:
   - Communication or use of aids not specifically authorized by the instructor during examinations. Such instances include giving or receiving unauthorized assistance in any form (including the use of unauthorized aids, copying from another student’s work, giving, soliciting or receiving unauthorized aid).
   - Submission of work prepared for another class, by another section of the same class in the same or prior years, or by other students without the prior authorization of the course instructor.
   - Submission of texts or partial texts prepared by anyone other than the student (plagiarism), including material from the internet, without proper attribution, including whether the true author is aware of, or condones, the act. Plagiarism can occur inadvertently due to the omission of proper credit and includes failure to properly footnote sources, to indicate quoted or paraphrased material, or to credit others for their ideas, words, or work.
   - Misrepresentation of oneself on a resume.

2. Computer software is private intellectual property; therefore, copying university owned or licensed software or data, or loading such software on to another computer system for personal or external non-CWRU use without prior written approval is prohibited. The modification of university owned licensed software or data without prior written approval is prohibited.

3. Information technology, including computers, data transmission and storage technology are essential to knowledge production and learning. Damage or disruption to the operation of computer equipment, data communications equipment or data communications lines is prohibited. The use of University owned or licensed computers for non-educational purposes or for purposes for which they were not intended is prohibited.

To maintain and consolidate information on prior Academic Integrity violations and associated consequences, prior to each academic year, Council will designate one Academic Integrity Officer (AIO) and one Associate Academic Integrity Officer (AAIO) from the full-time faculty to serve a term of one year of service during the coming academic year, renewable up to five years based upon the respective individuals’ willingness and capability to fulfill the respective roles. Council will carefully consider the fit between the workload demands of the AIO and AAIO and the characteristics of the individuals including such things as the individuals’ tenure, rank and previous involvement in other WSOM committees related to WSOM curriculum. To fulfill the responsibilities of the AIO, the individual will be provided with the appropriate administrative support.

The AIO is the first contact for allegations of violations of the code of academic conduct as explained below. The AAIO is appointed for two purposes. First, the AAIO serves as a backup for the AIO in the event that conflicts of interest or other obligations prevent the AIO from fulfilling AIO duties in a given case. Second, Council selects the AAIO with the idea that the AAIO may become the succeeding AIO when the AIO’s term is concluded whereupon Council will designate a replacement AAIO.

If a student witnesses an activity that appears to violate the code of academic conduct, that student’s academic integrity demands that he or she take proper action to address or curtail the activity. Proper action may include confronting the individuals involved, requesting that the instructor clarify the guidelines for appropriate conduct, and/or reporting the activity to the instructor or the AIO. Provision will be made for an anonymous reporting channel as necessary.

In the event that a faculty member has reasonable grounds to suspect that a student has violated the WSOM Code of Academic Conduct, the faculty member should consult the AIO. The purpose of the consultation is fourfold: (1) to provide the faculty member with an awareness of precedents for the violation in question, (2) to maintain consistency across departments in the WSOM, (3) to determine whether the student has prior violations, and (4) to allow the faculty member and the AIO to determine whether additional information should be gathered about the alleged incident and by whom.

A faculty member may resolve the violation without a hearing if the following four conditions are met: (1) the incident and sanction have been reported to the AIO, (2) the student admits to the violation, (3) based on the best information available, it is the student’s first violation, and (4) the student accepts the sanction proposed by the faculty member. The minimum sanction in such cases is failure in the work in question; the maximum sanction is failure in the course. In addition, any student guilty of an academic integrity violation shall not be permitted to participate in the evaluation process for either the faculty member(s) who brought the allegation or the course in which the violation occurred.

If any one of the four conditions noted above is not met, or if the faculty member concludes that the seriousness of the offense warrants a hearing, a hearing must be convened in accordance with the procedures outlines below. In addition Any student guilty of an academic integrity violation shall not be permitted to participate in the evaluation process for either the faculty member who brought the allegation or the course in which the violation occurred.

Procedures for Conducting Academic Integrity Disciplinary Hearings

INITIAL STEPS

1. The faculty member or other individual alleging the academic integrity violation shall prepare a written, signed statement containing a description of the acts constituting the alleged violation of the Code of Academic Conduct, including dates, times, locations and names of individuals involved. The written statement shall include all supporting evidence that is pertinent to the alleged violation.

2. The individual shall submit the statement to the WSOM AIO. The AIO will review the statement to determine whether the written statement
contains sufficient information to warrant further investigation. The AIO shall also notify the University’s Office of Student Affairs of the matter. The AIO and University’s Office of Student Affairs will collaborate to the extent appropriate to resolve the matter.

3. If the AIO determines that further investigation is warranted, the AIO may request that other parties prepare written statements describing their knowledge of the alleged violation of the Code of Academic Conduct.

4. The AIO shall notify the student of the allegations and that a hearing will be scheduled, which will provide the student with the opportunity to prepare a defense against the allegations and to have an advisor present at the hearing.

HEARING PROCESS

1. After receiving all written statements and any other pertinent information, the AIO shall convene an ad hoc Hearing Committee comprised of the following individuals: (a) two individuals typically from the body of elected student officers; (b) three full-time regular faculty members; and (c) one non-voting administrative staff member. The members of the committee will elect one member to serve as Chair with the staff member recording the minutes. The two individuals from the body of elected student officers should be comparable “peers” to the student alleged to have violated the Academic Integrity Policy. Cases may arise in which comparable peers may not exist in the body of elected student officers in which case the AIO may select a comparable peer from among the general student body.

2. Prior to the hearing, the ad hoc Hearing Committee members will be provided with the written documents concerning the alleged incident and any other pertinent information.

3. The ad hoc Hearing Committee will establish a hearing date and communicate the date to all parties involved. Prior to the hearing date, the student in question shall have access to all written documents and any other information the ad hoc Hearing Committee has reviewed, subject to situations in which the Committee foresees that privacy concerns or related legal issues may prevent the sharing of certain information with the student. For example, cases may arise in which the sharing for certain information may violate the Family Education Rights and Privacy Act (FERPA). In such cases, the Committee will consult with the University’s Legal Counsel.

4. All members of the ad hoc Hearing Committee must be present at the hearing.

5. The student may be accompanied and assisted by an advisor. The advisor shall not be permitted to participate in the hearing except to advise the student.

6. If the faculty member or other individual alleging the violation chooses not to attend the hearing, the AIO will appoint an individual, selected from among the faculty, to represent the faculty member or other individual.

7. Minutes of the hearing will be recorded by the staff member referenced in item 1 of this section.

8. The student shall have the opportunity to argue his/her defense and to present supporting evidence and witnesses. The student shall have the opportunity to hear and question witnesses against him/her by directing all such inquiry through the person chairing the meeting.

9. The Hearing Committee shall have the authority to reasonably limit the time for testimony for each witness, including the testimony of the student in question.

10. After the hearing, the Committee shall convene to discuss the information presented and to make a written recommendation. The recommendation shall be made to the Dean within a reasonable period of time after the hearing. The Dean will make the final decision regarding the outcome of the hearing.

11. The recommendation may include discipline up to and including suspension and expulsion. The student will receive a copy of the Committee’s recommendation.

SANCTIONS AND APPEAL PROCESS

1. The Dean shall have the authority to accept, reject or modify the Hearing Committee’s recommendation, after consultation with the AIO and, if possible, the AAIO. The student shall have the right to present in writing, his/her basis for requesting acceptance, rejection or modification. The Dean shall communicate his/her decision in writing to the student and the Committee.

2. In no event will a student be suspended from classes or expelled prior to a final resolution of the charges, except in cases where the Dean or the AIO believes the student’s presence on campus presents a risk of danger to the University community.

3. The procedures set forth herein do not preempt the jurisdiction and disciplinary processes of other University bodies that retain their own concurrent jurisdiction to investigate and enforce their own rules and impose their own disciplinary measures. In circumstances in which different disciplinary findings and/or measures may be imposed by different bodies, the more severe shall have precedent.

4. A student found in violation has the right to appeal the original decision to the Provost’s Office at according to the following procedures. An appeal of a decision must be submitted in writing and postmarked or hand delivered to the Provost or the Provost’s designee, within ten (10) calendar days after the date on which written notice of the decision is sent to the student. Each student shall be limited to one appeal. The decision of the appeal officer is final.

5. An appeal may be based only upon one or more of the following grounds: a. Procedural error; b. Misapplication or misinterpretation of the rule alleged to have been violated; c. Findings of facts not supported by a preponderance of evidence; d. Discovery of substantial new facts that were unavailable at the time of the hearing; or e. That the disciplinary sanction imposed is grossly disproportionate to the violation committed.

6. The appeal officer shall dismiss the appeal if the appeal is not based upon one or more of the grounds set forth in Section (B) above. The appeal officer may decide the appeal based upon a review of the record. The appeal officer may request additional written information or an oral presentation from any relevant person(s) and then decide the appeal based upon the enhanced record.

7. The appeal officer may, after a review of the record, uphold the original sanction, dismiss the original sanction, or impose a lesser sanction. An appeal officer may also remand the case to the original hearing body or refer the case to a new hearing officer or panel to be reheard. If possible, the new hearing officer or panel should be different from the one that originally decided the case. If a case is reheard by a hearing officer or panel, the sanction imposed can be greater than that imposed at the original hearing.

8. A student and hearing officer may agree in advance to minor deviations from procedure. Such deviations are not then subject to appeal. Other minor deviations are acceptable as long as such deviations are not found upon appeal to be unreasonably harmful to the student.
Standards of Conduct Beyond Academic Integrity

In addition to the standards set forth in the Academic Integrity Policy (p. 965), Weatherhead students are subject to the university’s Standards of Conduct (http://studentaffairs.case.edu/handbook/policy/standards.html) which specifically prohibit the following activities:

1. Interference with freedom of speech or movement, or intentional disruption or obstruction of teaching, research, administration, or other functions on university property
2. Any actual or threatened physical harm or mental abuse of any person on university premises or at functions sponsored or supervised by the university
3. Failure to comply with the directions of university officials, instructional or administrative, acting in performance of their duties
4. Theft or vandalism of university property or that of a member of the university community or campus visitor
5. All forms of dishonesty, including cheating, plagiarism, knowingly furnishing false information to the university, forgery, and the alteration or misuse of university documents, records, or instruments of identification
6. Falsification, distortion, or misinterpretation of information before a hearing body
7. Unauthorized carrying or possession on university premises of firearms or of any weapon with which injury, death, or destruction may be inflicted
8. Violation of law on university premises or in connection with university functions
9. Violation of published university rules and regulations

A student accused of any of the above prohibited activities will be referred to the disciplinary conduct procedures described below.

Disciplinary Conduct Procedures

Initial Steps

1. The student, faculty member, or member of staff making the allegation shall prepare a written and signed statement containing a complete description of the acts constituting the violation of the university Standards of Conduct, including dates, times, locations, and names of individuals involved.
2. The written statement must be directed to the dean of Weatherhead who may choose a designee to administer the disciplinary proceedings. The dean or designee shall review the statement to determine whether the written statement contains enough information to warrant further investigation. The dean or designee shall also notify the university’s Office of Student Affairs of the matter. The dean or designee and university Office of Student Affairs will work collaboratively on this matter to the extent appropriate.
3. If the dean or designee determines that further investigation is warranted, he or she may require that other parties involved make a written statement describing their knowledge of the incident. The student in question will be notified in writing of the nature of the charges against him or her.
4. The student will be notified that a hearing will be scheduled and that he or she will have the opportunity to defend himself or herself against the allegations, and to have an adviser present, at the hearing.

Hearing Process

1. After receiving all written statements and any other pertinent information, the dean or designee shall convene an ad hoc hearing committee consisting of two elected student officers, two full-time faculty members, and one administrative staff member. The members of the committee shall elect one member to serve as chair.
2. Prior to the hearing, the hearing committee will be provided with the written documents concerning the alleged incident and any other pertinent information.
3. A hearing date will be decided upon and communicated to all parties involved. Prior to the hearing date, the student in question shall have access to all written documents and any other information the hearing committee has reviewed, unless the committee decides that it would be inappropriate to provide certain information to the student.
4. On the hearing date, all members of the hearing committee must be present.
5. The student may be accompanied and assisted at the hearing by an adviser. The adviser shall not be permitted to participate in the hearing except to advise the student.
6. Minutes of the hearing will be recorded.
7. The student shall have the opportunity to argue his or her defense and to present supporting witnesses. The student shall have the opportunity to hear and cross-examine witnesses against him or her by directing all such inquiry through the meeting chair, unless the committee deems that it would be inappropriate to permit cross-examination for certain witnesses.
8. The hearing committee shall have the authority to limit the time for testimony for each witness, including the testimony of the student in question.
9. After the hearing, the committee shall convene to discuss the evidence presented and to make a written recommendation. The recommendation will be made to the dean or designee within a reasonable period of time after the hearing.
10. The recommendation may include discipline up to and including suspension and expulsion. The student shall receive a copy of the committee’s recommendation.

Sanctions and Appeal Process

1. The dean or designee shall have the authority to accept, reject, or modify the hearing committee’s recommendation. The student shall have the right to present, in writing, a request for acceptance, rejection, or modification. The dean or designee shall communicate his or her decision in writing to the student and the committee.
2. In no event will a student be suspended from classes or expelled prior to a final resolution of the charges, except in cases where the dean or designee believes that the student’s presence on campus presents a risk to the university community.

The procedures set forth herein do not preempt the jurisdiction and disciplinary processes of other university bodies, which retain their own concurrent jurisdiction to investigate and enforce their own rules and impose their own disciplinary measures. In circumstances where different disciplinary findings and/or measures may be imposed by different bodies, the more severe sanction shall take precedence.
Grievance Procedures
Staff and faculty members have an important role to play in supporting the best possible learning environment. In the event that a student feels unjustly affected by a non-disciplinary academic or administrative action, he or she may grieve the action or decision in the following manner:

1. The student should bring his or her complaint directly to the person responsible for the action in question. The student should make an effort to resolve the problem informally.

2. If efforts at informal resolution of the problem are not successful, the student shall prepare a written statement within a reasonable period of time after the action or decision that gives rise to the grievance. The statement shall contain the following:
   - Date of the grievance
   - Brief description of the alleged unjust academic or administrative action or decision
   - Names of individual(s) involved
   - Explanation of previous attempts to resolve the problem(s)
   - Action(s) that the student believes should be taken to resolve the problem

3. The written statement shall be directed to the Director of Student Affairs, Shannon Greybar Milliken.

4. The Dean or Dean’s designee may request that the individual(s) named in the grievant’s written statement prepare a written statement responding to the grievant.

5. Upon receiving the written statements, the Dean or designee shall convene an ad hoc committee consisting of one student and two full-time faculty members.

6. The committee shall consider the written statements of the individuals involved and any other information they deem relevant. The committee may interview the individuals involved, including the grievant.

7. The committee shall make a written recommendation to the Dean or designee and furnish a copy to the grievant.

8. The Dean or designee may accept, reject, or modify any or all of the committee’s recommendations. The Dean or designee shall make the final decision as to the grievance and shall communicate the decision to the grievant in writing.

All grievances will be held in strictest confidence by all involved. The grievance process cannot be used to circumvent the disciplinary process and procedures set forth elsewhere in this document.
Undergraduate Programs

Bachelor of Science (BS) in Accounting

Accountancy demands a high degree of technical training, similar to the professions of architecture, law, engineering, and medicine. The accounting profession requires a broad knowledge of the fundamentals of economics and business and a commitment to public well-being. Career opportunities in accounting include the public, corporate, government, nonprofit, and healthcare sectors. The undergraduate program in accounting is designed to prepare students for entrance into these careers and to provide a foundation for the examination to become a CPA or to achieve other professional certifications.

As part of the sequence of courses leading to the BS in Accounting offered through Weatherhead, the student takes required and elective courses in related fields of banking and finance, economics, marketing, organizational behavior, information systems, management policy, and operations.

BS in Accounting

General Education Requirements

SAGES (13-16)
First Seminar 4
Two University Seminars 6
Departmental Seminars - taken as MGMT 395, see below* 6
Senior Capstone ** 6

Breadth Requirements (26-30)
MATH 125  Math and Calculus Applications for Life, Managerial, and Social Science 4
or MATH 121  Calculus for Science and Engineering I 4
MATH 126  Math and Calculus Applications for Life, Managerial, and Social Science II 4
or MATH 122  Calculus for Science and Engineering II 4
Two Natural Science Courses  6
Two Arts & Humanities Courses  6
Two Social Science Courses - one of which is COSI 200 or COSI 280 6

Major Requirements

Principles Requirements (15)
ECON 102  Principles of Microeconomics 3
ECON 103  Principles of Macroeconomics 3
ACCT 101  Introduction to Financial Accounting 3
ACCT 102  Management Accounting 3
OPRE 207  Statistics for Business and Management Science I 3

Core Requirements (24)
BAFI 355  Corporate Finance 3
MGMT 250  Managing Organizations and People I 3
MGMT 251  Managing Organizations and People II 3
MIDS 301  Introduction to Information: A Systems and Design Approach 3
MKRI 201  Marketing Management 3
OPRE 301  Operations Research and Supply Chain Management 3
PLCY 399  Business Policy 3
Advanced Seminars - *MGMT 395 - one credit hour, each student must complete three. 3

Accounting Requirements (18)
ACCT 300  Corporate Reporting I 3
ACCT 301  Corporate Reporting II 3
ACCT 304  Advanced Financial Reporting 3
ACCT 305  Income Tax: Concepts, Skills, Planning 3
ACCT 314  Attestation and Assurance Services 3

Total Credit Hours for Degree: 122

- Students must complete one university-approved SAGES Senior Capstone. It is not required that students complete a Weatherhead-specific capstone. Most students choose to take MGMT 398 Action Learning, although a second option within Weatherhead is MGMT 397 Undergraduate Research Project.

Students pursuing the BS in Accounting are advised to take the two introductory classes, ACCT 101 Introduction to Financial Accounting and ACCT 102 Management Accounting, as early as possible. Students are advised to take the required MGMT 250 Managing Organizations and People I and MGMT 251 Managing Organizations and People II sequence in the Fall and Spring Semesters, respectively, of the second year.

Accounting majors may not use the P/NP option for Weatherhead courses. Twelve credit hours of accounting coursework taken at another accredited institution may be considered for transfer toward the BS in Accounting, although transfer credit for courses beyond introductory accounting must be approved by the Accountancy Department. Each student is required to consult with an advisor in the Office of Undergraduate and Integrated Study Programs at Weatherhead.

Integrated Study Programs in Accountancy

Integrated study programs enable attainment of a BS in Accounting and a Master of Accountancy (MAcc) degree in five years or less. These programs are strongly recommended for those individuals planning to obtain professional certification. CPA candidates must have completed 150 semester hours of study at the university level in order to qualify to sit for the CPA examination. There are two programs that integrate graduate and undergraduate course work in accountancy: the joint BS in Accounting/MAcc and the accelerated BS in Accounting/MAcc.

Application to either integrated study program should be made during the junior year directly to the MAcc program. The Graduate Management Admission Test (GMAT) is required for admission to the MAcc program and should also be completed during the junior year. Once admitted, students in an integrated study program are required to design a comprehensive study plan with both the Weatherhead adviser and the director of the MAcc program.

Joint BS in Accounting/MAcc

Undergraduate accounting majors accepted to the joint BS in Accounting/MAcc program are permitted to double count six credit hours of coursework towards both the BS in Accounting and the MAcc. Hence, the two programs require 152 credit hours of study rather than 158 credit hours (122 credit hours for the BS and 36 credit hours for the MAcc). For the first eight semesters of study, students register as undergraduates at Case Western Reserve; thereafter, students register in the graduate professional degree program at Weatherhead. Students complete and are awarded the BS in Accounting prior to completing the master’s degree program.

Accelerated BS in Accounting/MAcc

The accelerated BS in Accounting/MAcc program allows motivated students to complete both the BS in Accounting and the MAcc degrees in four years of study. These students are able to double count six credit hours of coursework, reducing the total credit hour requirement from 158
credit hours to 152 credit hours. To enroll in this program, students must have:

- Completed 90 hours of undergraduate coursework
- Completed all of the undergraduate Seminar Approach to General Education and Scholarship (SAGES) General Education Requirements at Weatherhead
- Completed 36 hours of the Weatherhead major requirements (including 15 hours of the required accountancy coursework)
- Achieved at least a 3.0 overall GPA

For all eight semesters of study, the student will register as an undergraduate at Case Western Reserve and never as a graduate student in the graduate professional degree program at Weatherhead. Students in this program will receive both the BS and the master’s degree at the end of the program.

Professional Practicum

A practicum is a planned, structured, supervised workplace experience at an approved "site" organization. The practicum is an Experiential Learning arrangement between the student, the employer, and the practicum adviser in conjunction with the University Career Center. Employers provide appropriate supervision and work-related learning, while the practicum adviser guides and evaluates the student’s experience.

The primary goal of this active learning experience is the intellectual, personal, and professional growth of the student in an area related to the student’s academic goals. The practicum should provide the student with new skills, insights, and experiences that are transferable to the academic setting.

Students apply to the University Career Center in the semester preceding the work assignment. A student may participate in up to two practica, but must spend at least one intervening semester on campus.

To be eligible, a student must have:

- Completed 21 credit hours of coursework at Case Western Reserve (prior to the start of the work assignment)
- A minimum GPA of 2.5 and good academic standing
- Completed ACCT 101 Introduction to Financial Accounting and ECON 102 Principles of Microeconomics or ECON 103 Principles of Macroeconomics
- Registered for MGMT 1 Supervised Professional Practicum - Semester 1 or MGMT 2 Supervised Professional Practicum - Semester 2, a non-credit practicum course
- Completed pre-practicum assignments with the University Career Center
- Secured a Weatherhead faculty member as a practicum advisor*
- Developed an approved Learning Agreement with the practicum advisor

* An advisor from the Office of Undergraduate and Integrated Study Programs at Weatherhead can serve as a practicum adviser during the summer.

All practica developed through the University Career Center must be taken for transcript notation, and students must have a faculty member serve as a practicum advisor. If a student elects to work in an internship/practicum without enrolling in the course for academic notation, he or she will not have the benefits of full-time student status. Additionally, he or she will not represent the practicum program in any official capacity.

---

Sample Plan of Study: Bachelor of Science in Accounting

### First Year

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<td>Math and Calculus Applications for Life, Managerial, and Social Sci I (MATH 125)</td>
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</table>
Bachelor of Science (BS) in Management

Graduates of the BS in Management program obtain a broad education within a scientific framework that enables them to bring an unusual degree of analytical capability to the problems of management and business. Each management student is required to complete a concentration in finance, marketing, or an approved, individualized program of study (see below in the section titled Dean’s Approved Concentration). In addition, each student must consult with an adviser in the Office of Undergraduate and Integrated Study Programs at Weatherhead.

BS in Management

General Education Requirements

Students must complete a 15 credit hour concentration in Banking & Finance, Marketing, or a Dean’s Approved Concentration.

Banking & Finance Concentration Requirements (15)

<table>
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<td>BAFI 341</td>
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Marketing Concentration Requirements (15)

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Additional Requirement (16-23)

Electives - to include 12 credit hours outside of WSOM

Total Credit Hours for Degree: 122

** Students must complete one university-approved SAGES Senior Capstone. It is not required that students complete a Weatherhead-specific capstone. Most students choose to take MGMT 398 Action Learning, although a second option within Weatherhead is MGMT 397 Undergraduate Research Project.

For more information, contact Teresa Kabat (http://bulletin.case.edu/weatherheadschoolofmanagement/undergradprograms/mailto:teresa.kabat@case.edu), Department Administrator, at 216.368.4110.
Organizations and People II sequence in the second year. Management majors may not use the P/NP option for any Weatherhead courses.

Sample Plan of Study: BS in Management

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Elective* 3
Elective* 3
Elective* 2
Year Total: 16 12

Total Units in Sequence: 122

* At least 12 credits of electives must be taken outside Weatherhead.

Concentrations

Banking and Finance

- BAFI 356 Investments 3
- BAFI 357 Financial Modeling, Analysis and Decision Making 3
- BAFI 359 Intermediate Corporate Finance 3
- BAFI 372 International Finance 3
- ACCT 300 Corporate Reporting I 3

Total Units 15

Marketing

- MKMR 304 Brand Management 3
- MKMR 308 Measuring Marketing Performance 3
- MKMR 310 Marketing Analytics 3
- MKMR 311 Consumer Relationship Management 3
- MKMR 312 Selling and Sales Management 3

Total Units 15

Dean’s Approved Concentrations

A student may construct a 15-credit sequence of courses in an area of individual interest, subject to approval by the Weatherhead Undergraduate Executive Committee.

For more information, contact Jim Hurley (http://bulletin.case.edu/weatherheadschoolofmanagement/undergradpgrams/mailto:james.hurley@case.edu), Assistant Dean of Undergraduate and Integrated Study Programs, at 216.368.3856.

Minors

Minor in Accounting

- ACCT 101 Introduction to Financial Accounting 3
- ACCT 102 Management Accounting 3
- ACCT 300 Corporate Reporting I 3
- Two additional 300-level accounting courses 6

Total Units 15

Minor in Banking and Finance

- ACCT 101 Introduction to Financial Accounting 3
  or ACCT 203 Survey of Accounting 3
- BAFI 355 Corporate Finance 3
- BAFI 356 Investments 3
- Two of the following three courses: 6
  - BAFI 357 Financial Modeling, Analysis and Decision Making 3
  - BAFI 359 Intermediate Corporate Finance 3
  - BAFI 341 Money and Banking 3

Total Units 15
### Minor in Business Management

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
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<tbody>
<tr>
<td>ECON 102</td>
<td>Principles of Microeconomics</td>
<td>3</td>
</tr>
<tr>
<td>or ECON 103</td>
<td>Principles of Macroeconomics</td>
<td></td>
</tr>
<tr>
<td>ACCT 101</td>
<td>Introduction to Financial Accounting</td>
<td>3</td>
</tr>
<tr>
<td>or ACCT 203</td>
<td>Survey of Accounting</td>
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Three electives from the Weatherhead Business Core:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
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<tbody>
<tr>
<td>BLAW 331</td>
<td>Legal Environment of Management</td>
<td></td>
</tr>
<tr>
<td>ENTP 301</td>
<td>Entrepreneurial Strategy</td>
<td></td>
</tr>
<tr>
<td>BAFI 355</td>
<td>Corporate Finance</td>
<td></td>
</tr>
<tr>
<td>MGMT 250</td>
<td>Managing Organizations and People I</td>
<td></td>
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<tr>
<td>MKMR 201</td>
<td>Marketing Management</td>
<td></td>
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<tr>
<td>MIDS 301</td>
<td>Introduction to Information: A Systems and Design Approach</td>
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<tr>
<td>OPRE 301</td>
<td>Operations Research and Supply Chain Management</td>
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**Total Units** 15

### Minor in Economics

<table>
<thead>
<tr>
<th>Course</th>
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<th>Units</th>
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<tbody>
<tr>
<td>ECON 102</td>
<td>Principles of Microeconomics</td>
<td>3</td>
</tr>
<tr>
<td>ECON 103</td>
<td>Principles of Macroeconomics</td>
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Three additional ECON courses

**Total Units** 9

### Minor in Entrepreneurial Studies

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
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<tbody>
<tr>
<td>ACCT 102</td>
<td>Management Accounting</td>
<td>3</td>
</tr>
<tr>
<td>or ACCT 203</td>
<td>Survey of Accounting</td>
<td></td>
</tr>
<tr>
<td>MKMR 201</td>
<td>Marketing Management</td>
<td>3</td>
</tr>
<tr>
<td>ENTP 301</td>
<td>Entrepreneurial Strategy</td>
<td>3</td>
</tr>
<tr>
<td>ENTP 310</td>
<td>Entrepreneurial Finance - Undergraduate</td>
<td>3</td>
</tr>
<tr>
<td>ENTP 311</td>
<td>Entrepreneurship and Wealth Creation</td>
<td>3</td>
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</table>

**Total Units** 15

### Minor in Marketing

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
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</thead>
<tbody>
<tr>
<td>MKMR 201</td>
<td>Marketing Management</td>
<td>3</td>
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</table>

Two courses from the following:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
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<tbody>
<tr>
<td>MKMR 307</td>
<td>Marketing Value Chain Management</td>
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<tr>
<td>MKMR 310</td>
<td>Marketing Analytics</td>
<td></td>
</tr>
<tr>
<td>MKMR 311</td>
<td>Consumer Relationship Management</td>
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</table>

Two courses from the following:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
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</thead>
<tbody>
<tr>
<td>ANTH 102</td>
<td>Being Human: An Introduction to Social and Cultural Anthropology</td>
<td></td>
</tr>
<tr>
<td>ECON 328</td>
<td>Experimental Economics</td>
<td></td>
</tr>
<tr>
<td>ENTP 301</td>
<td>Entrepreneurial Strategy</td>
<td></td>
</tr>
<tr>
<td>MKMR 304</td>
<td>Brand Management</td>
<td></td>
</tr>
<tr>
<td>MKMR 312</td>
<td>Selling and Sales Management</td>
<td></td>
</tr>
<tr>
<td>MKMR 350</td>
<td>Entrepreneurial Marketing</td>
<td></td>
</tr>
</tbody>
</table>

**Total Units** 15

For more information, contact Jim Hurley (http://bulletin.case.edu/weatherheadschoolofmanagement/undergradprograms/mailto:james.hurley@case.edu), Assistant Dean of Undergraduate and Integrated Study Programs, at 216.368.3856.
Weatherhead Center

Fowler Center for Sustainable Value

The Fowler Center (http://weatherhead.case.edu/centers/fowler) leverages interdisciplinary scholarship and practice to help leaders capitalize on new profitable business opportunities to solve the world's growing social and environmental problems. The Center works directly with all kinds of institutions to embed sustainability into their core strategy, applying cutting-edge competencies in design, innovation, whole systems, and Appreciative Inquiry. The Fowler Center is led by Executive Director Roger Saillant, PhD. The Fowler Center focuses on two primary areas: scholarship and outreach.

Sustainable Value is defined as a dynamic state that occurs when a company creates ongoing value for its shareholders and stakeholders. By "doing good" for society and the environment, the company does even better for its customers and shareholders than it otherwise would.

To learn more or to find out how you or your organization can get involved with the Fowler Center, visit our website (http://weatherhead.case.edu/centers/fowler) or contact Beau Daane (http://bulletin.case.edu/weatherheadschoolofmanagement/centers/mailto:beau.daane@case.edu), Fowler Center Manager, at 216.368.4795.
Weatherhead School of Management Courses

ACCT Courses

ACCT 101. Introduction to Financial Accounting. 3 Units.
Financial reports are the most significant means for an organization to communicate its management results to stockholders, creditors, and regulators. This course covers concepts, principles, and practices, including preparation and interpretation, of financial reports. The financial reporting system and basic internal controls for the balance sheet, income statement, and cash flow statements are discussed. A student may not receive credit for both ACCT 101 and ACCT 203.

ACCT 203. Survey of Accounting. 3 Units.
The course covers the principle of financial and managerial accounting for non-management students, including the framework that underlies financial and management accounting and how accounting information should be used by: (1) parties external to the firm, i.e., stockholders, creditors and government, to evaluate the financial performance of an organization; and (2) internal management to fulfill the planning, control and performance evaluation functions. Enrollment is limited to students who are neither management nor accounting majors nor enrolled in the Weatherhead School of Management. This course may be substituted for ACCT 101. A student may not receive credit for both ACCT 101 and ACCT 203. This course cannot be substituted for ACCT 102 without a waiver from the chairman. Offered as ACCT 203 and ACCT 403.

ACCT 300. Corporate Reporting I. 3 Units.
This course covers financial accounting theory, generally accepted accounting principles and reporting practices, including evaluation of current issues and practices related to asset valuation, including receivables, inventory and fixed assets. It also covers the users and uses of financial statements, the difference between cash-basis and accrual accounting, the determination of income, the financial statements, financial statement analysis, revenue recognition, and the role of financial information in valuation decisions and contracting. Prereq: ACCT 101 and ACCT 202 or requisite not met permission.

ACCT 301. Corporate Reporting II. 3 Units.
This course covers financial accounting theory, generally accepted accounting principles and reporting practices. Areas of focus include: liability determination, long-term debt, derivatives, leases, pensions and other postretirement benefits, accounting for income taxes, earnings per share, stock options, and investments. International aspects also are considered. Prereq: ACCT 300.

ACCT 304. Advanced Financial Reporting. 3 Units.
This course covers partnerships, consolidations, foreign exchange, international aspects of accounting, accounting for state and local governments and not-for-profit organizations, segment reporting and interim reporting. Prereq: ACCT 301.

ACCT 305. Income Tax: Concepts, Skills, Planning. 3 Units.
This course addresses U.S. Federal Income Taxation concepts and applications. The subject matter includes topics applicable to individuals, partnerships and corporations and various other entities required to file income tax returns. In addition the subject matter addressed includes a variety of business, legal and taxation concepts and practices related to effective tax planning. The purpose of the course is to provide the student with the appropriate knowledge and skill levels to "speak the language of U.S. tax." Prereq: ACCT 202 or ACCT 401 or requisite not met permission.

ACCT 314. Attestation and Assurance Services. 3 Units.
This course covers the role of the auditor, the audit process, the public accounting profession, audit risk and materiality, fraud, audit methods and techniques, audit planning, internal control, the effects of information technology on the audit, auditing revenue, receivables and inventories, professional ethics, legal responsibilities, emerging assurance services, and recent developments in the auditing profession. Prereq: ACCT 301.

ACCT 360. Independent Study. 1 - 18 Unit.

ACCT 403. Survey of Accounting. 3 Units.
The course covers the principle of financial and managerial accounting for non-management students, including the framework that underlies financial and management accounting and how accounting information should be used by: (1) parties external to the firm, i.e., stockholders, creditors and government, to evaluate the financial performance of an organization; and (2) internal management to fulfill the planning, control and performance evaluation functions. Enrollment is limited to students who are neither management nor accounting majors nor enrolled in the Weatherhead School of Management. This course may be substituted for ACCT 101. A student may not receive credit for both ACCT 101 and ACCT 203. This course cannot be substituted for ACCT 102 without a waiver from the chairman. Offered as ACCT 203 and ACCT 403.

ACCT 405. Advanced Federal Taxes. 3 Units.
Corporate income taxes, estate and gift tax, fiduciary income taxes, partnerships, and hybrid forms of organization are covered. Prereq: MAcc students only and ACCT 305.

ACCT 406. Accounting Information Systems. 3 Units.
This course is designed to explore and understand accounting as an information system. We will examine the use, development, evaluation, and management of both the information itself and the technology applied to it. The course assumes background in principles of accounting at the fundamental level or consent of instructor.

ACCT 413. Advanced Management Accounting and Control. 3 Units.
Managerial accounting is concerned with providing information and analysis to assist managers in the planning, directing, and controlling of company operations. This course covers advanced techniques for dealing with contemporary issues requiring accounting information and analysis. Writing communication and support for sustainable outcomes are emphasized. Prereq: ACCT 401 or MBAC 503 or equivalent.
ACCT 414. Corporate Reporting and Analysis. 3 Units.
This course provides a basis for evaluation of traditional and proposed uses of report and information for decision making in investment, credit and internal planning and control. Students are introduced to concepts and analytical techniques that can be used to critique and interpret the financial health of the organization. At a practical and theoretical level, the course integrates research in the areas of accounting, quantitative methods and finance which has proved useful in the financial analysis of organizations. Prereq: (ACCT 401 or MBAP 402 or MBAC 502) and (BAFI 402 or MBAP 405 or MBAC 504).

ACCT 418. Fraud, Governance and Reporting. 3 Units.
This course examines managerial fraud, primarily made possible by the manipulation of accounting. This includes treatments of the motives for fraudulent behavior but focuses primarily upon the techniques of earnings management and the processes of its detection. Governance of organizations in the post-Enron, WorldCom and Tyco environment will also be studied. Regulation and the duties of those responsible for proper governance will be among the topics in this portion of the course. Guest speakers from the forensic industry and materials from practice institutes will be employed. Prereq: ACCT 401 and BAFI 402 or equivalent.

ACCT 430. Taxes and Management Decisions. 3 Units.
This course is designed to sensitize students to the importance of tax planning opportunities and pitfalls inherent in management decisions. The course will focus on helping students recognize potential tax opportunities and problems by examining a variety of practical managerial decision contexts. The course is specifically designed for students preparing for careers in management, not necessarily in accounting or tax. Prereq: ACCT 401 or MAND 425 and MAND 426.

ACCT 431. Tax Practice: Analysis, Planning and Communications. 3 Units.
This course concentrates on teaching the identification of key U.S. tax issues, the analysis of fundamental tax concepts and the underlying interpretation and application of tax law through the use of appropriate authoritative sources. Both oral and written communication will be utilized to present tax planning research results. Actual court cases will be used as the basis for simulating practical client scenarios. Prereq: ACCT 305.

ACCT 437. Principles of Personal Financial Planning and Taxation. 3 Units.
This course focuses on financial planning for individuals. It is designed to be an overview course that touches on the basic concepts of each area of financial planning including general principles of financial planning, insurance planning, investment planning, income tax planning, retirement planning, estate planning, and planning for college education funding. Upon completion of this course, the student should be able to identify major issues in these areas and prepare a basic comprehensive financial plan for a hypothetical client. This course should provide the student with an appreciation for the amount of additional education necessary in order to become qualified as a Certified Financial Planner. Prereq: ACCT 305.

ACCT 439. Regulation of Accountancy. 3 Units.
This course examines the role and structure of government standard-setting agencies, including the U.S. Securities and Exchange Commission (SEC) and the Public Company Accounting Oversight Board (PCAOB) and related legislative and regulatory aspects as found in the Sarbanes-Oxley Act of 2002, and in studies by the General Accounting Office (GAO) and other regulatory agencies. The 1993 and 1994 securities acts, the notions of full and fair disclosure and auditor independence are addressed as important aspects of securities regulation. Research papers and assignments address technical and disclosure requirements of operating companies and mutual funds. Extensive use is made of web-based information including company and mutual fund sites and databases. Prereq: ACCT 301.

ACCT 444. Advanced Auditing Theory and Practice. 3 Units.
This course examines auditing concepts and issues in depth. A special focus exists on audit evidence and how auditors make decisions. Some topic areas include ethics, analytical review, fraud, and the role of technology. Prereq: MAcc students only; ACCT 314 or consent.

ACCT 480. International Tax. 3 Units.
A student will achieve a practical command of the tax issues, from an accountant's perspective, which are raised by international transactions and how the U.S. tax laws resolve those issues. Subject matter includes an overview of the U.S. tax system for international transactions, sourcing rules, foreign activities of U.S. persons, foreign tax credit, U.S. taxation of foreign persons, foreign-owned U.S. businesses, transfer pricing and tax treaties. In addition, examples of VAT (value-added taxation) and of the tax regime of a non-U.S. country will be studied. Prereq: ACCT 305.

ACCT 495. Advanced Accounting Seminar. 1 Unit.
This one semester credit hour seminar is designed to permit focus and attention upon specialized technical accounting and reporting topics which are individually insufficient to warrant larger credit offerings. It is expected that the topics of individual ACCT 495 seminars will vary based upon faculty availability and interest and the rapidly changing environment of professional circumstances. Individual seminar topics will be proposed, reviewed and approved by the accounting faculty at appropriate times and thereafter added to the ACCT 495 offering list. Possible seminar topics include: International Financial Accounting Standards; Securities and Exchange Commission Accounting; Federal Financial Accounting and Reporting; Mutual Fund Reporting; Financial Controls and Board Governance; Research Methods and Topics; and Triple-Bottom Line/Accountability topics.

ACCT 501. Special Problems and Topics. 1 - 18 Unit.
This course is offered, with permission, to students undertaking reading in a field of special interest.

ACCT 520. Advanced Accounting Theory. 3 Units.
This seminar studies contemporary issues in financial accounting theory and business reporting. Topics are considered from their historical development to contemporary circumstances. Academic and professional literatures are employed to gain a variety of perspectives on current matters. The development of communication skills, written and verbal, and use of support technology for presentations is emphasized throughout. Students are required to make several individual and team presentations, to conduct database and periodical research and to provide frequent written and oral research reports. Prereq: MAcc students only; ACCT 304 or consent.
ACCT 540. Contemporary Accountancy Policy. 3 Units.
This is a seminar on subjects of contemporary concern to the profession of accountancy which are currently being analyzed and debated by professional bodies and the academic community. These subjects involve the role of the profession in society, and the appropriate execution of that role. Some of the potential topics are government oversight in the profession, competitive pressures, independence, scope of services, and education/competency issues. The seminar provides a participative understanding of the press of society on the accountancy profession. Prereq: MAcc students only and ACCT 304 and ACCT 314, or requisites not met permission.

ACCT 601. Special Problems and Topics. 1 - 18 Unit.
This course is offered, with permission, to Ph.D. candidates undertaking reading in a field of special interest.

Prereq: Predoctoral research consent or advanced to Ph.D. candidacy milestone.

BAFI Courses

BAFI 341. Money and Banking. 3 Units.
This course emphasizes the importance of financial markets, the nature and role of the financial system, and the linkages between these—money and banking—and the economy. Emphasis is placed on both theoretical and practical constructs, on major innovations and contemporary changes, and the closely intertwined condition of financial and economic systems with monetary and fiscal policy. Offered as BAFI 341 and ECON 341. Prereq: ECON 102 and ECON 103.

BAFI 342. Public Finance. 3 Units.
Government intervention is a pervasive feature of every modern economy. The goal of this course is to develop the economic tools for understanding and evaluating a wide range of government behaviors such as taxation and redistribution policy, the public provision of goods and services, and the regulation of private markets. ECON 342 begins by considering "market failures" that justify government intervention in a market economy. To respond to such failures, governments must raise revenues through taxation. Using the tools of microeconomic theory, we will develop a framework for thinking about the positive and normative effects of alternative forms of taxation. Particular attention will be paid to the individual income tax in the U.S., allowing students to understand the efficiency, distributional and behavioral implications of recent changes in the tax code. We will then turn to the expenditure side of the public sector. The economic principles used to evaluate public expenditures will be discussed and exemplified through the analysis of significant public programs. Of particular interest will be the effect of public programs on the incentives faced by workers and families. Offered as BAFI 342 and ECON 342. Prereq: ECON 102.

BAFI 355. Corporate Finance. 3 Units.
The basic goals of this course are to familiarize students with the concepts and tools used in financial management at both the corporate and personal levels. They include the notion of present value, securities valuation, risk and return analysis, and other financial analysis techniques. The concepts and techniques are, in turn, used to evaluate and make decisions regarding the firm’s investments (capital budgeting) and the cost of capital. Prereq: Minimum sophomore standing; ACCT 101 or ACCT 303.

BAFI 356. Investments. 3 Units.
This course is about investing in securities. It provides a comprehensive introduction to security analysis and portfolio management. Investing is a rational decision-making process in which the investor seeks to select a package or portfolio of securities that meets a predetermined set of objectives. Descriptive, institutional and quantitative decision-making methods are arranged in a cohesive framework of analysis of interest to the informed investor. Topics include modern portfolio theory, the relation between risk and return, efficient markets, bonds, and options, among others. Prereq: BAFI 355.

BAFI 357. Financial Modeling, Analysis and Decision Making. 3 Units.
Firms try to create value. In their day-to-day operations, they are faced with numerous challenges: Should we accept trade credit or borrow? Will an acquisition create or destroy value? Should we introduce a new product line even if it cannibalizes an existing one? In each of these situations they try to quantify the impact on the value of their firm. The goal of this course is to develop your skills in financial modeling and valuation, so you can tackle issues like the ones described above. The course is designed to be “hands-on”: You will learn to apply the theory and develop spreadsheet modeling skills through homework, case studies and a group project. By the end of the course you will have a good understanding of both the theory and practice of valuation, and possess a set of cutting-edge financial modeling skills. This course is designed for students who aspire to work in a regular company, a bank or a consulting firm in (i) corporate finance (including mergers and acquisitions); (ii) strategy; or (iii) equity and analysis. Prereq: BAFI 355.

BAFI 359. Intermediate Corporate Finance. 3 Units.
This second course in corporate finance is designed to lay the analytic foundation for careers in business. The objective of the course is to strengthen students’ conceptual understanding and problem-solving skills. Topics covered include economic cash flows and valuation, long term financial planning and ratios analysis, growth and external financing, short term financial planning, working capital management, capital budgeting and managerial options, capital structure, payout policy, financial strategy, initial public equity offerings, and mergers and acquisitions. Topics covered may vary from semester to semester. The course envisages use of spreadsheets and case studies. Prereq: BAFI 355.

BAFI 360. Independent Study. 1 - 18 Unit.
This course is offered for candidates undertaking reading in a field of special interest. Permission of department chair required.

BAFI 361. Applied Financial Analytics. 3 Units.
This course is developed based on the feedback received from employers who have hired BS Management (finance) graduates in the past and will likely do so in future. The goal is to enable students to use financial econometrics to effectively analyze financial data, and hone skills in financial modeling and valuation with the objective of understanding the value created or destroyed by the activities or proposed activities of a firm. The course will draw on theoretical aspects of BAFI 355 but focus on developing financial analytic skills. SAS statistical package use and modeling skills will be developed. By the end of the course, students will appreciate what drives valuation, and be comfortable in financial data analytics using SAS. Prereq: BAFI 355. Coreq: BAFI 357.
BAFI 372. International Finance. 3 Units.
This course deals with open-economy macroeconomics and international financial markets, covering open-economy national income analysis, international macroeconomic policy coordination, exchange rate determination, foreign portfolio investment, and global financial crises. Offered as BAFI 372 and ECON 372. Prereq: ECON 102 and ECON 103.

BAFI 402. Financial Management I. 3 Units.
In this course, students are introduced to the basics of corporate finance, including the objectives, tasks, and decisions made by corporate financial managers. The course covers discounted cash flows, bond and stock valuation, cost of capital, capital budgeting, asset risk and return, and short-term and long-term financial management. Coreq: ACCT 401 or MBAC 502 or MBAP 402.

BAFI 402A. Financial Management 1. 2 Units.
This module reviews knowledge and refreshes core skills in managerial finance, especially those related to financial statement analysis, discounted cash flow valuation, and risk and return in the capital markets. Teaching methods include lectures, discussions, cases, and extensive exercises. Prereq: Open to ACL-MBA students.

BAFI 403. Financial Management. 3 Units.
The purpose of this course is to familiarize the student with the theory and application of additional models used in financial decision-making by corporations. Issues relating to efficient markets, dividend policy, capital structure, financing decisions, option pricing, leasing, and risk management are among the topics considered. In addition, special topics may include mergers and acquisitions, pension funds, and international financial management. Prereq: ACCT 401 or MBAC 502 or MBAP 402.

BAFI 404. Financial Modeling. 3 Units.
Firms try to create value. In their day-to-day operations, they are faced with numerous challenges; should we accept trade credit or borrow? Will an acquisition create or destroy value? Should we introduce a new product line even if it cannibalizes an existing one? In each of these situations they try to quantify the impact on the value of their firm. The goal of this course is to develop your skills in financial modeling and valuation, so you can tackle issues like the ones described above. The course is designed to be "hands-on": you will learn to apply the theory and develop spreadsheet modeling skills through homework, case studies and a group project. By the end of the course you will have a good understanding of both the theory and practice of valuation, and possess a set of cutting-edge financial modeling skills. This course is designed for students who aspire to work in a regular company, a bank or a consulting firm in (i) corporate finance (including mergers and acquisitions); (ii) strategy; or (iii) equity analysis. Prereq: BAFI 402 or MBAC 504 or MBAP 405.

BAFI 420. Health Finance. 3 Units.
Exploration of economic, medical, financial and payment factors in the U.S. healthcare system sets the framework for the study of decisions by providers, insurers, and purchasers in this course. The mix of students from various programs and professions allows wide discussion from multiple viewpoints. Offered as BAFI 420 and HSMC 420.

BAFI 427. Green Finance. 3 Units.
Natural systems and resources are being depleted, degraded, and impaired at a rapidly increasing pace. Yet there are very few businesses that are paying adequate attention to the adverse impact of such changes on their future as well as on their survival. How do these changes affect corporate risks? What financial challenges do they create? How can policy changes help move firms in the right direction? What innovative products and strategies can companies use to deal with these challenges? How can companies assess sustainability risk? How can these strategies add sustainable value to firms? These are just a sample of the questions that we will address in this course. This course on Green Finance will provide you with a unique opportunity to understand and explore such questions, especially as they pertain to the role of senior financial managers as well as other members of the senior management team of companies across different industries. It will expose you to cutting edge practices in the area of green finance, providing you with the thought leadership that is essential for success in today’s competitive world.

BAFI 428. Financial Strategy and Value Creation. 3 Units.
The intersection between the theory of perfect markets and the reality of market imperfections provides the basis for the exploration of value creation in this course. Opportunities in both product and financial markets are explored using case studies to develop a framework for strategic financial decisions. Prereq or Coreq: BAFI 403.

BAFI 429. Investment Management. 3 Units.
This course explores the characteristics of financial investments and markets and develops modern techniques of investment analysis and management. The goal is to help students develop a level of analytical skill and institutional knowledge sufficient to make sensible investment decisions. Topics include: an overview of stock, debt and derivative asset markets, practical applications of modern portfolio theory, equilibrium and arbitrage-based approaches to capital market pricing, the debate over market efficiency, the term structure of interest rates, bond portfolio management, and uses of derivative assets in investment portfolios. Prereq or Coreq: BAFI 403.

BAFI 430. Derivatives and Risk Management. 3 Units.
This course is intended to give students an understanding of options and futures markets both in theory and practice. The emphasis is on arbitrage and hedging. The course concentrates on listed common stock and index contracts as well as commodity markets. Various theories for trading strategies are studied. Prereq or Coreq: BAFI 403.

BAFI 431. Fixed Income Markets and Their Derivatives. 3 Units.
This class is concerned with fixed income securities, interest rate risk management, and credit risk. Fixed income securities account for about two thirds of the market value of all outstanding securities, and hence this topic is important. The course covers the basic products of fixed income markets including treasury and LIBOR products, such as interest rate swaps. Risk management and hedging strategies are covered as well as selected topics in credit risk models and mortgage-backed securities. Prereq: BAFI 430.
BAFI 432. Corporate Risk Management. 3 Units.
This is a unique strategic risk management course aimed at participants who wish to enhance their understanding of the risks faced by corporate firms, both financial and non-financial. Learn techniques to identify and measure these risks, and understand how derivatives and risk management solutions can be used to manage these risks, create value, and advance the strategic goals of the firm. The course is designed in a manner such that it would be of use to executives of all corporations, financial and nonfinancial, across all functional areas. Prereq or Coreq: BAFI 403.

BAFI 440. Advanced Corporate Finance. 3 Units.
This course exposes the students to a more in-depth treatment of some of the topics covered in BAFI 403 and introduces them to new topics. Topics include investment decisions, financing decisions, payout decisions, contracting decisions and performance metrics, internal control systems, risk management, real options, diversification and valuation. Topics covered may vary from semester to semester. Prereq: BAFI 403.

BAFI 444. Entrepreneurial Finance. 3 Units.
The objective of this course is to introduce students to the issues of financial management and capital formation in new ventures. The course will address issues of estimation of cash requirements, development of pro forma financial plans, firm valuation and the process and tools used in raising debt and equity financing. Bootstrapping, angel investing, venture capital, strategic alliances and initial public offerings will be covered. The emphasis is on the entrepreneur and how he/she can assess financial needs and develop a sensible plan for acquiring financial resources in a manner that is consistent with their financial needs and other strategic goals. Offered as BAFI 444 and ENTP 444. Prereq: BAFI 402.

BAFI 450. Mergers and Acquisitions. 3 Units.
This course examines the economic rationale and motivation for the different merger and acquisition and recapitalization activities undertaken by firms and individuals in the U.S. market. Emphasis is on the comparable publicly traded proxy company, comparable "change of control" transaction, and discounted cash flow methods of valuing a firm. The class will also review the different types of debt and equity capital employed to fund mergers and acquisitions and recapitalizations, how senior lenders and equity investors structure their loans and/or investments, and how investors realize the gains through different exit strategies. The legal and tax ramifications of various forms of M&A activity are also discussed. The course gives the student an excellent understanding of the role that senior commercial banks, insurance companies, pension funds, LBO funds, investment banking firms, and venture/growth capital investors play in mergers and acquisitions and will strengthen the students' ability to value a business enterprise. Prereq: BAFI 403.

BAFI 460. Investment Banking. 3 Units.
This course covers the role of the investment banker as a strategic financial advisor, primarily to corporate clients. The course is divided into three sections, roughly equal in length: (1) industry structure, key players, services and strategies, (2) the capital acquisition process, with a particular focus on initial public equity offerings, and (3) mergers and acquisitions, with a focus on advising financial and strategic buyers and financing these transactions. Students will gain extensive experience in applying financial models that support valuations in various markets. Prereq: BAFI 403.

BAFI 480. International Financial Management. 3 Units.
This course introduces students to international finance and foreign exchange risk management by corporations. Topics include foreign exchange markets and international financial institutions; fx contracts; exchange rate risk and corporate risk management; and international aspects of long-term financing. Prereq: BAFI 403.

BAFI 501. Special Problems and Topics. 1 - 18 Unit.
This course is offered, with permission, to students undertaking reading in a field of special interest.

BIOS Courses

BIOS 447. Regulatory Affairs for the Biosciences. 1.5 Unit.
This mini-course introduces students to the Food and Drug Administration (FDA) and the laws and regulations it enforces. A scientific regulatory agency with far-reaching enforcement authority, FDA is the most powerful consumer protection agency in the world. This course will familiarize students with FDA’s mission, philosophy and organizational structure, as well as policy and procedure it uses to ensure the safety and effectiveness of the food, drugs, biologics, cosmetics, medical devices and radiation-emitting products it regulates. Recommended preparation: Enrollment in the MEM Biomedical Entrepreneurship Track. Offered as BIOS 447, HSMC 447, and IIME 447.

BIOS 448. Engineering Statistics for Biosciences. 3 Units.
This course provides an introduction to biostatistics, emphasizing experimental design, analysis of data, and special emphasis on statistical and financial aspects of randomized clinical trials for biomedical applications. There will be a final project involving development of a clinical trial protocol including the experimental design, recruitment and retention strategy, analysis plan and budget. Offered as BIOS 448, HSMC 448, and IIME 445.

BLAW Courses

BLAW 331. Legal Environment of Management. 3 Units.
This course is designed as a survey course in the area of basic business law. It covers the fundamental legal principles and laws that underlie any business decision. The major topics include: contracts, the Uniform Commercial Code (sales), torts, real and intellectual property, business organizations, Securities Regulation and Agency.

BLAW 417. Legal Environment for Managers - M.B.A.. 3 Units.
This course will provide an overview of the legal environment in which business transactions take place. Through coverage of a number of topical areas, the student will be given a broad understanding of how the law impacts upon the daily decisions of managers. More specifically, the student will be better able to identify and understand how the legal issues facilitate or hinder the conduct of business. Topics covered will include contracts, property, products' liability, employment law, and corporate law. Special emphasis is placed on those regulatory areas of greatest interest to modern business.
ECON Courses

ECON 102. Principles of Microeconomics. 3 Units.
This course is an introduction to microeconomic theory, providing a foundation for future study in economics. In particular, it addresses how individuals and businesses make choices concerning the use of scarce resources, how prices and incomes are determined in competitive markets, and how market power affects the prices and quantities of goods available to society. We will also examine the impact of government intervention in the economy.

ECON 103. Principles of Macroeconomics. 3 Units.
While Microeconomics looks at individual consumers and firms, Macroeconomics looks at the economy as a whole. The focus of this class will be on the business cycle. Unemployment, inflation and national production all change with the business cycle. We will look at how these are measured, their past behavior and at theoretical models that attempt to explain this behavior. We will also look at the role of the Federal Government and the Federal Reserve Bank of the United States in managing the business cycle.

ECON 120. Life After Graduation. 1 Unit.
This is a one-credit seminar intended for freshmen, sophomores and juniors. The purpose of the class is to help students understand what career choices they will have with an economics major. During this course, students will assess their strengths and weaknesses, learn networking tools, and explore the options available to them. The class will meet once a week for an hour. Graduating seniors need to obtain permission to enroll. Students may not earn credit for ECON 120 if they have completed MGMT 250.

ECON 255. Economic History of the United States. 3 Units.
The growth of the American economy from the colonial period to the present. Competing explanations of economic growth; significant attention to the political and legal environment in which the U.S. economy developed; "lessons" of past experience for contemporary policy; some attention to inequality and the changing distribution of wealth and income. Offered as ECON 255 and HSTY 255.

ECON 301. Entrepreneurial Strategy. 3 Units.
This course is designed to show students how to identify potential business opportunities, determine what constitutes a good business model, and to strategically implement a business proposal. Topics of focus include an overview of the entrepreneurial process, determinants of venture success in high tech and other business environments, and strategies for industry entry and venture growth. Offered as ECON 301 and ENTP 301. Prereq: ACCT 101 or ACCT 203. Coreq: At least sophomore standing.

ECON 307. Intermediate Macro Theory. 3 Units.
Macroeconomics studies aggregate indicators of the performance of an economy, most commonly measured in terms of GDP, unemployment rate and inflation rate. An important goal of macroeconomic researchers is to develop a model of an economy that is simple, yet powerful enough to explain the historical trends of these aggregate economic indicators. Needless to say, coming up with a good model has remained a very difficult task. So far, there is no single model that is good enough to coherently explain even the most prominent historical trends of aggregate economic indicators. But several models have been built, each offering insight into a certain aspect of the economy. Throughout the course model building is motivated by real world cases from the American economy. Prereq: ECON 102 and ECON 103.

ECON 308. Intermediate Micro Theory. 3 Units.
This class will give you an overview of microeconomic theory, which forms a basis for much of economic analysis. The main focus of the class will be theoretical, in order to give you a solid foundation for future study in virtually any other field of economics. This includes the theory of how consumers decide what to consume and how firms decide when to stay in business, and how much to produce at what price. Note: a student cannot receive degree credit for both ECON 308 and ECON 309. Prereq: ECON 102.

ECON 309. Intermediate Micro Theory: Math Based. 3 Units.
This course will cover the same topics covered in Economics 102: theory of the consumer, theory of the firm, markets and government intervention in the market. However, we will cover these topics in more detail and we will use calculus in our analysis. You should come away from this course with a greater understanding of how consumers and firms make their decisions and how they interact in the market place. Note: a student cannot receive degree credit for both ECON 308 and ECON 309. Prereq: ECON 102, MATH 121 or MATH 125.

ECON 311. Entrepreneurship and Wealth Creation. 3 Units.
This course teaches students how to find, value, and finance the acquisition of a business, culminating in the class negotiation with a business owner to buy his/her business in a live simulation. Students will be exposed to the concepts and tools needed to successfully acquire a company. Negotiation strategies will be explored. Entrepreneurial Leadership approaches on how to grow and manage the business, once it is owned will also be presented, including how to create a strategic plan. The course also features a real-start up of a business. Student teams will each be given $1000 of seed capital. Learnings include how to select a product, and how to develop and execute a marketing plan. Students will meet top merger-acquisition experts and be exposed to some of Cleveland’s most respected entrepreneurs. Offered as ECON 311 and ENTP 311.

ECON 326. Econometrics. 3 Units.
Econometrics is the application of statistics to empirical economic analysis. One way of testing the validity of economic theories is to gather data and apply statistical tests to see if the data support the theory. These data are usually gathered by observing actual economies, firms and consumers, rather than by performing experiments in a laboratory. Because economic analysts lack the precision and control of the laboratory, they must compensate by adjusting their statistical procedures. In this class, we will concentrate on regression analysis, which is the basic tool of the economic researcher. We will study the assumptions commonly made in the application of this technique, the consequences of violating these assumptions, and the corrections that can be made. Students will have a chance to formulate and test their own hypotheses using econometric software available for personal computers. Recommended preparation: One semester of statistics or consent of instructor. Prereq: ECON 102 and ECON 103 and (STAT 207 or OPRE 207).

ECON 327. Advanced Econometrics. 3 Units.
This class builds on the foundations of applied regression analysis developed in ECON 326. The goal of the class is to equip students with the tools to conduct a causal analysis of a hypothesis in a variety of settings. Topics will include causality, panel and time series data, instrumental variables and quasi-experiments, semi- and non-parametric methods, and treatment evaluation. Prereq: ECON 326.
ECON 328. Experimental Economics. 3 Units.
This course introduces students to the use of experiments by economists to study individual choice behavior, policy, and markets. Students learn methods through exploring the recent experimental literature in fields such as charitable giving, discrimination, incentives, cooperation, self-control, and education. Topics include causality, experimental design, internal and external validity, biases, and inference problems. Prereq: ECON 102.

ECON 329. Game Theory: The Economics of Thinking Strategically. 3 Units.
The term "game theory" refers to the set of tools economists use to think about strategic interactions among small groups of individuals and firms. The primary purpose of this course is to introduce students to the basic concepts of game theory and its applications. The class will stress the use of game theory as a tool for building models of important economic phenomena. The class will also include a number of experiments designed to illustrate the game theoretic results, and to highlight how reality may depart from the theory. The course will stress the value of thinking strategically and provide students with a framework for thinking strategically in their everyday lives. Rather than approaching each strategic situation they encounter as a unique problem, students will be taught to recognize patterns in the situations they face and to generalize from specific experiences. Prereq: ECON 102.

ECON 330. Economic Behavior and Psychology. 3 Units.
This course will cover the relatively new field of Behavioral Economics, also sometimes called "Psychology and Economics." Behavioral economics involves incorporating insights into economics from other disciplines that enrich the understanding of how people make economic decisions. Most of the crossovers come from the field of psychology, but there is also a growing interest in ideas from sociology and neuroscience. We will cover fundamental concepts related to decision-making, such as how people respond to risk, how people make decisions over time, and the ways in which people really aren’t as selfish as economists sometimes make it seem. We will also discuss empirical work that shows how these concepts affect how economists think about real-world issues. Examples include examining how to set the default options for 401k programs, understanding why people pay for costly gym memberships they do not use, and looking at whether sellers on Ebay use the best possible ending times for their auctions. Prereq: ECON 102.

ECON 331. Money and Banking. 3 Units.
This course emphasizes the importance of financial markets, the nature and role of the financial system, and the linkages between these--money and banking--and the economy. Emphasis is placed on both theoretical and practical constructs, on major innovations and contemporary changes, and the closely intertwined condition of financial and economic systems with monetary and fiscal policy. Offered as BAFI 341 and ECON 341.

ECON 332. Economic Analysis of Labor Markets. 3 Units.
This course is about the economics of work and pay. We will take a comprehensive look at labor markets in the U.S. and other advanced countries and examine related social policy issues. This will include the effect of unions on wages, the underpinnings of the income distribution of the U.S., issues of poverty and welfare, discrimination and wage differential by gender and race, the relationship between work and family, education as a determinant of wages, and the way firms use wage and employment practices to motivate their employees to work productively. What makes labor economics special is that the commodity we examine is human labor, something that is central to the organization of our lives and the functioning of the economy. Labor economics thus applies the standard neoclassical model of demand, supply, and equilibrium to many areas that also have a profound human dimension. Prereq: ECON 102.

ECON 333. The Economics of Organizations and Employment Relationships. 3 Units.
Organizational Economics is the study of effective organizational design and management. It applies the powerful tools of modern economics to such questions as: what are the practices and structures that make for successful firms? Why are successful firms able to excel at some things (think Microsoft and word processors and spreadsheets) but not at other things (think Microsoft and web-based search)? Fundamentally organizations are human enterprises and their performance is driven by the people they employ. For this reason a good deal of organizational economics is concerned with how firms structure relationships with their employees. One of the important benefits students gain from studying organizational economics is a rigorous and logical framework for thinking about their jobs and careers. By applying this framework to many different real world settings, students become adept at translating general insights to their specific concerns. Organizational economics is built upon a hybrid approach to human behavior that draws from economics and social psychology. From economics, we take the idea that individuals can skillfully use the resources and information at their disposal to achieve their goals. From social psychology we take the idea that individual pursuit of their interests is complicated by the emotions, impulses, and cognitive biases built into human brains. The economic emphasis on goals implies that successful organizations must structure incentives and design jobs in ways that are consistent with the interests of employees. The psychological approach implies that successful organizations must also adopt motivational strategies that appeal to both the rational and non-rational drivers of human behavior. Prereq: ECON 102.

ECON 341. Money and Banking. 3 Units.
This course emphasizes the importance of financial markets, the nature and role of the financial system, and the linkages between these--money and banking--and the economy. Emphasis is placed on both theoretical and practical constructs, on major innovations and contemporary changes, and the closely intertwined condition of financial and economic systems with monetary and fiscal policy. Offered as BAFI 341 and ECON 341.

ECON 342. Public Finance. 3 Units.
Government intervention is a pervasive feature of every modern economy. The goal of this course is to develop the economic tools for understanding and evaluating a wide range of government behaviors such as taxation and redistribution policy, the public provision of goods and services, and the regulation of private markets. ECON 342 begins by considering "market failures" that justify government intervention in a market economy. To respond to such failures, governments must raise revenues through taxation. Using the tools of microeconomic theory, we will develop a framework for thinking about the positive and normative effects of alternative forms of taxation. Particular attention will be paid to the individual income tax in the U.S., allowing students to understand the efficiency, distributional and behavioral implications of recent changes in the tax code. We will then turn to the expenditure side of the public sector. The economic principles used to evaluate public expenditures will be discussed and exemplified through the analysis of significant public programs. Of particular interest will be the effect of public programs on the incentives faced by workers and families. Offered as BAFI 342 and ECON 342. Prereq: ECON 102.
ECON 343. Economics of State and Local Governments. 3 Units.
This course uses economic analysis to gain insight in the U.S. system of state and local governments. In the case of local governments, unlike the familiar case of the U.S. government, people often display their displeasure with the government’s actions by leaving rather than by voting against the incumbents. A careful consideration of the circumstances under which people will choose "exit" (moving out) over "voice" (voting) is central to the course. We’ll also examine economic theories of why people vote and how people vote. We consider a broad range of policy issues. Among them are school finance, zoning, local government economic development policies, lotteries, and affordable housing policy. Of course, we also analyze the full range of state and local government taxes, including the property tax, personal income tax, corporate income tax, and sales tax. Prereq: ECON 102 or consent of instructor.

ECON 346. Economic Perspectives. 3 Units.
This course examines important contemporary and historical issues from an economic perspective. It enables students to think about the world "like an economist." Possible topics of current interest include the transformation of Eastern Europe, ethnic and racial strife, environmental policy and sustainable development, and professional sports.

ECON 350. World Economic History: From Poverty to Prosperity. 3 Units.
The average person living in the industrialized world today has 10-20 times the annual income of his or her forbearers in 1800 and a much longer lifespan. What explains the massive increases in living standards for residents of the industrialized world? The average person living in Africa today has roughly the same if not less annual income than in 1800. Why haven’t all the world’s people seen a similar increase in living standards since 1800? These questions are the central themes of this course on the evolution of the world economy over the past millennium. Highlights of the class will include the pre-1800 Malthusian economy, the industrial revolution and its spread, 19th and 20th century globalization booms, and the development successes and failures of the 20th century. Prereq: ECON 102.

ECON 364. Economic Analysis of Business Strategies. 3 Units.
This course examines how companies compete against each other and interact with customers in an effort to increase profits. Topics include: pricing strategies, product differentiation, advertising, R&D strategies, bundling and tie-ins, entry barriers, mergers and acquisitions, collusion and cartels, the dynamics of network industries (e.g. information technology), and technology adoption and diffusion. The course will take two complementary perspectives. First, we will consider the point of view of companies, and ask how different business strategies can affect competitive success. Second, we will consider the perspective of consumers and policymakers: we will ask whether different firm strategies enhance or reduce social welfare, and will explore different policy options to increase welfare (e.g. antitrust policies, patent systems). The first part of the course will utilize a range of basic economic tools. In the second part of the course, we will apply what was learned in the first part to real examples of firms and industries, including both business and legal cases. Prereq: ECON 102.

ECON 367. Energy Economics and Engineering Solutions. 3 Units.
This course examines the economics of markets for various energy sources, and the potential of emerging technologies to alter the market outcomes. We will look at why energy markets have historically been subject to extensive government intervention. We will analyze the effects of traditional policy measures such as price controls and regulation; and we will examine current policy issues arising from the relationships among energy use, economic growth, and the environment. Prereq: ECON 102.

ECON 368. Environmental Economics. 3 Units.
This course will use economic theory as an aid to understanding environmental problems and their solutions. We will start with a study of the firm. Once we have developed an understanding of firms' incentives to pollute and overexploit natural resources, we will learn how various economic policies can change these incentives and thus prevent environmental degradation. Thereafter, we will evaluate the efficiency of these economic policies. Finally, we will apply our theoretical analysis to specific environmental problems. Prereq: ECON 102.

ECON 369. Economics of Technological Innovation and Entrepreneurship. 3 Units.
This course is designed to help students identify, evaluate, and obtain control over technological opportunities so they may successfully understand the challenges of starting new companies. The course focuses on four themes: 1) the source, discovery and evaluation of technological opportunities; 2) the process of organizing a new firm to produce new technology that satisfies the needs of customers; 3) the acquisition of financial and human resources necessary to exploit technological opportunities; and 4) the development of mechanism to appreciate the returns from exploitation of technological opportunities. Prereq: ECON 102.

ECON 372. International Finance. 3 Units.
This course deals with open-economy macroeconomics and international financial markets, covering open-economy national income analysis, international macroeconomic policy coordination, exchange rate determination, foreign portfolio investment, and global financial crises. Offered as BAFI 372 and ECON 372. Prereq: ECON 102 and ECON 103.

ECON 373. International Trade. 3 Units.
This course deals with international trade theories and policies, covering gains from and patterns of trade, immigration, foreign direct investment, protectionism, multilateral trade liberalization, regionalism and the costs and benefits of globalization within as well as among nations. Prereq: ECON 102 and ECON 103.
ECON 375. Economics of Developing Countries. 3 Units.
This course focuses on international aspects of economic development. The term "developing country" is often defined as a country that exhibits low per capita income, high poverty level, low level of industrialization, or low life expectancy. In terms of size, the developing countries make up at least three-fourth of the world population. Why do we study those countries' economies separately from the industrialized economies? In fact, low economic growth, high unemployment, or high poverty rates also exist in many developed countries. The differences lie not in the types of problems but in the causes of these problems. In addition, differences in the kind of institutions that prevail in developing countries also lead to different policy prescriptions. Among developing countries, differences in historical experience, cultural practices, political institutions and economic conditions are also enormous. Illustrations and explanations of those differences are provided from a wide range of developing countries. Prereq: ECON 102 and ECON 103.

ECON 376. Inside the Financial Crisis. 3 Units.
This is a case study in the events surrounding the 2007 global financial crisis. The course will build from fundamental economic concepts into a comprehensive analysis of the elements which led to the collapse and the contemporary policy debates about the recovery. The background for debate will come from an analysis of: Housing and housing finance, bank runs and Bear Sterns, mortgage backed securities and toxic asset purchases. The course will then examine major components of the Dodd-Frank Act and enable students to assess whether the act will address the causes of the 2007 crisis and more importantly establish the conditions to prevent a future crisis. Prereq: ECON 102 and ECON 103.

ECON 378. Health Care Economics. 3 Units.
The health care industry is the fastest growing sector of the U.S. economy, with expenditures on health care now accounting for over 14% of total GDP. Because of its complexity and sheer size, the health care industry affects virtually every facet of the economy including labor productivity, income distribution and international competitiveness. The goal of ECON 378 is to apply the tools of economic analysis to develop students' understanding of health care markets and related public policy issues. The course begins with an overview of the health care system in the U.S. with attention to disturbing statistics that have inspired calls for reform. The remainder of the course is approximately divided between analysis of the consumer side of the health care market and analysis of the provider side. Throughout the course, proposals for reforming the health care system will be described and discussed. Prereq: ECON 102.

ECON 386. Urban Economics. 3 Units.
Microeconomic theory as taught in principles (and even intermediate) does not usually take into account the fact that goods, people, and information must travel in order to interact. Rather, markets are implicitly modeled as if everyone and everything is at a single point in space. In the first part of the course, we will examine the implications of spatial location for economic analysis. In the second part of the class, we will use microeconomic tools to understand urban problems. Topics that we will cover include urban growth, suburbanization, land use, poverty, housing, local government, transportation, education, and crime. Prereq: ECON 102.

ECON 391. Advanced Topics and Writing in Economics. 3 Units.
This course is characterized by intensive yet open-ended intellectual inquiry, guided by reading from primary and secondary sources, and will include extensive practice in written and oral communication. The focus will be on contemporary economic issues and scholarship, and assumes a high level of ability in undergraduate economics training. Specifically, this course provides an avenue for an intellectual discourse on some of the most challenging present day economic issues, and we will rigorously think and write about how economic concepts can be applied to virtually any topic, issue and event in the social world. Students will be challenged throughout the course to think and write like an economist and see the world through the economist's lens. Prereq: ECON 308 or ECON 309 and ECON 326 and junior or senior standing.

ECON 395. The Economy in the American Century. 3 Units.
This class provides an approved SAGES capstone experience for economics majors. It uses American economic history as an arena for a culminating application of the diverse knowledge and skills students have acquired during their undergraduate careers. The twentieth century American economy was shaped by a series of transformations that make our lives profoundly different from those lived by Americans in 1900. Attempting to understand these transformations has shaped the discipline of economics. Events and processes such as mass migration, the Great Depression, the growth of women's participation in the workforce, and suburbanization generated questions that economists developed theories and bodies of empirical evidence to answer. Students will synthesize knowledge accumulated in their prior undergraduate study to tackle big questions posed by the history of the American economy during the 20th century. These questions cover the spectrum of economic life and scholarship, from finance and technology to human capital and gender. Students form teams to tackle an important question developed in consultation with the instructor. Each team will be responsible for educating the class on their research findings through researching and delivering a class-length presentation and preparing readings and exam questions. Students will produce an individual final paper related to their team's topic that expresses their own scholarly perspective and interest. Prereq: Junior or Senior standing.

ECON 397. Honors Research I. 3 Units.
All students admitted to the Honors Program will undertake an independent research project (Senior Thesis) under the guidance of a faculty member (Thesis Advisor). ECON 397 is used to define the topic, review relevant literature, formulate hypotheses, and collect appropriate data toward completing their research project. Students will have the responsibility of providing regular progress reports to their thesis advisor highlighting the work accomplished to date, the immediate challenges confronting them, and a plan to complete the project in the time remaining. Prereq: ECON 102, ECON 103, ECON 326 and ECON 308 or ECON 309; Junior standing and minimum GPA of 3.3 in ECON major and 3.0 overall.

ECON 398. Honors Research II. 1 - 3 Unit.
This is the second course in a two course sequence to complete the Honors Research Program in Economics. Prereq: A grade of B or higher in ECON 397.

ECON 399. Individual Readings and Research. 1 - 6 Unit.
Intensive examination of a topic selected by the student.
ECON 403. Economics for Management. 3 Units.
This course surveys the basic principles of micro and macroeconomics. Topics covered in microeconomics include supply and demand, the theory of production and costs, market structures and factor markets. Macroeconomics topics are the national incomes accounts, the determination of national income, employment and inflation, fiscal and monetary policies and international trade.

ECON 403A. Economics. 1 Unit.
This course serves as a review of economic principles and an introduction to the use of economics in the management setting. Basic economic concepts will be demonstrated by analyzing economic issues and policies relating to the environment in which organizations function. Economic analysis will be demonstrated with reference to particular decisions confronted by firms, including game theory. Prereq: Open to ACL-MBA students.

ECON 421. Health Economics and Strategy. 3 Units.
This course has evolved from a theory-oriented emphasis to a course that utilizes economic principles to explore such issues as health care pricing, anti-trust enforcement and hospital mergers, choices in adoption of managed care contracts by physician groups, and the like. Instruction style and in-class group project focus on making strategic decisions. The course is directed for a general audience, not just for students and concentration in health systems management. Offered as ECON 421, HSMC 421, and MPH 421. Prereq: ECON 403 or MBAC 512 or MBAP 406.

ECON 431. Economics of Negotiation and Conflict Resolution. 3 Units.
Students frequently enroll in a negotiation class with one thought in mind--negotiating a better job offer from an employer. They soon learn, however, that negotiation skills can do far more than improve a pay check. Negotiations occur everywhere: in marriages, in divorces, in small work teams, in large organizations, in getting a job, in losing a job, in deal making, in decision making, in board rooms, and in court rooms. The remarkable thing about negotiations is that, wherever they occur, they are governed by similar principles. The current wave of corporate restructuring makes the study of negotiations especially important for M.B.A.s. Mergers, acquisitions, downsizing and joint ventures call into question well established business and employment relationships. Navigating these choppy waters by building new relationships requires negotiation skills. The increased stress on quality and other hard-to-measure aspects of relationships with customers and suppliers makes the process of negotiation even more complex and subtle. For these reasons, negotiation classes have taken center stage in the study of management. Every major business school now offers classes in negotiation and these classes are overflowing with students. Offered as ECON 431 and LHRP 413.

ECON 464. Technology Entrepreneurship. 3 Units.
This course is designed to help students to identify, evaluate, and obtain control over technology opportunities that they can successfully exploit by starting new companies. The course focuses on four themes: (1) the source, discovery, and evaluation of technological opportunities, (2) the process of organizing innovation to produce new technology that satisfies the needs of customers, (3) the different mechanisms available to appropriate the returns from the exploitation of technological opportunities, and (4) the differences between opportunities and approaches that are valuable and sustainable for independent entrepreneurs and large firms. Students taking this course may not receive credit for both ECON 464 and ENTP 441. Offered as ECON 464 and ENTP 464.

ECON 474. International Trade. 3 Units.
This course deals with the causes and effects of international trade and investment. Its coverage includes the global and regional commercial agreements and institutions that affect the international business environment. The European Union, the North American Free Trade Agreement, and the World Trade Organization are treated extensively. Prereq: ECON 403.

ECON 486. Value Creation Through Real Estate. 3 Units.
Introduction to economic analysis of real estate markets, with focus on development of urban land. Introduction to financial instruments used in development, and to the role of government in facilitating and constraining the use of real property. Prereq: ECON 403.

ECON 501. Special Problems and Topics. 1 - 18 Unit.
This course is offered, with permission, to students undertaking reading in a field of special interest.

ECON 526. Advanced Econometrics. 3 Units.
This course focuses on the theoretical underpinning of multivariate regression analysis. The course also develops practical applications of econometric analysis. The course also introduces students to more advanced topics including discrete choice analysis, instrumental variables, and time-series methods.

ECON 601. Special Problems and Readings. 1 - 18 Unit.
This course is offered, with permission, to Ph.D. candidates undertaking reading in a field of special interest.

ECON 701. Dissertation Ph.D.. 1 - 18 Unit.
Prereq: Predoctoral research consent or advanced to Ph.D. candidacy milestone.

EDMP Courses

EDMP 610. Culture and World Politics. 3 Units.
Religion, ethnicity, and nationalism have assumed major political significance in the post Cold-War and post-9/11 eras. The course examines ideas of political democracy and economic liberalism in relation to different cultural and religious ideas and explores relationships among social values, political structures, and economics. Prereq: Must be enrolled in the DM Program.
EDMP 611. Theory and Practice of Collective Action. 3 Units.
The ability of autonomous and interdependent parties to coordinate actions, or to act cooperatively, affects a wide range of organizational and social problems. This course addresses the theory and practice of collective action in local, national and global contexts. Case studies of collective action problems, such as environmental protection, community revitalization, and the mobilization of interest groups will be discussed.

EDMP 613. Leading Change. 3 Units.
Change is an enigma and yet sustained, desirable change (SDC) drives adaptation, growth and life itself. In this course, we will continuously attempt to answer two questions: What is the process of sustained, desirable change? and What is the role of a leader? Concepts from complexity theory will be used, including understanding the multilevel nature of SDC at the individual, dyad, team, organization, community, country, and global levels. Intentional Change Theory (ICT) will be used as the organizing concept for the changes studied. Leadership and its development will be examined by studying a number of topics and applying them to three major case studies: (1) yourself; (2) practice coaching with compassion; and (3) a major change project. This course will explore questions, such as: Who are effective leaders? How do they think and act? What makes us want to follow them? How are leaders developed? What is the role of emotional and social intelligence? How does a leader’s mind, body, heart, and spirit affect their performance?

EDMP 614. Business as an Evolving Complex System. 3 Units.
The goal of this course is to provide a foundation for understanding how business systems evolve, why the business systems in the major advanced countries have evolved differently over the last 100 years or so, and what the underlying driving forces are. The focus is on transformation rather than economic growth. The course examines the evolution of business systems as a result of technological and organizational change. It deals with the role of history, culture and finance in generating business organizations in various countries. The course also studies the emergence of regional innovation systems and industry clusters, as well as how digitization and globalization are changing the "industrial logic."

EDMP 616. Global Economic Systems and Issues. 3 Units.
This course provides a framework and analytical tools for understanding globalization and international economic relations in the context of the global political system. It analyzes the economic and political forces that are shaping global cooperation on economic matters, the role and impact of international economic institutions such as the World Bank, the International Monetary Fund, and the World Trade Organization, and evolving forms of regional governance, such as the European Union. It covers national and international policies and development and the causes and cures of international financial crises. The course revolves around concepts of efficiency, equality, power, and institutions in the making of public policy towards globalization of communications and transportation. Prereq: EDMP 665.

EDMP 617. Technology and Social System Design. 3 Units.
Managers are designers who shape the social and technical world we inhabit. This course explores the process of design and asks how managers can become better designers and interventionists who anticipate and evaluate the social, economic, and political consequences of existing and emerging products, processes, and organizational forms.

EDMP 627. Applied Research IV. 3 - 9 Units.
(See EDMP 621.)

EDMP 638. Qualitative Inquiry I. 3 Units.
This course explores ways to conceptualize an object of study and facilitates formulation of students’ conceptual work and production of research reports at the end of the first year of the program. The course conveys how to generate research ideas by critically reviewing literature and developing ideas that contribute to a problem or issue of interest by working with theory and extending previous research. The practicality of conducting certain kinds of research is evaluated and length, intensity and ethical constraints of different research efforts are examined. Each student produces a report communicating and supporting a conceptualization of the phenomenon of interest involving independent, mediating and dependent variables. The paper defines a problem of practice, presents, both visually and in narrative form, concepts shaped by field experience and prior writing that promote understanding of the problem, and includes a research proposal describing sample, data collection and data analysis. Prereq: EDMP 665.

EDMP 640. Social Ethics: Contemporary Issues. 3 Units.
The course draws upon intellectual ancestors and current thinkers in moral philosophy and ethics to assist each student in identifying, analyzing, and discussing social and ethical questions pertaining to the definition and purpose of contemporary life, the need for moral coherence, and the meaning of life in a global society. The unifying theme of the course is Tolstoy’s question, “How then shall we live?” The course does not seek to provide answers to the great questions of life. Rather, it tries to expand each student’s capacity to grapple with such questions. Prereq: Must be enrolled in the DM Program.

EDMP 641. Qualitative Inquiry II. 3 Units.
This course guides the student in conducting the qualitative research project that was proposed in EDMP 638. Fieldwork and initial analysis is conducted during the summer when data based on semi-structure interviews is collected and analysis begins using inductive coding techniques. A summer residency is held in mid-June to assess progress as final data collection and analysis continues. The aim of the fall semester is to prepare a formal research report on that project, which will be submitted to an academic research conference. The final report includes a revision of one’s conceptual model, integrating new understandings and literature arising from the data collection and analysis. Prereq: EDMP 638.

EDMP 642. Directed Studies Seminar. 1 - 9 Unit.
At different times during the Program, EDM students register for Directed Studies courses. The purpose of these courses is to recognize the work the students are doing to conduct and present their individualized research at a high quality level. Activities conducted under the Directed Studies courses are dedicated to the collection of qualitative or quantitative data and the preparation of research reports.

EDMP 643. Measuring Business Behaviors and Structures. 3 Units.
This course aims to develop the basic foundations and skills for designing and executing generalizable studies. It focuses on building competence in model building, construct measurement, research design, data collection methodologies, and application of analytical software commonly involved in quantitative inquiry. Covered topics include framing research questions, reliability and validity of measurement, quasi-experimental research design, and fieldwork for data collection. Classes are designed to balance between the theory and practice of quantitative research design, and will be linked to the participant’s own research projects. Prereq: EDMP 641.
EDMP 644. Multivariate Data Analysis. 2 Units.
Building on instruction in univariate statistics, this course covers the fundamental assumptions, principles, and applications of multiple regression and structural equation modeling methodologies for analyzing quantitative data. It focuses on building competence in analytical skills for testing hypotheses guided by a conceptually sound and pragmatically useful model of some real world phenomenon. Analytical software used include SPSS and AMOS. Prereq: EDMP 641.

EDMP 645. Integration of Qualitative and Quantitative Inquiry. 3 Units.
Using the mixed method research toolkit developed in previous courses, this course focuses on critically analyzing selected pieces of published applied and policy research to develop a critical appreciation of issues and debates that have wide applicability and relevance. In particular, it offers students ways to integrate and triangulate using a mixed method approach, different forms of evidence, and related evidence. In addition, this course addresses common method choice and justification issues and related challenges of validity and theory formulation that typically arise during the students’ execution of a series of individual research projects. Application of critical analysis and appreciation approach in justifying mixed methods designs to the student’s own research work is encouraged and supported by sharing and discussing common research and methodology themes and problems. Prereq: Must be enrolled in the DM Program.

EDMP 646. Advanced Analytical Methods for Generalizing Research. 3 Units.
This course addresses advanced topics in regression and structural equation modeling such as latent growth curve models, partial least squares, logit models, tests for various types of invariance, multiple-group analysis, multilevel analysis, and analyzing qualitative/categorical data. These analytical methods are intended to enhance the student’s toolkit as to facilitate a strong bridge to the academic literature and the application to specific data based problems that arise in applied managerial research.

EDMP 647. Introduction to Statistics. 1 Unit.
This course introduces basic statistical concepts and their application in social research building, elementary statistical methods and applications, descriptive statistics, random variables, sampling distribution, estimation, hypothesis tests. The course also provides an introduction to data analysis using SPSS computer software.

EDMP 648. Causal Analysis of Business Problems I. 3 Units.
Model Building & Validation I introduces fundamental concepts in theory-based model building and validation. In this course students will develop, explore, refine and validate a range of models appropriate for addressing their problem of practice including classification models, process models, variance models, and articulating nomological networks. In particular, the course will focus on effective conceptualizations of causation, control, mediation, and moderation. Further, foundational statistical techniques such as tests of assumptions of the data, exploratory factor analysis, and regression and path analysis will be introduced. Prereq: Must be enrolled in the DM Program.

EDMP 649. Causal Analysis of Business Problems II. 3 Units.
Building upon the first course in Model Building & Validation, this course will guide students through the theoretically-grounded variance models that are required for testing through structural equation modeling (SEM) in the quantitative portion of their research. Fundamental concepts in model testing will be reinforced using path analysis, and will include a deeper exploration of moderation by addressing topics such as moderated mediation and interaction effects. Beyond the analysis the course will emphasize precise and accurate formulation of theoretical models and associated reasoning, as well as careful interpretation of findings. The class will also delve into testing of data assumptions and prepare students for the model testing portion of their capstone assignments. Prereq: Must be enrolled in the DM Program.

EDMP 660. Directed Studies: Qualitative Fieldwork. 1 - 3 Unit.
This course is part of the qualitative research sequence which began with EDMP 638, Qualitative Research Methods I. In this qualitative fieldwork course, students will conduct a series of interviews based on the research proposal and interview guide which they developed in EDMP 638. Students are expected to complete their interviews and work with faculty to begin initial analysis of the interview data.

EDMP 661. Directed Studies: Qualitative Research Report Preparation. 1 - 3 Unit.
This course is dedicated to individualized student research. Student research objectives and plans are implemented through qualitative and quantitative fieldwork, report preparation, and manuscript development and submission.

EDMP 662. Directed Studies: Quantitative Fieldwork. 1 - 3 Unit.
This course is dedicated to the design, development and execution of the student’s individualized research work. Each student will be expected to develop a proposal for research work that aims to empirically test a conceptual model to address a significant substantive problem. Following faculty approval and feedback, each student will be expected to conduct field work for data collection in accord with a research design that yields high quality data. Completion of the course requirements will rest on the satisfactory completion the fieldwork as per guidelines provided in the course.

This course is dedicated to the execution and completion of student’s individualized research work. Each student will be expected to execute a research study to provide reliable and valid conclusions using rigorous quantitative methodologies and write a publishable quality paper for submission to faculty for approval. It is highly desired that student papers be submitted for presentation and publication at appropriate academic and/or practitioner outlets. Completion of the course requirements will rest on the satisfactory completion and submission of the research paper as per guidelines provided in the course.
EDMP 664. Knowledge Dissemination to Influence Managerial Practice. 3 Units.
The aim of this course is twofold. First, it supports students organizing and writing their DM thesis overview or their PhD thesis proposal. Also discussed are ways to organize and communicate in scientific genres, their aims and their generic properties. Secondly, students become acquainted with scientific communication and publishing. Effective reviewing, criteria for judging articles and theses, management of review processes, and how to communicate and respond to reviews are topics discussed. The course also addresses publication strategies and ways of managing and communicating scientific and managerial knowledge to different stakeholders. Prereq: Must be enrolled in the DM Program.

EDMP 665. Introduction to Research Inquiry. 3 Units.
This course begins participants’ three-year research experience. Energized by one’s personal passion and commitment to the topic, we seek for the work to be accomplished at a level that makes it worthy of widespread dissemination and influence as engaged scholars. The goal in this course is to prepare students to develop their minds as scholars by understanding the world of research; develop a research identity by identifying one’s research domain; learn to read academic literature and write in a scholarly style; work with academic literature to identify and digest concepts and theories that inform research on that problem; begin to develop a conceptual model that abstracts how the world may be functioning in that problem domain and points to a research question that can guide the next stage of the research. The final deliverable for this course is to present the research topic with substantiation for its significance, relevance and timeliness in the management field. This would include the research question(s); the literature review; and proposed qualitative methodology and analytical approach(es).

EDMP 671. Design and Sustainable Systems. 3 Units.
The goal of this course is to introduce doctoral students to the nature and practice of design as a strategy of inquiry as well as a mode of action in addressing the problems of creating and managing sustainable human systems. The objectives are (1) to introduce the conceptual framework of design, (2) the nature of human interaction as seen from the perspective of design, (3) the intellectual and practical strategies of design, (4) the methods and techniques of design that are relevant to the study and design of sustainable human systems, and (5) the nature of “wicked problems” and the ethical issues of design, with special attention to the place of human dignity in the design of sustainable systems. The course will employ key elements of the literature of design, close reading and discussion, and exercises that explore the concepts and methods of design. Prereq: Must be enrolled in the DM Program.

EDMP 672. Sustainability and Social Value Creation. 3 Units.
This course is designed to galvanize new visions of business and society, as well as organizational leadership. The course is born of a conviction that the future of human society and the natural world is intimately linked to the future of the world economy, business enterprises, and management education. The course presentations, books, dialogues, and interview projects are organized around three themes: (1) the state of the world and the economics possibilities of our time, (2) the business case for understanding business as an agent of world benefit—how business performance can profit from current and future advances in sustainable design and social entrepreneurship; and (3) tools for becoming a change leader—including the methods of Appreciative Inquiry and new insights about “strength-based” change emerging from the science of human strengths. The overarching aim is to provide a powerful introduction to the many facets of sustainable value creation as a complete managerial approach. Prereq: Must be enrolled in the DM Program.

EDMP 673. Understanding, Designing, Managing Complex Systems. 3 Units.
The purpose of this course is to provide a perspective on systems thinking and complex systems and aid PhD students in expanding the ideas in their research on systems, systems models, and complex systems. The work of the course will develop with increasingly difficult books on the subject of complex systems, a major case study in health care, and individual applications of the concepts to their potential research model and methods. Prereq: Must be enrolled in the DM Program.

EDMP 674. Effectiveness of Institutional, Individual and Organizational Decision Making. 3 Units.
This course introduces students to research on individual judgment and decision making. Drawing insights from research in economics, political science, psychology, management, and sociology, behavioral decision making and judgment is the study of how-why-when people make decisions. Sessions introduce and explore the discipline. Along with a historical review of the literature, the general topics of emotion, experience, self control, and motivation are introduced. Behavioral finance is a topic specifically used as the lens through which individual, group, and firm decision making and judgment are analyzed. Designed to expose the student to a number of academic theories which may be incorporated into their second year paper, this course will also allow the student to experience a deeper dive into the particulars of academic literature including research design, literature reviews, discussion and dissemination, etc. This course will employ an integrated learning format. Lectures, group projects, written assignments, etc. will be used throughout this semester. Prereq: Must be enrolled in the DM Program.

EDMP 676. Conflict & Cooperation in the Global Arena. 3 Units.
The global arena is described by some as a realm of perpetual conflict. Others argue that given the right institutions and incentives, international actors can find ways to achieve cooperation, peace and increased global prosperity. Still others suggest that the international political and economic arena is “what you make of it”—emphasizing the role of norms, identities and ideas in shaping international outcomes. This course will examine both theoretical and policy perspectives regarding the question of international conflict and cooperation, with a specific emphasis on drawing on insights from collective action theory and international relations scholarship. Prereq: Must be enrolled in the DM Program.
Program participants who have not successfully completed their Applied Research Projects before the start of the fall semester following their third year of enrollment in the E.D.M. Program will have seven years from the date of their initial matriculation into the Program to complete degree requirements. If their work continues beyond the normal 54 credit hours of designed courses, they will register for Applied Research Project Continuation. Continuation credits may also be used for students enrolling in the Program after August 2000, who have not completed their required course work and research requirements within the Program’s required 54 semester credit hours. Prereq: EDMP 665.

EMBA Courses

EMBA 417. TEAMS. 1 Unit.
This course enables the formation of E.M.B.A. study groups and classroom learning environment by introducing participants to their adult learning styles, models of group decision-making, theories of team development and rules of engagement for effective learning teams. Prereq: E.M.B.A. students only.

EMBA 436. Accounting for Business Executives. 3 Units.
This course is an introduction to financial and managerial accounting, rather than a course in introductory accounting. This course is designed for the business professional and is intended to prepare the student to use the information prepared by accountants. It will not dwell in detail on the technical aspects of accounting or bookkeeping. In addition, this course is designed to help the student become an effective user of cost information, from the perspective of parties internal to the firm. This aspect of accounting is a compilation of techniques rather than a set of rules. Since the information is for private use, the goal is to create the most meaningful and useful data for use by managers. Assignments will be designed to develop the student’s ability to analyze and interpret accounting data and to more effectively utilize accounting data in day to day business decisions. Finally, this course is intended to strengthen abilities to identify problems and opportunities, to search out and analyze desired information leading to a well-reasoned conclusion, and to perform sensitivity analysis around that conclusion, using financial information. Prereq: E.M.B.A. candidates only.

EMBA 437. Economic Analysis for Managers. 3 Units.
This course, which is limited to students in the Executive M.B.A. program, explores the basic elements of the economic system which the executive needs to know in order to understand how the firm interacts with the system and how economic factors affect decision making. Prereq: E.M.B.A. candidates only.

EMBA 437B. Economic Analysis for Managers. 1.5 Unit.
This course, which is limited to students in the Executive M.B.A. program, explores the basic elements of the economic system which the executive needs to know in order to understand how the firm interacts with the system and how economic factors affect decision making. Prereq: EMBA 437A

EMBA 438A. Business Statistics and Quantitative Analysis. 1.5 Unit.
In this course, students study the use of modern quantitative and business statistics to support the executive decision-making process. With the help of computer software, the models examined assist in describing and analyzing problems and suggesting possible managerial actions. The techniques discussed include tools for decision making under uncertainty including regression analysis. This course is part of a two (2) course sequence. Prereq: E.M.B.A. candidates only.

EMBA 438B. Business Statistics and Quantitative Analysis. 1.5 Unit.
In this course, students study the use of modern quantitative and business statistics to support the executive decision-making process. With the help of computer software, the models examined assist in describing and analyzing problems and suggesting possible managerial actions. The techniques discussed include tools for decision making under uncertainty including regression analysis. This course is part of a two (2) course sequence. Prereq: EMBA 438A

EMBA 439. Corporate Finance. 3 Units.
The central organizing principle of this course is to familiarize the class with the basics of valuation. This first course in finance introduces the tools and methods employed in valuation of projects and corporate securities. Valuation involves the determination of (i) cash flows of the firm, project or financial assets and (ii) the discount rates that are used to compute the present values of the cash flows. Asset pricing models provide the underpinnings for the development of the discount rates. The material is synthesized in capital budgeting exercises which are cost-benefit analyses of capital project cash flows to evaluate whether they are value enhancing. Prereq: E.M.B.A. candidates only.

EMBA 439B. Corporate Finance. 1.5 Unit.
The central organizing principle of this course is to familiarize the class with the basic of valuation. The first course in finance introduces the tools and methods employed in valuation of projects and corporate securities. Valuation involves the determination of (i) cash flows of the firm, project or financial assets for (ii) the discount rates that are used to compute the present values of the cash flows. Asset pricing models provide underpinnings for the development of the discount rate. The material is synthesized in capital budgeting exercises which are cost-benefit analyses of capital project cash flows to evaluate whether they are value enhancing. Prereq: EMBA 439A

EMBA 441A. Leading Change: Self. 2 Units.
The primary objective of Leading Change: Self is to learn a method for assessing your knowledge, abilities, values, and interests relevant to leadership and executive management so that you will be able to develop and implement a plan for enhancing your leadership and executive capability throughout your career and life. The enabling objectives are: (a) To systematically identify your current and desired capability (i.e., knowledge, abilities, values, and interests); (b) To develop an individualized learning agenda and plan for the next 3-5 years; and (c) To explore techniques to assist others in doing the same. This course will explore questions, such as: Who are effective leaders? How are they different than managers? How do they think and act? What makes us want to follow them? How are leaders developed? How can people help others become effective leaders? What type of leader do I want to be? And, what can I do to become that type of leader? This course is part of a two (2) course sequence. Prereq: E.M.B.A. candidates only.
EMBA 441B. Leading Change: Self. 1 Unit.
The primary objective of Leading Change: Self is to learn a method for assessing your knowledge, abilities, values, and interests relevant to leadership and executive management so that you will be able to develop and implement a plan for enhancing your leadership and executive capability throughout your career and life. The enabling objectives are: (a) To systematically identify your current and desired capability (i.e., knowledge, abilities, values, and interests); (b) To develop an individualized learning agenda and plan for the next 3-5 years; and (c) To explore techniques to assist others in doing the same. This course will explore questions, such as: Who are effective leaders? How are they different than managers? How do they think and act? What makes us want to follow them? How are leaders developed? How can people help others become effective leaders? What type of leader do I want to be? And, what can I do to become that type of leader? The course will take place over two semesters. This course is part of a two (2) course sequence. Prereq: EMBA 441A.

EMBA 442. Innovation. 3 Units.
Organizations are under continuous pressure to be efficient and productive in order to generate (often short-term) profit. At the same time they must innovate to remain competitive in the long-term. Innovation involves the generation, development, and delivery of new products, processes, or businesses. Intrapreneurs are those who can successfully bring new ideas to fruition in established organizations. Innovation in the context of an established organization requires that intrapreneurs fundamentally understand the dynamics of innovation and innovation management. This course introduces fundamental concepts associated with innovation in the context of an established organization. Prereq: E.M.B.A. candidates only.

EMBA 443. Supply Chain Management. 3 Units.
Operations managers, ranging from supervisors to vice presidents, are concerned with the production of goods and services. More specifically, they are responsible for designing, running, controlling and improving the systems that accomplish production. This course is a broad-spectrum course with emphasis on techniques and information that are helpful to the practice of management in general and at any level. We will discuss commonly occurring application problems such as process analysis, inventory control, quality management, just-in-time concepts, etc. The field of operations management was originally concerned with manufacturing systems. But many of the same ideas apply, and the same trade-offs are present, in service organizations like health care, insurance, hotel-management, airlines and government related operations. Several manufacturing and non-manufacturing environments will be discussed explicitly, and the emphasis will be on the fundamentals of the operations function in an organization. Also we will explore the interface of operations management with other functional areas such as marketing, finance, accounting, etc. Prereq: E.M.B.A. candidates only.

EMBA 443B. Supply Chain Management and International Experience. 1.5 Unit.
Operations managers, ranging from supervisors to vice presidents, are concerned with the production of goods and services. More specifically, they are responsible for designing, running, controlling and improving the systems that accomplish production. This course is a broad-spectrum course with emphasis on techniques and information that are helpful to the practice of management in general and at any level. We will discuss commonly occurring application problems such as process analysis, inventory control, quality management, just-in-time concepts, etc. The field of operations management was originally concerned with manufacturing systems. But many of the same ideas apply, and the same trade-offs are present, in service organizations like health care, insurance, hotel-management, airlines and government related operations. Several manufacturing and non-manufacturing environments will be discussed explicitly, and the emphasis will be on the fundamentals of the operations function in an organization. Also we will explore the interface of operations management with other functional areas such as marketing, finance, accounting, etc. Prereq: E.M.B.A. candidates only.
EMBA 446. Managing Risk and Real Options. 3 Units.
The course seeks to help corporate managers understand how financial design can be used to advance the goals and strategies of the firm. In the Finance course, you concentrated almost exclusively on the firm's capital expenditure decision. You studied in great detail the discounted cash flow model, NPV, how you get your cash flows, and how you discount according to risk. Now we move to the other side of the balance sheet to look at how the firm can finance these expenditures. The first part of this class provides the basic building blocks of financial engineering which begins with call and put options. The course focuses on using derivatives (calls and puts) to change a firm's risk profile with respect to equity, interest rate, foreign exchange, credit, and commodity risks. We look at capital structure decisions and securitization issues and discuss what it means to create optimal structures. Almost immediately we will tie this to our financial crisis and obtain an appreciation for financial designs that could be setup so as to enhance firm value, mitigate systemic risks, or accomplish specific sustainable goals in a global economy. The second part of the class is geared towards real options and its relationship to strategic planning. In competitive markets, no one expects to formulate a detailed long-term plan and follow it mindlessly. As soon as we start down the path, we begin learning about business conditions, competitors' actions, and so forth and we need to respond flexibly to what we learn. Unfortunately, the financial tool most widely relied on to estimate the value of strategy, DCF, assumes that we follow a predetermined plan, regardless of how events unfold. A better approach to valuation would incorporate both the uncertainty inherent in business and the active decision making required for strategy to succeed. Prereq: E.M.B.A. candidates only.

EMBA 449. Contemporary Issues in Management. 3 Units.
This course is intended to address the contemporary issues in management to be decided by faculty and student interest. With the current global economic crisis, this year the course will focus on International Finance and Economics. In subsequent years, the topics will evolve as the global business climate changes. Prereq: E.M.B.A. candidates only.

EMBA 450. Managerial Marketing. 3 Units.
This course is designed with three overarching objectives. The first is an emphasis on decision making in a broad range of market contexts. The second objective builds on the notion that decision making is dynamic; that is, market situations demand not just one good decision but a series of them as a situation unfolds (providing new and varied information for each subsequent decision). Integrating concepts from a number of the courses that you are taking concurrently into decision-making about markets is a final objective. Prereq: E.M.B.A. candidates only.

EMBA 451. Business Model Design. 3 Units.
In most companies the process of designing business models is an ad hoc process and in my opinion an inefficient process. In this course you will learn a systematic but iterative process to do this. We will expose you to some broad categories of business models and internalize the basic logic of how to make money in each of these categories. The first step is to recognize which of these categories is most applicable to your business. The second step is to customize these broad patterns to the specifics of the business at hand. This seems easy because everything is in English and there are no hard formulas to figure out. However, unless you discipline yourself to systematically go through a structured process (there are other equally valid processes than the ones you'll be exposed to) it is very easy to fall into the ad hoc trap. You will internalize this process by applying it over a wide range of business situations that will give you confidence in its applicability to any business opportunity. After the completion of this course you should be quickly able to draw the outline of a business model for any business opportunity that you're considering. Prereq: E.M.B.A. candidates only.

EMBA 457. International Trade and Finance. 2.5 Units.
This course consists of two parts. The first part deals with the global trade and direct investment environment. It covers the theories as well as the political economy of international trade and foreign direct investment. Its aim is twofold: (i) to enable an understanding of such technical issues as to how the effects of tariffs and quotas differ or how free trade areas and customs unions differ; and (ii) to provide a systemic view of how government policies and corporate strategies interact in changing the global trade and investment environment of business. The second part of the course deals with regional economic integration and the global monetary system. Its aim is twofold (i) to enable an understanding of such technical issues as to how different stages of economic integration such as free trade areas and customs union differ; how the foreign exchange market functions in terms of different hedging instruments in the context of the international monetary system; and (ii) to provide a systemic view of how government policies and corporate strategies interact in changing the global trade and financial environment of business. Prereq: E.M.B.A. candidates only.

EMBA 464. Legal Environment. 3 Units.
This course provides a brief overview of the legal system that managers face, with an emphasis on contracts, corporate law, property rights and the modern regulatory apparatus of government. Contracts include full coverage of the Uniform Commercial Code. Corporate law is the capstone of the consideration of other forms of business organizations such as partnerships. Regulatory areas include employment law and environmental law. Property coverage includes modern struggles over intellectual ownership claims (patents, copyrights, etc.). Prereq: E.M.B.A. candidates only.

EMBA 472. Leading Change: The Organization. 3 Units.
Participants in this course will be challenged to enhance their leadership capacity by assessing and analyzing the knowledge, abilities, values and interests relevant to executives. The course will also explore the art of reading and understanding organizations in ways that help us imagine, design, and develop organization excellence. Prereq: E.M.B.A. candidates only.
EMBA 473. Leading Change: Teams. 3 Units.
Sustainability of effective leadership is necessary for adaptive, resilient organizations and for the health and functioning of the leader. Chronic stress results in diminished cognitive functioning, as well as poor health and a contagion of negative mood in organizations. The latest advances in social neuroscience and endocrinology will be used to develop an understanding how someone in a leadership position can renew themselves and mitigate the ravages of chronic stress. The short course will focus on how to coach others toward renewal and sustainability. Prereq: E.M.B.A. candidates only.

EMBA 473A. Leading Change in Dyads and Teams and Beyond. 1.5 Unit.
Sustainability of effective leadership is necessary for adaptive, resilient organizations and for the health and functioning of the leader. Chronic stress results in diminished cognitive functioning, as well as poor health and a contagion of negative mood in organizations. The latest advances in social neuroscience and endocrinology will be used to develop an understanding how someone in a leadership position can renew themselves and mitigate the ravages of chronic stress. Examining leadership in dyads, the course will focus on how to coach others toward renewal, sustainability, and effective leadership. In the context of an International Change Theory and complexity concepts, the course will also examine in detail how to lead and develop teams to be effective. This course is part of a two (2) course sequence. Students will receive a grade of "R" at the end of the Fall Semester; the "R" will then be changed to the appropriate grade at the end of the Spring Semester. Prereq: E.M.B.A. candidates only.

EMBA 473B. Leading Change in Dyads and Teams and Beyond. 1.5 Unit.
Sustainability of effective leadership is necessary for adaptive, resilient organizations and for the health and functioning of the leader. Chronic stress results in diminished cognitive functioning, as well as poor health and a contagion of negative mood in organizations. The latest advances in social neuroscience and endocrinology will be used to develop an understanding how someone in a leadership position can renew themselves and mitigate the ravages of chronic stress. Examining leadership in dyads, the course will focus on how to coach others toward renewal, sustainability, and effective leadership. In the context of a International Change Theory and complexity concepts, the course will also examine in detail how to lead and develop teams to be effective. Prereq: EMBA 473A.

EMBA 475. International Tour. 3 Units.
This course is designed to present first-hand issues in international management. It accomplishes this by means of readings, a written assignment and, most importantly, an international trip designed to witness different management cultures, styles and environments for business in the international community. Faculty responsibility rests with the Faculty Director of the E.M.B.A. Program as well as a "Resident Faculty" specific to each field trip. Such faculty are drawn from the Weatherhead community and vary by the design and destination of the trip. In addition, the course is staffed by an administrative assistant from the complement of Dively CMDR staff. Occasionally and where appropriate, there is also "in-tourist" assistance in some of our foreign locations. Prereq: E.M.B.A. candidates only.

EMBA 476. Corporate Governance. 3 Units.
The course structure is grounded in the following themes: - The role of the board of directors; - The CEO relationship to the firm's principal stakeholders (shareholders, board of directors, employees, customers) and the CEO's responsibility to give back (time and money) to the community; - CEO role in developing and maintaining the organization's vision, values and corporate culture. Prereq: E.M.B.A. candidates only.

EMBA 477. Behavioral Economics. 1.5 Unit.
This class develops practical, actionable insights into how people make economic decisions in the real world. Standard economics proposes that decisions are motivated by a rational response to financial incentives and information. Behavioral economics expands the standard approach by incorporating and understanding the systematic biases and errors we make in interpreting information and making decisions. This expanded toolbox will help the student to improve their own decisions and to understand and motivate behavior in employees, customers, and others. Prereq: E.M.B.A. candidates only.

EMBA 478A. Leading Design in Organization. 1.5 Unit.
This course explores the ideas and methods of design as a new approach to management practices that is well suited to the changing environment that organizations face in contemporary culture and the emerging economic environment in the United States and abroad. It is a studio course as well as a seminar, because it is designed around a project that each student brings to the EMBA program, a project that is grounded in the issues and operations of the student's organization or in the kind of organization that the student wishes to explore. In addition to the yearlong project, the course will also include important readings in management and organizational literature that are relevant to the new direction of strategic thinking. Finally, the course will draw on the expertise of other faculty at the Weatherhead School of Management who will be called upon to share their practical expertise and theoretical knowledge in the development and execution of the student's management design project, whether in the area of vision and strategy, new product development of goods and services, operations, organizational design and configuration, or related topics. This is the first part of a two semester course. Prereq: E.M.B.A. candidates only.

EMBA 478B. Leading Design in Organizations. 1.5 Unit.
This course explores the ideas and methods of design as a new approach to management practices that is well suited to the changing environment that organizations face in contemporary culture and the emerging economic environment in the United States and abroad. It is a studio course as well as a seminar, because it is designed around a project that each student brings to the EMBA program, a project that is grounded in the issues and operations of the student's organization or in the kind of organization that the student wishes to explore. In addition to the yearlong project, the course will also include important readings in management and organizational literature that are relevant to the new direction of strategic thinking. Finally, the course will draw on the expertise of other faculty at the Weatherhead School of Management who will be called upon to share their practical expertise and theoretical knowledge in the development and execution of the student's management design project, whether in the area of vision and strategy, new product development of goods and services, operations, organizational design and configuration, or related topics. This is the second part of a two semester course. Prereq: E.M.B.A. candidates only.
ENTP Courses

ENTP 301. Entrepreneurial Strategy. 3 Units.
This course is designed to show students how to identify potential business opportunities, determine what constitutes a good business model, and to strategically implement a business proposal. Topics of focus include an overview of the entrepreneurial process, determinants of venture success in high tech and other business environments, and strategies for industry entry and venture growth. Offered as ECON 301 and ENTP 301. Prereq: ACCT 101 or ACCT 203. Coreq: At least sophomore standing.

ENTP 310. Entrepreneurial Finance - Undergraduate. 3 Units.
This course explores the financing and financial management of entrepreneurial new ventures. The course will focus on issues of financial management of new ventures (forecasting cash flows, cash flow management, capital budgeting, valuation, capital structure) and the various financial methods and mechanisms available to entrepreneurs (bootstrapping, angel investors, venture capitalists, IPOs). Prereq or Coreq: ACCT 101 or ACCT 303 or consent of instructor.

ENTP 311. Entrepreneurship and Wealth Creation. 3 Units.
This course teaches students how to find, value, and finance the acquisition of a business, culminating in the class negotiation with a business owner to buy his/her business in a live simulation. Students will be exposed to the concepts and tools needed to successfully acquire a company. Negotiation strategies will be explored. Entrepreneurial Leadership approaches on how to grow and manage the business, once it is owned will also be presented, including how to create a strategic plan. The course also features a real-start up of a business. Student teams will each be given $1000 of seed capital. Learnings include how to select a product, and how to develop and execute a marketing plan. Students will meet top merger-acquisition experts and be exposed to some of Cleveland’s most respected entrepreneurs. Offered as ECON 311 and ENTP 311.

ENTP 312. Senior Seminar in Entrepreneurship. 3 Units.
The main objective of this course is to meet the advanced needs of our students in honing their entrepreneurial skills. This objective will be achieved through readings and case instruction, presentations by entrepreneurs who are actively engaged in starting new ventures and the commercialization of new technologies, and the successful completion of a research project for an entrepreneurial venture. These projects will be graded by the professor and presented to the class and to the client entrepreneur. Prereq: ENTP 310 and ENTP 311.

ENTP 418. Enterprise Development. 3 Units.
-course features new product launch by students and new business idea competition judged by actual venture capitalists. Students will also learn how to acquire control of an existing company, including valuation methods, sources of funding, tactics for finding companies to buy, and how to negotiate the purchase of a business. Also includes actual student negotiation with sellers of a company. Course is designed to accelerate career success through bold entrepreneurial strategies. Offered as ENTP 418 and PLCY 418.

ENTP 419. Entrepreneurship and Personal Wealth Creation. 3 Units.
Course explores the accumulation of personal wealth utilizing entrepreneurial strategies. The underlying competencies of successful entrepreneurs are identified and applied to individual lives of students. Active entrepreneurs will be studied, and original case studies of start-ups and acquisitions provide the basis for class exercises. Offered as ENTP 419 and PLCY 419.

ENTP 425. Managing Human Resource Issues in Entrepreneurial Firms. 3 Units.
This course examines how entrepreneurial firms can develop human resource practices and strategies to sustain their vision, grow their businesses, and create value for customers, shareholders, and employees. The first half of the course will be devoted to exploring the distinctive challenges entrepreneurial firms encounter in aligning organizational goals and human resource strategy and practices. Among those practices are staffing, recruitment and selection, compensation, and employee motivation. The second half of the course will explore these issues further in the context of key organizational phases ranging from firm foundings, the transition from entrepreneurial to professional management, the development of “entrepreneurship” in existing organizations, and the spin-off of the new corporate ventures. Offered as ENTP 425 and LHRP 425.

ENTP 428. Entrepreneurship and Innovation. 3 Units.
In all companies, new and old, large and small, innovation and entrepreneurship are important ways economic value is created. Whether a person wants to found their own company or work in an existing one, and whether one wants to run a business or simply work in one, it is difficult to go through one’s career without needing to engage in innovation or entrepreneurship. The purpose of this course is to equip students to think about how to manage innovation and entrepreneurship. The course will provide frameworks and tools for understanding four important dimensions of innovation and entrepreneurship: (1) identifying and evaluating opportunities for the new products, processes, ways of organizing, materials, and markets; (2) assessing the needs of customers for new products and services and developing products and services that fulfill those needs; (3) creating strategies to financially benefit from investing in innovation and entrepreneurship; and (4) designing groups and organizations to be innovative and entrepreneurial. Prereq: MBAC 502, MBAC 503, MBAC 504, MBAC 505, MBAC 508B or ACCT 401, BAFI 402, MGMT 499, or ACCT 401A, BAFI 402A, MGMT 499 or MBAP 402, MBAP 405, MBAP 410.
ENTP 444. Entrepreneurial Finance. 3 Units.
The objective of this course is to introduce students to the issues of financial management and capital formation in new ventures. The course will address issues of estimation of cash requirements, development of pro forma financial plans, firm valuation and the process and tools used in raising debt and equity financing. Bootstrapping, angel investing, venture capital, strategic alliances and initial public offerings will be covered. The emphasis is on the entrepreneur and how he/she can assess financial needs and develop a sensible plan for acquiring financial resources in a manner that is consistent with their financial needs and other strategic goals. Offered as BAFI 444 and ENTP 444. Prereq: BAFI 402.

ENTP 450. Entrepreneurial Marketing-M.B.A.. 3 Units.
This course addresses the entrepreneurial/intrapreneurial process of commercializing an idea for a market opportunity. Students select an opportunity and develop a deployable, one-year market entry program and a five-year strategic marketing program. Emphasis is on the entrepreneurial marketing decision process, including defining the business, defining the market, specifying customer perceived value, assessing competitive capability and advantage, identifying and properly using secondary and primary information, and deploying marketing programs throughout the organization and the supply chain. Offered as ENTP 450 and MKMR 450B.

ENTP 464. Technology Entrepreneurship. 3 Units.
This course is designed to help students to identify, evaluate, and obtain control over technology opportunities that they can successfully exploit by starting new companies. The course focuses on four themes: (1) the source, discovery, and evaluation of technological opportunities, (2) the process of organizing innovation to produce new technology that satisfies the needs of customers, (3) the different mechanisms available to appropriate the returns from the exploitation of technological opportunities, and (4) the differences between opportunities and approaches that are valuable and sustainable for independent entrepreneurs and large firms. Students taking this course may not receive credit for both ECON 464 and ENTP 441. Offered as ECON 464 and ENTP 464.

ENTP 501. Special Problems and Topics. 1 - 18 Unit.

HSMC Courses

HSMC 420. Health Finance. 3 Units.
Exploration of economic, medical, financial and payment factors in the U.S. healthcare system sets the framework for the study of decisions by providers, insurers, and purchasers in this course. The mix of students from various programs and professions allows wide discussion from multiple viewpoints. Offered as BAFI 420 and HSMC 420. Prereq: ACCT 401.

HSMC 421. Health Economics and Strategy. 3 Units.
This course has evolved from a theory-oriented emphasis to a course that utilizes economic principles to explore such issues as health care pricing, anti-trust enforcement and hospital mergers, choices in adoption of managed care contracts by physician groups, and the like. Instruction style and in-class group project focus on making strategic decisions. The course is directed for a general audience, not just for students and concentration in health systems management. Offered as ECON 421, HSMC 421, and MPHP 421.

HSMC 427. Health Law. 3 Units.
The course examines the nature and structure of the health care system; the relationship between patient, provider, and payer; private legal controls on health care delivery such as malpractice and informed consent law; and public controls in the form of government regulatory and payment programs. Offered as HSMC 427 and LAWS 227.

HSMC 432. Health Care Information Systems. 3 Units.
This course covers concepts, techniques and technologies for providing information systems to enhance the effectiveness and efficiency of health care organizations. Offered as HSMC 432, MIDS 432, MPHP 532 and NUNI 432.

HSMC 444. Models of Health Care Systems. 1.5 Unit.
This course is for professionals who will pursue their careers in, or associated with, the health care industry; and therefore, need to understand the structure, operations and decision influences in the health care delivery system. The course is intended to develop competence and confidence in the participant’s ability to understand and operate in the industry. It is applicable to the private and public, profit and not-for-profit sectors. In this course students are introduced to: the different systems of care delivery; their organization and operations; their markets and the nature of the demand for their services; and the dynamics of their interoperation among themselves and with other entities in the industry (e.g., payors/insurers, regulators and accreditors, technology and pharmaceuticals suppliers). Offered as HSMC 446 and IIME 446.

HSMC 447. Regulatory Affairs for the Biosciences. 1.5 Unit.
This mini-course introduces students to the Food and Drug Administration (FDA) and the laws and regulations it enforces. A scientific regulatory agency with far reaching enforcement authority, FDA is the most powerful consumer protection agency in the world. This course will familiarize students with FDA’s mission, philosophy and organizational structure, as well as policy and procedure it uses to ensure the safety and effectiveness of the food, drugs, biologics, cosmetics, medical devices and radiation-emitting products it regulates. Recommended preparation: Enrollment in the MEM Biomedical Entrepreneurship Track. Offered as BIOS 447, HSMC 447, and IIME 447.

HSMC 448. Engineering Statistics for Biosciences. 3 Units.
This course provides an introduction to biostatistics, emphasizing experimental design, analysis of data, and special emphasis on statistical and financial aspects of randomized clinical trials for biomedical applications. There will be a final project involving development of a clinical trial protocol including the experimental design, recruitment and retention strategy, analysis plan and budget. Offered as BIOS 448, HSMC 448, and IIME 445.

HSMC 456. Health Policy and Management Decisions. 1.5 Unit.
This seminar course combines broad health care policy issue analysis with study of the implications for specific management decisions in organizations. This course is intended as an applied, practical course where the policy context is made relevant to the individual manager. Offered as HSMC 456 and MPHP 456.

HSMC 501. Special Problems and Topics. 1 - 18 Unit.
This course is offered, with permission, to students undertaking reading in a field of special interest.
LHRP Courses

LHRP 360. Independent Study. 1 - 18 Unit.
This course is offered for candidates undertaking reading or independent research in a field of special interest.

LHRP 413. Economics of Negotiation and Conflict Resolution. 3 Units.
Students frequently enroll in a negotiation class with one thought in mind--negotiating a better job offer from an employer. They soon learn, however, that negotiation skills can do far more than improve a pay check. Negotiations occur everywhere: in marriages, in divorces, in small work teams, in large organizations, in getting a job, in losing a job, in deal making, in decision making, in board rooms, and in court rooms. The remarkable thing about negotiations is that, wherever they occur, they are governed by similar principles. The current wave of corporate restructuring makes the study of negotiations especially important for M.B.A.s. Mergers, acquisitions, downsizing and joint ventures call into question well established business and employment relationships. Navigating these choppy waters by building new relationships requires negotiation skills. The increased stress on quality and other hard-to-measure aspects of relationships with customers and suppliers makes the process of negotiation even more complex and subtle. For these reasons, negotiation classes have taken center stage in the study of management. Every major business school now offers classes in negotiation and these classes are overflowing with students. Offered as ECON 431 and LHRP 413.

LHRP 421. Strategic Human Resource Management. 3 Units.
The effective motivation and management of human resources within the enterprise is treated in this course with special emphasis on the integration of Human Resources strategy into the overall competitive strategy of the enterprise. Implications of the inevitable conflict of goals and interests among organization members are considered, covering such areas as hiring, performance appraisal, labor-management relations, employee rights, pay systems, grievance systems, and worker participation.

LHRP 425. Managing Human Resource Issues in Entrepreneurial Firms. 3 Units.
This course examines how entrepreneurial firms can develop human resource practices and strategies to sustain their vision, grow their businesses, and create value for customers, shareholders, and employees. The first half of the course will be devoted to exploring the distinctive challenges entrepreneurial firms encounter in aligning organizational goals and human resource strategy and practices. Among those practices are staffing, recruitment and selection, compensation, and employee motivation. The second half of the course will explore these issues further in the context of key organizational phases ranging from firm foundings, the transition from entrepreneurial to professional management, the development of "entrepreneurship" in existing organizations, and the spin-off of the new corporate ventures. Offered as ENTP 425 and LHRP 425.

LHRP 431. Negotiations for Managers. 3 Units.
The aim of this course is to enhance individual as well as organizational performance and competitive advantage through "principled negotiation", "win-win bargaining", and collaborative as opposed to competitive approaches to team problem solving. The context crosses all types of business, government and non-governmental organizations. Concepts, strategies, and models of negotiation are drawn from social psychology, economics, labor relations, and legal literature. Students will also be introduced to mediation (both as mediators and negotiators); to the complex art of advocacy and to the latest alternative dispute resolution (ADR) techniques. There is heavy reliance on simulations and role play to enhance student understanding of key course concepts. Although immediate skill enhancement through practice is a goal, students understanding of key concepts will enable them to continuously improve their insights and skills long after the course is concluded. There is no prerequisite for the course.

LHRP 451. Alternative Dispute Resolution. 2 Units.
Students will examine the processes of alternative dispute resolution (ADR) through reading materials, videotapes, guest lectures, and simulation exercises. Particular emphasis will be given to the interaction of lawyers and clients in business negotiations and in litigation. Negotiation, arbitration, mediation, the summary jury trial, and the mini-trial will be examined. The class will also cover impediments to ADR, such as lack of understanding or hostility on the part of clients or lawyers. Offered as LAWS 351 and LHRP 451.

LHRP 501. Special Problems and Topics. 0.5 - 18 Units.
This course is offered, with permission, to students undertaking individual reading or research projects in a field of special interest.

LHRP 601. Special Problems and Topics. 1 - 18 Unit.
This course is offered, with permission, to Ph.D. candidates undertaking reading in a field of special interest.

Prereq: Predoctoral research consent or advanced to Ph.D. candidacy milestone.
MBAC Courses

MBAC 502. Financial Accounting. 3 Units.
This course examines the key terminology, frameworks, concepts and principles for financial reporting to stockholders, creditors and government agencies. Foundations of the financial reporting systems including the balance sheet, income statement and cash flow statements are explained.

MBAC 503. Managerial Accounting. 3 Units.
Managerial accounting provides information to managers that helps them make effective business decisions, control operations, plan for the future, and evaluate performance. This course examines some of the important managerial accounting systems and analytical tools used in business today. Prereq: ACCT 401 or MBAC 502 or equivalent.

MBAC 504. Corporate Finance I. 3 Units.
This is the first part of a 2-semester-long MBA core course. In this semester, students are introduced to the basics of corporate finance, including the objectives of and the decisions made by corporate financial managers. Topics covered include time value of money, stock and bond valuation, cost of capital and risk and return, investment decision rules, cash flows and free cash flows, and capital budgeting. The course envisions extensive use of spreadsheets as well as an intensive workshop involving data analysis.

MBAC 505. Corporate Finance II. 3 Units.
This is the second part of a 2-semester-long MBA core course. In this semester, topics covered include cash flow projections and planning, working capital management and short-term financing, capital structure, dividend policy, efficient markets, and macroeconomic/industry analysis and valuation. The course envisions extensive use of spreadsheets, case studies, data analysis, and an intensive workshop.

MBAC 506. Marketing and Supply Chain Management. 3 Units.
MBAC 506 (Marketing and Supply Chain Management) and MBAC 507 (Operations and Supply Chain Management) are an integrated presentation of the process of marketing, operations and supply chain management. Thus, they must be taken in numerical sequence or concurrently. Through lecture, discussion, cases and/or simulations you will learn theory and practice of how firms develop processes to understand, create and deliver "triple bottom line" value (i.e., economic, social and environmental) to business and/or consumer markets. In systems theory these continual-input-transformation-output stages comprise value chains. Specifically, in this course, we will introduce you to, and help you to practice, the ways managers forecast demand, establish production processes for the product or service, manage inbound resource flows, and manage outbound distribution so the customer can get the product or service the way he or she wants (i.e., place, form, time and "experience" utility). Throughout both courses (see MBAC 506 for its specific content) we will address the integrated process of managing ongoing long-term relationships with customers, distribution partners and suppliers to assure long-term customer satisfaction and achievement of the organization’s economic, social and environmental goals. Prereq: MBAC 506.

MBAC 507. Operations and Supply Chain Management. 3 Units.
MBAC 506 (Marketing and Supply Chain Management) and MBAC 507 (Operations and Supply Chain Management) are an integrated presentation of the process of marketing, operations and supply chain management. Thus, they must be taken in numerical sequence or concurrently. Through lecture, discussion, cases and/or simulations you will learn theory and practice of how firms develop processes to understand, create and deliver "triple bottom line" value (i.e., economic, social and environmental) to business and/or consumer markets. In systems theory these continual-input-transformation-output stages comprise value chains. Specifically, in this course, we will introduce you to, and help you to practice, the ways managers forecast demand, establish production processes for the product or service, manage inbound resource flows, and manage outbound distribution so the customer can get the product or service the way he or she wants (i.e., place, form, time and "experience" utility). Throughout both courses (see MBAC 506 for its specific content) we will address the integrated process of managing ongoing long-term relationships with customers, distribution partners and suppliers to assure long-term customer satisfaction and achievement of the organization’s economic, social and environmental goals.

MBAC 508. Strategic Issues and Applications. 3 Units.
Strategic management deals fundamentally with the ways firms build and sustain superior competitive positions and profitability. Successful strategy design and implementation requires an understanding of a firm’s external environment, its internal resources and capabilities. It also requires an integrative view of the firm that spans functional areas such as operations, marketing and finance. Strategic analysis draws on a number of academic disciplines including economics, psychology, political and management science.

MBAC 509. Leadership Assessment and Development. 3 Units.
This course focuses on developing the student. In this course the student will get to know themselves better by completing assessments and making sense of them, having group discussions, presenting to a group, engaging in various experiential activities, participating in a coaching session, working with a team, and expanding your knowledge of leadership skills and abilities. We encourage students to take every opportunity to reflect on their experiences during this course.

MBAC 510. Managing People and Organizations. 3 Units.
Using the behavioral and social sciences as a basis, this course examines concepts relevant to the effective management of people and organizations. Topics related to HR and organizational behavior are covered and include: organizational and team structure; organizational culture; conflict and decision-making; reward systems and motivation; recruiting and selection; management practices; group and team dynamics; and managing differences. A variety of methods, including experiential and interactive learning methods, are used to study these topics.
MBAC 511. Statistics and Decision Modeling. 3 Units.
This course provides the foundations of statistical and operations research methodologies for managerial decision-making. Topics covered include making inferences for populations from sample data via (a) estimation with confidence intervals, (b) hypothesis tests, and (c) forecasting with simple and multiple regression. Decision modeling of organizational systems uses mathematical and computer models to provide a quantitative approach to analyzing and solving complex decision problems. This course includes an introduction to linear programming models and applications, queuing models, and simulation models.

MBAC 512. Economics. 3 Units.
In this short class you will be introduced to the basics of modern microeconomic and macroeconomic thinking. Topics include consumers, firms, markets, the role of the government, information and public choice. This class will also focus on the economy as a whole: business cycle, statistics used to measure the economy, fiscal and monetary policy, international trade and development.

MBAC 517A. Management Perspectives and Dialogues. 3 Units.
This course serves as a vehicle to exercise critical thinking and integration skills. While much is learned by attending to the various functions of a business, effective management requires that you be able to integrate these to better understand the whole (organization, supply chain, market, industry, etc.). The course addresses that objective in three ways. First, we will bring in teams of senior managers for you to engage in dialogue about issues they have recently addressed, expect to address in the near future and how they function as leaders of their organizations. Next, are several modules that explore a couple of particular perspectives on management—that managers are designers and that businesses play a critical role in shaping a sustainable world. These are viewed as lenses for integrating the skills you are developing in the functional courses. Finally, we will have sessions in which you will practice thinking on your feet about how to approach business problems and situations. These are structured to help you in job interviews and to help you stand out in your early days in new work environment. The goal of this course is pragmatic. You can help by actively engaging with us in a dialogue about which elements work in helping you achieve these objectives and which do not. Prereq: MBAC 517A.

MBAP Courses

MBAP 401. Leadership Assessment and Development. 3 Units.
This course is designed to increase competitive attractiveness in the marketplace and maximize the added value of the M.B.A. program. The objective of the course is to have students learn a method for assessing and developing in themselves the knowledge and abilities relevant to management throughout their careers. This is accomplished by helping students develop an individualized learning plan to enhance their level of knowledge in 11 fields and 22 abilities. Students engage in a number of assessment activities, then receive feedback and interpret it. This occurs in the context of an Executive Action Team (i.e., students and a facilitator) in which students help each other assess their current capability and future development needs. This course is limited to students in the Part-time Cohort M.B.A. program. Prereq: This course is for students in the Part-time Cohort MBA Program only.

MBAP 402. Accounting for Decision Making. 3 Units.
This course will cover the use and application of basic financial statements, the basic cost structures in a firm, and decision making using accounting information. We will discuss usage and analysis of information from the annual report, focusing on the balance sheet, income statement, cash flow statement and related notes. The course will also cover internally generated accounting information about the cost structure of the firm. We will discuss use of this information in decision making. You are expected to be comfortable with definitions of basic accounting terms, and you should be familiar with the accounting structure and the financial statements. Prereq: This course is for students in the Part-time Cohort MBA Program only.

MBAP 403. Statistics and Decision Modeling. 3 Units.
This course provides the foundations of statistical and operations research methodologies for managerial decision-making. Business statistics focuses on statistical thinking as one of the fundamentals of effective management. Topics covered include sampling and the normal distribution, making inferences from data via confidence intervals and hypothesis tests, and analyzing relationships between samples. Decision modeling of organizational systems uses mathematical and computer models to provide a quantitative perspective on identifying, analyzing and solving complex decision problems. This course includes an introduction to linear programming models and applications, simulation techniques in decision-making, and project management. Prereq: This course is for students in the Part-time Cohort MBA Program only.

MBAP 404. Managing People in Organizations. 3 Units.
Examines the behavioral sciences relevant to the effective management of people and the effective design of human resources system, structure and policies. Topics include leadership, change management, motivation and pay systems, team dynamics, staffing, decision making, organizational communications, employee participation, performance appraisal, conflict management, negotiation, work design, organizational design, and organizations culture. A variety of methods, including experiential and interactive learning methods, are used to study these topics. Prereq: This course is for students in the Part-time Cohort MBA Program only.
MBAP 405. Financial Management I. 3 Units.
This is a Corporate Finance course that deals with investment theory and financial value. The course materials cover discounted cash flows, bond and stock valuation, capital budgeting, applications of real options in investment analysis, asset's risk and return, cost of capital, market efficiency and capital structure. The tools, problem solving techniques, and ways of thinking that you develop in this course have broad applicability to all areas of business. They also form the basis for sensible personal decisions in the areas of investments, borrowing, and financial planning. Prereq: This course is for students in the Part-time Cohort MBA Program only.

MBAP 406. Economics for Managers. 3 Units.
This course surveys the basic principles of micro and macroeconomics. Topics covered in microeconomics include supply and demand, the theory of production and costs, market structures and factor markets. Macroeconomics topics are the national incomes accounts, the determination of national income, employment and inflation, fiscal and monetary policies and international trade. Prereq: This course is for students in the Part-time Cohort MBA Program only.

MBAP 407. Managerial Marketing. 3 Units.
This course focuses on managing marketing as a process of creating value and mutually desirable exchanges of values. That is the foundation of a customer orientation and a central theme of market-driven management. Methods for strategic marketing planning, understanding buyer behavior, market analysis, segmentation and devising integrated marketing programs are introduced. Creating customer value and competitive advantage in worldwide markets is the central theme. Prereq: This course is for students in the Part-time Cohort MBA Program only.

MBAP 408. Operations Management. 3 Units.
Operations management deals with the design of products and processes, the acquisition of resources, the conversion of inputs to outputs, and the distribution of goods and services. It is central to a firm's ability to compete effectively. As global competition in both goods and services increases, the management of operations is becoming more and more important. This course provides a broad overview of the managerial issues associated with production and delivery of goods and services. It includes the use of quantitative modeling using computers as a central methodology. Prereq: This course is for students in the Part-time Cohort MBA Program only.

MBAP 409. Sustainability and Social Entrepreneurship. 3 Units.
This course creates a foundational platform featuring key models and managerial tools for building sustainable value and "turning the social and global issues of our day into business opportunities." Case studies of leading mainstream companies are used to analyze how business value is created for a range of social and environmental initiatives. Students will look at sustainability business strategies that reduce risks, drive down costs, create new revenue streams, serve new markets, and position companies to take advantage of changing societal expectations. Environmental issues such as climate change are covered along with social issues such as global poverty. Students acquire the competencies required to make effective business decisions based on integrating sustainability into the core of a company’s value added activities. Prereq: This course is for students in the Part-time Cohort MBA Program only.

MBAP 410. Strategic Issues and Applications. 3 Units.
This course wraps the M.B.A. core by providing an integrative experience of applying the full range of managerial skills addressed throughout the core in a comprehensive case exercise. Students develop, document, and present comprehensive, implementable strategic and tactical actions programs in groups. Prereq: This course is for students in the Part-time Cohort MBA Program only.

MBAP 411. Identifying Design Opportunities. 3 Units.
Designing is giving form to an idea for a more desirable product, service, process or organization, and refining the idea into something that can be delivered reliably and efficiently. Good design integrates these evolving ideas with the day-to-day realities of a firm's operations, systems, marketing, economics, finance and human resources. Designing is thus a unique managerial activity that brings together changing technologies, capabilities, relationships, activities and materials to shape an organization's plans and strategies. It combines analysis and synthesis to create opportunities for improvement and means of attaining them. Viewed this way, designing is a core competence of a successful entrepreneur or innovative leader. Design analysis is the systematic review of the four orders of design found in every firm--namely, the firm's communications, products, interactions and environments--and the creation of opportunities to increase firm value by improving each. Students will identify ill-defined, ill-structured problems within organizations. Such problems are ones for which there are no definitive formulations and for which the formulation chosen affects the solutions available. For such problems, there is no explicit way of knowing when you have reached a solution, and solutions cannot necessarily be considered correct or incorrect. But finding innovative solutions to such problems can provide unique opportunities to create exceptional value. A major outcome of the semester's inquiry is a presentation of the design problem and proposed design solution. Prereq: This course is for students in the Part-time Cohort MBA Program only.

MBAP 412A. Dialogues in Leadership. 1.5 Unit.
This course is a three credit hour two-semester course sequence that seeks to educate students of management in the intricacies of issues management through a process of facilitated dialogs with practicing management professionals who possess deep and highly contextualized knowledge and experiences in addressing a varied range of management issues in contemporary real life settings. The goal of the course is to help students bring their in-class theoretical learning into a safe laboratory setting for active testing. Real life managerial contexts will be introduced as faithfully as possible wherein theory and practice are brought into constructive juxtaposition, each providing a complementary and not necessarily a counter perspective to the other. Prereq: This course is for students in the Part-time Cohort MBA Program only.

MBAP 412B. Dialogues in Leadership. 1.5 Unit.
This course is a three credit hour two-semester course sequence that seeks to educate students of management in the intricacies of issues management through a process of facilitated dialogs with practicing management professionals who possess deep and highly contextualized knowledge and experiences in addressing a varied range of management issues in contemporary real life settings. The goal of the course is to help students bring their in-class theoretical learning into a safe laboratory setting for active testing. Real life managerial contexts will be introduced as faithfully as possible wherein theory and practice are brought into constructive juxtaposition, each providing a complementary and not necessarily a counter perspective to the other. Prereq: This course is for students in the Part-time Cohort MBA Program only.
MGAB Courses

MGAB 501. Study Abroad. 1 - 15 Unit.
Place holder for students studying abroad, to be replaced with actual course work taken at Exchange location once course work is completed and a transcript is sent to CWRU.

MGMT Courses

MGMT 1. Supervised Professional Practicum - Semester 1. 0 Units.
A professional practicum is a workplace experience, the primary goal of which is the intellectual, personal and professional growth of the student. It occurs under the sponsorship or supervision of a mentor in the workplace who is committed to seeing that it is an educational as well as a work venture. It requires skills appropriate to the student’s year in college and provides students with new skills, insights and experiences that are transferable back to the academic setting and/or to a future position in the workplace. (Only available to declared Weatherhead Accounting or Management majors.) Prereq: Junior standing or higher.

MGMT 2. Supervised Professional Practicum - Semester 2. 0 Units.
A professional practicum is a workplace experience, the primary goal of which is the intellectual, personal and professional growth of the student. It occurs under the sponsorship or supervision of a mentor in the workplace who is committed to seeing that it is an educational as well as a work venture. It requires skills appropriate to the student’s year in college and provides students with new skills, insights and experiences that are transferable back to the academic setting and/or to a future position in the workplace. (Only available to declared Weatherhead Accounting or Management majors.) Prereq: Junior standing.

MGMT 201. Contemporary Business: Connecting Principles to Performance. 3 Units.
This course is designed to survey business topics, issues, and practices. Students will be introduced to each of the functional areas of business, including accounting, finance, marketing, operations, business intelligence, and human resources management. The course is designed to help students appreciate the interrelationship of these business functions and, more generally, the role and context of business in society. Other topics considered include: the economic and legal environment of business, the globalization of markets, workforce diversity, leadership and entrepreneurship. To convey course content, lectures, in-class discussions, exercises, simulations, and guest speakers are used. Weekly discussions and a high level of student interaction amplify on class materials and concepts by focusing on contemporary issues of actual businesses.

MGMT 250. Managing Organizations and People I. 3 Units.
The principal goals of this course are to help students understand: 1) The context in which they, as managers, will function; the options they have for careers in management based on their own aptitudes and orientations; and how they can develop the skills they need for success in their chosen fields; and 2) How the effective strategic management of people contributes to organizational performance and the production of value, and that for many organizations, the effective management of people has been the driver of competitive advantage. This is the first course in a two course sequence. Prereq: At least sophomore standing.

MGMT 251. Managing Organizations and People II. 3 Units.
The principal goals of this course are to help students understand: 1) The context in which they, as managers, will function; the options they have for careers in management based on their own aptitudes and orientations; and how they can develop the skills they need for success in their chosen fields; and 2) How the effective strategic management of people contributes to organizational performance and the production of value, and that for many organizations, the effective management of people has been the driver of competitive advantage. This is the second course in a two course sequence. Prereq: MGMT 250 and at least sophomore standing.

MGMT 315. International Management Institute. 3 Units.
The course provides undergraduate students with a unique overseas visitation, language orientation, and management subject experiences during periods such as Spring Break, or during interims immediately following the end of the semester. Opportunities for diverse cultural and language experiences which result from the institute are added benefits of these programs. Prereq: ECON 102, ECON 103, ACCT 101 and BAFI 355.

MGMT 360. Special Topics and Issues in Management. 1 - 9 Unit.
This course option is available to qualified students who are undertaking special projects in a management related field.

MGMT 395. Advanced Seminar. 1 Unit.
This seminar, for undergraduate students with junior class standing or above, provides an opportunity to consider topics of importance in the community of ideas and activities related to the professional and managerial world. The development of writing and communication skills and in-depth discussion are expected attributes of seminar activity. The topic and scope of the coverage will be defined by the course instructor as consistent with the seminar approach to learning of the University. Prereq: Declared ACCT or MGMT Major and At Least Junior Standing.

MGMT 397. Undergraduate Research Project. 3 - 6 Units.
This course provides a supervisory structure for students completing a capstone research project in the Weatherhead School of Management. Arrangements should be made by consultation with a faculty member selected and the Senior Capstone Committee of the School of Management. Open to all management and accounting majors and other qualified students with instructor approval. A written report, presentation to the faculty department most closely related to the student’s topic, and an approved public presentation are required.

MGMT 398. Action Learning. 6 Units.
This is an experiential course built around a live project in a local organization. The project-based course is focused on improving business process. Students will work in teams to analyze the current situation and diagnose its problems or opportunities, creatively envision new possibilities, evaluate potential improvements and recommend appropriate solutions. Students will be evaluated by the professor and the project managers at the client organizations. Prereq: ACCT 202, BAFI 355 and MKMR 301, Senior Standing, and Declared ACCT or MGMT major.
MGMT 403. Leadership Assessment and Development. 3 Units.
This course is designed to increase competitive attractiveness in the marketplace and maximize the added value of the M.B.A. program. The objective of the course is to have students learn a method for assessing and developing in themselves the knowledge and abilities relevant to management throughout their careers. This is accomplished by helping students develop an individualized learning plan to enhance their level of knowledge in 11 fields and 22 abilities. Students engage in a number of assessment activities, then receive feedback and interpret it. This occurs in the context of an Executive Action Team (i.e., students and a facilitator) in which students help each other assess their current capability and future development needs. This course is limited to students in the M.B.A. program.

MGMT 405-1. Challenges of Globalization: Field Studies of Problems and Opportunities Facing Business. 0 Units.
This course is an exploration of current and emergent impacts of globalization on businesses, governments and non-profit organizations in Northeastern Ohio. Students will be organized into teams exploring aspects of these impacts, with each team developing archival and interview (and sometimes observational) data on the global challenges facing organizations in the region. Each team will be guided by mentors with extensive international experience. Throughout the course students will read and engage in on-going face-to-face and on-line discussions of relevant international news and analysis from such publications as Economist and Financial Times. At the conclusion of the course each team will present its findings to the community and contribute a chapter to a professional-quality report that will be circulated throughout the region.

MGMT 405-2. The Challenges of Globalization: Field Studies of Problems and Opportunities Facing Business. 6 Units.
This course is an exploration of current and emergent impacts of globalization on businesses, governments and non-profit organizations in Northeastern Ohio. Students will be organized into teams exploring aspects of these impacts, with each team developing archival and interview (and sometimes observational) data on the global challenges facing organizations in the region. Each team will be guided by mentors with extensive international experience. Throughout the course students will read and engage in on-going face-to-face and on-line discussions of relevant international news and analysis from such publications as Economist and Financial Times. At the conclusion of the course each team will present its findings to the community and contribute a chapter to a professional-quality report that will be circulated throughout the region.

MGMT 413. Human Value in Organizations. 3 Units.
Examines the behavioral sciences relevant to the effective management of people and the effective design of human resources system, structure and policies. Topics include leadership, change management, motivation and pay systems, team dynamics, staffing, decision making, organizational communications, employee participation, performance appraisal, conflict management, negotiation, work design, organizational design, and organizations culture. A variety of methods, including experiential and interactive learning methods, are used to study these topics.

MGMT 413A. Human Values in Organizations. 1 Unit.
Classes will explore research in the fields of organizational behavior and human resource management and apply this knowledge in actual situations and cases. They will learn about how to learn from experiences they have in class and in their EATs. Students will be able to directly apply skills learned in class to leadership, project management, task force management, team development, staff meetings, decision making, problem solving, interpersonal relations, environmental analysis, job redesign, organizational change, and labor and human resource policy. Prereq: Open to ACL-MBA students.

MGMT 418. Curricular Practical Training. 0 Units.
This course is intended for graduate business students who wish to gain curricular practical training in support of career goals. The experience developed in an internship will complement academic experience gained in Weatherhead classes.

MGMT 419. Corporate Field Research. 1 - 3 Unit.
This course is intended for the graduate business student who wishes to gain applied/practical business experience based on his/her intended career path and/or with an organization. This course will assist building required skills and bridge the gap between the classroom and real world application.

MGMT 420A. Dialogues in Top Management I. 1.5 Unit.
MGMT 420A and MGMT 420B Dialogues in Top Management I and II. Students must take the two courses in sequence. The courses comprise a series of dialogues with teams of top-echelon managers of pre- and post-dialogue student groups; analytic papers based on the content of the dialogues, class discussions, and readings. Readings and class discussions address both the character and dynamics of complex, enterprise-wide management problems and processes of effectively managing them. In open dialogues with practicing top-echelon managers students explore the practice and theory of effective top-echelon/general management. That is management that involves applying concepts and skill across all functional areas of management. Student groups' analytical essays after each dialogue stimulate in-depth discussion both of possible conceptual models of the management process and of the relationships to it of the course materials in the graduate programs

MGMT 420B. Dialogues in Top Management II. 1.5 Unit.
MGMT 420A and MGMT 420B Dialogues in Top Management I and II. Students must take the two courses in sequence. The courses comprise a series of dialogues with teams of top-echelon managers of pre- and post-dialogue student groups; analytic papers based on the content of the dialogues, class discussions, and readings. Readings and class discussions address both the character and dynamics of complex, enterprise-wide management problems and processes of effectively managing them. In open dialogues with practicing top-echelon managers students explore the practice and theory of effective top-echelon/general management. That is management that involves applying concepts and skill across all functional areas of management. Student groups' analytical essays after each dialogue stimulate in-depth discussion both of possible conceptual models of the management process and of the relationships to it of the course materials in the graduate programs
MGMT 440. Leadership Assessment and Development II. 0 Units.
The exit assessment course (MGMT 440) is aimed at assessing how students’ career goals, values and abilities may have changed since the program began. The course meets for one mandatory half day seminar in the Spring Semester and carries 0 units of credit. In the MGMT 403 course, students were provided the tools and opportunities for self-assessment and career planning. In the very first semester, they completed several assessment instruments (LSI, POQ, 360-Feedback (ECI-U), ASI, My Values, Career Anchors and others). They had to identify their top values, set a career vision and create an individualized learning plan. The ultimate goal was to assure that their personal development and preparation was relevant to, and in alignment with, the emergent requirements of today’s business management careers. This course is specifically designed to identify if a student’s prior learning plan (completed in the MGMT 403 course) still fits with his/her current career reality and to also identify what has changed for him/her. The activities in the course will include: Viewing the current reality of today’s business environment; Revisiting their experience in the MBA program including any internships/jobs; Determining if a student’s values, vision and learning plan still fit; Retaking the 360-Feedback (Emotional Intelligence Competencies) to identify development of competencies; Identifying relevant areas of personal development; Committing to a refined learning plan and goals. Through a highly interactive and team based process, students will be able to reflect on their current reality, get feedback on your personal growth and discover what changes would enhance their professional career journey.

MGMT 458. International Institute. 3 Units.
The International Institute involves semester-long study of a particular region, followed by a class trip to an area within that region. The preparatory coursework varies depending on the region selected for that particular semester; however, it typically consists of research about cultural, financial, political, and economic topics. The trip consists of daily research meetings with organizations within the region being studied. Upon return, a summary exercise is required to complete the coursework. The class trip is a mandatory component of the course.

MGMT 460. Managing in a Global Economy. 3 Units.
Managers need new skills to enable them to manage effectively in what is increasingly a global economy. They need a deeper understanding of cultural differences and how these differences may influence communications with foreign employers, employees, customers, suppliers or partners. They need a better understanding of the economic and political mechanics of the world business system. They need to learn how to find out more about potential opportunities and threats that lie outside the United States. This course is designed to address these needs.

MGMT 464. Business Ethics. 3 Units.
This course is built around two core learning tracks. The first is extended analyses of case studies, which identifies ethical problems, diagnoses import, and develops strategic programs to address them. The second learning track uses short pieces of fiction to explore issues of ethical character, leadership, and organizational responsibility. Each student keeps an ethics journal over the course of the semester to reflect on ethical issues, both inside and outside the classroom. In addition, small student groups are formed to write case studies focusing on a business ethics problem.

MGMT 467-1. Commercialization and Intellectual Property Management. 3 Units.
This interdisciplinary course covers a variety of topics, including principles of intellectual property and intellectual property management, business strategies and modeling relevant to the creation of start-up companies and exploitation of IP rights as they relate to biomedical-related inventions. The goal of this two-semester course is to address issues relating to the commercialization of biomedical-related inventions by exposing law students, MBA students, and Ph.D. candidates (in genetics and proteomics) to the challenges and opportunities encountered when attempting to develop biomedical intellectual property from the point of early discovery to the clinic and market. Specifically, this course seeks to provide students with the ability to value a given technological advance or invention holistically, focusing on issues that extend beyond scientific efficacy and include patient and practitioner value propositions, legal and intellectual property protection, business modeling, potential market impacts, market competition, and ethical, social, and healthcare practitioner acceptance. The course will meet over two consecutive semesters--fall and spring--and is six credit hours (three credits each semester). During these two semesters, law students, MBA students, and Ph.D. candidates in genomics and proteomics will work in teams of five (two law students, two MBA students and one Ph.D. candidate), focusing on issues of commercialization and IP management of biomedical-related inventions. The instructors will be drawn from the law school, business school, and technology-transfer office. To be eligible for this course, law students must also have a B.S or equivalent in the life sciences, such as biology, biochemistry, genomics, molecular biology, etc. Offered as LAWS 367, MGMT 467, GENE 367 and GENE 467.

MGMT 467-2. Commercialization and Intellectual Property Management. 3 Units.
This interdisciplinary course covers a variety of topics, including principles of intellectual property and intellectual property management, business strategies and modeling relevant to the creation of start-up companies and exploitation of IP rights as they relate to biomedical-related inventions. The goal of this two-semester course is to address issues relating to the commercialization of biomedical-related inventions by exposing law students, MBA students, and Ph.D. candidates (in genetics and proteomics) to the challenges and opportunities encountered when attempting to develop biomedical intellectual property from the point of early discovery to the clinic and market. Specifically, this course seeks to provide students with the ability to value a given technological advance or invention holistically, focusing on issues that extend beyond scientific efficacy and include patient and practitioner value propositions, legal and intellectual property protection, business modeling, potential market impacts, market competition, and ethical, social, and healthcare practitioner acceptance. The course will meet over two consecutive semesters--fall and spring--and is six credit hours (three credits each semester). During these two semesters, law students, MBA students, and Ph.D. candidates in genomics and proteomics will work in teams of five (two law students, two MBA students and one Ph.D. candidate), focusing on issues of commercialization and IP management of biomedical-related inventions. The instructors will be drawn from the law school, business school, and technology-transfer office. To be eligible for this course, law students must also have a B.S or equivalent in the life sciences, such as biology, biochemistry, genomics, molecular biology, etc. Offered as MGMT 467, LAWS 367, GENE 367 and GENE 467.
MGMT 495A. Ames Advanced Business Plan Seminar. 3 Units.
This two semester 6 credit hour course teaches students to write a strategic business plan. Working in teams, students study a Cleveland area business through meetings with company executives, including the CEO, under the supervision of a faculty member and outside planning expert. In Semester One, multiple leading faculty members will conduct classes which focus on key components of a business plan, including marketing, strategy, finance, supply chain and leadership. Semester One will culminate with a case study of an assigned company written by each team. Semester Two is a practicum experience during which student teams write a strategic business plan for their assigned company, once again under the supervision of faculty and outside mentors. Plans will be presented by teams to a Business Plan Competition jury composed of leading private equity executives, investment bankers and/or corporate CEOs.

MGMT 495B. Ames Advanced Business Plan Seminar. 3 Units.
This two semester 6 credit hour course teaches students to write a strategic business plan. Working in teams, students study a Cleveland area business through meetings with company executives, including the CEO, under the supervision of a faculty member and outside planning expert. In Semester One, multiple leading faculty members will conduct classes which focus on key components of a business plan, including marketing, strategy, finance, supply chain and leadership. Semester One will culminate with a case study of an assigned company written by each team. Semester Two is a practicum experience during which student teams write a strategic business plan for their assigned company, once again under the supervision of faculty and outside mentors. Plans will be presented by teams to a Business Plan Competition jury composed of leading private equity executives, investment bankers and/or corporate CEOs.

MGMT 498. Action Learning. 3 Units.
This course allows teams of students to integrate functional core knowledge from the first year of the M.B.A. program and apply analysis and strategic management skills in a real-world setting. Students will be evaluated by the instructor and the project managers at the client organizations. Recommended preparation: Second year full-time M.B.A. status.

MGMT 499. Strategic Issues and Applications. 3 Units.
This course wraps up the M.B.A. core by providing an integrative experience of applying the full range of managerial skills addressed throughout the core in a comprehensive case exercise. Students develop, document, and present comprehensive, implementable strategic and tactical actions programs in groups. Prereq: ACCT 401 and BAFI 402.

MGMT 501. Special Problems and Topics. 1 - 18 Unit.
This course is offered, with permission, to students undertaking reading in a field of special interest.

MGMT 502. Advanced Topics. 1 - 18 Unit.
This is a course of flexible design to meet advanced theoretical and/or methodological needs of doctoral students. Approval is needed from the instructor, and it requires a letter grade.

MGMT 575. Doctoral Research Project. 3 Units.
The objective of the course is to produce a stand-alone piece of scholarship in the academic discipline pursued by the student. The paper or project should be of publishable quality as judged by the instructor. The work of the student is to be accomplished on the independent study basis under the direction of a faculty member. Although there are no specific course prerequisites, the understanding is that all other coursework should have been completed to be admitted into the class. Prereq: Ph.D. standing.

MGMT 601. Special Topics. 1 - 18 Unit.
This course is offered, with permission, to Ph.D. candidates undertaking reading in a field of special interest.

MGMT 602. Advanced Topics. 1 - 18 Unit.
This is a course of flexible design to meet advanced theoretical and/or methodological needs of doctoral students. Approval is needed from the instructor, and it requires a letter grade.

MGMT 610. Culture and World Politics. 3 Units.
Religion, ethnicity, and nationalism have assumed major political significance in the post Cold-War and post-9/11 eras. The course examines ideas of political democracy and economic liberalism in relation to different cultural and religious ideas and explores relationships among social values, political structures, and economics. Prereq: Only for students in PhD in Management: Designing Sustainable Systems, or by permission of the Program Director.

MGMT 614. Business as an Evolving Complex System. 3 Units.
The goal of this course is to provide a foundation for understanding how business systems evolve, why the business systems in the major advanced countries have evolved differently over the last 100 years or so, and what the underlying driving forces are. The focus is on transformation rather than economic growth. The course examines the evolution of business systems as a result of technological and organizational change. It deals with the role of history, culture and finance in generating business organizations in various countries. The course also studies the emergence of regional innovation systems and industry clusters, as well as how digitization and globalization are changing the industrial logic. Prereq: Must be enrolled in PhD in Mgt: Designing Sustainable Systems.

MGMT 616. Global Economic Systems and Issues. 3 Units.
This course provides a framework and analytical tools for understanding globalization and international economic relations in the context of the global political system. It analyzes the economic and political forces that are shaping global cooperation on economic matters, the role and impact of international economic institutions such as the World Bank, the International Monetary Fund, and the World Trade Organization, and evolving forms of regional governance, such as the European Union. It covers national and international policies and development and the causes and cures of international financial crises. The course revolves around concepts of efficiency, equality, power and institutions in the making of public policy towards globalization of communications and transportation. Prereq: Must be enrolled in Ph.D in Management: Designing Systems track.
MGMT 617. Technology and Social System Design. 3 Units.
Managers are designers who shape the social and technical world we inhabit. This course explores the process of design and asks how managers can become better designers and interventionists who anticipate and evaluate the social, economic, and political consequences of existing and emerging products, processes, and organizational forms. Prereq: Students in PhD Management program or requisites not met permission.

MGMT 640. Social Ethics: Contemporary Issues. 3 Units.
The course draws upon intellectual ancestors and current thinkers in moral philosophy and ethics to assist each student in identifying, analyzing, and discussing social and ethical questions pertaining to the definition and purpose of contemporary life, the need for moral coherence, and the meaning of life in a global society. The unifying theme of the course is Tolstoy’s question, “How then shall we live?” The course does not seek to provide answers to the great questions of life. Rather, it tries to expand each student’s capacity to grapple with such questions. Prereq: Students in PhD Management program or requisites not met permission.

MGMT 641. Qualitative Res Methods II. 3 Units.
This course guides the student in conducting the qualitative research project that was proposed in EDMP 638. Fieldwork and initial analysis is conducted during the summer when data based on semi-structure interviews is collected and analysis begins using inductive coding techniques. A summer residency is held in mid-June to assess progress as final data collection and analysis continues. The aim of the fall semester is to prepare a formal research report on that project, which will be submitted to an academic research conference. The final report includes a revision of one’s conceptual model, integrating new understandings and literature arising from the data collection and analysis. Prereq: Only for students in PhD in Management: Designing Sustainable Systems, or by permission of the Program Director.

MGMT 643. Measuring Bus Behav & Struc. 3 Units.
This course aims to develop the basic foundations and skills for designing and executing generalizable studies that measure business behaviors and structures. It focuses on building the student's capacity to grapple with such questions. Prereq: Students in PhD Management program or requisites not met permission.

MGMT 644. Causal Analy of Bus Prob II. 3 Units.
Causal Analysis of Business Problems II introduces fundamental concepts in theory-based model building and validation. In this course students will develop, explore, refine a range of models appropriate for addressing their problem of practice including classification models, process models, variance models, and articulating nomological networks. In particular, the course will focus on effective conceptualizations of causation, control, mediation, and moderation. Further, foundational statistical techniques such as tests of assumptions of the data, exploratory factor analysis, and regression and path analysis will be introduced to analyze concepts of causation, control, mediation and moderation. Prereq: Only for students in PhD in Management: Designing Sustainable Systems, or by permission of the Program Director.

MGMT 645. Integration of Qualitative and Quantitative Inquiry. 3 Units.
Using the mixed method research toolkit developed in previous courses, this course focuses on critically analyzing selected pieces of published applied and policy research to develop a critical appreciation of issues and debates that have wide applicability and relevance. In particular, it offers students ways to integrate and triangulate using a mixed method approach, different forms of evidence, and related evidence. In addition, this course addresses common method choice and justification issues and related challenges of validity and theory formulation that typically arise during the students’ execution of a series of individual research projects. Application of critical analysis and appreciation approach in justifying mixed methods designs to the student’s own research work is encouraged and supported by sharing and discussing common research and methodology themes and problems. Prereq: Students in PhD Management program or requisites not met permission.

MGMT 646. Advanced Analytical Methods for Generalizing Research. 3 Units.
This course addresses advanced topics in regression and structural equation modeling such as latent growth curve models, partial least squares, logit models, tests for various types of invariance, multiple-group analysis, multilevel analysis, and analyzing qualitative/categorical data. These analytical methods are intended to enhance the student's toolkit as to facilitate a strong bridge to the academic literature and the application to specific data based problems that arise in applied managerial research. Prereq: Students in PhD Management program or requisites not met permission.

MGMT 648. Advanced Analytical Methods for Generalizing Research. 3 Units.
This course addresses advanced topics in regression and structural equation modeling such as latent growth curve models, partial least squares, logit models, tests for various types of invariance, multiple-group analysis, multilevel analysis, and analyzing qualitative/categorical data. These analytical methods are intended to enhance the student's toolkit as to facilitate a strong bridge to the academic literature and the application to specific data based problems that arise in applied managerial research. Prereq: Students in PhD Management program or requisites not met permission.

MGMT 649. Integration of Qualitative and Quantitative Inquiry. 3 Units.
Using the mixed method research toolkit developed in previous courses, this course focuses on critically analyzing selected pieces of published applied and policy research to develop a critical appreciation of issues and debates that have wide applicability and relevance. In particular, it offers students ways to integrate and triangulate using a mixed method approach, different forms of evidence, and related evidence. In addition, this course addresses common method choice and justification issues and related challenges of validity and theory formulation that typically arise during the students’ execution of a series of individual research projects. Application of critical analysis and appreciation approach in justifying mixed methods designs to the student’s own research work is encouraged and supported by sharing and discussing common research and methodology themes and problems. Prereq: Students in PhD Management program or requisites not met permission.

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MGMT 664. Knowledge Dissemination to Influence Managerial Practice. 3 Units.
The aim of this course is twofold. First, it supports students organizing and writing their DM thesis overview or their PhD thesis proposal. Also discussed are ways to organize and communicate in scientific genres, their aims and their generic properties. Secondly, students become acquainted with scientific communication and publishing. Effective reviewing, criteria for judging articles and theses, management of review processes, and how to communicate and respond to reviews are topics discussed. The course also addresses publication strategies and ways of managing and communicating scientific and managerial knowledge to different stakeholders. Prereq: Students in PhD Management program or requisites not met permission.

MGMT 671. Design and Sustainable Systems. 3 Units.
The goal of this course is to introduce doctoral students to the nature and practice of design as a strategy of inquiry as well as a mode of action in addressing the problems of creating and managing sustainable human systems. The objectives are (1) to introduce the conceptual framework of design, (2) the nature of human interaction as seen from the perspective of design, (3) the intellectual and practical strategies of design, (4) the methods and techniques of design that are relevant to the study and design of sustainable human systems, and (5) the nature of "wicked problems" and the ethical issues of design, with special attention to the place of human dignity in the design of sustainable systems. The course will employ key elements of the literature of design, close reading and discussion, and exercises that explore the concepts and methods of design. Prereq: Students in PhD Management program or requisites not met permission.

MGMT 672. Sustainability and Social Value Creation. 3 Units.
This course is designed to galvanize new visions of business and society, as well as organizational leadership. The course is born of a conviction that the future of human society and the natural world is intimately linked to the future of the world economy, business enterprises, and management education. The course presentations, books, dialogues, and interview projects are organized around three themes: (1) the state of the world and the economics possibilities of our time, (2) the business case for understanding business as an agent of world benefit--how business performance can profit from current and future advances in sustainable design and social entrepreneurship; and (3) tools for becoming a change leader--including the methods of Appreciative Inquiry and new insights about "strength-based" change emerging from the science of human strengths. The overarching aim is to provide a powerful introduction to the many facets of sustainable value creation as a complete managerial approach. Prereq: Students in PhD Management program or requisites not met permission.

MGMT 673. Understanding, Designing, Managing Complex Systems. 3 Units.
The purpose of this course is to provide a perspective on systems thinking and complex systems to aid PhD students in expanding the ideas in their research on systems, systems models, and complex systems. The work of the course will develop with increasingly difficult books on the subject of complex systems, a major case study in health care, and individual applications of the concepts to their potential research model and methods. Prereq: Students in PhD Management program or requisites not met permission.

Prereq: Must be enrolled in Ph.D. in Management: Designing Sustainable Systems and have predoctoral research consent or advanced to Ph.D. candidacy milestone.

MIDS Courses

MIDS 301. Introduction to Information: A Systems and Design Approach. 3 Units.
Managers must design business systems and flows of information that enable an organization to operate successfully in changing environments. This course will explore what "design," "systems," "information" and "environment" really mean in this context. You will develop a systems and design perspective on information and organizations that will inform your future work as a manager and leader. You will learn how to model organizations and their environments to reveal how they reflect foundational concepts of information theory, cybernetic control and complexity. You will also learn to evaluate multiple levels of information design, including communication design, product design, experience design and organization design, as an integral part of your management skills. In addition, you will study the strategic use of contemporary information technologies (e.g., enterprise systems, cloud computing, crowd sourcing, viral marketing, distributed innovation, and social media) to understand how they have changed the competitive landscape of business. Throughout the course, you will be challenged to develop new skills for analyzing organizations, environments and systems, and for using design concepts and methods to create information environments that will enable successful organizations.

MIDS 315. Multimedia Systems. 3 Units.
Current practices and future directions of multimedia systems are discussed. Special attention is given to management issues involved in specifying, designing, developing, and assessing multimedia systems and to design principles that can be used to improve the quality of multimedia. This is a project-based course in which students gain experience in developing web sites, CD-ROMs, and films. Description for MIDS 415: As information becomes more abstract and therefore more difficult to perceive directly with one’s sense, sonic and visual presentation become more important than ever. Designing systems that take advantage of people’s aesthetic sensibilities is an area wide open to the enterprising and inventive entrepreneur. This course will interest those who think that artists have a say about how sound and graphics and words might be put together. The course examines aesthetic issues that arise in the development of multimedia. It focuses on creative integration of video, audio, and graphics particularly for the web, interactive CDs, and virtual reality. Offered as MIDS 315 and MIDS 415. Prereq: Not open to first-year students.

MIDS 326. Systems Analysis and Design. 3 Units.
This course investigates concepts and techniques for analyzing organizational systems in order to identify opportunities for redesigning the organization, its work practices and/or its information systems. It emphasizes creativity in diagnosing organizational problems and opportunities. You will learn consultation and intervention strategies for moving to a consensus on problem definition and a vision of desired changes. You will learn both soft and structured object-oriented methods for performing systems analysis. In addition you will learn the process of documenting new organizational and information system requirements in a form suitable for detailed system design and implementation.

MIDS 360. Independent Study. 1 - 18 Unit.
MIDS 385. Web Systems Integration. 3 Units.
Standards-based technology is used to help solve complex information system problems in modern organizations. This course brings together component-based development approaches in the context of doing business on the global Internet and on corporate intranets. Enabling technologies are based on published and de facto Internet standards including HTTP and HTML, CGI/API and Perl, CSS, JavaScript, ActiveX, XML, CORBA/DCOM, and SSL/SET. Students are encouraged to contribute to a team effort to design, implement, and integrate an appropriate solution to a selected business problem in electronic commerce or distance learning. They will also develop competency in the foundation technologies. Offered as MIDS 385 and MIDS 485.

MIDS 409. System and Design Thinking. 3 Units.
For over a half-century, the field of information systems has been learning about the design, development, testing, and use of complex systems. Computers are just the start. The networks that connect them to create a massive communications grid, the software that runs on them, and the impact of these artifacts on organizations have all generated large bodies of knowledge. Two modes of thinking have proven particularly valuable in making sense of these developments—system thinking and design thinking. While this course applies concepts from system thinking and design thinking to problems related to using information in organizations, the techniques are widely applicable to managing.

MIDS 409A. System and Design Thinking. 1 Unit.
For over a half-century, the field of information systems has been learning about the design, development, testing, and use of complex systems. Computers are just the start. The networks that connect them to create a massive communications grid, the software that runs on them, and the impact of these artifacts on organizations have all generated large bodies of knowledge. Two modes of thinking have proven particularly valuable in making sense of these developments—system thinking and design thinking. While this course applies concepts from system thinking and design thinking to problems related to using information in organizations, the techniques are widely applicable to managing. Prereq: Open to ACL-MBA students.

MIDS 413. Managing Large Systems. 3 Units.
This course will help you understand the complex nature of the selection, implementation and management of large enterprise business systems (such as Enterprise Resource System, Customer Relationship Management systems and Supply Chain Management systems). It is no secret that many companies have publicly, and privately, struggled with large enterprise business systems projects which ended up millions of dollars over budget, many years behind schedule, or worse, crippling the companies’ operations by failing to meet the day-to-day demands of the business. During this course, we will examine case studies of successful, and unsuccessful, projects and organize the common themes into a framework applicable to the successful navigation of the life cycle of large enterprise business systems. Prereq: MIDS 409.

MIDS 415. Multimedia Systems. 3 Units.
Current practices and future directions of multimedia systems are discussed. Special attention is given to management issues involved in specifying, designing, developing, and assessing multimedia systems and to design principles that can be used to improve the quality of multimedia. This is a project-based course in which students gain experience in developing web sites, CD-ROMs, and films. Description for MIDS 415: As information becomes more abstract and therefore more difficult to perceive directly with one’s sense, sonic and visual presentation become more important than ever. Designing systems that take advantage of people’s aesthetic sensibilities is an area wide open to the enterprising and inventive entrepreneur. This course will interest those who think that artists have a say about how sound and graphics and words might be put together. The course examines aesthetic issues that arise in the development of multimedia. It focuses on creative integration of video, audio, and graphics particularly for the web, interactive CDs, and virtual reality. Offered as MIDS 315 and MIDS 415.

MIDS 420A. Design in Management: Concept and Practices. 3 Units.
Designing is giving form to an idea to conceive of a more desirable product, service, process or organization and refining the idea into something that can be delivered reliably and efficiently. Good design integrates these evolving ideas with the day-to-day realities of a firm’s operations, systems, marketing, economics, finance and human resources. Designing is thus a unique managerial activity that brings together changing technologies, capabilities, relationships, activities and materials to shape an organization’s plans and strategies. It combines analysis and synthesis in ways that are integrative and inventive, and through it managers create opportunities and means of attaining them. Viewed this way, designing is a core competence of a successful entrepreneur or innovative leader. This course is the first in a two-semester sequence. Design analysis is the systematic review of the four orders of design found in every firm—namely, the firm’s communications, products, interactions and environments—and the creation of opportunities to increase firm value by improving each. Students will identify ill-defined, ill-structured problems within organizations. Such problems are ones for which there are no definitive formulations and for which the formulation chosen affects the solutions available. For such problems, there is no explicit way of knowing when you have reached a solution, and solutions cannot necessarily be considered correct or incorrect. But finding innovative solutions to such problems can provide unique opportunities to distinguish organizations and to create exceptional value. A major outcome of the semester’s inquiry is a presentation of the challenges and opportunities discovered during the design analysis of the client organization. The presentation will include a conceptualization of the client’s current situation and opportunities, along with a statement of their design requirements. It is successful to the extent that it demonstrates learning by creating unexpected value to the client.
MIDS 420B. Design in Management: Concept and Practices. 3 Units.
Designing is giving form to an idea to conceive of a more desirable product, service, process or organization and refining the idea into something that can be delivered reliably and efficiently. Good design integrates these evolving ideas with the day-to-day realities of a firm’s operations, systems, marketing, economics, finance and human resources. Designing is thus a unique managerial activity that brings together changing technologies, capabilities, relationships, activities and materials to shape an organization’s plans and strategies. It combines analysis and synthesis in ways that are integrative and inventive, and through it manages to create opportunities and means of attaining them. Viewed this way, designing is a core competence of a successful entrepreneur or innovative leader. This course is the first in a two-semester sequence. Design analysis is the systematic review of the four orders of design found in every firm—namely, the firm’s communications, products, interactions and environments—and the creation of opportunities to increase firm value by improving each. Students will identify ill-defined, ill-structured problems within organizations. Such problems are ones for which there are no definitive formulations and for which the formulation chosen affects the solutions available. For such problems, there is no explicit way of knowing when you have reached a solution, and solutions cannot necessarily be considered correct or incorrect. But finding innovative solutions to such problems can provide unique opportunities to distinguish organizations and to create exceptional value. A major outcome of the semester’s inquiry is a presentation of the challenges and opportunities discovered during the design analysis of the client organization. The presentation will include a conceptualization of the client’s current situation and opportunities, along with a statement of their design requirements. It is successful to the extent that it demonstrates learning by creating unexpected value to the client. Prereq: MIDS 420A.

MIDS 432. Health Care Information Systems. 3 Units.
This course covers concepts, techniques and technologies for providing information systems to enhance the effectiveness and efficiency of health care organizations. Offered as HSMC 432, MIDS 432, MPH 532 and NUNI 432.

MIDS 461. Change Management. 3 Units.
Change is an inherent dimension of organizational life—new policies, regulations, technologies, people, products, competitors, markets, processes, physical facilities...the list goes on. Consequently, the abilities to adapt to and manage technical and organizational changes are critical managerial competencies. This course aims to provide a framework for planning, analyzing, and managing those changes over which you as a manager will have some control. Though our discussions will focus on technology-enabled and technology-related change, the intention is to equip you with a process model, tools, and guiding principles that can be applied more generally to other change processes.

MIDS 485. Web Systems Integration. 3 Units.
Standards-based technology is used to help solve complex information system problems in modern organizations. This course brings together component-based development approaches in the context of doing business on the global Internet and on corporate intranets. Enabling technologies are based on published and defacto Internet standards including HTTP and HTML, CGI/API and Perl, CSS, JavaScript, ActiveX, XML, CORBA/DCOM, and SSL/SET. Students are encouraged to contribute to a team effort to design, implement, and integrate an appropriate solution to a selected business problem in electronic commerce or distance learning. They will also develop competency in the foundation technologies. Offered as MIDS 385 and MIDS 485.

MIDS 501. Special Problems and Topics. 1 - 18 Unit.
This course is offered, with permission, to students undertaking reading in a field of special interest.

MIDS 527. Seminar in MIDS. 3 Units.
This seminar addresses topics of current interest with a strong emphasis on research. It is intended primarily for the faculty and doctoral students of the MIDS Department.

MIDS 601. Special Topics in MIDS. 1 - 18 Unit.
This course is offered, with permission, to Ph.D. candidates undertaking reading in a field of special interest.

Prereq: Predoctoral research consent or advanced to Ph.D. candidacy milestone.

MKMR Courses

MKMR 201. Marketing Management. 3 Units.
This is an introductory marketing course designed to provide students with the concepts and theories necessary for understanding the fundamental principles of marketing and its role in any organization. Students will learn concepts such as marketing orientation, marketing-mix, relationship marketing and service logic, as well as behavioral theories of customer response and strategic frameworks of customer brand management. Students develop capabilities for understanding marketing issues in real world situations and to create and implement basic marketing plans. Prereq: At least Sophomore standing.

MKMR 304. Brand Management. 3 Units.
Successful innovation and management of brands and products creates customer, firm and societal value. This course is designed to help students understand the principles of product and brand development and management such as understanding evolving customer needs; creating and delivering the right products, services, and experiences; and managing the process to enhance brand equity and customer satisfaction. Through text, cases, and simulation this engaging class will cover the branding process from new brand and product development; brand communication and promotion, and brand equity measurement. The course will also discuss specific topics such as global brands, brand extensions, brand revitalization, and social responsibility. Prereq: ACCT 102, ECON 102 and MKMR 201.
MKMR 307. Marketing Value Chain Management. 3 Units.
This course views the supply chain (including the distribution channels) as a multi-organization business system that enables customers at all points in the system to acquire the benefits/value they want in the way they want to acquire them. It is a collaborative human network creating customer and shareholder value throughout the system. Strategic and tactical management topics include specifying customer desired value, assessing network members’ (suppliers, producers, distributors, and customers) abilities to create it, and consequently allocating decisions, tasks, and rewards to members. Emphasis is on structure, communication, motivation, and control/discipline to encourage effective implementation throughout the supply chain system. Offered as MKMR 307, MKMR 407 and OPMT 407. Prereq: ACCT 102 and MKMR 201.

MKMR 308. Measuring Marketing Performance. 3 Units.
Evaluation and control are important strategic marketing processes and without effective and consistent measurement, these processes cannot be performed adequately. In recent years, marketing budgets have been challenged by top managers as the value of these expenditures to an organization’s financial well being is not often clear. Marketing activities such as advertising, sales promotions, sales force allocation, new product development and pricing all involve upfront investments and making these investments now require increasing scrutiny. This course will be about knowing and understanding what to measure, how to measure and how to report it so the link between marketing tactics and financial outcomes is clearer. The course will include lecture by the instructor, readings, cases, computer based data exercises and guest lectures. There will also be a team project requirement. Prereq: ACCT 102, ECON 102 and MKMR 201.

MKMR 310. Marketing Analytics. 3 Units.
To appreciate, design, and implement data-based marketing studies for extracting valid and useful insights for managerial action that yield attractive ROI, five essential processes are emphasized: (a) making observations about customers, competitors, and markets, (b) recognizing, formulating, and refining meaningful problems as opportunities for managerial action, (c) developing and specifying testable models of marketing phenomenon, (d) designing and implementing research designs for valid data, and (e) rigorous analysis for uncovering and testing patterns and mechanisms from marketing data. Prereq: MKMR 201.

MKMR 311. Consumer Relationship Management. 3 Units.
Customer Relationship Management (CRM) is the strategic process of building and maintaining profitable, sustainable customer relationships through co-creation of value with customers in both business-to-business (B2B) and business-to-consumer (B2C) markets. This course starts with understanding the relationship between an organization’s strategic goals and the structure and dynamics of organization-customer relationships. Topics include assessing CRM system design, implementation and management; the fundamentals of customer profitability analysis; customer portfolio management; B2B relationship management; sales force management and automation; and designing services programs to optimize customer experiences; and expanding customer relationships through services. Additionally, students will explore how one-to-one marketing and social networks enhance customer relationships. Learning will be accomplished through lecture and discussion, critical discussion of case studies and contemporary marketing issues, and interaction with experienced CRM marketing professionals. Prereq: MKMR 201.

MKMR 312. Selling and Sales Management. 3 Units.
Selling and sales management are keys to implementing an organization’s marketing program and customer relationships. This course emphasizes developing an understanding of basic marketing concepts, selling principles, interrelationships among sales force management and other business functions, appropriate strategy for managing a sales force and measurement of sales force productivity. We will use theories of work motivation and explore how individual difference variables influence the choices of sales managers. This course uses a synthesis of sales research and leading practices to focuses on both a strategic and a tactical perspective. Strategic issues include: entrepreneurial strategy, the sales force’s role in company strategy, customer relationship and strategic account management, sales force size and organization and career paths to sales management. Tactical issues include: effective approaches to selling, finding and retaining top sales talent, motivating and compensating the field force, evaluating performance, and aligning sales territories. Prereq: MKMR 301 or consent of instructor.

MKMR 350. Entrepreneurial Marketing. 3 Units.
You have a great idea. This course helps you achieve your goals for it - whether they are commercial, societal, environmental, public policy/ political or a combination of the four. The course addresses the conceptually creative and data-driven entrepreneurial/intrapreneurial process of conceiving and implementing an operational program for realizing the goals of a market opportunity. Students select an opportunity and develop a deployable, one-year market entry program and five-year strategic marketing program. Emphasis is on the entrepreneurial marketing decision process, including defining the business model, selecting performance objectives and measures, specifying customer perceived value, assessing competitive capability and advantage, defining and analyzing the value chain and evaluating market space structure and dynamics, and complementing the players in the value chain. Identifying and properly using both secondary and primary information in management decision making is a major focus of the course. Offered as MKMR 350 and MKMR 450. Prereq: Sophomore standing.

MKMR 355. Communications Management in a Digital Marketplace. 3 Units.
In a marketplace where consumer touchpoints have gone digital and new digital methods of connecting with the consumers are emerging, this course provides a sound understanding of management of an organization’s total marketing communications. The focus is on identifying appropriate strategy and tactics for effectively communicating with end consumers and other stakeholders/public in both conventional ways and also in new and emerging ways. Students examine the roles of advertising, sales promotion and public relations, along with below the line methods like direct response advertising, and Internet based methods including display and search advertising, affiliate marketing and viral campaigns. They work with developing and managing these elements as part of an overall, synergistic communications strategy. Perspectives and metrics for evaluation of the effectiveness of marketing communications are also introduced and discussed. Prereq: MKMR 301.

MKMR 360. Independent Study. 1 - 3 Unit.
This course is offered, with permission, to students undertaking reading and research in an area of their special interest.
MKMR 403. Managerial Marketing. 3 Units.
This course focuses on managing marketing as a process of creating value and mutually desirable exchanges of values. That is the foundation of a customer orientation and a central theme of market-driven management. Methods for strategic marketing planning, understanding buyer behavior, market analysis, segmentation and devising integrated marketing programs are introduced. Creating customer value and competitive advantage in worldwide markets is the central theme. Prereq: ACCT 401.

MKMR 403A. Marketing. 1 Unit.
This course is designed to refresh and enhance student familiarity with fundamental concepts in marketing management, and with how those concepts are applied to solve realistic business problems. The course exposes students to basic marketing theory in the areas of consumer behavior and decision making (both individual consumers and organizational buyers), pricing strategies, channel management and its importance to marketing strategy, new product development and management and its importance to marketing strategy, new product development and management, and promotion management. Equal emphasis is given to analyzing business cases that deal with realistic situations where the theories described above can be applied. Considerable emphasis is also given to learning analysis techniques and back-of-the-envelope calculations that can be applied to case data (financial, market research results, industry reports, etc.) to gain further insights. Prereq: Open to ACL-MBA students.

MKMR 407. Marketing Value Chain Management. 3 Units.
This course views the supply chain (including the distribution channels) as a multi-organization business system that enables customers at all points in the system to acquire the benefits/value they want in the way they want to acquire them. It is a collaborative human network creating customer and shareholder value throughout the system. Strategic and tactical management topics include specifying customer desired value, assessing network members’ (suppliers, producers, distributors, and customers) abilities to create it, and consequently allocating decisions, tasks, and rewards to members. Emphasis is on structure, communication, motivation, and control/discipline to encourage effective implementation throughout the supply chain system. Offered as MKMR 307, MKMR 407 and OPMT 407.

MKMR 408. Marketing Metrics. 3 Units.
Evaluation and control are important strategic marketing processes and without effective and consistent measurement, these processes cannot be performed adequately. In recent years, marketing budgets have been challenged by top managers as the value of these expenditures to an organization’s financial well being is not often clear. Marketing activities such as advertising, sales promotions, sales force allocation, new product development and pricing all involve up-front investments and making these investments now require increasing scrutiny. This course will be about knowing and understanding what to measure, how to measure and how to report it so the link between marketing tactics and financial outcomes is clearer. The course will include lecture by the instructor, readings (no textbook), cases, computer based data exercises and guest lectures. There will also be a team project requirement. Prereq: MBAC 506 or MKMR 403 or MBAP 407.

MKMR 410. Marketing Insight Management. 3 Units.
To appreciate, design, and implement data-based marketing studies for extracting valid and useful insights for managerial action that yield attractive ROI. Five essential processes are emphasized: (a) making observations about customers, competitors, and markets, (b) recognizing, formulating, and refining meaningful problems as opportunities for managerial action, (c) developing and specifying testable models of marketing phenomenon, (d) designing and implementing research designs for valid data, and (e) rigorous analysis for uncovering and testing patterns and mechanisms from marketing data. Prereq: MKMR 403 or MBAC 506 or MBAP 407.

MKMR 411. Customer Relationship Management. 3 Units.
Customer Relationship Management (CRM) is the strategic process of building and maintaining profitable customer relationships through co-creation of value with customers. This course starts with understanding the relationship between an organization’s strategic goals and customer relationships, including assessing CRM systems, management and implementation, in both B2B and B2C markets. Students will learn the fundamentals of customer profitability analysis, customer portfolio management, B2B relationship/sales force management and automation, designing services to optimize customer experiences, as well as expanding customer relationships through services. Additionally, students will explore how one-to-one marketing and social networks enhance customer relationships. Learning will be accomplished through critical discussion of case studies and contemporary marketing issues, and hands-on group project and presentation, and interaction with experienced CRM marketing professionals. Prereq: MKMR 403 or MBAC 506 or MBAP 407.

MKMR 419. Market Space Management. 3 Units.
This course will introduce you to the fundamental marketing ideas, tools and skills that enable managers to pursue high growth, high return business models in today’s complex and severely competitive markets. Kim and Mauborgne (1999) broke new marketing ground by emphasizing the idea of discovering fundamentally new (unoccupied) market spaces (i.e., where there are no direct competitors). Innovators look across, rather than within, traditional competitive market boundaries to create real value innovation. The reward is a rapid growth, high return business model. Chakravorti (2004) addressed methods of managing those models. Today’s market space networks are so complex that one’s customer’s adoption of an innovation usually depends on its systematic adoption by many other members of the value chain. So, innovators must develop multiple partnerships by changing the behaviors of numerous players, while concurrently dealing with competitive threats. In the course you will learn and practice the seven major tasks of market space discovery and management: 1. Identifying unoccupied market space(s) in which the product or service offers network partners and end users long-term, demonstrable value, 2. determining those parties’ perceptions of the product’s unique benefits to them, 3. mapping the structure and dynamics of the Inter-organizational networks—including both potential partners and competitors, 4. determining the members’ perception of the costs to them of partnering, 5. developing and costing a program to develop relationships with the partners and end users, 6. estimating profitability and ROI, and 7. executing the management program. Course materials include text, readings and cases as a basis for lectures and discussions. Guest speakers address managerial perspectives. Student individual and team deliverables can include active class participation, position papers, case analyses, tests, and a Market Space Audit project. Offered as MKMR 419 and MSOR 419.
MKMR 421. Marketing Value Creation. 3 Units.
Marketing value creation is the process of creating and managing successful brands through continuous innovation. Successful brand innovation and management requires understanding evolving customer needs; creating and delivering the right products, services, and experiences; and managing the process to enhance brand equity and customer satisfaction. Through text, readings, cases, high-profile guest lectures and team projects, this engaging class will cover the innovation and branding process from discovery of unmet needs, brand and product development, to brand promotion and advertising and brand equity measurement. A sustainability thread will weave through the course, covering topics such as brand's ecological footprint, product safety, eco-friendly branding, the ethics of advertising, the impact of pricing on consumers and corporate social responsibility. The result of proper sensitivity to customer needs, social concerns and the environment is integral to the process of value creation for customers, companies and society. Prereq: MKMR 403 or MBAC 506 or MBAP 407.

MKMR 450. Entrepreneurial Marketing. 3 Units.
You have a great idea. This courses helps you achieve your goals for it - whether they are commercial, societal, environmental, public policy/ political or a combination of the four. The course addresses the conceptually creative and data-driven entrepreneurial/intrapreneurial process of conceiving and implementing an operational program for realizing the goals of a market opportunity. Students select an opportunity and develop a deployable, one-year market entry program and five-year strategic marketing program. Emphasis is on the entrepreneurial marketing decision process, including defining the business model, selecting performance objectives and measures, specifying customer perceived value, assessing competitive capability and advantage, defining and analyzing the value chain and evaluating market space structure and dynamics, and complementing the players in the value chain. Identifying and properly using both secondary and primary information in management decision making is a major focus of the course. Offered as MKMR 350 and MKMR 450.

MKMR 450B. Entrepreneurial Marketing-M.B.A.. 3 Units.
This course addresses the entrepreneurial/intrapreneurial process of commercializing an idea for a market opportunity. Students select an opportunity and develop a deployable, one-year market entry program and a five-year strategic marketing program. Emphasis is on the entrepreneurial marketing decision process, including defining the business, defining the market, specifying customer perceived value, assessing competitive capability and advantage, identifying and properly using secondary and primary information, and deploying marketing programs throughout the organization and the supply chain. Offered as ENTP 450 and MKMR 450B. Prereq: MKMR 403.

MKMR 460. Marketing Communications Management. 3 Units.
This course provides a sound understanding of management of an organization’s total marketing communications. The focus is on identifying appropriate strategies and tactics for effectively communicating with end consumers and other stakeholders/publics, in order to manage the firm’s brand equity and its market, industry and societal positioning. Students examine the roles of advertising, sales promotion, point-of-purchase efforts, and public relations, and emerging direct marketing technologies. They work with developing and managing these elements as part of an overall, synergistic communications strategy. Marketing communications for ongoing as well as crisis situations are developed. Multiple perspectives on evaluation of the effectiveness of marketing communications are introduced. Topics addressed include: integrated marketing communications, brand equity management, corporate communications strategies, public relations management, and crisis management. Prereq: MKMR 403.

MKMR 475. Supply Chain Logistics. 3 Units.
The focus of this course is on the effective management of a firm’s downstream processes in the supply chain that deliver goods and services to customers. Concepts, methods, and strategies are presented that can lower supply chain costs while maintaining or improving customer service. In addition, ideas for using the supply chain for competitive advantage leading to revenue enhancement are discussed. Adding value for customers is the objective. Key topics include transportation planning, inventory management, network design, and customer service goal setting. Offered as MKMR 475 and OPMT 475.

MKMR 476. Strategic Sourcing. 3 Units.
The primary purpose of the course is to provide a comprehensive introduction to supply issues in manufacturing and service organizations. Procurement and supply management has evolved as a strategic function across various industries. Recent volatility in commodity process has further enhanced the challenges in procurement. This course explores sourcing strategies in global supply chains to reduce cost and enhance the competitiveness of the firm. This course will provide you with a framework for thinking about strategic sourcing and tools to procure commodities and services efficiently. Offered as MKMR 476 and OPMT 476.

MKMR 501. Special Problems and Topics. 1 - 18 Unit.
This course is offered, with permission, to students undertaking reading or a project in a field of special interest.

MKMR 601. Special Problems and Topics. 1 - 18 Unit.
This course is offered, with permission, to Ph.D. candidates undertaking reading or a project in a field of special interest.

Prereq: Predoctoral research consent or advanced to Ph.D. candidacy milestone.
MPOD Courses

MPOD 413. Foundations of Positive Organization Development and Change. 4 Units.
This course explores and develops the art of reading and understanding social systems in ways that help us imagine, design and develop organization excellence. First it seeks to show how many of our conventional ideas about organizations are based on discourse and metaphors that lead us to see and understand organizations in partial and often limiting ways. Growing research from the domains of Positive Psychology and Positive Organization Scholarship and the theory and practice of Appreciative Inquiry will be explored to show how we can create new and more positive, strength-based ways of designing and developing social systems. Includes presentations, guest lectures and panel discussions on current topics of interest for the Masters in Positive Organization Development and Change (MPOD) candidates. Led by a faculty member of the Department of Organization Behavior, these dialogues and seminars will be presented in several of the six main residencies of the MPOD program. Reflective essays and integrative papers will enable participants to explore their practice of OD, leadership capacity, application of learnings from the program and deeply held values related to current issues and opportunities in the domain of human systems change and development. Prereq: Open to MPOD candidates only.

MPOD 414. Organization Design for a Knowledge World. 3 Units.
The objective of this course is to familiarize participants with the theory and technique of organization design and corporate change with particular emphasis on helping leaders understand and implement the latest forms of organizing in a customer-focused, electronically mediated and knowledge-driven world. Frameworks presented will be used to explore the impact of the information revolution on organization design and change, and the evolution of traditional vertically integrated and multi-divisional enterprises toward spider web structures, trans-organizational networks and communities of practice. Prereq: Open to MPOD candidates only.

MPOD 416A. Leadership, Executive Assessment and Development. 1 Unit.
Leadership with emotional intelligence will be examined by studying a number of topics and applying them to two major case studies: 1) a CEO; and 2) yourself. In this context, coaching the development of leadership will be a major topic throughout the course. This course will explore questions such as: Who are effective leaders? Are they different from effective managers? How do they think and act? What makes us want to follow them? How are leaders developed? What and how can people (you) help/coach others develop their competencies to become more effective leaders? (Part one of a three-section course.) Prereq: Open to MPOD candidates only.

MPOD 416B. Leadership and Executive Assessment and Development. 1 Unit.
Leadership with emotional intelligence will be examined by studying a number of topics and applying them to two major case studies: 1) a CEO; and 2) yourself. In this context, coaching the development of leadership will be a major topic throughout the course. This course will explore questions such as: Who are effective leaders? Are they different from effective managers? How do they think and act? What makes us want to follow them? How are leaders developed? What and how can people (you) help/coach others develop their competencies to become more effective leaders? (Part two of three) Prereq: MPOD 416A.

MPOD 416C. Leadership, Executive Assessment and Development. 1 Unit.
Leadership with emotional intelligence will be examined by studying a number of topics and applying them to two major case studies: 1) a CEO; and 2) yourself. In this context, coaching the development of leadership will be a major topic throughout the course. This course will explore questions such as: Who are effective leaders? Are they different from effective managers? How do they think and act? What makes us want to follow them? How are leaders developed? What and how can people (you) help/coach others develop their competencies to become more effective leaders? (Part three of a three-section course.) Prereq: MPOD 416B.

MPOD 418. Sustainability for Strategic Advantage. 2 Units.
Sustainability is introduced as a movement in business to create value by responding to social and environmental problems in ways that meet current needs without reducing future capacity. Students are introduced to systems thinking skills, such as whole system mapping, causal loop modeling, emergent hypotheses, stakeholder analysis and engaging productive dialogues. Emphasis is placed on use of these skills as methods for working with clients to create actionable knowledge, thereby integrating reflection with action to leave the client system stronger. Prereq: Open to MPOD candidates only.

MPOD 419. Building the Sustainable Enterprise. 4 Units.
In this course, participants will build on skill developed in MPOD 418 by working in the field with a client system to build a sustainable enterprise. Emphasis is on clarifying what sustainability means for a successful enterprise, the advantages to stakeholders of working as action researchers and the use of systems tools to foster generative dialogue. Professional presentations and papers are developed to advance a collaborative learning network among participants and clients. Prereq: Open to MPOD candidates only.

MPOD 431. Experiential Learning for Individuals, Teams, and Organizations. 3 Units.
This course focuses on the theory of experiential learning and its application at the individual, team, and organizational levels of analyses. This course offers the chance for students to gain insight into their individual learning and adaptive styles, and how such styles impact the way they interact and have consequence for team. The course also explores how teams and organizations learn, and the effect that cultural determinants have on learning and adaptability. In addition, the course examines how learning theory can be applied to focused institutional development projects and educational processes. The course uses presentations, lectures, research findings, interactive activities, and class discussion. The current topics of interest are for the Masters in Positive Organization and Change (MPOD) candidates. It is led by a faculty member of the Department of Organization Behavior. Reflective essays and integrative papers will enable participants to explore their learning styles and that of their organizations and teams to strengthen the practice of OD and human systems change and development. Prereq: MPOD students only.
MPOD 435. Practicum in Appreciative Inquiry and Positive OD. 4 Units.
This course develops participants' consultative skills. Competence in role entry and development, data collection, intervention and evaluation is gained through class exercises and field projects. The focus is on developing a problem-centered approach to intervening in organizations that minimizes reliance on programmed techniques and maximizes collaborative innovation and learning between client and consultant. Prereq: Open to MPOD candidates only.

MPOD 439A. Individual Field Project. 2 Units.
The objective of this course is to plan and execute a significant organization development, change and/or analysis project with an ongoing client or employer. Emphasis is placed on the craft of developing projects that are consistent with one's current skills, career plans and developmental needs, combined with the needs, opportunities, readiness, and resources of the client organization. This course is limited to candidates for the MPOD program. (Part one of a two section course.) Prereq: Open to MPOD candidates only.

MPOD 439B. Individual Field Project. 2 Units.
The objective of this course is to plan and execute a significant organization development, change and/or analysis project with an ongoing client or employer. Emphasis is placed on the craft of developing projects that are consistent with one's current skills, career plans and developmental needs, combined with the needs, opportunities, readiness, and resources of the client organization. This course is limited to candidates for the MPOD program. (Part two of a two-section course.) Prereq: MPOD 439A.

MPOD 470A. Leading Change from a Complexity Perspective. 1 Unit.
In this course, we will continuously attempt to answer two questions: (1) What is the process of sustained, desirable change? and (2) What is the role of a leader? Concepts form complexity theory will be used, including understanding the multilevel nature of SDC at the individual, dyad, team, organization, community, country, and global levels. Intentional Change Theory (ICT) will be used as the organizing concept for the changes studied. In this context, coaching the development of leadership will be a major topic throughout the course. Prereq: MPOD candidates only.

MPOD 470B. Leading Change from a Complexity Perspective. 2 Units.
In this course, we will continuously attempt to answer two questions: (1) What is the process of sustained, desirable change? and (2) What is the role of a leader? Concepts form complexity theory will be used, including understanding the multilevel nature of SDC at the individual, dyad, team, organization, community, country, and global levels. Intentional Change Theory (ICT) will be used as the organizing concept for the changes studied. In this context, coaching the development of leadership will be a major topic throughout the course. Prereq: MPOD candidates only.

MPOD 479. Foundations of Strategic Thinking. 3 Units.
This course will define what constitutes strategic change and what does not. Students will be introduced to a variety of strategic interventions and models from which to interpret, understand and achieve positive organizational change. Opportunity will be provided to apply selected models to the student's organization and other cases in order to gain insight and appreciation for financial and non-financial factors that influence fundamental organizational growth and development. Prereq: Open to MPOD candidates only.

MPOD 480A. Dynamics of Effective Consulting and Implementation. 2 Units.
This course will: 1) highlight the major current trends and changes that affect the nature of managerial work; 2) describe how OD practitioners and consultants need to factor such trends into their consulting strategies; 3) differentiate between types of interventions, the circumstances in which they apply and their unique strengths; 4) provide background theories that explain the challenges inherent in mobilizing positive change; 5) describe ways to bridge the gap between knowing and doing in order to build organization resilience; and 6) introduce a variety of consulting techniques and skills that the students can add to their repertoire. (Part one of two) Prereq: Open to MPOD candidates only.

MPOD 480B. Dynamics of Effective Consulting and Implementation. 1 Unit.
Additional models and consulting skills will be introduced and the class will be given the chance to practice these consultative/facilitative techniques. In addition, the course will integrate the learning from the first and second sessions. Toward this end, the course will develop a framework that considers the purpose of a consulting strategy (why); the process that one might employ (how); and the principles that form the foundations for action and intervention (what). (Part two of two) Prereq: Open to MPOD candidates only.

MPOD 498. Global Citizenship and Multi-Cultural OD: International Study Tour. 4 Units.
This course will broaden perspectives and knowledge of how OD principles and technologies are generated and applied in contexts and cultures outside of North America. Selected literature representing global perspectives on the practice of OD and field experiences will provide support and background for personal experience and reflection on cross-cultural issues in organizing. The primary learning context will be an intense, 10-day study tour to some country outside of North America to provide the participants with opportunities for: 1) comparative studies of OD practices in different cultural settings; 2) in-depth experiences with OD practitioners and students in a different national, regional and cultural context; 3) co-inquiry with non-North American students also involved in developing OD knowledge and skills; and 4) on-site organization visits outside of North America to observe and learn about on-going dynamic change efforts. Prereq: Open to MPOD candidates only.

MSFI Courses

MSFI 403. Corporate Finance. 3 Units.
The purpose of this course is to familiarize the student with the theory and application of additional models used in financial decision-making by corporations. Issues relating to efficient markets, dividend policy, capital structure, financing decisions, option pricing, leasing, and risk management are among the topics considered. In addition, special topics may include mergers and acquisitions, pension funds, and international financial management. Prereq: For MSF-MSM and ACL-MSF students only.
MSFI 404. Financial Modeling. 3 Units.
Firms try to create value. In their day-to-day operations, they are faced with numerous challenges: Should we accept trade credit or borrow? Will an acquisition create or destroy value? Should we introduce a new product line even if it cannibalizes an existing one? In each of these situations they try to quantify the impact on the value of their firm. The goal of this course is to develop your skills in financial modeling and valuation, so you can tackle issues like the ones described above. The course is designed to be "hands-on": You will learn to apply the theory and develop spreadsheet modeling skills through the homework, case studies and a group project. By the end of the course you will have a good understanding of both the theory and practice of valuation, and possess a set of cutting-edge financial modeling skills. This course is designed for students who aspire to work in a regular company, a bank or a consulting firm in (I) corporate finance (including mergers and acquisitions); (II) strategy; or (III) equity analysis. This course is for MSF-MSM and ACL-MSF students only. Prereq: For MSF-MSM and ACL-MSF students only.

MSFI 421. Fundamental Analysis of Companies and Industries. 3 Units.
The goal of this course is twofold--to revisit important concepts in financial and managerial accounting, marketing, strategy and operations, and to see how they can be applied through the filter of finance. Put a little differently, what should students think about above and beyond analyzing accounting and financial information in assessing how value gets created within the firm? While students may have been exposed to some of these subjects in their undergraduate studies, this course will ensure they all have a common background and language. We will rely heavily on working with financial information from a broad range of companies and industries. Emphasis will be placed on understanding the key drivers behind financial results--what choices about business model and business strategy lead to the reported financial results. Prereq: For MSF-MSM and ACL-MSF students only.

MSFI 428. Financial Strategy and Value Creation. 3 Units.
The intersection between the theory of perfect markets and the reality of market imperfections provides the basis for the exploration of value creation in this course. Opportunities in both product and financial markets are explored using case studies to develop a framework for strategic financial decisions. Prereq: For MSF-MSM and ACL-MSF students only.

MSFI 429. Investment Management. 3 Units.
This course explores the characteristics of financial investments and markets and develops modern techniques of investment analysis and management. The goal is to help students develop a level of analytical skill and institutional knowledge sufficient to make sensible investment decisions. Topics include: an overview of stock, debt and derivative asset markets, practical applications of modern portfolio theory, equilibrium and arbitrage-based approaches to capital market pricing, the debate over market efficiency, the term structure of interest rates, bond portfolio management, and uses of derivative assets in investment portfolios. Prereq: For MSF-MSM and ACL-MSF students only.

MSFI 430. Derivatives and Risk Management. 3 Units.
This course is intended to give students an understanding of options and futures markets both in theory and practice. The emphasis is on arbitrage and hedging. The course concentrates on listed common stock and index contracts as well as commodity markets. Various theories for trading strategies are studied. This course is for MSF-MSM and ACL-MSF students only. Prereq: For MSF-MSM and ACL-MSF students only.

MSFI 431. Fixed Income Markets and Their Derivatives. 3 Units.
This class is concerned with fixed income securities, interest rate risk management, and credit risk. Fixed income securities account for about two thirds of the market value of all outstanding securities, and hence this topic is important. The course covers the basic products of fixed income markets including treasury and LIBOR products, such as interest rate swaps. Risk management and hedging strategies are covered as well as selected topics in credit risk models and mortgage-backed securities. Prereq: For MSF-MSM and ACL-MSF students only.

MSFI 432. Corporate Risk Management. 3 Units.
This is a risk management course aimed at developing an understanding of the risks faced by financial and nonfinancial firms, learning techniques to identify and measure these risks, and understanding how financial engineering (especially derivatives) can be used to manage these risks and advance the strategic goals of the firm. Main topics include Value-at-Risk (VaR) techniques and implementation of VaR systems (RiskMetrics, Delta-normal, Historical Simulation, Structured Monte-Carlo); financial risk measurement and management using forwards, futures, options, swaps, and exotics; and credit risk management, including implementing various credit risk and credit VaR models, estimating capital at risk, and using credit derivatives for managing credit risk. Several classes are devoted to discussing recent risk management debacles and relating them to theory. Prereq: For MSF-MSM and ACL-MSF students only.

MSFI 434. Financial Econometrics. 3 Units.
MSFI 434 represents a rigorous study of the latest developments in the area of financial econometrics. The class assumes no prior knowledge of econometrics. It assumes that you have had a basic statistics class and that you have had regression analysis. It is taught using economic motivations and examples from the financial world. The course concerns modern econometric topics like time-series forecasting, volatility modeling, and panel data analysis. Various concepts and approaches in the course will be subjected to real world data. Students are expected to have basic knowledge of the fundamentals of corporate finance and statistics. The course aims at providing a lasting conceptual framework for model building using modern applied econometric techniques commonly employed in finance. Prereq: For MSF-MSM and ACL-MSF students only.

MSFI 435. Empirical Finance. 3 Units.
MSFI 435 provides an introduction to empirical analysis and research in finance. This involves the management of empirical datasets and the aspects of quantitative applications of finance theory. The goal is to enable the student to deal with the need to analyze complex and large financial and economic datasets that is present in many fields of the financial profession. The scope of the data as well as the quantitative methods used in such analysis often requires familiarity with robust computational environments and statistical packages. As such, another goal of the course is to familiarize the student with at least one such environment. Applications are conducted using real financial and economic data. The course draws on the theoretical aspects of the subjects covered, but mainly focuses on the practical matters required to undertake an empirical analysis of financial topics--e.g., the definition of the research question, the datasets required, the computational needs, and, then, the implementation. The course enables the student to evaluate outstanding financial research as well as to conduct his or her own research. Prereq: For MSF-MSM and ACL-MSF students only.
MSFI 436A. Individual, Team and Career Development. 1.5 Unit.
This course is designed to focus on three areas of development critical to students’ personal and professional success: 1) Individual; 2) Team; and 3) Career. The individual and team aspects include developing self and other awareness through exploration of learning styles, process skills, and building communication and presentation competencies. Career development includes a focus on strategies for success such as networking, resume building, and learning from executives through intensive and interactive seminars. The course involves use of assessments, group discussions, presentations and experiential activities. Prereq: For MSF-MSM and ACL-MSF students only.

MSFI 436B. Individual, Team and Career Development. 1.5 Unit.
This course is designed to focus on three areas of development critical to students’ personal and professional success: 1) Individual; 2) Team; and 3) Career. The individual and team aspects include developing self and other awareness through exploration of learning styles, process skills, and building communication and presentation competencies. Career development includes a focus on strategies for success such as networking, resume building, and learning from executives through intensive and interactive seminars. The course involves use of assessments, group discussions, presentations and experiential activities. Prereq: For MSF-MSM and ACL-MSF students only.

MSFI 440. Advanced Corporate Finance. 3 Units.
This course exposes the students to a more in-depth treatment of some of the topics covered in BAFI 403 and introduces them to new topics. Topics include investment decisions, financing decisions, payout decisions, contracting decisions and performance metrics, internal control systems, risk management, real options, diversification and valuation. Topics covered may vary from semester to semester. Prereq: For MSF-MSM and ACL-MSF students only.

MSFI 450. Mergers and Acquisitions. 3 Units.
This course examines the economic rationale and motivation for the different merger and acquisition and recapitalization activity undertaken by firms and individuals in the U.S. market. Emphasis is on the different three (3) methods of valuing a firm, the various forms of debt and equity capital employed to fund mergers and acquisitions and recapitalizations, how lenders and investors structure their loans and/or investments, and how investors realize the gains through different exit strategies. The course gives the student an excellent understanding of the role that senior commercial banks, insurance companies, pensions funds, LBO funds, investment banking firms, and venture/growth capital investors play in mergers and acquisitions. Prereq: For MSF-MSM and ACL-MSF students only.

MSFI 490. Projects in Corporate Finance. 3 Units.
This course is focused on engaging groups of students in identifying, analyzing and making decisions on real-world corporate financial problems. Teams of students will be assigned to a specific client situation drawn from one of three general areas: (i) mergers and acquisitions (involving corporations and/or leveraged buyout firms), (ii) public equities (IPOs and/or equity research) and (iii) corporate financial policies and transactions. This course is structured to be a capstone experience that allows students to leverage the broad range of skills, tools and approaches introduced throughout the program. It is intended to provide an important bridge from work in the classroom to the unstructured, chaotic nature of real world business. Prereq: For MSF-MSM and ACL-MSF students only.

MSFI 491. Projects in Risk Management. 3 Units.
This course is focused on engaging groups of students in identifying, analyzing and making decisions on real-world risk management financial problems. Teams of students will be assigned to a specific client situation drawn from one of two general areas: (i) investments and hedge funds, equity and portfolio management, fixed income and foreign exchange and (ii) risk management with derivatives, credit risk management, risk analytics, regulatory capital, asset liability bank management. This course is structured to be a capstone experience that allows students to leverage the broad range of skills, tools and approaches introduced throughout the program. It is intended to provide an important bridge from work in the classroom to the unstructured, chaotic nature of real world business. Prereq: For MSF-MSM and ACL-MSF students only.

MSOR Courses
MSOR 406. Operations Management for MSM OR. 3 Units.
Operations managers, ranging from supervisors to vice presidents, are concerned with the production of goods and services. More specifically, they are responsible for designing, running, controlling and improving the systems that accomplish production. This course is a broad-spectrum course with emphasis on techniques helpful to the practice of management at the analyst level. Its goal is to introduce you to the environments, to help you appreciate the problems that operations managers are confronted with, and provide you with the tools to address these problems. Operations Management spans all value-adding activities of an organization including product and process design, production, service delivery, distribution network and customer order management. As global competition in both goods and services increases, a firm’s survival depends upon how well it structures its operations to respond quickly to changing consumer needs. Thus, it is essential for all business managers to acquire an understanding of operations management to maintain their competitive advantage. This course provides students with the basic tools needed to become an analyst in Supply Chain and Operations Management. This course provides an overview of Process analysis, Capacity management, Queuing system, analysis, Forecasting, Quality management, Material Requirements planning, Inventory management, and Supply Chain management. The emphasis of the course is on both real world applications and technical problem solving. Several manufacturing and non-manufacturing environments will be discussed explicitly, like health care, insurance, hotel-management, airlines and government related operations. Also we will explore the interface of operations management with other functional areas such as marketing, finance, accounting, etc. This coursework includes individual and group assignments, case analyses and experiential learning through simulations and educational games. Prereq: Course limited to students in Program=OPRMS, Plan=ORSC-MSM.
MSOR 410. Financial Management for Supply Chain. 3 Units.
This course focuses on learning the language of business, how basic accounting information is reported and analyzed, and how basic financial principles can be applied to understanding how value is created within an enterprise. This course is intended for individuals who have a limited background in accounting, finance and business. Most of the exercises will involve evaluating and building models in Excel. Teaching objectives are fairly straightforward: 1. Provide you with a basic understanding of the key principles of accounting and finance. We will quickly cover material that is typically covered in a three-course sequence (Introductory Accounting and Finance I and II). We will fly at a fairly high level, but we want to make sure you understand the basic concepts. 2. Apply these concepts to real (but straightforward) business situations, to gain a better understanding of how companies utilize accounting and financial information. 3. Time permitting, explore how these concepts can be applied to securities, mergers and acquisitions and leveraged buyout transactions, with a specific emphasis on how these concepts are likely to surface in your role in such transactions. Prereq: Course limited to students in Program=OPRMS, Plan=ORSC-MSM.

MSOR 419. Market Space Management. 3 Units.
This course will introduce you to the fundamental marketing ideas, tools and skills that enable managers to pursue high growth, high return business models in today’s complex and severely competitive markets. Kim and Mauborgne (1999) broke new marketing ground by emphasizing the idea of discovering fundamentally new (unoccupied) market spaces (i.e., where there are no direct competitors). Innovators look across, rather than within, traditional competitive market boundaries to create real value innovation. The reward is a rapid growth, high return business model. Chakravorti (2004) addressed methods of managing those models. Today’s market space networks are so complex that one customer’s adoption of an innovation usually depends on its systematic adoption by many other members of the value chain. So, innovators must develop multiple partnerships by changing the behaviors of numerous players, while concurrently dealing with competitive threats. In the course you will learn and practice the seven major tasks of market space discovery and management: 1. Identifying unoccupied market space(s) in which the product or service offers network partners and end users long-term, demonstrable value, 2. determining those parties’ perceptions of the product’s unique benefits to them, 3. mapping the structure and dynamics of the Inter-organizational networks—including both potential partners and competitors, 4. determining the members’ perception of the costs to them of partnering, 5. developing and costing a program to develop relationships with the partners and end users, 6. estimating profitability and ROI, and 7. executing the management program. Course materials include text, readings and cases as a basis for lectures and discussions. Guest speakers address managerial perspectives. Student individual and team deliverables can include active class participation, discussions. Guest speakers address managerial perspectives. They are also expected to engage with projects external to the university (similar to an action learning project). Prereq: For ORSC-MSM students only.

MSOR 485A. Individual Development. 1.5 Unit.
This course is unique in the sense that its primary focus is on the student as an individual. In this course the student will get to know themselves better by completing assessments and making sense of them, having group discussions, presenting to a group as individuals, engaging in various experiential activities, conducting career interviews, attending various individual development programs and participating in two individual coaching sessions. Prereq: For ORSC-MSM students only.

MSOR 485B. Team Development. 1.5 Unit.
This course is unique in the sense that its primary focus is on the student working in teams. In this course the student will assess their team interaction based on team assignments simulated and action learning type projects, presenting to the class as a team, engaging in various experiential activities, participating one team coaching session, working with a team, and expanding their knowledge of team leadership and membership skills and abilities. They are also expected to engage with projects external to the university (similar to an action learning project). Prereq: For ORSC-MSM students only.

OPMT Courses

OPMT 405. Operations Management. 3 Units.
Operations management deals with the design of products and processes, the acquisition of resources, the conversion of inputs to outputs, and the distribution of goods and services. It is central to a firm’s ability to compete effectively. As global competition in both goods and services increases, the management of operations is becoming more and more important. This course provides a broad overview of the managerial issues associated with production and delivery of goods and services. It includes the use of quantitative modeling using computers as a central methodology. Prereq: QUMM 414.

OPMT 405A. Operations Management. 1 Unit.
In recent years, a changing competitive landscape has highlighted the critical role of the operations function in ensuring business success. In this course, we treat business as a value-added chain of processes that supply and convert disparate inputs into products and services and distribute these outputs. We examine how to best design, run and improve these processes. A variety of manufacturing and service sector settings will be used as examples to illustrate the concepts. It is assumed that the student is familiar with the material covered in a basic undergraduate course in operations management. Specifically, a vocabulary of operations management terminology and proficiency in basic tools and techniques of operations management are expected. Prereq: Open to ACL-MBA students.

OPMT 407. Marketing Value Chain Management. 3 Units.
This course views the supply chain (including the distribution channels) as a multi-organization business system that enables customers at all points in the system to acquire the benefits/value they want in the way they want to acquire them. It is a collaborative human network creating customer and shareholder value throughout the system. Strategic and tactical management topics include specifying customer desired value, assessing network members’ (suppliers, producers, distributors, and customers) abilities to create it, and consequently allocating decisions, tasks, and rewards to members. Emphasis is on structure, communication, motivation, and control/discipline to encourage effective implementation throughout the supply chain system. Offered as MKMR 307, MKMR 407 and OPMT 407.
OPMT 420. Six Sigma and Quality Management. 3 Units.
The Six Sigma process is the standard for quality improvement in organizations around the globe. In this course, we study the details of the five steps in the Six Sigma process: DEFINE, MEASURE, ANALYZE, IMPROVE, and CONTROL (DMAIC). We introduce the concept of sustainability into the criteria to use to evaluate proposed solutions during the Six Sigma process. Many tools, concepts, and processes that are often an integral part of Six Sigma projects in companies are included in the course content. They range from the very basic tools of quality (such as cause-and-effect diagrams for brainstorming) to complete processes (such as benchmarking, quality function deployment, failure mode and effects analysis-FMEA). Statistical concepts that are central to Six Sigma including statistical process control and introduction design of experiments are also included. Once the Six Sigma process and its various components are understood, we study quality management including quality control, quality planning, quality improvement, strategic quality management, and quality strategy. Students meeting the required standards of performance will earn a Green Belt Certification in Six Sigma and Quality Management from the Weatherhead School of Management.

OPMT 430. Sustainable Operations. 3 Units.
This course takes a business approach to environmental and social issues to answer "what do I need to know about environmental and social issues to make my company more successful, and how can I act on that knowledge profitably?" We summarize important environmental and social issues facing business (and all of society), such as global climate change, pollution, economic development, hunger, and social unrest. Drawing on most areas of the MBA program, we examine environmental and social issues associated with product design and component commonality, recycling materials, product packaging, process design and remanufacturing, facility location and design (including green building), reverse logistics and closed-loop supply chains, and global supply chains.

OPMT 450. Project Management. 3 Units.
Project management is concerned with the management and control of a group of interrelated tasks required to be completed in an efficient and timely manner for the successful accomplishment of the objectives of the project. Since each project is usually unique in terms of task structure, risk characteristics and objectives, the management of projects is significantly different from the management of repetitive processes designed to produce a series of similar products or outputs. Large-scale projects are characterized by a significant commitment of organizational and economic resources coupled with a high degree of uncertainty. The objective of this course is to enhance the ability of participants to respond to the challenges of large-scale projects so that they can be more effective as project managers. We study in detail up-to-date concepts, models, and techniques useful for the evaluation, analysis, management, and control of projects. Prereq: QUMM 414 or MBAC 511 or MBAP 403 or OPRE 433.

OPMT 475. Supply Chain Logistics. 3 Units.
The focus of this course is on the effective management of a firm's downstream processes in the supply chain that deliver goods and services to customers. Concepts, methods, and strategies are presented that can lower supply chain costs while maintaining or improving customer service. In addition, ideas for using the supply chain for competitive advantage leading to revenue enhancement are discussed. Adding value for customers is the objective. Key topics include transportation planning, inventory management, network design, and customer service goal setting. Offered as MKMR 475 and OPMT 475.

OPMT 476. Strategic Sourcing. 3 Units.
The primary purpose of the course is to provide a comprehensive introduction to supply issues in manufacturing and service organizations. Procurement and supply management has evolved as a strategic function across various industries. Recent volatility in commodity processes has further enhanced the challenges in procurement. This course explores sourcing strategies in global supply chains to reduce cost and enhance the competitive firm. This course will provide you with a framework for thinking about sourcing and tools to procure commodities and services efficiently. Offered as MKMR 476 and OPMT 476.

OPMT 477. Enterprise Resource Planning in the Supply Chain. 3 Units.
Enterprise resource planning is the dominant system by which companies translate the needs from their customers into the detailed plans that the company must perform to meet the customer needs, and the resulting support the company will need from its suppliers. As such, it is a central player in the process of supply chain management. In this course, we study both the quantitative and qualitative concepts and techniques to help manage a company's operations to perform these important translation and planning tasks in order to help the company be successful. The quantitative analysis will be supported by microcomputer software available in the Weatherhead computer lab. Student teams complete a series of integrated case studies from the same company to vividly see the relationships between various planning and control activities. A major emphasis during the course is the design of processes and procedures (algorithms) for solving very complex (wicked) problems as a part of both class discussions and while working on case studies, as well as critiquing the designs so as to clearly understand their limitations.

OPMT 490. Independent Study in Operations Management. 1 - 15 Unit.
This course is offered, with permission, to students undertaking reading in a field of special interest.

OPMT 501. Special Problems and Topics. 1 - 18 Unit.
This course is offered, with permission, to students undertaking reading in a field of special interest.

OPRE Courses

OPRE 207. Statistics for Business and Management Science I. 3 Units.
OPRE 301. Operations Research and Supply Chain Management. 3 Units.
Operations research (OR) or management science, is the discipline of applying advanced quantitative methods to make better decisions. Techniques covered include linear programming, queuing models and simulation. The second part of the course focuses on how OR tools are used in managing various aspects of Supply Chain. Topics covered include demand forecasting, design of distribution systems, capacity planning, and inventory management. Recommended preparation: one semester of statistics or consent of instructor. Prereq: STAT 207 or OPRE 207.

OPRE 345. Decision Theory. 3 Units.
This course provides an understanding of the principles, basic concepts, and methodology of engineering economics. It develops proficiency with these methods and with the process for making rational decisions regarding situations likely to be encountered in professional practice.

OPRE 402. Stochastic Models with Applications. 1.5 Unit.
This course surveys fundamental methods and models in operations research and operations management that incorporate random elements. Topics discussed will include basic results from the theory of stochastic processes, especially Markov chains; an introduction to stochastic dynamic programming; and models in the control of queues and inventories. Prereq: OPRE 433 or OPRE 433A and OPRE 433B.

OPRE 411. Optimization Modeling. 3 Units.
The first half of the course provides a practical coverage of linear programming, a special type of mathematical model. The art of formulating linear programs is taught through the use of systematic model-building techniques. The simplex algorithm for solving these models is developed from several points of view: geometric, conceptual, algebraic, and economic. The role and uses of duality theory are also presented. Students learn to obtain and interpret a solution from a computer package and how to use the associated output to answer “What-happens-if...” questions that arise in post-optimality analysis. Specific topics include: problem formulation, geometric and conceptual solution procedures, the simplex algorithm (phase 1 and phase 2), obtaining and interpreting computer output, duality theory, and sensitivity analysis. The second half of this course provide a practical approach to formulating and solving combinatorial optimization problems in the areas of networks, dynamic programming, project management (CPM), integer programming, and nonlinear programming. The art of formulating problems, understanding what is involved in solving them, and obtained and interpreting the solution from a computer package are shown. A comparison with formulating and solving linear programming problems is provided as a way to understand the advantages and disadvantages of some of these problems and solutions procedures. Recommended preparation: Knowledge of Excel, one semester each of undergraduate linear algebra and undergraduate calculus (derivatives); or consent of instructor.

OPRE 427. Convexity and Optimization. 3 Units.
Introduction to the theory of convex sets and functions and to the extremes in problems in areas of mathematics where convexity plays a role. Among the topics discussed are basic properties of convex sets (extreme points, facial structure of polytopes), separation theorems, duality and polars, properties of convex functions, minima and maxima of convex functions over convex set, various optimization problems. Offered as MATH 327, MATH 427, and OPRE 427. Prereq: MATH 223 or consent of instructor.

OPRE 432. Computer Simulation. 3 Units.
Computer simulation is a process of designing and creating a computerized model that mimics an existing or proposed system so as to better understand the behavior of the system. Many studies have shown that in industry, simulation is most frequently used Operations Research tool due to its ability to deal with complex systems. The first half of this course is designed to give students a basic idea of simulation methodology with the aid of population simulation software. The emphasis of the course is in simulating business processes, however, the versatility of the technique will be demonstrated with applications from finance, health care, etc. The second half of the course covers the statistical design and analysis of simulation models. The topics include random number generation, input data analysis, statistical analysis of simulation outputs, variance reduction techniques, and design of simulation experiments. Prereq: OPRE 433 or OPRE 433A and OPRE 433B or requisites not met permission.

OPRE 433. Probability, Statistics, and Forecasting. 3 Units.
Data of many kinds are typically available in practice, but the challenge is to use those data to make effective professional decisions. This software-intensive course begins with useful descriptions of data and the probability theory foundation on which statistics rests. It continues to statistics, including the central limit theorem, which explains why data often appear to be normally distributed, and the Palm-Khintchine theorem which explains why data often appear to have a Poisson distribution. The remainder of the course focuses on regression and forecasting, including detecting and overcoming some of the deadly sins of regression, and the surpassing flexibility of regression models. Recommended preparation: One semester of undergraduate calculus or consent of instructor.

OPRE 434. Regression and Forecasting. 1.5 Unit.
The first part of this course covers the fundamentals of multiple linear-regression analysis and logistic regression models emphasizing understanding and forecasting relationships between variables in a variety of data settings. The second part includes time series analysis and forecasting. Using case studies and commonly used state-of-the-art statistical software (e.g., SPSS, SAS, etc.) students learn to summarize relationships and measure how well these relationships fit data, and how to make meaningful statistical inferences and forecasts. Prereq or coreq: OPRE 433B or QUMM 414.

OPRE 435B. Integrated Problem Solving in OR and OM. 1.5 Unit.
This project-oriented course uses a variety of software to involve the student in the complete problem-solving process in OR and OM. This process includes problem definition and formulation, data collection, and storage in a database, connecting the database to the solution algorithm, designing and implementing an appropriate user interface, and presenting the final solution. Prereq or Coreq: OPRE 411 or OPRE 411B.

OPRE 435C. Data Structures. 1.5 Unit.
The objective of this course is to provide the student with the data structures (arrays, files, linked lists, trees, and so on) and the numerical methods (differentiation, integration, and solving linear equations) needed for implementing algorithms that solve operations research and operations management problems. These topics are illustrated with C++ and object-oriented programming. Emphasis is given to ensuring that the programs are robust and usable by nontechnical people.
OPRE 454. Analysis of Algorithms. 3 Units.
This course presents and analyzes a number of efficient algorithms. Problems are selected from such problem domains as sorting, searching, set manipulation, graph algorithms, matrix operations, polynomial manipulation, and fast Fourier transforms. Through specific examples and general techniques, the course covers the design of efficient algorithms as well as the analysis of the efficiency of particular algorithms. Certain important problems for which no efficient algorithms are known (NP-complete problems) are discussed in order to illustrate the intrinsic difficulty which can sometimes preclude efficient algorithmic solutions. Recommended preparation for EECS 454: MATH 304 and (EECS 340 or EECS 405). Offered as EECS 454 and OPRE 454. Prereq: OPRE 435A and OPRE 435C.

This course is offered, with permission, to students undertaking reading in a field of special interest.

OPRE 501. Special Problems and Topics. 1 - 36 Unit.
This course is offered, with permission, to students undertaking reading in a field of special interest.

This course is limited to candidates for the Ph.D. degree who are preparing dissertations in some field of operations research. Prereq: Predoctoral research consent or advanced to Ph.D. candidacy milestone.

ORBH Courses
ORBH 303. Leadership and Personal Development. 3 Units.
This is an experience-based course designed for increased integration of cognitive and emotional processes, greater awareness of one’s behavior and impact on others, and greater opportunity for behavioral choice in interpersonal relations. Several Saturday classes.

ORBH 370. Women in Organizations. 3 Units.
The purpose of this course is to explore the unique challenges of life for women in their twenties as they increase understanding of the issues surrounding women, ambition, and success in a variety of organizations and professions. At this stage of life there are many choices women can make regarding careers and relationships. This course will broaden understanding of the context of work in women’s lives and help women and men understand the leadership and managerial issues that will surround them in organizations. Offering more complex understandings of issues women face in the workplace related to race and gender, the course will help increase self knowledge about personal identity and direction, values, and abilities including the enhancement of leadership capabilities. It will also facilitate career development, improving the ability of individual women to be choiceful about the quality of integration of both a personal and professional life. Offered as ORBH 370 and WGST 370.

ORBH 403. Developing Interpersonal Skills for Managers. 3 Units.
This course is intended to sharpen students’ skills in the art of relating successfully to other individuals and groups. The course uses an intensive group experience to make students more aware of how their actions affect others, more capable of giving and receiving interpersonal feedback, and more cognizant of processes through which groups work. Several Saturday classes.

ORBH 412. Appreciative Inquiry. 3 Units.
This course studies organizational analysis through appreciative inquiry. It explores multiple framework for understanding the complexity of organizational life. Students form teams and conduct appreciative studies across industries. This course also addresses questions of organizational change (how to move from theory/ideal to practice). Learning is experiential in nature.

ORBH 425. Developing Emotional Intelligence. 3 Units.
Although helping or stimulating individuals to change, learn, and develop is considered a responsibility of the human resource function in an organization, every professor, manager, consultant, and helping professional spends most of their time trying to provoke, evoke, or catalyze a change in others. This course will examine the processes by which individuals change and the methods often used to facilitate this change. How and what a person chooses to change (i.e., select their change goals) will be explored, as well as factors affecting the extent to which he/she changes. The efficacy and ethics of various approaches to individual change as part of human resource and organization development efforts will be discussed. Prereq: MGMT 403.

ORBH 430A. MBA Institute In Sustainable Value and Social Entrepreneurship I. 3 Units.
The MBA Institute in Sustainability and Social Entrepreneurship involves 6 credits divided up into two "courses." The first course --- phase one ---- creates a foundational platform featuring key models and managerial tools for the building sustainable value and “turning the social and global issues of our day into business opportunities.” The second course in an applied sustainability field experience where teams work with companies and communities or real-life sustainability and social entrepreneurship opportunities. The foundations course is a prerequisite to the applied field project phase.

ORBH 430B. MBA Practicum in Sustainable Value and Social Entrepreneurship II. 3 Units.
The MBA Institute in Sustainability and Social Entrepreneurship involves 6 credits divided up into two “courses.” The first course--phase one--creates a foundational platform featuring key models and managerial tools for the building sustainable value and “turning the social and global issues of our day into business opportunities.” The second course is an applied sustainability field experience where teams work with companies and communities or real-life sustainability and social entrepreneurship opportunities. The foundations course is a pre-requisite to the applied field project phase. Prereq: ORBH 430A.

ORBH 450. Executive Leadership. 3 Units.
This course explores answers to questions such as: Who are leaders? Are they different than managers, heroes and heroines? How do the effective ones think and act? What situations create leaders, foster their emergence or provide opportunities? What makes us want to follow them? What are the personal pits of being a leader (i.e., sex, drugs, alcohol, insomnia, ulcers, etc.)? How are leaders developed? Case studies, self-study and at-work projects will be the primary methods used in the course.
ORBH 460. Women in Organizations. 3 Units.
This course addresses important leadership and management issues concerning women in organizations. The course provides complex understandings of issues pertinent to professional women and work such as sex role typing, sex-based discrimination, equal pay, sexual harassment, work-family balance, women’s leadership and women’s career issues and development. The course helps students increase self-knowledge about their own values and practices as well as enhance their capabilities as leaders and managers. We will examine the opportunities, challenges, trade-offs, and organizational dynamics experienced by women in work settings, as well as the interpersonal, organizational, and societal structures and processes impacting women in organizations. Through a variety of course methods, students gain greater awareness of the gendered nature of work and organizations and learn effective strategies for women's career progress and effective participation in organizations.

ORBH 470A. Leading Change from a Complexity Perspective. 1 Unit.
In this course, we will continuously attempt to answer two questions: (1) What is the process of sustained, desirable change? and (2) What is the role of a leader? Concepts from complexity theory will be used, including understanding the multilevel nature of SDC at the individual, dyad, team, organization, community, country, and global levels. Intentional Change Theory (ICT) will be used as the organizing concept for the changes studied. In this context, coaching the development of leadership will be a major topic throughout the course. Prereq: Open to MPOD candidates only.

ORBH 470B. Leading Change from a Complexity Perspective. 2 Units.
In this course, we will continuously attempt to answer two questions: (1) What is the process of sustained, desirable change? and (2) What is the role of a leader? Concepts from complexity theory will be used, including understanding the multilevel nature of SDC at the individual, dyad, team, organization, community, country, and global levels. Intentional Change Theory (ICT) will be used as the organizing concept for the changes studied. In this context, coaching the development of leadership will be a major topic throughout the course. Prereq: Open to MPOD candidates only.

ORBH 479B. Foundations of Strategic Thinking. 2 Units.
This course will define what constitutes strategic change and what does not. Students will be introduced to a variety of strategic interventions and models from which to interpret, understand and achieve positive organizational change. Opportunity will be provided to apply selected models to the student's organization and other cases in order to gain insight and appreciation for financial and non-financial factors that influence fundamental organizational growth and development. (Part two of a two-section course.) Prereq: ORBH 479A.

ORBH 488. Leadership and the Global Agenda. 3 Units.
This course will attempt to develop leadership values and competencies in Organization (OD) within the global arena. Objectives for the course include: (1) developing an executive view of the state of the world; (2) building skills in appreciative inquiry for researching best practices of organizations to maintain sustainable economic development; (3) learning how to build organizational capacities for responding to the global agenda for change; and (4) developing a global consciousness to a larger set of global values to provide a vision for a better world and the potentials of our organizations to assist in realizing such a vision.

ORBH 490. Special Topics. 1 - 18 Unit.
This is a seminar course led by a member of the faculty of the Department of Organizational Behavior. Specific topics are announced at the start of each semester. This course is intended also for independent study.

ORBH 491. Managing Diversity and Inclusion. 3 Units.
This course addresses workforce diversity issues from individual, group, and organizational perspectives. The focus is on innovative ways of utilizing today's culturally expanding workforce. Emphasis is on the "what and how" for managers in developing a corporate culture that embraces diversity, helping them in learning to work with, supervise and tap the talent of diverse employees within their organizations. Included are methods for modifying systems to attract, retain, develop, and capitalize on benefits of the new workforce demographics. A retreat experience is part of this course and is required of all participants.

ORBH 501. Special Problems and Topics. 1 - 18 Unit.
This course is offered, with permission, to students undertaking reading in a field of special interest.

ORBH 510. Organizational Behavior Department Seminar. 3 Units.
The OB Department Seminar is organized and managed by the first year PhD students. Seminar sessions will alternate between first year meetings and gatherings of the ORBH community of students, faculty and friends. Community sessions will be organized around research presentations of PhD Qualifying Papers, Dissertation Proposals and Dissertation Defense. Seminar Objectives: 1. To create and sustain an appreciative, intellectually nourishing learning space for the ORBH community that will support, inspire and empower us to explore the frontiers of scholarship in our field; 2. To provide a forum for sharing the ongoing research and scholarship of the department; 3. To develop productive collaborative research relationships; 4. To increase our collective knowledge of the current state of the art in OB and to develop productive collaborative research relationships; 4. To increase our collective knowledge of the current state of the art in OB and related fields.

ORBH 511. Micro Organizational Behavior. 1 Unit.
Examines the field of micro-organizational behavior. Specifically, the study of individuals and groups within an organizational context and the study of internal processes and practices as they affect individuals and groups. Major topics include individual characteristics such as beliefs, values and personality. Individual processes such as motivation, emotions, commitment, group and team processes, such as decision-making; organizational processes and practices such as goal setting, performance appraisal and rewards, and the influence of all of these on such individual, group and organizational outcomes as performance, job satisfaction, citizenship behaviors, turnover, justice, absenteeism and employee engagement.

ORBH 513. Appreciative Inquiry and Strength-Based Change. 1 Unit.
This course explores and develops the art of understanding social systems in ways that help us imagine, design and develop organization excellence. It seeks to show how many of our conventional ideas about organizations are based on discourse and metaphors that lead us to see and understand organizations in partial and often limiting ways. Growing research from the domains of Positive Psychology and Positive Organization Scholarship and the theory and practice of Appreciative Inquiry will be explored to show how we can create new and more positive, strength-based ways of designing and developing social systems.
ORBH 520. Group and Interpersonal Analysis. 1 Unit.
This course is a review of major concepts and research in group dynamics and interpersonal relations. Topics concern face-to-face social interaction such as communication patterns, power, hierarchy, leadership, norms, goals, productivity, social theories of personality, and personal change through group methods. The course combines cognitive emphasis and personal experience-based learning.

ORBH 523. Business as an Agent of World Benefit: The Discovery and Design of Positive Institutions. 1 Unit.
The relationship between business and society--and the search for mutually beneficial advances between industry and the world's most pressing global issues--has become one of the defining issues of the 21st century. Throughout the world, immense entrepreneurial energy is finding expression, energy whose converging force is in direct proportion to the turbulence, crises, and the call of our times. Factories and buildings are being designed in ways that, surprisingly, give back more clean energy to the world than they use. Bottom-of-the-pyramid strategies and micro-enterprise models are demonstrating how business can eradicate poverty through profitability. Companies are designing products that leave behind no waste--only "food" that becomes input into their biological or technological cycles. And macrowikinomics--everything from telepresence to megacommunity--is rebooting our capacity for human cooperation and global action. Prereq: Limited to ORBH PhD students only.

ORBH 525. Leading Change from a Complexity Perspective. 1 Unit.
Change is an enigma and yet sustained, desirable change (SDC) drivers adaptation, growth and life itself. In this course, we will continuously attempt to answer two questions: (1) What is the process of sustained, desirable change? and (2) What is the role of a leader, including their emotional and social intelligence? Concepts from complexity theory will be used, as well as case studies and longitudinal studies including understanding the multilevel nature of SDC at the individual, dyad, team, organization (including family business), community, country, and global levels. Intentional Change Theory (ICT) will be used as the organizing concept for the changes studied. Prereq: Limited to ORBH PhD students only.

ORBH 528. The Dynamics of Managing Effective Change. 1 Unit.
This course explores and develops an understanding of how individuals actually effect positive change and outcomes within an organization without the requisite authority or decision making power to do so. It seeks to show how managing a change process appears to follow a path of cumulative activities that in time produce a punctuated equilibrium—one that triggers a step up in performance. Such activities seem to be small episodes or learning cycles geared at converting inert knowledge into action; increasing awareness; reinforcing accountability, and/or attaining results. These findings will be compared and contrasted to existing change models and theories. Prereq: Limited to ORBH PhD students only.

ORBH 535. Organization Development and Change. 1 Unit.
This seminar addresses the applications of Organizational Behavior concepts and theories to the creation, development and change of organized systems; the domain of Organization Development. We will examine literature and research on organization and large systems change from modernist and post-modernist perspectives. Specific attention will be given to normative—re-educative models (Organization Development) and recent movements in strength-based models of change informed by positive psychology and positive organization scholarship. Intervention theory and method related to large groups and system-wide change will also be addressed.

ORBH 538. Research and Theory on Dynamical Behavior in Groups. 1 Unit.
This seminar exposes student to a variety of conversations in the study of group dynamics. Major topics include work on commons dilemmas, communal and exchange relationships, social facilitation, social loafing, social combination, and social creativity drawing deeply on our historical roots. It will also focus on current topical issues such as demographic faultlines, transactional memory, and issues of time and transition. Prereq: Limited to ORBH PhD students only.

ORBH 540. Social Exchange, Social Networks, and Social Capital in Organizations. 1 Unit.
In this course we will examine the nature of social exchange relationships in organizations. We will explore how individual perceptions regarding the quality of the relationship they have with their immediate supervisor, their work group, and the organization as an entity can impact their workplace attitudes and behaviors. Additionally, we will learn how the examination of networks of relationships can enhance our understanding of how individuals experience organizational life. The course will also provide a brief introduction to the theory, methods and procedures of social network analysis with an emphasis on applications to individual and organizational social capital.

ORBH 541. Organizational Systems. 1 Unit.
This course covers the use of general systems theory as a conceptual base for examining organizations from the macro-perspective. The course examines organizational structure and technology, organizations and interorganizational networks in interaction with their societal environments, and large-scale problems of organizational and social power, conflict and change. It is designed to present a large-scale perspective on organization theory and behavior that is complementary to the micro-perspective of organizational behavior.

ORBH 550. Team and Small Group Research. 1 Unit.
This seminar is designed to focus primary on understanding the state of team research from 1950s to the present. The seminar will include in-depth reviews and critical analysis on the philosophical and methodological perspectives of team researchers. The seminar will also include topics, research design and methods (including analytical approaches) used in team research. Students will be expected to develop a research design and analysis proposal for a team research project using both qualitative and quantitative approaches.
ORBH 560. Research Methods I. 3 Units.
This course concerns itself with issues associated with the conduct of social research. The primary focus is on learning the "craft" of research and its associated technologies. Among the topics that are addressed are: scientific method; research terminology and definitions; search design; laboratory experiments; simulations; field experiments; field studies; measurement, reliability and validity; and sampling. This course is intended to help students acquire the skills necessary in undertaking dissertation-related research.

ORBH 565. Research in Gender and Diversity in Organizations. 1 Unit.
This course will provide a full range of feminist research methods exploring relationships between feminism and methodology involving a plurality of perspectives for conducting research and creating knowledge with an emphasis on collecting and interpreting qualitative materials. Particular attention is paid to understanding gender and diversity related phenomenon that occurs in the workplace. Classic feminist research from a variety of historical, societal, economic, interpersonal and organizational paradigms are incorporated. Coreq: ORBH doctoral students only.

ORBH 570. Learning and Development. 1 Unit.
This course provides an exploration of the learning and development paradigm underlying the human potential development approach to human resource development. The origins of this approach in the naturalist epistemologies John Dewey's pragmatism, Kurt Lewin's gestalt psychology, the work of James, Follett, Emerson, Piaget, Maslow, Rogers, and others and current research in adult development, biology and brain/mind research, artificial intelligence, epistemology, moral philosophy and adult learning will be considered. The course will focus on applications of theses ideas to current issues in human resource development such as adult learning in higher education, advanced professional development, and large system learning and development. Coreq: ORBH doctoral students only.

ORBH 572. Thematic Analysis. 1 Unit.
This course will help students develop the ability to sense themes, or patterns, the ability to apply coding systems in a reliable manner, the ability to develop a coding system, and the ability to design research studies for developing or using codes. Participants will develop and practice these abilities on four types of data which are: conscious and unconscious thought; an individual's behavior; interaction among people; and historical documents such as speeches, myths, ballads, etc. Assignments will involve reading, practice coding material provided, developing preliminary codes from material selected, and a research project in which development and/or use of a code is required. Appropriate for doctoral students in behavioral or social sciences (Mini-Course, Occasional Offering). Prereq: Doctorate students only.

ORBH 601. Special Problems and Topics. 1 - 18 Unit.
This course is offered, with permission, to candidates undertaking reading in a field of special interest.

Prereq: Predoctoral research consent or advanced to Ph.D. candidacy milestone.

PLCY Courses

PLCY 360. Independent Study. 1 - 18 Unit.

PLCY 399. Business Policy. 3 Units.
This course uses case analysis to develop perspective and judgment on business problems through the integration of functional areas. Formulation, development, and implementation of organization goals and policies, the development of strategy in relation to the competitive environment, and applications of quantitative and behavioral decision-making techniques are examined. Prereq: Senior standing.

PLCY 418. Enterprise Development. 3 Units.
Course features new product launch by students and new business idea competition judged by actual venture capitalists. Students will also learn how to acquire control of an existing company, including valuation methods, sources of funding, tactics for finding companies to buy, and how to negotiate the purchase of a business. Also includes actual student negotiation with sellers of a company. Course is designed to accelerate career success through bold entrepreneurial strategies. Offered as ENTP 418 and PLCY 418.

PLCY 419. Entrepreneurship and Personal Wealth Creation. 3 Units.
Course explores the accumulation of personal wealth utilizing entrepreneurial strategies. The underlying competencies of successful entrepreneurs are identified and applied to individual lives of students. Active entrepreneurs will be studied, and original case studies of start-ups and acquisitions provide the basis for class exercises. Offered as ENTP 419 and PLCY 419.

PLCY 425. Chief Executive Officer. 3 Units.
This course is designed for students who aspire to become a chief executive officer. The unique role, responsibilities, and requirements of the CEO will be explored. Students will benchmark CEO best practices through exposure to leading chief officers, study the paths to and preparation for the top job, and develop a personal career strategy to increase their chances of becoming a CEO.

PLCY 474. Innovation for Competitive Advantage. 3 Units.
In this course, we will develop frameworks to identify new value propositions for the customer. We will then apply these frameworks to three types of innovations that we see in practice--incremental, disruptive and white space--and more importantly understand business model innovations that go beyond just a product or process innovation. The course will also explore techniques of focused brainstorming and creative problem solving techniques. Prereq or Coreq: MGMT 499.
PLCY 490. Corporate Strategy. 3 Units.
This course is an advanced strategy course that explores the determinants of successful corporate strategy. In Strategy Issues and Applications you were exposed to the basic frameworks for developing successful competitive or business unit level strategy. Corporate strategy takes you to the next level and provides the frameworks you need to be able to be successful in multiple businesses. At its core corporate strategy constitutes any and all decisions that change the core business model of a firm. Examples are vertical integration, new but related product lines, entering new markets with existing products and entering new or existing markets with unrelated products. The fundamental premise of the course is that successful corporate strategy is rooted in competitive advantage arising from capabilities residing at the business unit level. Starting from analyzing business level strategies of very simple firms, the course successively builds frameworks towards more complicated business level strategies. Next, the course develops frameworks to discuss corporate strategy based around the concept of core competencies and market entry strategies. Finally, the course develops the concepts that are useful in greenfield entries, alliances and acquisitions as part of an overall corporate strategy. Prereq: MGMT 499 or MBAC 508 or MBAP 410.

PLCY 494. Managerial Consultancy. 3 Units.
Students will learn to match consulting methodologies with client needs and employ a step by step strategy development process applied to actual companies which are semester-long clients of the class. Accelerated career strategies in the consultancy business are featured as well as tactics for getting hired in the first place. The course views consultancy as a role rather than career and conceptualizes consultancy as a process of optimizing an organization’s value creation potential and competitive advantage. Students should be able to apply the concepts regardless of career choice. Exposure to senior practicing consultants is featured.

PLCY 495. Industry and Competitive Analysis for Strategic Planning. 3 Units.
This course introduces methods of industry and competitive analysis. Industry structure and firm competitive behavior are studied with a view to develop business strategies for securing and preserving competitive advantage. Emphasis is placed on understanding industry dynamics and the processes by which industries undergo change and evolution. Emphasis is also placed on firms’ capabilities and core competencies and their capacity to implement major strategic changes in their industries. Readings and cases are the principal pedagogical tools utilized in this course. Students are required to analyze an industry of their choice in small project teams and present their analyses in class.

PLCY 496. Strategic Planning and Control Systems for Strategy Implementation. 3 Units.
This course introduces the principal tools of strategy implementation, namely the design of organization structures, the use of formal planning and control systems, and the design of measurement and reward systems. The importance of organizational context (small vs. large, for profit vs. not-for-profit, manufacturing vs. service, etc.) and the need to tailor systems to the context of the organization are emphasized. New and emerging organizational forms and their role in strategy development and implementation are reviewed. Cases and readings are the principal pedagogical methods utilized. Students work in small project teams, study the operation and effectiveness of systems for strategic control in organizations, and present the results of their analysis in class presentations.

PLCY 501. Special Problems and Topics. 1 - 18 Unit.
This course is offered, with permission, to students undertaking reading in a field of special interest.

PLCY 601. Special Problems and Topics. 1 - 18 Unit.
This course is offered, with permission, to Ph.D. candidates undertaking reading in a field of special interest.

Prereq: Predoctoral research consent or advanced to Ph.D. candidacy milestone.

QUMM Courses
QUMM 414. Statistics and Decision Modeling. 3 Units.
This course provides the foundations of statistical and operations research methodologies for managerial decision-making. Business statistics focuses on statistical thinking as one of the fundamentals of effective management. Topics covered include sampling and the normal distribution, making inferences from data via confidence intervals and hypothesis tests, and analyzing relationships between samples. Decision modeling of organizational systems uses mathematical and computer models to provide a quantitative perspective on identifying, analyzing and solving complex decision problems. This course includes an introduction to linear programming models and applications, simulation techniques in decision-making, and project management.

QUMM 414A. Statistics and Decision Modeling. 1 Unit.
This class provides a brief look at management science and selected key tools and applications. Topics include modeling, linear programming, simulation and linear regression. Students should have a background in statistics and college-level algebra. Just-in-time statistics review workshops will be available at the beginning of the semester. Prereq: Open to ACL-MBA students.

QUMM 501. Special Problems and Topics. 1 - 18 Unit.
This course is offered, with permission, to students undertaking reading in a field of special interest.
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Professor, Organizational Behavior

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(University of Chicago)
Professor, Organizational Behavior

Chris Laszlo, PhD
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Assistant Professor, Organizational Behavior

Melvin L. Smith, PhD
(University of Pittsburgh)

Associate Professor, Organizational Behavior; Faculty Director, Executive Education

John Paul Stephens, PhD
(University of Michigan)

Assistant Professor, Organizational Behavior
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