General Bulletin

Undergraduate Programs • Graduate Programs • Professional Programs

CASE WESTERN RESERVE UNIVERSITY

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Foreword

This publication has the limited purpose of providing information concerning the programs of Case Western Reserve University for the period listed.

This publication should not be construed as the basis of an offer or contract between the University and any present or prospective student. The University has the right to amend, add, or delete any information in the bulletin, including any course of study, program, or regulation of the University. Announcements of such changes are made on a routine basis within the University.

NonDiscriminatory Policy

Case Western Reserve University admits students of any race, religion, age, sex, color, disability, sexual orientation and national or ethnic origin to all the rights, privileges, programs, and activities generally accorded or made available to students at the University. It does not discriminate on the basis of race, religion, age, sex, color, disability, sexual orientation or national or ethnic origin in administering its educational policies, admission policies, employment, promotion and compensation policies, scholarship and loan programs and athletic or other University-administered programs.
UNIVERSITY MISSION

The following statement of the University’s mission, character, and priorities was endorsed by the Board of Trustees. It represents an updated articulation of CWRU’s fundamental attributes: Case Western Reserve University’s mission is to serve society as a leading center for undergraduate, graduate, and professional education, for research that adds to society’s store of knowledge and addresses its priorities, and for active, responsible world and community citizenship. The students, faculty, staff, volunteers, alumni and others who constitute the University community pursue and represent this mission through their teaching, research, professional activities, and public service, all marked by a commitment to continuous learning.

Character

The University’s mission is sustained by intellectual vigor and honesty, open expression of ideas, independent judgment, a commitment to a just and humane campus community, and a tradition that integrates the dominant themes in modern education: the arts and sciences, technology, and the professions.

Integrity in all of the University’s pursuits, both scholarly and administrative, is essential to the search for knowledge. This requires that we respect new ideas and encourage examination and discussion of differing opinions. It requires as well that we recognize the dignity of each individual, that we appreciate and enjoy the rich cultural, racial, and ethnic diversity of our campus community, and that we respect the contributions of all disciplines to the advancement of knowledge.

These characteristics make it possible for the larger society to place trust in the degrees we confer, in the instruction and research we conduct, in the new knowledge we disseminate, and in the judgments we make about academic and administrative matters. To strengthen and preserve these qualities, each member of the University community has a responsibility to serve as a mentor for other members.

Priorities

The University’s highest priority is on learning. This encompasses a wide range of activities, from formal classes and extracurricular activities for students to research and other avenues for continuous development of the knowledge and skills of faculty and staff. In the interest of learning, and in recognition of the special role that society assigns to universities, we make parallel and inseparable commitments to teaching and research.

Case Western Reserve enrolls promising students in courses and programs in the arts and sciences, in engineering and the applied sciences, and in the professions of dentistry, law, management, medicine, nursing, and social work. We have no task more important than the superlative education of these students, which includes classroom and laboratory instruction, advising, mentoring and other assistance, and providing a campus environment that supports learning through a challenging curriculum, high standards, and active scholarship. Our goal in this education is to help our students develop in-depth knowledge in a field of special study as well as integrate the humanistic, scientific, technological, and professional cultures that are represented within the University, thus to prepare them to make important contributions to society.

The region, the nation, and the world look to Case Western Reserve and a small number of other universities worldwide to provide the new knowledge upon which society depends. The University’s faculty conduct research in the full range of disciplines in which we offer instruction, generally with the active participation of students and with a commitment to share the results of the research widely and, when appropriate, to promote their dissemination through the market. Sustaining this high level of quality in research is vital to preserving an environment supportive of learning.

The University is itself a community, but it exists in several communities as well: University Circle, the City of Cleveland, the State of Ohio, the United States, and the world. We draw from each, and we contribute to each. We are committed to the principle that a great university must be active at each level of community, and that it can be no greater internationally than locally. In support of this principle, we encourage and support activities by faculty, staff, students, alumni, and other members of the University that address community needs and opportunities. We pledge as well that the University will itself be a responsible citizen.

ACCREDITATION

Case Western Reserve University is accredited at the institutional level by the North Central Association of Colleges and Schools, Commission on Institutions of Higher Education, 30 North LaSalle Street, Suite 2400, Chicago, Illinois 60602-2504; 312/263-0456; 800/621-7440; FAX: 312/263-7462; Internet: Info@ncacihc.org. In addition, several of CWRU’s individual programs are accredited by nationally recognized professional associations, including: Accreditation Council for Cooperative Education American Speech-Language-Hearing Association (speech pathology) American Assembly of Collegiate Schools of Business (accountancy and business) American Chemical Society (chemistry) American Psychological Association (clinical psychology) American Dental Association (dentistry) Accreditation Board for Engineering and Technology (engineering programs) American Bar Association (law) Association of American Law Schools (law) American Medical Association and Association of American Medical Colleges, Liaison Committee on Medical Education (medicine) Commission on Accreditation for Dietetics Education of The American Dietetic Association Council on Social Work Education (applied social sciences) National Association of Schools of Music (music) National League for Nursing (nursing) State of Ohio Division of Teacher Education and Licensure

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.

For further information, contact the University’s Office of the Provost or the Office of Public Affairs.
The University

Case Western Reserve University 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.

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 citizen of Cleveland. The name Case Institute of Technology was adopted in 1947 to reflect the institution’s growing stature in the sciences and engineering.

Academic Programs

The academic programs of the University are administered through the College of Arts and Sciences and seven professional schools, including applied social sciences, dentistry, engineering, law, management, medicine, and nursing, with coordination provided by the President and the Provost. The major academic divisions of the University are described below, along with a listing of their principal offerings. Note that several of these units cooperate to offer programs leading to joint degrees.

The College of Arts and Sciences (est. 1992, but tracing its origins to 1826) offers a broad range of courses leading to B.A. and B.S. degrees in a full range of disciplines in the humanities, arts, social sciences, and natural sciences. Departmental faculty also conduct research and offer instruction leading to master’s and doctoral degrees in these fields. The College is also the academic home for some undergraduates pursuing major fields of concentration in disciplines included in the faculties of Management and Medicine.

The Case School of Engineering (est. 1892, but tracing its origins to 1880) offers curricula leading to the B.S. degree in a wide range of engineering disciplines. Departmental faculty also offer advanced instruction leading to the M.S. and the Ph.D. in these fields, conduct a substantial body of research, and maintain close ties to industry as well. The School also offers a practice-oriented degree, the Master of Engineering, tailored for employed engineers seeking to advance their knowledge.

The School of Graduate Studies (est. 1892) confers M.A., M.S., M.F.A., M.P.H., and Ph.D. degrees upon students who have completed advanced study in the arts and sciences and various professional fields. The School is an administrative unit, working closely with the deans and faculty in CWRU’s colleges and professional schools, who provide instruction and mentoring for graduate students.

The Mandel School of Applied Social Sciences (est. 1916) offers curricula leading to the M.S.S.A. (Master of Science in Social Administration) degree in social work, and to the Ph.D. degree in social welfare. In collaboration with the Schools of Law and Management, the School administers the Mandel Center for Nonprofit Organizations. The Mandel School also operates a continuing education program for social-work practitioners in the community. Through the Mandel Center, the Mandel School and the School of Management offer a joint program leading to the degree of Master of Nonprofit Organizations (M.N.O.).

The School of Dentistry (est. 1892) offers a curriculum leading to the D.D.S. degree, and postdoctoral training in several dental specialties leading to the M.S.D. degree. In conjunction with its curriculum, the School also operates a dental clinic on campus where students provide faculty-supervised dental service to area residents.

The School of Law (est. 1892) offers a broad range of courses leading to the J.D. degree. The School also offers graduate instruction leading to the LL.M. in taxation and in U.S. legal studies. As part of its curriculum, the School operates a legal clinic in which law students, under faculty supervision, provide services to clients from the community. The School administers the Law-Medicine Center, the Canada-United States Law Institute, the Frederick K. Cox International Law Center, and a seminar for federal judges sponsored by the Federal Judicial Center, and participates in the Mandel Center for Nonprofit Organizations.

The Weatherhead School of Management (est. 1967) offers curricula leading to the B.S., M.S., M.Acc., M.B.A., E.D.M. (Executive Doctor of Management), and Ph.D. degrees in management, accounting, organizational behavior, operations research and other areas of business administration. Members of the School’s faculty also provide instruction in economics for undergraduate students enrolled in the College of Arts and Sciences. The School offers a wide range of educational programs for professional managers and participates in the Mandel Center for Nonprofit Organizations.

The School of Medicine (est. 1843) offers a curriculum leading to the M.D. degree. This curriculum, developed at the School and emulated widely throughout the world, features an interdisciplinary approach to organ systems. The School’s pre-clinical departments offer instruction leading to the M.S., Ph.D. and M.D.-Ph.D. degrees in the biomedical sciences. Faculty in the School are extensively involved in biomedical research. Full-time faculty in the School’s clinical disciplines also have a major commitment to patient care and close supervision of medical students’ involvement in patient services in a network of affiliated hospitals and clinics.

The Frances Payne Bolton School of Nursing (est. 1923) offers curricula leading to professional degrees in nursing: the Bachelor of Science in Nursing (B.S.N.) degree, with an emphasis on acute care, and the Doctor of Nursing (N.D.) degree, a professional degree for students who already have baccalaureates in the liberal arts or sciences. The School also offers instruction leading to the M.S.N. degree in several nursing specialties and the Ph.D. in nursing. The School’s faculty
members also maintain an active research program.

CLEVELAND

From a settlement that began nearly two centuries ago on the banks of the Cuyahoga River, Cleveland has grown into a metropolis of more than 2 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 of Cleveland, the Cleveland Clinic, the MetroHealth Medical Center, and others are internationally recognized 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 teams in baseball, football, basketball, soccer and hockey; and facilities for softball, skiing, hiking, cycling, picnics, and other activities. More than 60 ethnic groups are represented in Cleveland; summer festivals continue traditions brought to the region from throughout the world.

UNIVERSITY CIRCLE

Case Western Reserve University is located in University Circle, a 550-acre, park-like concentration of more than 40 cultural, medical, educational, religious, and social service institutions located at the eastern edge of the city. In addition to the 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 Museum of Natural History; and many others. All are within walking distance of the University.

University Circle attracts visitors 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 Facilities and Services

UCITE

University Center for Innovation in Teaching and Education
James Zull
122 Baker
368-1224
Fax 216-368-0197
e-mail: jez2@po.cwru.edu

The purpose of UCITE is to support and encourage change and innovation in teaching. Faculty who wish to improve their classroom teaching, or who wish to undertake innovations in teaching methodology or education programs work with the UCITE director toward those ends. The center offers class videotaping, class visitation, mentoring and consultation with regard to teaching. UCITE also conducts workshops and seminars on areas of interest in pedagogy such as learning styles, lecturing, how the brain learns, leading discussions, and catalyzing deeper learning. A program of regular teaching discussions is organized for new and inexperienced teachers each year, and these serve as an important function in faculty development and socialization to the university culture, as well as growth of teaching skills.

Fostering faculty use of the Electronic Learning Environment (ELE) provided by CWRUnet, the University Library system, and the World Wide Web is a major goal of UCITE. Outside experts and speakers are frequently brought on campus to increase faculty awareness of the rapid changes in education which are made possible through the ELE. Faculty proposals for creative use of the ELE in teaching and education are entertained by UCITE and supported as resources allow.

UCITE administers a program designed to encourage junior faculty members to develop and experiment with their teaching and education activities: the Glennan Fellows Program. Five stipends of $6,500 are available each year from the income of an endowment provided by the Glennan family. Fellows must be un-tenured faculty members who exhibit outstanding talent as both teachers and scholars. Glennan fellows are nominated by their peers and awards are made on the basis of proposals which they submit following nominations. It is a significant honor to serve as a Glennan Fellow, and these young faculty become recognized as leaders and role models for junior faculty.

Periodic gifts are also utilized to support faculty innovations in education. One such program is supported by the family of Walter Nord which has given $50,000 each of the past five years for innovative courses. Additional support by gifts and donations of alumni and friends is continually being sought. These funds are used to provide “teaching grants” to CWRU faculty members.

UCITE is administered by a director who is a senior faculty member, and an associate director. The center has a full-time secretary.

INFORMATION SERVICES

Information Services is the division of the University that is responsible for information technology. It is composed of units providing a wide variety of technology-related services, including generalized user services and training, instructional and research computing, administrative information, digital media, university archives, the campus communications system known as CWRUnet, and data center operations. There is also a development group to carry out projects involving advanced technologies. Central to Information Services are campus-wide strategies and technology standards.

CWRUnet

Utilizing CWRUnet, the University’s technologically advanced communication
network, students, faculty and staff have access to computing and information resources both on-campus and distributed around the world. CWRU\textsuperscript{net} provides direct communication access from approximately 15,000 information outlets, or faceplates, located in residence hall rooms, Greek society houses, classrooms, offices, libraries, and laboratories. CWRU\textsuperscript{net} supplies a family of communication services for data, video, voice, telemetry, and control signaling.

**CWRUdata**

Data services are provided to users who have computers attached to CWRU\textsuperscript{net}. This constantly expanding assortment of on-campus CWRU\textsuperscript{data} resources and services presently includes:

- **A. Software libraries providing personal productivity and general purpose software packages (e.g., word processors, spreadsheets, desktop publishing tools, drawing, CAD, and painting packages, mathematical and statistical packages and tools, and programming languages);**
- **B. Software libraries of courseware providing applications and simulations, scanned images and digital movies (e.g., notes, exam keys, syllabi, texts, and reference materials);**
- **C. Online databases providing reference works, locator materials, and a wide variety of both general purpose and specific databases;**
- **D. Euclid\textsuperscript{PLUS} system (the University’s integrated on-line library catalog) providing the ability to search the electronic catalog of all CWRU library holdings plus search and retrieve materials from the holdings of all higher education institutions in the state via the OhioLINK system;**
- **E. Electronic mail providing on-campus and world wide Internet mail service;**
- **F. Campus-wide information system called AURORA which uses standard World Wide Web browser software to provides CWRU-related information (e.g., online CWRU courses, calendar of CWRU activities, programs for international students, virtual campus tours, student organizations, etc.);**
- **G. Administrative data bases and services, providing off-line access to student, financial, administrative and personnel related information;**
- **H. Departmental and individual computers providing shared applications, data bases, images, files and other information. CWRU\textsuperscript{data} services also link users to thousands of other universities and millions of computers and computer-based resources throughout the world using regional networks (such as the OAR\textsuperscript{net} - the Ohio Academic Research Network) and the Internet.**
- **I. Microcomputer disk storage back-up and archiving services using HARBOR software.**
- **J. I-drive, a web-based file hosting service, is available for use. Every member of the CWRU community has access to space for storing files, sharing files, and hosting a personal web site. Files stored in an I-drive can be accessed from anywhere in the world via the web.**

**CWRUvideo**

Services are provided to users who have cable-ready televisions or video receivers attached to CWRU\textsuperscript{net}. Currently, CWRU receives 42 cable channels, as well as generating three of its own (e.g., video bulletin board, CWRU originated and satellite broadcasts). They are distributed in three packages, educational (e.g., Turner Network Television, USA Network, Nickelodeon/Nick at Night, Black Entertainment Television, MTV, VH-1 Video Hits One, American Movie Classics, ESPN, Sportschannel, Comedy Central, Sci-Fi Channel) and HBO.

**CWRUphone**

Services are provided to users who have telephones attached to CWRU\textsuperscript{net}. CWRU\textsuperscript{phone} is CWRU’s telephone service providing on-campus, local and long distance telephone calling. The CWRU\textsuperscript{phone} student long-distance telephone program offers users significant discounts below the costs of other long distance methods, electronic access to account information, electronic billing and electronic payment. An additional service through CWRU\textsuperscript{phone} Services is Voicemail. Those who register for Voicemail will be notified of their messages via e-mail when they activate their CWRU\textsuperscript{net} id account.

**Support Services**

The University provides a complete range of technical support services. At this time, these services include:

- the installation of network interface cards in computers belonging to resident students;
- providing the software needed to access CWRU\textsuperscript{net};
- operating a Help-Desk to provide telephone support and troubleshooting to members of the CWRU community;
- dispatching technicians to residence halls to resolve user problems that cannot be resolved over the telephone;
- providing ongoing free training and documentation on how to access and use the Electronic Learning Environment (ELE);
- providing walk-in service for non-resident students who need assistance in connecting to CWRU from remote locations.

**Audio/Video Services**

Also offered through Information Services, Image Services area is a full line of digital services including digital color laser printing, scanning, digital slide imaging and custom digital artwork. This area also operates a retail store specializing in Kodak film along with a full line of processing services available from Kodak and Konica.

**KS Learn**

Instructing users on how to use the library and its resources has always been central to the mission of an academic library. KS\textsuperscript{Learn} is a teaching program within University Library designed to fulfill this mission. It offers instruction and classes to CWRU faculty, students and staff in the following areas:

- Information literacy skills (particularly targeted to undergraduates)
- Effective use of Internet/WWW for research and teaching.
- How to select and effectively use sub-
The consumption of shared resources.

Acceptable use always is ethical, reflects academic honesty, and shows restraint in the consumption of shared resources.

Acceptable use demonstrates respect for intellectual property, truth in communication, ownership of data, system security mechanisms, and individuals, right to privacy and freedom from intimidation, harassment, and unwanted annoyance. The University considers any violation of acceptable use principles or guidelines to be a serious offense and reserves the right to test and monitor security, and copy and examine any files or information resident on University systems allegedly related to unacceptable use.

Disciplinary Action

Those who do not abide by the policies and guidelines listed below should expect at least suspension of CWRUnet network privileges and possible disciplinary action in accordance with University rules for misconduct and existing judicial, disciplinary, or personnel processes. Offenders may also be subject to criminal prosecution under federal or state laws, and should expect the University to pursue such action.

Guidelines

Standards of Conduct

The general standards of conduct expected of members of the Case Western Reserve University community also apply to the use of the University computers, network facilities, information services and resources. These facilities and resources include:

- wiring or infrastructure used for communications;
- electronics, digital switches and communication equipment used for processing or communications;
- programs, programming languages, instructions, or routines which are used to perform work on a computer;
- electronic information such as records, digital images, digital sounds (including voice mail), digital video or textual material stored on or accessible through a computer or telephone;
- computers used for automation or the administration of information services;
- information such as CWRUnet IDs, authorization codes, account numbers, usage and billing records, or textual material stored on or accessible through the network or other communication lines. Property Rights

University computing, network facilities and information resources are made available to individuals to assist in the pursuit of educational goals. In order to promote the most effective use of these, it is expected that users will cooperate with each other and respect the ownership of works and privacy of information even though it is in electronic form rather than printed form. Individuals and organizations will be held no less accountable for their actions in situations involving University computers, network facilities and information resources than they would be dealing with other media.

Though some of them are intangible, these University computing resources, network facilities, and information resources are the property of the University. Rules prohibiting theft or vandalism apply to authorization codes, long distance telephone services, television signals, service information, and voice mail services as well as to physical equipment.

Conduct which violates the University’s property rights with respect to University computers, network facilities, information services and resources is subject to University disciplinary action. This conduct includes, but is not limited to:

- using University computers, network facilities, information services and resources for purposes other than those intended by the University body granting access to those resources (especially using them for personal financial gain or allowing access to them by unauthorized persons even if they are members of the University community);
- using any portion of University computers, network facilities, information services and resources for the purpose...
of:
- copying University-owned or licensed information to another computer system for personal or external use without prior written approval;
- attempting to modify University-owned or licensed information (including software and data) without prior approval;
- attempting to damage or disrupt the operation of computer equipment, communications equipment, communications lines or information services;
- knowingly accepting or using University owned or licensed information (including software and data) which has been obtained by illegal means;
- from a single CWRUnet faceplate, receiving more than one set of television signals or distributing these signals to multiple receivers;
- knowingly accepting or using television signals which have been obtained by illegal means.

Confidentiality

The University seeks to protect the civil, personal, and property rights of those actually using its computing, network facilities and information resources and seeks to protect the confidentiality of University records stored on its computer systems. The University also seeks similarly to protect those computers, network facilities, information services and resources of other institutions to which University personnel have access via the University computers, network facilities and resources.

Conduct which involves the use of University computers, network facilities and information services and resources to violate another’s rights is subject to University disciplinary action. This conduct includes; but is not limited to:
- invading the privacy of an individual by using electronic means to ascertain confidential information, even if an individual or department inadvertently allows access to information;
- copying another user’s information without the permission of the owner, even if it is readily accessible by electronic means;
- knowingly accepting or using information which has been obtained by illegal means;
- abusing or harassing another user using the University computers, network facilities, information services and resources.

Accessibility/Use

Some of the University computers, network facilities, information services and resources require that each user have a unique identity (e.g. CWRUnet ID, telephone long distance authorization code). The identity is used to represent a user in various University computers, network facilities, information services and resources activities; to provide access to certain University computers, network facilities, information services and resources based on his/her credibility and purpose for requiring such access; and to associate his/her own service use and information with his/her identity. As such, this identity is another instrument of identification and its misuse constitutes forgery or misrepresentation.

Conduct which involves inappropriate access or misuse of University computers, network facilities, information services or resources and service identities is subject to University disciplinary action. This conduct includes; but is not limited to:
- Allowing another individual to use the computer identity;
- using another individual’s identity, even if the individual has neglected to safeguard it;
- using the University computers, network facilities, information services or resources in the commission of a crime;
- gaining access to non-public computers, network facilities, information services and resources.

Case Western Reserve University’s computers, network facilities, information services and resources are networked on the CWRU campus and to other locations. Information on the University’s networks and communication lines is considered to be private. Tapping the University’s network or communication lines for the purpose of examining or using information other than that destined for the intended user is considered unacceptable conduct and is subject to disciplinary action.

Campus Policies

The management of University computing, network facilities and information resources is distributed among several University bodies. Rules and regulations governing specific resources are available through the individual managing bodies.

State and National Laws

Conduct in violation of the principles set forth above, with respect to the use of University computing resources may be subject to criminal or civil legal action in addition to University disciplinary action.

UNIVERSITY LIBRARIES

The University’s libraries are a system made up of the University Library, the Cleveland Health Sciences Library, the School of Law Library, and the Lillian F. and Milford J. Harris Library in the Mandel School of Applied Social Sciences. They support the University’s undergraduate, graduate, and professional programs and contain more than two million volumes. All of these libraries maintain World Wide Web sites to facilitate communication of their unique services to the University community. Collections of electronic databases and electronic journals are available through the campus network. The main collection of the University Library, numbering approximately 1.25 million volumes, is housed in the Kelvin Smith Library in the center of the CWRU campus. The Astronomy and Music Libraries, which are branches of the University Library, are located with their respective academic departments. The University Library currently subscribes to more than 7,000 serials and periodicals and has a particularly large retrospective collection; over 3,000 of these serials are in electronic formats and may be used over the campus network. Collections for the biological sciences, medicine, nursing, and dentistry are located in the Cleveland Health Sciences Library, which is open to all CWRU students, faculty, and staff.

The Mandel School of Applied Social Sciences 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 the general university community. The Lillian F. and Milford J. Harris Library contains approximately 37,500 volumes and subscriptions to some 275 periodicals and about 1200 video and audio items to support these academic programs. The library also has a variety of electronic media and other materials which are available for classroom use by faculty. This library’s Web site provides information resources for social work students, faculty, practitioners, and other human service workers in the greater Cleveland area.

The Cleveland Health Sciences Library operates in two locations, the Allen Memorial Medical Library and the Health Center Library. The CHSL collection consists of books, journals, theses, government documents, audiovisual items, and electronic resources. The Dittrick Medical History Center collection also contains archives, rare books, and artifacts for research in the history of medical technology. The total collection numbers over 390,000 volumes. CHSL receives more than 2,000 print subscriptions and, in addition, has access to approximately 3,000 electronic journals.

Collections on the Law are located in the School of Law Library, which has holdings of more than 250,000 volumes, including complete collections of statutory and case law, law reviews, the National Reporter System, state reports, administrative reports, current law services; there is also an extensive British collection and special collections in taxation, labor law, and foreign investments. The Law Library’s Web site provides core links to legal information sources, government agencies, and legislative history resources.

EuclidPLUS is the University’s comprehensive on-line, public-access catalog; it has search and display functions for the cataloguing records of all holdings in the campus’ libraries. It is also accessible through the World Wide Web and from the Internet. Computer workstations are located in each library to facilitate use of all digital library information resources. From any port on the campus network, students, faculty and staff may search the holdings of other academic and research libraries and local public and specialized libraries and request the delivery of books or journal articles which are not locally held. The University also supports remote authentication services which allow access to Internet resources from off campus.

Case Western Reserve University is a founding member of the OhioLINK consortium which provides a unified catalog for all the major academic libraries in Ohio. OhioLINK also provides access to many online databases and collections of CD-ROMs. Through reciprocal borrowing arrangements, Case Western Reserve University students may also borrow from all the universities participating in OhioLINK, including libraries at Cleveland State University, Kent State University, Youngstown State University, the University of Akron, the College of Wooster, and Oberlin College. Materials from the Cleveland Public Library may be borrowed for three weeks with a CleveNET card which may be obtained with proper student identification. Other libraries in University Circle include those in 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. The University is a member of the Association of Research Libraries (ARL) which includes 119 of the largest academic research libraries in the United States and Canada. CWRU is also a member of the Center for Research Libraries (CRL) which gives the campus community access to more that 3.5 million volumes in addition to our own collections.

SQUIRE VALLEVEUVE FARM

Squire Valleeveue Farm, located on Fairmount Boulevard about ten miles east of campus in the Village of Hunting Valley, is a CWRU-owned beautiful 389 acre property that includes within its boundaries forest, ravines, waterfalls, meadows, ponds, and a self-contained natural watershed. It is the site of several buildings designed for educational, research, and recreational purposes, and seven residences. The buildings accommodate research and instructional laboratories, classrooms, a large greenhouse, and in the Sheep Barn, Pink Pig (a lodge with overnight accommodations), and Manor House, facilities for conferences, retreats, and recreation. There is also a five-mile running (or cross country skiing) trail, a nature trail, several picnic areas, and playing fields for volleyball and softball.

CWRU activities, including academic courses, research, intercollegiate athletic events, picnics, continuing education, and retreats, take advantage of this facility. Squire Valleeueve Farm is open and available to all students, faculty, staff, and alumni.

DENTAL CLINIC

368-3600
School of Dentistry, Emergency Drive

The School of Dentistry of Case Western Reserve University maintains a clinic that provides complete dental services to students and faculty as well as the general public.

UNIVERSITY BOOKSTORE

Thwing Center
Phone 216-368-2650
Fax 216-368-5205
David Johncock, Manager

The University Bookstore, located in Thwing Center, serves as the source for all required and recommended course materials that include new and used textbooks and CWRU notes (custom produced course packets designed by faculty for their classes). In addition to course books, the University Bookstore features complete reference sections and a large general book department, quality school and office products, the latest in computer software and accessories, a broad selection of clothing and gift items, and a variety of convenience food and beverages. A few of the services available through the University Bookstore are book special orders as well as custom orders of clothing and gift items for groups and organizations.

The University Bookstore is open 8:30 a.m. to 5 p.m. on Monday, Thursday, and Friday; 8:30 a.m. to 6 p.m. Tuesday and Wednesday; Saturday hours are 10 a.m. to 2 p.m. Hours are subject to change for special events, please contact the store. The bookstore accepts cash, checks, American Express, Visa, Mastercard, Discover, CWRU charge, all campus points and department requisitions.
CWRU HEALTH SCIENCES BOOKSTORE
School of Medicine, West Wing WB10
Phone 216-368-3464
Fax 216-368-6636
Carmella Gambatese, Manager

The CWRU Health Sciences Bookstore, located in the basement of the west wing in the School of Medicine, is the source for medical and dental texts, health sciences reference books, medical instruments and supplies. Additionally, there is a variety of imprinted gifts and clothing.

The CWRU Health Sciences Bookstore is open 9:30 a.m. to 5 p.m. Monday, Wednesday, Thursday, Friday; 9:30 a.m. to 6 p.m. Tuesdays; Saturdays 10 a.m. to 1 p.m. Hours are subject to change based on special events, please contact the store. The bookstore accepts cash, checks, American Express, Visa, Mastercard, Discover, CWRU charge, all campus points and department requisitions.

TRANSPORTATION

A free shuttle bus system that runs on a continual schedule throughout the week serves the 550-acre University Circle area. In the evenings, a loop bus runs every 20 minutes over a specific campus route. Bus schedules are available in the Access Services Office, Thwing, and several other buildings. In addition, Regional Transit Authority bus routes run through the heart of University Circle, linking the campus with the greater community. Rapid Transit trains run directly from the campus to Cleveland Hopkins International Airport.

CAMPUS PARKING

All parking for Case Western Reserve University and University Hospitals is administered by University Circle, Inc. (UCI), which has also undertaken a program of increasing the space available for parking.

The privilege of parking on campus is granted first to students who must drive cars to reach the campus and to students who require cars because of physical disability or the special needs of their curricula. Parking privileges are then granted, as space permits, to other students. Students living in residence halls and fraternities must obtain parking permits if they maintain cars while in residence. Resident student parking is granted on a confirmed housing assignment, class seniority basis. Parking on campus is not allowed except by permit and then only in the areas for which the permit is valid.

Students may apply for fall parking permits in the previous spring. To the extent that space is available, full-time students who meet the above qualifications are eligible to purchase parking permits. Part-time students attending classes for fewer than 12 credit hours (undergraduate) or 9 credit hours (graduate) are eligible to purchase permits on the same basis as above at a lower cost. Graduate students registered for 651 or 701 courses must purchase full-time permits. Current proof of part-time registration is required when a request for a part-time parking permit is made. Summer session permits are also available.

Questions about the cost of permits may be directed on or after May 1 to Access Services, Crawford Hall, 10900 Euclid Avenue, Cleveland, Ohio 44106-7084 (216-368-7274).

Maps detailing the complete parking inventory of UCI will be issued with each permit.

All students registered at the University must abide by the parking rules of University Circle, Inc. (UCI). Complete copies of the rules are available at the University Circle Parking Department and at Access Services.

Violators are subject to fines, and, if fines are not paid, to towing. A person charged with a violation has the opportunity for a first written appeal to the University Circle Parking Department. In the event of an unsuccessful first written appeal, the alleged violator has the opportunity of reappealing in person, with counsel if desired, before the UCI Parking Appeals Committee. Failure to pay a fine will ultimately result in the withholding of transcripts.

Academic Policies

UNDERGRADUATE ADMISSION

Admission to Case Western Reserve University is competitive. All applicants are evaluated on the basis of high school performance, including class rank, level of courses completed, grades, recommendations, and personal accomplishments. Scores from the Scholastic Aptitude Test or the American College Test are also an important consideration. Students are encouraged, but not required, to take three of the College Board SAT II Subject Tests. An interview with an admission counselor is highly recommended. Students who have been out of high school several years may wish to consult the Office of Undergraduate Admission about entrance requirements.

Freshmen

Application Dates and Notification of Admission

The University operates on a two-semester calendar and has an abbreviated summer session. Students seeking to enroll in the fall may use any one of three application plans. Those for whom Case Western Reserve University is a clear first choice may apply for Early Decision by meeting a January 1 application deadline. They will be notified of the Admission Committee’s decision within two weeks of a completed application, and if admitted, will be required to withdraw all applications from other colleges and universities and commit themselves to enroll at Case Western Reserve within three weeks of the admission decision. Students who wish to be considered for the University’s Pre-Professional Scholars Program (PPSP) must submit their applications by December 15. They will be notified of the University’s decision on their admission in early March, and PPSP results by April 15. The regular application deadline is February 1. Students meeting this deadline will be notified of their admission by April 1, and will be expected to indicate whether or not they will accept the University’s offer by May 1.

Applicants for the spring semester or summer session should have all admis-
his year. Results of the tests aid in the admission decision and in placement in freshman courses. Students interested in science or engineering should take subject tests in English Composition, Mathematics Level I or II, Chemistry and/or Physics. Others should take English Composition and two other tests of their choice. Applicants for Pre-Professional Scholars Programs, for full-tuition scholarships, or the Six-Year Dental Program must submit either the SAT I and three SAT II test scores, including English Composition, or the ACT.

Interview
An interview is recommended as part of the admission process, but it is not required. Prospective students should schedule an appointment in advance for an interview with an admission counselor. Parents are welcome. Guided tours of the campus and visits to classes are also arranged upon request. The Office of Undergraduate Admission is open for interviews by appointment from 9 a.m. to 4 p.m. on weekdays and for group information sessions from 9 a.m. to noon on selected Saturdays during the school year. The office is closed on holidays. Students may arrange appointments by writing or calling:
Office of Undergraduate Admission
Tomlinson Hall
Case Western Reserve University
Cleveland, Ohio 44106-7055
(216) 368-4450
A campus map with directions will be sent with the appointment confirmation.

APPLICATION PROCESS
Before an admission decision can be made, the applicant must submit the following:
1. An application form, completed and signed. No application fee is required.
2. The secondary school record, including class rank, courses and grades from school years 9 through 11, and senior year courses in progress. If class rank is not available, this should be noted on the high school transcript. It is the applicant’s responsibility to have the guidance counselor prepare and send the secondary school record to the Office of Undergraduate Admission.
3. Scores from the ACT or SAT I. Scores may be reported either through the testing agency or on the official high school transcript.
4. Written recommendations from a high school counselor (required) and a teacher (optional).
To aid the Admission Committee in its decision, applicants should submit, whenever possible, the following supporting materials: SAT II subject test results as noted above and grades for the first semester of the senior year.

Notification of Admission
Offers of admission are contingent upon successful completion of secondary school work and graduation. Admitted students should arrange to have final semester grades sent to the Office of Undergraduate Admission.

Acceptance of Admission
Case Western Reserve University subscribes to the College Board Candidate’s Reply Date Agreement. Under this agreement, accepted candidates (except Early Decision Candidates) have until May 1 to accept or decline the offer of admission. Students admitted under the Early Decision plan are required to withdraw applications from other colleges and universities and accept Case Western Reserve’s offer within three weeks of admission.

Note: Applicants who have been offered admission by a college or university that requires a response before May 1 should contact that college or university to ask for an immediate extension of its deadline until all the colleges applied to have responded. They should also contact the Office of Undergraduate Admission to inform the Admission Committee of the problem.

CWRU subscribes to the National Association of College Admission Counselors’ Statement of Principles of Good Practice.

Enrollment Deposit
Students who accept the offer of admission must submit a non-refundable enrollment deposit of $200.00 to reserve a place in the entering class. If a student does not respond to the offer of admission by May 1 or does not make the ap-
appropriate deposit, the Office of Undergraduate Admission may release the student’s place to another applicant.

Advanced Placement and Proficiency Examinations
Case Western Reserve University grants degree credit and placement in advanced courses on the basis of the College Board Advanced Placement Examinations and the International Baccalaureate (IB) Diploma or the International Baccalaureate higher level examinations. The determination of credit and placement is made by the appropriate academic departments. An Advanced Placement score of 4 or higher or an IB higher level examination score of 5, 6, or 7 may receive favorable consideration. Students who are enrolled in high schools that do not offer Advanced Placement courses but who wish to take the examinations should contact their high school counselors for registration information. It is the student’s responsibility to have Advanced Placement scores sent to the Office of Undergraduate Admission. Students may also receive college credit on the basis of proficiency examinations administered by individual departments.

Transfer Students
Transfer applicants (any student who has enrolled in a college or university after graduation from high school is considered a transfer student) are considered for admission for the fall semester, spring semester, or summer session. In order to provide adequate time for evaluation, applications should be completed as early as possible and not later than six weeks before the beginning of each semester. The degree requirements for all students are established by the undergraduate colleges. For specific requirements for transfer students, please see the appropriate section under “Undergraduate Studies.” It is generally expected that the final two academic years will be taken in residence at the University.

Each transfer applicant is asked to submit:
1. An application form, completed and signed. No application fee is required.
2. An official transcript of the high school record.
3. Official transcripts from each college attended.
4. The Statement of Good Standing completed and signed by a school official.
5. Typed or printed descriptions of each course completed in college, including those in which the student is currently enrolled, as well as those the student will complete before transferring. Such descriptions should include the name of the department offering the course, course number, number of credit hours, and, when possible, course syllabus and title and author of text.
6. If available, College Board SAT I and SAT II test scores or American College Test scores. The scores may be included with the high school transcript or sent directly to the University from the testing service. The applicant will be notified of the admission decision as soon as the file is complete. Admitted students who accept the offer of admission must respond by submitting the same reservation deposits as those listed for freshmen (see above). Offers of admission are contingent upon satisfactory completion of work in progress at another college or university.

In order to evaluate transfer credit, the Office of Undergraduate Admission must receive a complete official transcript of all work taken and course descriptions.

Binary (3-2) Program
In cooperation with a number of liberal arts colleges, Case Western Reserve offers the Binary (3-2) Program in engineering, in which students complete three years of study in the liberal arts college and two years in engineering at the Case School of Engineering and receive degrees from both colleges. For further details, consult the program description found under “Undergraduate Studies.”

Special Admission Programs
Students seeking admission to one of the University’s joint programs with the Cleveland Institute of Art or the Cleveland Institute of Music should consult the appropriate program descriptions elsewhere in this Bulletin. For information regarding admission as a transient student or adult non-degree student, admission to the Pre-Professional Scholars Program and Six-Year Dental Program, admission to the PreCollege Program, or admission to the Minority Engineers Industrial Opportunity Program, consult the appropriate section of this bulletin.

Registration
(Summer, fall, and spring)
Students register at the time indicated on the “Schedule of Classes.” Registration for fall begins in April and continues through the beginning of classes in August; 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 early. The University Controller 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. Each student must have an ID number on record in the student information system. The social security number is used as the student ID number, and it appears on all documents and records. As part of the registration process, photographs are taken of all new freshmen and other first-time students, and ID cards are prepared. Students from other countries who do not have social security numbers are issued student ID numbers. The Schedule of Classes is published once per semester and an electronic version is updated routinely to indicate changes and is available through the World Wide Web.

The Schedule of Classes includes the academic calendar, the dates for late registration and drop/add, and a complete listing of courses offered. Students obtain course selection forms, instructions, and Schedules of Classes in their deans’ offices. Completed schedule forms are to be signed by the student’s adviser and/or dean, before the student goes to the registrar’s office. No zero credit only reg-
GRADING SYSTEM

The following grading system is used at Case Western Reserve University.

Letter Grade | Meaning | Quality Points
-------------|---------|----------------
A ............ Excellent .................... 4
B ............ Good .......................... 3
C ............ Fair ............................ 2
D ............ Passing ......................... 1
F ............ Failure .......................... 0
I ............ Incomplete
W ............ Withdrawal from a class
WD ........... Withdrawal from all classes for a particular semester
WF ........... Withdrawn under Academic Regs. 5 & 6 (Law School)
AD ........... Successful audit
NG ........... Unsuccessful audit
P ............ Passing in a pass/no pass course
NP ........... Not passing in a pass/no pass course
H ............ Honors in a pass/no pass course (Nursing School only)
R ............ For courses that extend for more than one semester.
S ............ Satisfactory (for master’s or doctoral thesis and EMBA seminar courses)
U ............ Unsatisfactory (for master’s or doctoral thesis and EMBA seminar courses)
RPT .......... Repeated Course

EXPLANATION OF GRADES

The responsibility for assigning grades rests exclusively with the instructor of a course or section, who must announce the general method of grading to his/her class at the beginning of the course. Grades in all courses are reported to the University Registrar at the end of each semester for all students and at midterm for undergraduates (midterm grades are not considered part of the student’s permanent academic record). Changes to student grades must be reported on grade change cards and have all required signatures.

I (Incomplete)

The grade of I is assigned at the discretion of an instructor provided that:
1. 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 preventing completion.
2. The student has been passing the course and only a small segment of the course remains to be completed, such as a term paper, for which the extenuating circumstances justify a special exception.

An Incomplete grade may not be assigned if a student is absent from a final examination, unless the dean has authorized the absence. Unauthorized absence from a final examination will result in a failing grade. When the student completes the work, the Incomplete is changed to an A, B, C, D, P, F, or NP. (Note: not all schools award all of these grades, see first paragraph of “Grading System” above.)

For undergraduate students: 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 11th week of the session following the one in which the Incomplete grade was received. In certain cases, (such as students on probation or graduating students) the dean may establish an earlier date for completion of courses with Incomplete grades. When a student fails to submit the work required for removing the Incomplete by the date established, the instructor shall transmit to the Registrar a final grade that assumes a failing performance for the missing work.

COURSES OF INSTRUCTION

All courses at the University, except courses in the Medical School, Law School, School of Dentistry, 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)
- 500-701 Advanced graduate courses

Roman numerals (I, II, etc.) after course titles indicate segments of a multi-course sequence. Arabic numerals in parentheses after course titles indicate the semester credit hours for each course. A double-numbered course (i.e., 231, 232) indicates that both semesters must be completed before credit is awarded.

The “Schedule of Classes,” published by the Office of the University Registrar before the beginning of each semester, contains information as to when courses are being offered, the instructor, and the location of the class meetings. Students are advised to consult with the appropriate department concerning the proposed scheduling of courses.

OFFICE OF THE VETERANS’ COORDINATOR

The Office of 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) 368-4320.

For information call (216) 368-4320.
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. Failure to meet this deadline for removing the Incomplete will result in a failing grade. An instructor may elect to give the grade of F or NP if the Incomplete is not removed within the specified time limit. For students in the graduate and professional schools: 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.

**S (Satisfactory)**

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.

**R (Conditional)**

The grade of R is used for work, such as undergraduate thesis and project laboratories, that extends more than one semester. The R grade will be replaced by the letter grade finally reported for the completed work.

**AD (Audit) and NG (Unsuccessful Audit)**

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 for this grade.

**Undergraduate Students**

A student may audit a course with the dean’s or adviser'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 towards degree programs in the dental school 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 adviser 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.

**W (Partial withdrawal)**

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. This procedure necessitates completion of a form that must be signed by the dean and/or faculty adviser and submitted to the University Registrar. After this date, the grade as determined by the instructor will be posted.

**WD (Complete withdrawal)**

The grade WD is assigned by the University registrar for complete withdrawal from all course work for the semester. All withdrawal forms 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.

For students on probation, except those enrolled at the Weatherhead School of Management, grade points earned in a summer session are credited to the preceding spring semester, with a corresponding re-evaluation of probationary status. For Weatherhead students, probation is in effect for the next semester in which the student registers for classes. 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.

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 Office of the Provost a copy of the 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.

EDUCATIONAL RECORDS MAINTAINED
Deans’ Offices
The following records are generally maintained for each student in the office of his or her dean in order to facilitate and document the student’s academic work. Access to these records is normally limited to the staff of the dean’s office and to other academic and administrative officers of the University who are judged to have legitimate and appropriate reasons for access.
- Directory information
- Application materials
- Preadmission and other test scores
- Letters of recommendation (however, letters of recommendation received in confidence before January 1, 1975, are not among those materials to which students are provided access by FERPA)
- Transcripts of current and past academic work
- Copies of correspondence between the student and the dean’s office
- Application review record
- Reports on the student’s academic progress
- Copies of letters of appointment and related payroll information for a student named to a fellowship or assistantship
- Letters presenting medical reasons for a student’s absence
- Materials related to academic or disciplinary probation, if applicable (notification of certain forms of disciplinary action is not retained in the student’s permanent record)
- Reports from Educational Support Services
- A record of financial aid awards, if applicable
- A photograph of the student, if furnished

Financial Aid Offices
The following records are maintained for students in order to administer the University’s programs of financial assistance. For undergraduate, graduate, and professional students, these records are maintained in the University Office of Financial Aid; for the School of Medicine, records are maintained in the office of the dean. Access to these files is normally limited to authorized personnel, to other academic and administrative officers of the University judged to have legitimate and appropriate reasons for access, and to other individuals who must review a student’s records when the student applies for externally funded financial assistance. Items marked with an asterisk are not among those to which the student may have access under the provisions of FERPA:
- Parents’ financial information*
- Student’s financial information
- University Financial Aid Application
- Parents’ federal income tax return (IRS form 1040, 1040A, or 1040EZ)*
- Student’s federal income tax return (IRS form 1040, 1040A, or 1040EZ)
- Parents’ statement of nonsupport (independent students only)
- Financial Aid Transcript (graduate and transfer students)
- Verification Forms (Dependent and Independent students)
- Copies of application for Stafford Student Loan, Supplemental Loan, or Parent Loan
- Copies of student’s financial aid award
- Statements regarding assistance from outside sources
- Copies of all correspondence and interview notes related to requests for financial assistance
- Student’s employment records
- Copies of draft registration compliance form
- Ohio Student Choice Grant Program Eligibility form
- Correspondence from a parent including a specific request that it be withheld from student*

REGISTRAR’S OFFICE
The University Registrar’s Office files contain current schedules and grade reports. In addition, the Registrar’s Office maintains the complete historical permanent record of courses and grades on microfilm and on paper for all students who have attended the University. The registrar regularly provides the deans’ offices with copies of permanent student records for student files, advisers, and students.

Departmental Files
An academic department may maintain a semipermanent file for a student whose course of study is under the direction of members of that department. The student should check with the chairperson of his or her department with respect to any such file.
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 that are created by, and that are the sole possessions of, faculty, staff, and other personnel, and that are not accessible to any other persons except a substitute.
- Records created and maintained by law enforcement units solely for law enforcement purposes that are not made available to persons other than law enforcement officials of the same jurisdiction.
- 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.
- Employment records of a student made and maintained in the normal course of business.
- Financial records of a student’s parents, or any information contained therein.
- Confidential letters and statements of recommendation placed in the file before January 1, 1975.
- Records for which the student previously waived his or her right of access.
- Records that contain only information about a person after that person is no longer a student, such as alumni records.

The office to which the request is made will arrange an appointment within a reasonable period of time (not to exceed 45 days) for the student to review the file in the presence of a member of the office staff.

If, during the course of this review, the student questions the accuracy of a record contained in the file, the staff member will attempt to resolve the problem informally. Should this attempt at resolution be unsuccessful, a formal hearing will be set up and a decision made by a University official or other party chosen by the University who does not have a direct interest in the outcome of the hearing. At this hearing, the student will be given a full and fair opportunity to present evidence relevant to the issue under consideration, and the decision will be given in writing within a reasonable period of time after the hearing.

If, as a result of the hearing, the University decides that the information is inaccurate, misleading, or otherwise in violation of the privacy or other rights of the student, it will amend the educational records of the student accordingly and so inform the student in writing. If, as a result of the hearing, the University decides that the information is not inaccurate, misleading, or otherwise in violation of the privacy or other rights of the student, it will inform the student of the right to place in the student’s educational records a statement commenting on the information in the records or setting forth any reasons for disagreeing with the University’s decision.

The purpose of this provision of FERPA is to “insure that records are not inaccurate, misleading, or otherwise in violation of the privacy or other rights of students, and to provide an opportunity for the correction or deletion of any such inaccurate, misleading, or otherwise inappropriate data contained therein and to insert into such records a written explanation . . . respecting the content of such records.” This provision of the act was not intended, in the words of the Secretary of Health, Education, and Welfare, “to overturn established standards and procedures for the challenge of substantive decisions made by the institution,” nor “to permit a parent or student to contest the grade given the student’s performance in a course.”

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

In general, the University will not release personally identifiable student record information to a third party unless the information has been specifically requested in writing and the student has consented to its release in writing. At the student’s request and expense, the University will furnish a copy of the information whose release has been requested.

FERPA provides for certain exceptions to the requirement of prior student consent for the release of student record information. These include the release of information:

- To other University officials who are determined by the University to have legitimate educational interests. University officials are persons who are employed by the University and whose job descriptions include duties the performance of which may require access to student files. The University considers a legitimate educational interest to be any interest that is reasonably related to the educational process and overall functioning of the University.
- To officials of other schools in which the student wishes or intends to enroll, upon written authorization by the student, provided that the student is notified of the transfer, receives a copy of the record if desired, and has an opportunity to challenge the content of the record.
- In connection with financial aid for which the student has applied or which he or she has received, in order to determine eligibility, amount of or conditions for aid or enforce these conditions.
- In connection with a disciplinary proceeding against a student who is an alleged perpetrator of a crime of violence.
- To authorized representatives of the Comptroller General of the United States, the Attorney General of the United States (for law enforcement purposes), Secretary of Education, to certain state or local officials under certain circumstances.
- To organizations conducting studies for educational agencies or institutions, provided that these studies are conducted in a manner that will not permit the personal identification of students or their parents by persons other than representatives of these organizations.
- To accrediting organizations that need
the information to carry out their accrediting functions.
• To the parents of a dependent student, as defined in the Internal Revenue Code of 1954.
• To the parent or legal guardian of a student under the age of 21 regarding the student’s violation of a law, rule or institutional policy pertaining to use or possession of alcohol or controlled substances, under certain conditions.
• In compliance with judicial order or subpoena, provided that the student is notified in advance of compliance except in those cases where notification is not permitted.
• To appropriate persons in connection with an emergency, if the knowledge of such information is necessary to protect the health or safety of a student or other persons.
• To a court if the student or his or her parent(s) initiates legal action against the University
• As specified under “Directory Information” below.

Under the terms listed above, personal information will be released from a student’s file to a third party only on the condition that the third party will not share the information with any other party without the written consent of the student. Case Western Reserve University will maintain a record of request for access to and disclosure of personally identifiable information.

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 student’s or parent’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 graduate 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. The student should also inform the Office of News Services, Adelbert Hall (368-4440), in writing, as it is the responsibility of that office to provide the student’s hometown newspapers with news stories. 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 request of the student, either in person or by mail. A fee is charged for each transcript copy. Transcripts will not be issued to, or on behalf of, students who have not discharged all delinquent obligations to the University.

POLICY ON SEXUAL HARASSMENT

It is the policy of Case Western Reserve University to provide a positive, discrimination-free educational and working environment. Sexual harassment is unacceptable conduct which will not be tolerated. All members of the University community share responsibility for avoiding, discouraging, and reporting any form of sexual harassment.

Members of the University community found in violation of this policy may be disciplined, up to and including being discharged for cause or being expelled from the University. Retaliation against persons raising concerns about sexual harassment is prohibited and will constitute separate grounds for disciplinary action, up to and including discharge or expulsion from the University.

This policy and the accompanying procedures shall serve as the only internal University forum of resolution and appeal of sexual harassment complaints.”

The University has passed and disseminated to all parties on this campus—students, faculty and staff—a detailed statement titled Policies and Procedures Regarding Sexual Harassment and Sexual Assault. Copies are available in the Provost’s Office, all the deans’ offices and at many of the University offices throughout the campus. Consultation and advice are available in the offices of the Provost, Affirmative Action, and Student Affairs. See the section, “Student Affairs,” for policies and procedures regarding sexual assault.

STUDENTS’ RIGHT TO KNOW

The Students’ Right to Know and Campus Security Act requires that universities throughout the country produce statistics on the retention and graduation rates for their students, as well as crime statistics on their campuses. The data on retention and graduation rates is available in the Office of the Provost in Adelbert Hall and in the various undergraduate, graduate and professional schools’ admissions offices.

Case Western Reserve University’s annual security report includes statistics for the previous three years concerning reported crimes that occurred on campus; in certain off-campus buildings owned or controlled by the University; and on public property within, or immediately adjacent to and accessible from the campus. The report also includes institutional policies concerning campus security, such as policies concerning alcohol and drug use, crime prevention, the reporting of crimes, sexual assault and other matters. You can obtain a copy of this report by contacting the Security Office at 216-368-2908, or by accessing the following web site: http://www.cwru.edu/finadmin/security/reports/secul999/report99.htm
University Administration

David H. Auston  
President
James W. Wagner  
Provost and University Vice President
James A. Barker  
Interim Vice President for Information Services
Richard E. Baznik  
Vice President for Public Affairs
Nathan A. Berger  
Vice President for Medical Affairs
Kenneth L. Kutina  
Vice President for Institutional Planning
Bruce A. Loessin  
Vice President for University Relations and Development
Glenn Nicholls  
Vice President for Student Affairs
Nancy D. Suttonfield  
Vice President for Finance and Administration
Joyce E. Jentoft  
Vice Provost
William M. Rose  
Treasurer
Kenneth A. Basch  
Associate Vice President for Facilities Management and Operations
Susan S. Jaros  
Associate Vice President for Development and Alumni Affairs
Earl L. McLane  
Associate Vice President for Human Resources
Hossein Sadid  
Associate Vice President for Finance and Administration and Controller
Thomas R. Shrout  
Associate Vice President for Public Affairs
Robert V. Edwards  
Assistant to the President for Minority Affairs
Robert A. Knight  
Interim Director of Budgets
Lori J. Neiswander  
Executive Assistant to the President
Ann E. Penn  
Director of Affirmative Action and Equal Employment Opportunity
Susan J. Zull  
Secretary of the Corporation and Secretary of the Faculty

ACADEMIC DEANS

Darlyne Bailey  
Dean of the Mandel School of Applied Social Sciences
Nathan A. Berger  
Dean of the School of Medicine
Dorothy A. Brooten  
Dean of the Frances Payne Bolton School of Nursing
Jerold S. Goldberg  
Dean of the School of Dentistry
Joyce E. Jentoft  
Dean of the School of Graduate Studies
Gerald Korngold  
Dean of the School of Law
William Laidlaw  
Interim Dean of the Weatherhead School of Management
Samuel M. Savin  
Interim Dean of the College of Arts and Sciences
Robert F. Savinell  
Interim Dean of the Case School of Engineering

Trustees

As of September, 2000

Officers

John F. Lewis, Chairman
Managing Partner – Cleveland Squire, Sanders & Dempsey, L.L.P.
Richard A. Derbes, Vice Chairman
Managing Director
Morgan Stanley Dean Witter

Trustees

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President
Case Western Reserve University
Malvin E. Bank  
Partner
Thompson Hine & Flory LLP
William G. Bares  
Chairman, President and Chief Executive Officer
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Charles P. Bolton  
Chairman of the Board
Britannia Corporation
David L. Brennan  
Chairman
Brennan Industrial Group, Inc.
William E. Bruner, II, M.D.  
Clinical Professor of Ophthalmology, CWRU University Ophthalmology Associates, Inc.
Timothy J. Callahan  
President
MCT Corporation
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CWRU School of Medicine
Antony E. Champ  
Owner
White Hall Vineyards
Archie G. Co  
President and Chief Executive Officer, retired
Singpore Industrial Equipment Pte. Ltd.
David A. Daberko  
Chairman & Chief Executive Officer
National City Corporation
Edward M. Esber, Jr.  
Chairman
The Esber Group
Allen H. Ford  
Consultant
Robert W. Gillespie  
Chairman and Chief Executive Officer
KeyCorp
Fred D. Gray  
Senior Partner
Gray, Langford, Sapp, McGowan & Nathanson
Sally Gries  
Chairperson, President and Chief Executive Officer
Gries Financial LLC
Elaine G. Hadden
Peter S. Hellman  
Executive Vice President
Nordson Corporation
Robert J. Herbold  
Executive Vice President and Chief Operating Officer
Microsoft Corporation
George M. Humphrey, II  
President
Extrudex
David P. Hunt  
President and Chief Executive Officer, retired
CNB Producing Company
Jennie S. Hwang, Ph.D.  
President
H-Technologies Group, Inc.
Joseph P. Keithley  
Chairman, President and Chief Executive Officer
Keithley Instruments, Inc.
Bruce J. Klatsky  
Chairman and Chief Executive Officer
Phillips-Van Heusen Corporation
Charles J. Koch  
Chairman, President and Chief Executive Officer
Charter One Bank, F.S.B.
Edith K. Lauer  
Chairman
Hungarian American Coalition
Richard G. LeFauve  
Senior Vice President
General Motors Corporation and Saturn Corporation, retired
Alfred Lerner  
Chairman
MBNA Corporation and Charter One Bank, F.S.B.
Sanford Levin
Frank N. Linsalata  
Chairman and Chief Executive Officer
Linsalata Capital Partners
Joshua W. Martin, III  
President and Chief Executive Officer
Verizon Delaware
A. Malachi Mixon, III  
Chairman and Chief Executive Officer
Invacare Corporation
Mario M. Morino  
Chairman
Morino Institute
Financial Information
Financial Information

All financial obligations to the University must be discharged before a student can graduate and obtain a degree. A student will not be considered to have registered in the University until all tuition and fees have been paid in full or deferred in accordance with the deferred payment plan outlined at the end of this section. Checks and money orders should be made payable to Case Western Reserve University and should show the name and social security number of the student for whom payment is made.

TUITION CHARGES

Students registered in all colleges and schools except dentistry, law, management, and medicine will be charged tuition according to the following schedule for 2000-2001:

1 to 11 credit hours (credit or audit) $837.50 per semester hour
12 or more credit hours (credit or audit) - undergraduate students, and 12 to 17 credit hours (credit or audit) - graduate students $10,050 per semester.

More than 17 credit hours (credit or audit) $10,050 + $837.50 per semester hour in excess of 17 credit hours (graduate students only). The tuition rate for students enrolled in 18 hours of course 702 (2 semesters) will be $1,675 for 2000-2001.

Students enrolled in undergraduate courses for the summer semester will be charged at a rate, which is one-half of the previous semester’s per credit hour charge.

Registration in the fall or spring semester for more than 9 credit hours of dissertation research or more than a total 16 graduate credit hours requires special permission of the Dean of Graduate Studies. Such permission is also necessary for summer session registration in excess of 6 graduate credit hours.

Dentistry

Students registered in the School of Dentistry will be charged $28,030 for the 2000-2001 academic year, one-half of which is payable each semester. Dentistry students pay additional tuition for each summer clinic. For summer 2000, this amount is $1,650.

Medicine

The School of Medicine has implemented a fixed, four-year rate for each entering class effective with the 1997-98 academic year. Classes entering prior to 1997-98 are charged a tuition rate that increases each year. The tuition rate for students entering in Fall 2000 is $32,130. Students who entered in Fall 1999 will be charged $30,600 in tuition. Students who entered in Fall 1998 will be charged $28,600 in tuition. Students who entered in Fall 1997 will be charged $26,475 in tuition. Students entering prior to Fall 1997 will be charged $28,350 for the 2000-2001 academic year.

Management

Full-time students registered in the various masters programs of the Weatherhead School of Management will be charged $22,900 for the 2000-2001 academic year with a part-time rate of $954 per credit hour and $10,950 for selected summer 2000 programs. Full time students enrolled for credit hours in excess of 20 during a semester will be assessed an additional $954 per credit hour. Students in the Executive Master of Business Administration program are charged $30,000 for the academic year 2000-2001 and $7,000 for summer 2000. Students in the Executive Doctor of Management program will be charged $25,350 for the 2000-2001 academic year.

Law

In the School of Law, a student pursuing a J.D. degree taking 10 credit hours or more will be charged $22,200 for the 2000-2001 academic year with a part time rate of $925 per credit hour.

MSASS

In the Mandel School of Applied Social Sciences, a student in the master’s program will be charged $10,050 for the 2000-2001 academic year with a part-time rate of $670. Full time students enrolled for credit hours in excess of 16 will be assessed an additional $670 per credit hour. Doctoral candidates will be charged $837.50 per credit hour to a maximum of $10,050 per semester for registrations of 12-17 credit hours. Students enrolled in the Mandel Center for Nonprofit Organizations will be charged $837.50 per credit hour to a maximum of $10,050 per semester for 12-17 credit hours. There are no activity fees.

SPECIAL FEES-NOT REFUNDABLE

Application Fees

Required with all applications for admission. This fee is payable at the time of filing the application. It is not refundable and no portion will be applied to tuition.

- Applied Social Sciences: $25
- Dentistry: $35
- Graduate Studies: $25 (not required for non-degree students)
- Law: $40
- Management: $50
- Medicine: $60
- Nursing: $75 (N.D. & M.S.N.)
- Health Service and Medical Insurance Fee: $312/semester

The CWRU Medical Plan fee is automatically billed at the beginning of the fall semester and spring semester (spring semester coverage extends through the summer) to all students registered for one or more credit hours. The CWRU Medical Plan provides coverage for medical care not available at the University Health Service. Students registered for one or more credit hours are eligible to use the University Health Service regardless of their participation with the CWRU Medical Plan. Students who have alternate medical insurance may waive the CWRU Medical Plan fee each semester by completing a waiver form, which is available at the University Health Service (216-368-2450). The deadline date for returning the completed waiver form is stated on the top of the waiver form. Remember, this fee is billed twice a year; therefore, a waiver must be completed twice a year. Completed waivers may be returned to Student Accounts Receivable in Yost Hall or to the University Health Service.

Late Registration Fee

Required of students who register after classes have begun: $25

Transcript Fee

There is a $5 fee assessed for each transcript request.
Student Activities Fee
Undergraduate: $80 per semester
Dentistry: $80 per semester
Graduate: $5 per semester
Law: $30 per semester
Nursing: $15 per semester (N.D. & M.S.N.); $7.50 per semester (Ph.D.)
Medicine: $15 per semester

Co-op Fee
First time participants: $150
Subsequent placements: $75

Clinical Practice Fee
All nursing undergraduates are charged a clinical practice fee in the fall semester of each year. For the 2000-2001 academic year, the clinical practice fee is $150.

Laboratory Fee
Dentistry: $45 per semester

Graduation Fee
Doctor of Philosophy: $120
This fee for the doctorate includes the cost of microfilming the doctoral dissertation by University Microfilms, Ann Arbor, Michigan, which is a requirement for the degree.

In Absentia Fee
Paid by CWRU undergraduate degree candidates who are registered in an approved program at another institution: $500.

Junior Year Abroad
Undergraduates: $500.

Tuition Deposit
Mandel School of Applied Social Sciences: $100 (non-refundable)
Dentistry: $1,000 (non-refundable)
Nursing (NS, ND, NG): $200 (non-refundable)
Law: $150 spring deposit and $250 summer deposit (both non-refundable)
Management: $500 (non-refundable)
Undergraduate: $200 enrollment deposit (non-refundable)

Special Nursing Fees
Professional and personal liability insurance ($1,000,000 limit): $79-$158
FPB/NSNA insurance, N.D. students: $35 per year

OTHER EXPENSES (ESTIMATED)

Books, Supplies, and Equipment
Nursing—Level I: $1,450; Level II: $900; Levels III and IV: $820
Medicine—$1,000 year (students must also supply their own microscopes; contact School of Medicine for requirements)
Dentistry—first year: $5,360; second year: $7,040; third year: $1,690; fourth year: $1,690
Law: $920 per year
Management: $1050 for first year students; $920 for second year students

Housing and Meals (On Campus)
See “Office of Housing and Residence Life” in this Bulletin.

PERSONAL PROPERTY INSURANCE
Students are responsible for their personal property while on campus. The University assumes no responsibility for loss of or damage to a student’s personal property, and the University insurance program does not cover such losses. Many “homeowner policies” purchased by a student’s family provide coverage for such perils as fire, water, and theft. If this coverage does not exist, the student may wish to consider the purchase of a separate policy.

POLICY FOR TUITION PAYMENT
Students enrolled in fall, spring, and summer terms for courses of full term length may arrange to pay bills for tuition and fees in two installments. At least one-half of the total bill must be paid at registration; the remainder must be paid by October 15 for the fall semester, March 15 for the spring semester, and July 15 for the summer session. Any remainder after the dates specified will be considered delinquent and will be assessed a late payment charge of 1.5% per month. Students registering as transient from another institution must pay the tuition and fees in full at the time of registration. Case Western Reserve University provides a Tuition Made E-Z Payment Plan. This ACH process will automatically debit a designated checking account on a monthly basis and apply the credits electronically to the student’s account. This process will eliminate the need for writing checks and the cost of postage. Information on this plan is available through the Office of Student Accounts Receivable at (216) 368-2226 or the Controller’s Office Web site at www.cwru.edu/finadmin/controller/conthome.htm.

REFUNDS
It is the policy of Case Western Reserve University that a refund from a scholarship, a grant, a loan or other assistance will be issued only after all charges payable to the University for an entire semester have been satisfied. If the gift assistance and loans for a semester exceed the student’s charges for that semester, a refund will be issued during that semester. Since a refund cannot be processed until after the end of the late registration/drop/add period, there is a delay of approximately two weeks after the costs and aid are confirmed. Any student, who is anticipating a refund, should make provision to cover costs to be incurred prior to the issuance of the refund check. (Please note that any form of aid designated as Pending is not considered to be received until the pending designation is removed and the credit has been applied to the student’s account.)

Complete Withdrawal
A student who completely withdraws from a fall or spring semester must pay a percentage of the tuition charge. The percentage charged is based on the number of weeks classes have been in session at the time of withdrawal.

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<tr>
<th>WEEK</th>
<th>AMOUNT OF CHARGE</th>
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<tr>
<td>1</td>
<td>0%</td>
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<tr>
<td>2-3</td>
<td>12%</td>
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<tr>
<td>4-5</td>
<td>25%</td>
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<td>6-7</td>
<td>37%</td>
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<tr>
<td>8-10</td>
<td>50%</td>
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<tr>
<td>After 10th week</td>
<td>100%</td>
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</table>

There is no tuition refund after the tenth week of classes.
A student who completely withdraws from a summer session must likewise pay a percentage of the tuition charge. The amount is based on the number of weeks
classes have been in session at the time of withdrawal.

<table>
<thead>
<tr>
<th>WEEK</th>
<th>AMOUNT OF CHARGE</th>
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<tbody>
<tr>
<td>1</td>
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<tr>
<td>2</td>
<td>12%</td>
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<td>3</td>
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<td>4</td>
<td>37%</td>
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<td>5-6</td>
<td>50%</td>
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<tr>
<td>After 6th week</td>
<td>100%</td>
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</table>

There is no tuition refund after the sixth week of classes.

The University will refund any tuition paid for a semester by any student in good standing who is inducted into the armed forces before the end of that semester and who does not receive credit for the work completed during that semester.

Return of Federal and Institutional Student Aid Funds

This policy applies to students who withdraw or are dismissed and refunds for these students are determined according to the following policy:

1) The term “Federal Student Aid Funds” refers to the Federal financial aid programs authorized under the Higher Education Act of 1965 (as amended) and includes the following programs: unsubsidized FFEL Loans, subsidized FFEL Loans, unsubsidized Federal Direct Loans, subsidized Federal Direct Loans, Federal Perkins Loans, FFEL PLUS Loans, Federal Direct PLUS Loans, Federal Pell Grants, Federal Supplemental Educational Opportunity Grants, other Title IV Federal assistance, other Federal sources of aid, other state, private, institutional aid, and the student.

2) A student’s withdrawal date is the date the student began the institution’s withdrawal process by submitting a completed withdrawal form to the University Registrar. The form must be signed by representatives of all specified departments, including a representative of the Dean’s Office of the school of enrollment. Students who leave the University without official notification will be considered to have withdrawn as of the midpoint of the semester or the last date of attendance at an academically related activity as documented by the University.

3) Refunds on tuition and room and board, if contracted with the University, will be prorated on a weekly basis based upon the University calendar up to the 60% point of the semester. There are no refunds after that time.

4) Federal aid and institutional aid is earned in a prorated manner on a per diem basis based upon the University calendar up to the 60% point in the semester. Federal and all other aid is viewed as 100% earned after that date.

5) In accordance with Federal regulations, when financial aid is involved, refunds are allocated in the following order:
   - Unsubsidized Federal Direct Loans
   - Subsidized Federal Direct Loans
   - Federal Perkins Loans
   - FFEL PLUS Loans
   - Federal Direct PLUS Loans
   - Federal Pell Grants
   - Federal Supplemental Educational Opportunity Grants
   - other Title IV Federal assistance
   - other Federal sources of aid
   - other state, private, institutional aid
   - the student

6) Any funds received in excess of the amount earned must be returned to the funding source. If the return of unearned Federal assistance causes any portion of the student’s tuition and other charges to be unpaid, the student will be billed by the University.

7) Refunds and adjusted bills will be sent to the student’s home address following withdrawal.

Partial Withdrawal

A student who withdraws from a course or courses after the normal drop/add period without completely withdrawing from the university is not entitled to a tuition refund for the course or courses dropped. At the discretion of the dean of a school, a partial tuition refund may be authorized in cases in which unforeseen and unavoidable circumstances necessitate that a student withdraws from a course or courses, and the student does not wish to withdraw completely. Federal, state or institutional aid may be adjusted to reflect the adjusted tuition cost in accordance with federal, state and institutional rules, regulations and policies. These may require a minimum level of enrollment to receive any assistance from a specific program.

Financial Assistance

An important consideration for nearly every student is how much higher education will cost and how much the student will be expected to provide toward that cost. Students should not assume that they will be unable to attend Case Western Reserve University for financial reasons. Each year more than half of the entering class receives financial assistance. Sources of support are many and varied. Students and parents are encouraged to investigate the financial aid opportunities at Case Western Reserve University. For undergraduate students, in addition to a comprehensive program of financial assistance based on a student’s demonstrated need, the University offers academic awards based solely on academic merit. Individual students may be eligible for the Financial Aid Program or the Academic Awards Program, or both.

Scholarship and university-controlled grant support are restricted to tuition only, unless otherwise noted. An individual student may not receive gift assistance from university programs or scholarship funds in excess of full tuition.

Case Western Reserve University has established academic prizes to recognize the outstanding academic achievement of its students in the pursuit of their educational programs and objectives. These prizes are announced at honors assemblies at the conclusion of each academic year. In recognition of its commitment to scholarship and research excellence, Case Western Reserve University permits the first $500 of any academic prize received at the honors assemblies to be awarded to a student without affecting other University scholarship or grant assistance. In instances in which federal or state regulations would mandate a reduction in need-based assistance, financial aid and scholarship policy will result in a reduction of up to $500 in self-help assistance (loan and job), if possible, before any grant or scholarship assistance will be adjusted.

For graduate and professional students, in addition to extensive loan assistance and in some cases opportunities for employment, a number of schools and departments offer assistantships and/or grant and scholarship aid. Financial aid
The University requires that all new undergraduate students complete the Free Application for Federal Student Aid (FAFSA) and the supplemental Financial Aid Profile Form of the College Scholarship Service, which together provide the University with an objective means of determining a reasonable educational contribution. All continuing undergraduate students are requested to submit the FAFSA and the Profile Form to the processing centers and send other documents directly to the Office of University Financial Aid for use in determining eligibility and the amount of financial aid to be awarded. Graduate and professional students are required to complete the FAFSA. The Profile Form is optional.

The analysis of the application documents considers the family’s annual income and accumulated assets, with allowances for family size, the number of dependent family members attending postsecondary educational institutions, retirement needs, and other factors. A determination is also made of the amount a student may be expected reasonably to contribute toward college expenses from savings and employment. Financial need is computed by subtracting the student and parental contributions from the cost of attendance, also called student’s budget. This budget includes the actual cost of tuition and fees, an allowance for housing and meals, books and supplies, miscellaneous personal and incidental expenses, and transportation. An undergraduate student’s financial aid award consists generally of three basic types of financial assistance: non-repayable gift or grant assistance, repayable loans, and student employment during the school year. A graduate or professional student’s financial aid award is primarily in the form of loan assistance, although in many instances other types of aid may be awarded. Most gift assistance is in the form of assistantships, fellowships, or scholarships. Case Western Reserve University adheres to the principle that a student’s need-based financial assistance may not exceed demonstrated financial need.

Because financial aid is initially awarded without regard to any other aid a student may receive from other sources (University or non-University), a student’s financial aid may be adjusted if additional assistance is received. It is the obligation of each financial aid recipient to report the amount, terms, and sources of other assistance not included in the University’s financial aid award. This includes any work, loan, or gift assistance not incorporated in the financial aid package. Any significant change in the family’s financial circumstances (an increase or decrease of $300 or more in income or assets), should be reported to the Office of Financial Aid. The amount of an individual’s financial aid will vary from year to year as the individual’s financial need varies. The determination of eligibility for financial aid is usually based on the prior calendar year’s income. Normally, financial aid is awarded with the expectation that it will be renewed each year upon reapplication on the basis of funds available, continued demonstrated financial need, and satisfactory academic performance and conduct. Each applicant will be considered for all programs of financial assistance for which he or she is eligible.

In most cases, students who are classified as independent are not required to provide information on their parents’ finances. For purposes of receiving financial aid, a student is considered independent who is:

1. 24 years of age or older by December 31 of the year for which aid is requested; or
2. An orphan or ward of the court at age 18; or
3. A veteran; or
4. Married; or
5. A graduate or professional student; or
6. Not married but with legal dependents.

Even though a student is classified as independent, the Office of Financial Aid may make an objective determination of the total resources available to the student from all sources, including parents.

**Application Procedures**

**UNDERGRADUATE STUDENTS**

The Free Application For Federal Student Aid and the Profile Form of the Col-
le Scholarship Service, available at the applicant’s secondary school or from the Office of University Financial Aid, should be submitted to the Federal Processor and College Scholarship Service respectively. Return address envelopes are included in each application packet. Submission of these forms by February 1 is strongly recommended because it takes approximately four weeks to analyze and forward the information to the University. Case Western Reserve University’s school code for the Profile is 1105. The Federal code for the FAFSA is 003137 for all undergraduates. Case Western Reserve University also requires as part of the application for financial aid a signed photocopy of the parents’ Internal Revenue Service Form 1040, including all schedules and W-2 forms, for the latest calendar year. The student’s name, Social Security number, and the college in which the student will be enrolled should be printed clearly at the top of the form. The IRS form should be sent directly to: University Office of Financial Aid Case Western Reserve University Yost Hall, Room 417A 10900 Euclid Avenue Cleveland, Ohio 44106-7049 Fax (216) 368-5054

If the student filed a federal tax return for the previous year, a signed copy, along with all W-2 forms from employers, must be submitted to the University Office of Financial Aid. If the student did not file a tax return, a Student Statement of Income must be completed and submitted to the University Office of Financial Aid. This form is available from the University Office of Financial Aid. In addition, all sophomore, junior, and senior applicants must obtain and complete a Case Western Reserve University Financial Aid Application. This form should be returned directly to the Office of University Financial Aid.

Transfer students are evaluated for all sources of financial aid. Transfer students must submit the Free Application for Federal Student Aid, the Profile Form, and IRS forms as noted above. In addition, transfer students must complete a Case Western Reserve University Application for Financial Aid and may have to provide a Financial Aid Transcript from the previous college or university attended, whether or not aid was received at that institution. Undergraduate students admitted to either the Integrated Graduate Studies or the Bachelor of Science/Master of Science program must include a memorandum of departmental financial support with their annual application. To maintain continued eligibility for undergraduate aid, the student must register for a 12-credit-hour, full-time undergraduate course load and meet all other requirements of undergraduate aid awards. Undergraduate financial aid eligibility including federal, state, and institutional gift assistance normally terminates after ten semesters of enrollment, regardless of degree completion.

Students selected for Verification by the Federal Processor or the Office of Financial Aid will be sent a Verification Form by the University. Applicants should respond promptly to the request for completion of the Verification Form because Federal regulations prevent the disbursement of any Federal funds until the verification process has been completed.

For more information about application procedures, request the booklet “Undergraduate Financial Aid and Scholarships” from: University Office of Financial Aid Case Western Reserve University Yost Hall, Room 417A 10900 Euclid Avenue Cleveland, Ohio 44106-7049

GRADUATE AND PROFESSIONAL STUDENTS

Following is a summary of procedures for applying for need-based assistance by school. For more detailed and specific information, request the booklet “Financing Graduate and Professional Education at Case Western Reserve University” from:

University Office of Financial Aid Case Western Reserve University Yost Hall, Room 417A 10900 Euclid Avenue Cleveland, Ohio 44106-7049

Students in the School of Medicine should contact the Financial Aid Office in the School of Medicine.

In most instances it is the policy of the University Office of Financial Aid to meet the first $8,500 of financial need with a William D. Ford Federal Direct Loan or Stafford Loan. All financial aid application forms are available from the admission offices of the various schools or the University Office of Financial Aid. Some schools may have specific application forms for institutional funds. Check with the Admissions Office of the graduate/professional school for information on the application procedures and forms. (Students of the School of Medicine should obtain all application forms from the School of Medicine’s Financial Aid Office.)

Each student in or applying to a dual-degree program must request and provide the University Office of Financial Aid with a memorandum detailing financial support that the student will receive from each school involved in the dual-degree program.

MANDEL SCHOOL OF APPLIED SOCIAL SCIENCES

First-year students or first-time financial aid applicants must submit:
1. A Free Application for Federal Student Aid (FAFSA) Federal Code E00084
2. To the University Office of Financial Aid:
   b. A signed copy of the student’s (and, where appropriate, the student’s spouse’s) prior year federal income tax return and W-2 forms; if a tax return was not filed, a completed Student/Spouse Statement of Income.
   c. A memorandum from the Mandel School of Applied Social Sciences specifying the amount and types of aid, if any, the student will be receiving from the School.
   d. Some applicants may be required to submit a Financial Aid Transcript from the previous school attended, whether or not financial assistance was received.

Continuing students must submit:
1. A Free Application for Federal Student Aid (FAFSA) Federal Code E00084
2. To the University Office of Financial Aid:
   b. A signed copy of the student’s (and, where appropriate, the student’s spouse’s) prior year federal income tax return and W-2 forms; if a tax return was not filed, a completed Student/Spouse Statement of Income.
   c. A memorandum from the Mandel School of Applied Social Sciences specifying the amount and types of aid, if any, the student will be receiving from the School.

SCHOOL OF DENTISTRY
All financial aid applicants must submit:
2. To the University Office of Financial Aid:
   b. A signed copy of the parents’ prior year federal income tax return and W-2 forms.
   c. A signed copy of the student’s (and, where appropriate, the student’s spouse’s) prior year federal income tax return and W-2 forms; if a tax return was not filed, a completed Student/Spouse Statement of Income.
   d. A financial aid transcript from any previous U.S. dental school attended (transfer students and applicants to the graduate master’s programs only).

SCHOOL OF GRADUATE STUDIES
New and continuing students must submit a Free Application for Federal Student Aid (FAFSA) Federal Codes E00680-Engineering Students; E00681-All applicants for financial aid, other than that awarded by the department, must submit to the Office of Financial Aid:
   b. A signed copy of the student’s (and, where appropriate, the student’s spouse’s) prior year federal income tax return and W-2 forms; if a tax return was not filed, a completed Student/Spouse Statement of Income.
   c. Some new applicants may be required to submit a Financial Aid Transcript from the previous college or university attended, whether or not financial assistance was received.
   d. A memorandum from the student’s department or program specifying the amount and type of aid, if any, the student will be receiving from the department/program for each period of enrollment during the academic year, and the number of credit hours to be taken during each term.

SCHOOL OF LAW
All applicants for financial aid must submit:
2. To the University Office of Financial Aid:
   a. A signed copy of the student’s (and, where appropriate, the student’s spouse’s) prior year federal income tax return and W-2 forms; if a tax return was not filed, a completed Student/Spouse Statement of Income.
   b. A CWRU Application for Financial Aid.
   c. Some new applicants may be required to submit a Financial Aid Transcript from the previous college or university attended, whether or not financial assistance was received.
   d. A memorandum from the Weatherhead School of Management specifying the amount and types of aid, if any, the student will receive from the school.

SCHOOL OF MEDICINE
All financial aid applicants must submit a Free Application for Federal Student Aid (FAFSA) Federal Code E00079 and complete the electronic Need Access application provided by the Access Group. Other required documentation should be sent directly to the School of Medicine.

FRANCES PAYNE BOLTON SCHOOL OF NURSING
Graduate Programs
The following procedures must be observed for all Doctor of Nursing (N.D.), M.S.N., and Ph.D. students seeking financial aid based on need
1. All new and continuing students must submit a Free Application for Federal Student Aid (FAFSA) Federal Code E00083.
2. Some new students may be required to submit a Financial Aid Transcript from the college or university previously attended. The transcripts are to be sent to the University Office of Financial Aid at Case Western Reserve University.
3. All new and continuing students must submit to the University Office of Financial Aid:
   a. a CWRU Financial Aid Application;
   b. a signed or certified copy of the student’s and spouse’s (if applicable) prior year federal income tax return and W-2 forms. If a tax return was not filed, a completed Student/Spouse Statement of Income;
4. For all students the School of Nursing must submit to the University Office of Financial Aid a Memo of Assistance indicating the number of credits the student will be taking during each period of enrollment during the academic year, and the amount and kind of assistance awarded for each term.

MANDEL CENTER FOR NONPROFIT ORGANIZATIONS

Students applying for scholarships must apply directly to the Mandel Center. One application is sufficient to apply for any scholarship available. The following procedure applies to those students who wish to borrow through the educational loan programs, in addition to any scholarship(s) received. Students must be enrolled at least halftime to qualify for Federal educational loans.

All financial aid applicants must submit
1. New and continuing students: A Free Application for Federal Student Aid (FAFSA) Federal Code E00080
2. To the University Office of Financial Aid
   a. a CWRU Application for Financial Aid.
   b. a signed or certified copy of the student’s and spouse’s (where applicable) prior year federal income tax return and W-2 forms; if a tax return was not filed, a completed Student/Spouse Statement of Income.
   c. Some new students may be required to submit a Financial Aid Transcript from the previous college or university attended, whether or not financial assistance was received.
   d. a memorandum from the Mandel Center for Nonprofit Organizations specifying the amount and types of aid, if any, the student will receive from the school.

Types of Aid

GIFT AND SCHOLARSHIP AID

AID AVAILABLE TO UNDERGRADUATE, GRADUATE, AND PROFESSIONAL STUDENTS

Ukrainian Student Assistance Fund Scholarship

Available to students in the Case School of Engineering, the College of Arts and Sciences, the School of Graduate Studies, and each of the professional schools, this scholarship stipulates that the applicant must be a full-time student in good standing, must demonstrate financial need, and normally must have at least one parent or grandparent who was born in the Ukraine. The student must be a U.S. Citizen or Permanent Resident and must be otherwise eligible for need-based financial assistance.

UNDERGRADUATE AID RELATED TO ACADEMIC ACHIEVEMENT OR POTENTIAL, AWARDED BY CASE WESTERN RESERVE UNIVERSITY

(Follow the application procedures indicated above, unless otherwise indicated.)

Academic Awards Program

The following academic awards, honoring distinguished faculty, alumni, and benefactors of the University, are offered to qualified applicants for admission as freshmen. Transfer students are ineligible. These awards are renewable for each of the four years of undergraduate study, provided high academic achievement is maintained.

Four full-tuition Albert W. Smith Scholarships for freshmen accepted in engineering, science, or mathematics.

Two full-tuition Treuhaft Scholarships for freshmen accepted in engineering, science, or mathematics.

Up to five $3,000 Materials Science and Engineering Scholarships for entering freshmen who are interested in majoring in materials science and engineering.

Five full-tuition Andrew Squire Scholarships for freshmen accepted in the arts, humanities, natural sciences, social and behavioral sciences, management and accountancy.

Two full-tuition Adelbert Alumni Scholarships for freshmen accepted in the arts, humanities, natural sciences, social and behavioral sciences, management and accountancy.

One $15,000 Curtis Lee Smith Scholarship every four years for a freshman accepted in the arts, humanities, natural sciences, social and behavioral sciences, management and accountancy.

One $12,500 Elizabeth Walker Scholarship every four years for a freshman accepted in the arts, humanities, natural sciences, social and behavioral sciences, management and accountancy.

A Trustee’s Scholarship for freshmen entering the College of Arts and Sciences or the Case School of Engineering who rank in the top 10% of their high school graduating class and have composite SAT scores of at least 1500, or a composite ACT score of at least 35. (Value for freshmen entering in 2000 is $20,100.) The University may establish annual limits on the number of Trustee’s Scholarships to be offered.

A President’s Scholarship for freshmen entering the College of Arts and Sciences or the Case School of Engineering who rank in the top 10% of their high school graduating class and have composite SAT scores of at least 1400, or a composite ACT score of at least 33. (Value for freshmen entering in 2000 is $15,100.) The University may establish annual limits on the number of President’s Scholarships to be offered.

A Provost’s Scholarship for freshmen entering the College of Arts and Sciences or the Case School of Engineering who rank in the top 15% of their high school graduating class and have composite SAT scores of at least 1300, or a composite ACT score of at least 31. (Value for freshmen entering in 2000 is $10,050.) The University may establish annual limits on the number of Provost’s Scholarships to be offered.

Up to 16 Provost’s Special Scholarships for freshmen entering the College of Arts and Sciences or the Case School of Engineering who demonstrate superior academic performance (rank in the top 15% of high school graduating class and have composite SAT scores of at least 1,200 or
composite ACT scores of at least 28), and who have encountered economic or educational obstacles that affected their college preparation. Applicants from inner city and remote rural schools, including Indian Reservations, and members of underrepresented minority groups are encouraged to apply. Students with special talents and significant extracurricular and community activities are encouraged to apply as well. (Value for freshmen entering in 2000 is $12,600.)

Ohio Leadership Awards Program

Minimum of twelve awards of up to $5,000 to freshmen admitted to the undergraduate colleges. Academic and leadership qualities required. Selection is on basis of nomination by high school teacher and interview.

Cleveland Plain Dealer Scholarship Program

The Cleveland Plain Dealer Scholarship Program provides two $1,000 scholarships to incoming freshmen who intend to concentrate in business management or print journalism, and are residents of Northeast Ohio. They must have demonstrated high academic achievement in their high school record and be determined by the Office of Financial Aid to have financial need. Scholarship availability is contingent upon annual funding levels. Interested students should contact the Office of University Financial Aid.

Creative Achievement Awards Program

Three scholarships for entering freshmen who demonstrate outstanding creative ability and achievement in the arts. Each applicant is required to submit a portfolio of original work. An on-campus interview is required. The scholarship is valued at $10,050 for students entering in 2000.

Minority Scholars Program

A special program of academic preparation, career counseling, internships, and mentoring is offered for selected minority students. Program participants may qualify for special financial assistance designated for low income or disadvantaged students. To apply, a student must identify himself or herself as an underrepresented minority to the Office of Undergraduate Admission. Minorities who are underrepresented in higher education include Native Americans, African Americans, Mexican Americans, Puerto Ricans, Native Alaskans, and Native Pacific Islanders.

National Merit Scholarship

Case Western Reserve University sponsors at least 25 four-year scholarships for National Merit Scholarship Corporation finalists who have listed Case Western Reserve University as their first-choice institution. Scholarships range from $500 to $2,000 per year.

Case School of Engineering Alumni Association Scholarships

The Case School of Engineering Alumni Association provides scholarship assistance to selected juniors and seniors who have demonstrated outstanding academic achievement and participation in extracurricular activities.

Alden Undergraduate Fellowship in Systems Engineering

Several scholarships of varying amounts are offered for the junior and senior years to students in Case School of Engineering who have declared a major in systems engineering. Contact the Department for further details.

Accountancy Scholarships

Several $1000 competitively awarded scholarships are offered to freshmen who intend to major in accountancy. They are renewable for four years of study if high achievement is maintained.

James Dysart Magee Scholarships

Two or more scholarships are awarded annually to seniors in the Integrated Graduate Studies programs in economics and the social and behavioral sciences.

Peter Witt Scholarships

Several scholarships are offered by the Office of Collegiate Affairs to juniors and seniors interested in social welfare, city planning, and community responsibility.

UNDERGRADUATE AID BASED ON FINANCIAL NEED AND CONTINGENT UPON SATISFACTORY ACADEMIC PROGRESS, AWARDED BY CASE WESTERN RESERVE UNIVERSITY

(Follow the application procedures outlined above, unless otherwise indicated.)

Grants-in-Aid from the schools

Grants-in-aid comprise non-repayable gift assistance which vary according to the amount of unmet financial need but which may not exceed tuition.

Federal Supplemental Educational Opportunity Grants (FSEOG)

Students with financial need may receive a Federal Supplemental Educational Opportunity Grant. The FSEOG is awarded to students with great financial need who would be unable to attend the University without this grant. Grants may range from $200 to $4,000 per year.

UNDERGRADUATE AID AWARDED OUTSIDE CASE WESTERN RESERVE UNIVERSITY

Federal Pell Grant

The Federal Pell Grant program is a Federal grant program through which a student can receive a maximum of $3,300 (for 2000-2001). The student must apply for the Federal Pell Grant by completing the Free Application for Federal Student Aid (FAFSA). Within four to six weeks of filing, the student will receive a Student Aid Report, and the Office of University Financial Aid will receive the results electronically. The amount of Federal Pell Grant the student is eligible to receive will be determined according to Federal payment tables which are updated annually. The U.S. Department of Education requires that eligibility for a Federal Pell Grant be determined before any other Federal aid can be awarded.

Ohio Instructional Grant (OIG)

Ohio residents who will be enrolled as undergraduate students at an eligible Ohio or Pennsylvania college or university may apply for an Ohio Instructional
Grant. Application is made through completion of the Free Application for Federal Student Aid (FAFSA). The student will receive an Award Certificate or letter of denial by return mail, and the Office of University Financial Aid will receive a roster of eligible students.

**Ohio Student Choice Grant**
All full-time undergraduate students who are residents of Ohio and were not full-time students at a college or university on or prior to July 1, 1984, are eligible to receive this grant. For 2000-2001 the amount is $1062.

**Ohio 12th Grade Proficiency Scholarship**
This program provides a one-time $500 scholarship to high school seniors who pass all five sections of the Ohio 12th Grade Proficiency Test. Scholarship benefits may be applied to all direct educational expenses and are disbursed in full during the student’s first semester of enrollment.

**Ohio Academic Scholarship Program**
The State of Ohio has established the Ohio Academic Scholarship Program, through which 1,000 scholarships of $2,000 each are offered each year. Each high school in the State of Ohio is guaranteed at least one Ohio Scholarship each year. The scholarships are renewable for each of four consecutive years of undergraduate or graduate study, beginning with the freshman year, provided that satisfactory academic progress toward a degree is maintained. Individual applications to the State of Ohio are submitted through the student’s high school. The high school record and composite score on the American College Test (ACT) will be used to select the winners of the scholarships. Students should see their high school guidance counselors for additional information.

**War Orphans Scholarship Program**
The State of Ohio provides scholarship assistance to children of veterans who were killed in action during times of war, who received a service-connected disability of at least 60 percent, or who are totally disabled. The veteran must have entered the service as a resident of Ohio. The scholarship provides a sum of money equal to the average of tuition and fees of state-assisted institutions to students who attend eligible private institutions in the state of Ohio. Students should contact the Student Assistance Office of the Ohio Board of Regents for further details.

**Other State Scholarship and Grant Programs**
The states of Delaware, Maryland, Pennsylvania, Rhode Island, and Vermont have state scholarship or grant programs for residents. The recipients of these state scholarship or grant programs may use this assistance at any eligible college or university. Students should contact their high school guidance directors or the appropriate state agency for further information.

**ROTC**
U.S. Army and Air Force Scholarships are available on a competitive basis. The scholarships pay a portion or all of the recipient's tuition, laboratory, textbook, and incidental fees. Recipients also receive a $150 tax free stipend on a monthly basis during the academic year. Students compete for three or four year scholarships. Case Western Reserve University provides matching grants to assist with tuition for up to ten new students each year.

**Other Grants and Scholarships**
Many students receive grants or scholarships from companies, community organizations, ethnic or religious groups, or fraternal organizations. Students are encouraged to seek such outside assistance. It is a condition of receiving financial assistance from the University that the student notify the University Office of Financial Aid of all assistance received from outside the University, whether paid directly to the University or to the student.

**MANDEL SCHOOL OF APPLIED SOCIAL SCIENCES**

**Direct Mandel SASS Grants**
Grants are awarded to students in varying amounts, as determined by financial need and academic merit.

**Scholarships**
Alumni Scholarships in varying amounts are awarded to one or more second-year students based on outstanding performance and financial need. Two Full Time Full Tuition Scholarships are awarded annually. Two Intensive Semester Half Tuition Scholarships are awarded annually. Three International Student Scholarships are awarded annually.

**SCHOOL OF DENTISTRY**

**Alumni Scholarships**
The School of Dentistry, with the support of the Alumni Association, awards a number of four-year partial tuition scholarships to entering students of outstanding achievement and potential.

**Scholarships for Students with Exceptional Financial Need**
The University may receive funding to award one or more scholarships per year to students with exceptionally great financial need. The scholarship will pay up to full tuition and fees and other reasonable educational costs. Eligible students are identified by the University Office of Financial Aid on the basis of their aid application showing zero resources. Complete financial information on the applicant’s parents must be provided. Recipients must agree to perform general practice Dentistry for a minimum period of five years following graduation, exclusive of any periods of residency in General or Pediatric Dentistry.

**Financial Assistance for Disadvantaged Health Professional Students**
The University may receive funding to award a limited amount of gift assistance to students from a disadvantaged background who have exceptionally high financial need.

**American Dental Association (ADA) Endowment and Assistance Fund**
The ADA provides competitive scholarships to second year Dental students. Selection criteria include U.S. citizenship; demonstrated need of at least $2,500; cu-
cumulative grade point average of 3.0 on a 4.0 scale. Applications are available through the School of Dentistry. The application deadline is June 15.

**American Dental Association (ADA) Endowment Fund Minority Dental Student Scholarship Program**

The ADA offers scholarships for second year minority Dental students.

Selection criteria include demonstration of financial need and cumulative grade point average of 2.5 on a 4.0 scale. Applications and information are available through the School of Dentistry.

**Armed Services Scholarship Program**

The Army, Navy, and Air Force permit selected students to be commissioned as officers in their programs. Terms and conditions of each branch scholarship program are available from the Health Professions recruiter for the specific branch of service.

**Other Financial Assistance**

There are several loan programs, both public and private, which offer educational assistance to supplement Federal and university loans. Among the programs currently available for Dentistry are Ohio Supplemental Loan, Dental Access, Medfunds, AADS DEAL, and Sallie Mae Signature Loan. Further information and application forms are available from the Office of University Financial Aid or the Financial Aid Advisor in the School of Dentistry.

It is suggested that applicants check with local fraternal and community organizations and with their local dental societies.

**SCHOOL OF GRADUATE STUDIES**

**Fellowships, Traineeships, Assistantships, and Awards**

The University has approximately 1,000 competitive awards for the support of full-time study in the School of Graduate Studies. These include a variety of fellowships, traineeships, and assistantships, and are assigned through most of the departments offering graduate degree programs. Most awards are granted for study beginning in the fall semester. New students are eligible for award consideration at the time they apply for admission. The general deadline for completed applications for admission with financial aid consideration is March 1 for the following semester.

**Other Resources**

The Office of Research Administration has access to a terminal-based data system (SPIN) which can provide information on a variety of additional public and private sources for financial assistance.

**SCHOOL OF LAW**

**Law School Scholarships**

Each year 10 full-tuition scholarships are awarded to entering students on the basis of merit. The scholarship is renewable provided the recipient maintains the requisite grade point average. Funds for these scholarships are provided from the generous support of alumni and friends of the law school. Other scholarships are awarded in varying amounts up to full-tuition, depending upon academic performance and availability of funds.

**WEATHERHEAD SCHOOL OF MANAGEMENT**

In addition to participating in Federal financial aid programs, the Weatherhead School of Management sponsors its own programs of financial assistance for qualified M.B.A., M.Acc., and M.S.M. in information systems students. The Weatherhead School programs include scholarships, grants, and loans. All requests for financial aid should be submitted no later than April 1. Because the availability of financial aid is limited, students are encouraged to apply as early as possible for such aid. Decisions concerning admission and financial aid are made independently of one another. Applying for financial aid will neither help nor hinder an applicant's chances for admission.

To apply for any of the Weatherhead Scholarships, check the appropriate space on the application for admission. Scholarship decisions are made on a rolling basis until funds are exhausted.

**Scholarships**

The Weatherhead School awards a limited number of scholarships each year to entering full-time M.B.A., M.Acc., and M.S.M. students. Primary consideration is given to students who have demonstrated a high level of academic achievement in undergraduate studies in conjunction with outstanding scores on the GMAT. Relevant work experience is also evaluated in the award decision. Special fellowships and scholarships are awarded to full-time M.B.A. candidates who add to the diversity of the student body. The Weatherhead Alumni Association awards an annual full-tuition scholarship to an outstanding full-time M.B.A. candidate, with a minimum of two years’ work experience. The student must demonstrate outstanding academic achievement and GMAT test results. Internships, extracurricular activities, community service, and the application essay will also be considered in determining management and leadership potential.

**SCHOOL OF MEDICINE**

**Scholarship Funds**

It is the policy of the School of Medicine to use its limited scholarship funds to assist those students whose financial needs are so great that, if they were all met by loans, the burden of indebtedness would be extreme. No scholarships are granted merely because of academic excellence to students whose personal and family resources are adequate to meet the costs of a medical education. Minority group students selected for admission to the medical school are eligible to apply for aid from:

- National Medical Fellowships, Inc.
- 110 West 32nd St.
- New York, NY 10001-3205

It is desirable for eligible students (African-Americans, Mexican-Americans, mainland Puerto Ricans, and Native Americans) to initiate such applications promptly after they are accepted.

**Fellowships**

Many students seek opportunities to devote vacation months to intensivestudy of some subject in which they have become interested. Summer research fellowships are made available to students to enable
them to engage in such investigations under the supervision of a faculty sponsor. The present policy is to provide, insofar as possible, a stipend of $1,200, with the requirement that the student devote a minimum of two months of full-time effort to the project. Support for the vacation research fellowship program comes from many sources.

Federal Scholarship Programs
Branches of the military service and the National Health Service Corps offer scholarship benefits to recipients including tuition, fees, and a stipend. Participants are obligated for a full year of service for each year of benefits with a minimum obligation of two years. Further information about these programs may be obtained from the local recruiting office of the armed forces or through the financial aid officer of the medical school.

FRANCES PAYNE BOLTON SCHOOL OF NURSING

Doctorate of Nursing (N.D.)
Grants-in-Aid are awarded to full-time students in the N.D. program who demonstrate financial need and maintain satisfactory academic progress. Some of these are from endowments but the majority are contributions from alumni of the School.

The Ohio League for Nursing (OLN) provides a scholarship and loan program for full-time students who are pursuing the first nursing degree (B.S.N. or N.D.) who are residents of Cuyahoga, Geauga, Lake, Lorain, Medina, Portage, or Summit Counties in Ohio. For information write to:
Ohio League for Nursing, Greater Cleveland Area
2800 Euclid Avenue, Suite 235
Cleveland, Ohio 44115

M.S.N. and Ph.D. Students
The following grants and scholarships are available through the School of Nursing:

Professional Nurse Traineeships are Federal traineeships designed for full-time graduate students preparing for teaching, administration, or specialization in a particular field of nursing practice. Students must be enrolled full-time both fall and spring semesters to qualify. Students entering in the spring will qualify if they commit to full-time enrollment thereafter. Professional Nurse Traineeships may be used for master’s study for up to 18 months. The current level of funding pays for approximately 1 to 1 1/2 credit hours per semester.

National Research Service Awards for Individual Predoctoral Nurse Fellowships are awarded under the authority of the Public Health Service Act to nurses for predoctoral training in specified areas of nursing. These awards are made to individuals selected in national competition. Applicants must be enrolled for study leading to the Ph.D. in nursing and be sponsored by faculty of the School of Nursing.

Research and/or teaching graduate fellowships/assistantships may be available to full-time students who are Registered Nurses based on academic merit and prior relevant academic and/or work experience. A fellowship/assistantship carries a remission of tuition for 9 hours each semester plus a monthly stipend competitive with those at other major private universities in exchange for 17-1/2 hours of work a week by the student. To apply for a fellowship/assistantship, check the appropriate space on the School of Nursing’s application form.

Loan Assistance

LOANS AWARDED BY CASE WESTERN RESERVE UNIVERSITY OFFICE OF FINANCIAL AID

These loans are awarded on the basis of financial need. A loan will probably be a part of a package awarded in response to an application for financial assistance.

Federal Perkins Loan
Perkins Loans enable students to borrow up to $40,000 through graduate school (up to $20,000 as an undergraduate). Repayment begins six months after graduation or after the student ceases enrollment on at least a half-time basis. To be eligible a student must be a citizen of the United States or have a permanent resident visa, be at least a half-time student making satisfactory progress toward a degree, and establish financial need for the loan. The Federal Perkins Loan may be awarded to undergraduate students and graduate and professional students in all programs except the School of Medicine.

Health Profession Student Loans (HPSL)
Awarded to students in the School of Dentistry and School of Medicine who demonstrate financial need, HPSL is a federal loan that enables eligible students to borrow at 5 percent simple interest, with repayment made over a 10-year period. Parental information must be provided by all students wishing consideration for these funds.

Federal Nursing Loan Program
Only N.D. and M.S.N. students in the School of Nursing are being awarded the limited federal loans provided under the Nursing Student Loan Program. They may receive up to $4,000 per year, depending upon financial need and availability of funds. Interest is 5%, and repayment begins when the student completes the program or ceases to be enrolled at least half time.

University Loans
A university loan is a low-interest long-term loan provided to a student to assist with educational expenses. Repayment is made over a five-year period after graduation or over a five-year period after the student ceases enrollment on at least a half-time basis. Interest is 8%.

a) Undergraduate
Forty-eight loan funds have been established for undergraduate students. Loans are awarded by the Office of Financial Aid on the basis of need.

b) Graduate and Professional
The Mandel School of Applied Social Sciences has a small amount of loan money available to meet financial need after Federal loan availability has been exhausted. These loans are awarded by the University Office of Financial Aid.
A number of loan funds have been established for students in the School of Dentistry. Loans from these funds are
awarded only to meet cases of exceptional need which cannot be met by other funding, and some of these funds are restricted to certain classes and categories of students.

The School of Law provides low-interest, long-term loans to students with unmet need who have exhausted all other available assistance.

The Weatherhead School of Management has loan funds for M.B.A. students who demonstrate financial need.

Loans are available to students in the School of Medicine from funds given to the School of Medicine for that purpose. The Medical Alumni Association Rotating Loan Fund, augmented each year by contributions from graduates of the school, is a major source of aid for currently enrolled students.

The Frances Payne Bolton School of Nursing has several loans funds available to assist students with exceptional financial need as determined by the Office of Financial Aid.

LOANS AWARDED BY AGENCIES OUTSIDE THE UNIVERSITY

The following loans are available to all undergraduate, graduate, and professional students who are enrolled on at least a half time basis, hold U.S. citizenship or permanent resident status, and are admitted to or enrolled in a degree-seeking program.

Subsidized Loans
Case Western Reserve University participates in the Federal Stafford Loan program and in the William D. Ford Federal Direct Loan program.

A student is eligible to receive funds under only one of the programs.

The Direct Loan is awarded by the University and serviced by the Federal Department of Education. If a student does not receive a William D. Ford Direct Loan, he/she is eligible to apply for funds under the Federal Stafford Loan program which lends money through private lenders. Students must be enrolled half time (6 credit hours per semester) and demonstrate financial need. The variable interest rate is adjusted annually and is capped at 8.25%. The interest is subsidized (paid) by the Federal Government as long as the student remains enrolled at least half time (6 credit hours per semester). A student making satisfactory academic progress may borrow up to $2.625 for the first year of undergraduate study, up to $3500 for the second year, $5,500 for each year of subsequent undergraduate study, and $8,500 for each year of graduate study, with an aggregate maximum of $23,000 undergraduate and $65,000 undergraduate and graduate. Repayment begins six months after the student ceases to be enrolled on at least a half-time basis. No principal or interest must be paid while the student is enrolled half time or more. All students must demonstrate financial need as determined by the University Office of Financial Aid in accordance with criteria established by the Federal Government. All undergraduate students must apply for the Federal Pell Grant. Promissory notes for the William D. Ford Federal Direct Loan are mailed to the students by the University Office of Financial Aid. Application forms for the Federal Stafford Loan Program may be obtained from a bank or other lending institution, or, in the case of some lenders, from the University Office of Financial Aid. The appropriate forms must then be submitted to the University Office of Financial Aid. All applicants for Federal Direct or Stafford Loans must submit the following
1. A Free Application for Federal Student Aid (FAFSA). Undergraduate students must complete the Profile Form of College Scholarship Service as well.
2. To the Office of University Financial Aid:
   b. A signed copy of the parents’ prior year federal income tax return, including all schedules and W-2 forms (in the case of dependent students).
   c. A signed copy of the student’s prior year federal income tax return, including all schedules and W-2 forms (and where appropriate, the student’s spouse’s), or, if a tax return was not filed, a completed Student/Spouse Statement of Income.
   d. New applicants may be required to submit a Financial Aid Transcript from the previously attended college or university, whether or not financial aid was received.
   e. In the case of students enrolled or admitted to the Mandel School of Applied Social Sciences, School of Graduate Studies, School of Law, Weatherhead School of Management, Mandel Center for Nonprofit Organizations, or the N.D., M.S.N. or Ph.D. program of the Frances Payne Bolton School of Nursing, the Office of University Financial Aid also requires a memorandum from the school specifying the admission status, number of credit hours enrolled for each term, current academic standing, and the amount of other financial assistance, if any, being awarded. The student should allow at least 8 to 10 weeks between submission of the forms to the Office of University Financial Aid and receipt of the loan proceeds.

Unsubsidized Loans
Unsubsidized William D. Ford Direct Loans and Federal Stafford Loans require the same enrollment criteria and feature the same interest rates as their subsidized counterparts. Borrowers are responsible for paying the interest during the in-school and deferment periods. Borrowers may choose to make periodic interest payments to the lender/servicer, or opt to have the accrued interest capitalized (added on to) the principal loan amount. Borrowers who do not qualify for the maximum amount under a subsidized loan may borrow an unsubsidized loan up to the maximum allowable loan amount. The maximum allowable loan amounts for dependent students are $2,625 per year for freshmen, $3,500 per year for sophomores, $5,500 per year for juniors and seniors, and $8,500 per year for graduate students. Independent undergraduate students are eligible for an additional unsubsidized loan in the amounts of $4,000 per year for freshmen and sophomores, $5,000 per year for juniors and seniors, and $10,000 per year for graduate students. Students enrolled in the Schools of Medicine and Dentistry are eligible to borrow an additional...
$20,000 annually. The application process is identical to that for the subsidized loans. Undergraduate students must apply for and have eligibility determined for the Federal Pell Grant and all students must have eligibility for the subsidized loan determined before borrowing an unsubsidized loan. Promissory notes are mailed to the student by the University Office of Financial Aid. Stafford Loan applications are available from lenders and the University Office of Financial Aid.

**Federal Parent Loans for Undergraduate Students (FPLUS)**

Many lending institutions participate in the FPLUS program, through which a parent may borrow on behalf of a dependent undergraduate student up to the difference between the cost of education and any other financial assistance awarded. Students must be enrolled at least half time (6 credit hours per semester), be admitted to or enrolled in a degree seeking program, and be making satisfactory academic progress. Interest and repayment begin 60 days after disbursement of the loan. The interest rate is variable but cannot exceed 9 percent. There is no aggregate borrowing limit. Eligibility is not based on need, but the loan application and a CWRU Application for Financial Aid must be submitted to the Office of University Financial Aid. First time applicants will be required to submit financial aid transcripts from each of their previous colleges or universities attended. The loan applications may be obtained from lending institutions such as banks, credit unions, and savings and loan associations. The student should allow at least 8 to 10 weeks between submission of the forms to the Office of Financial Aid and receipt of the loan.

**Federal Consolidation Loans**

Borrowers with outstanding indebtedness through the William D. Ford Federal Direct Loan Program, Federal Stafford Loan, Unsubsidized Stafford Loan, Federal Supplemental Loan for Students, National Direct Student Loan, Federal Perkins Loan, or Health Professions Student Loan programs may consolidate their loans, provided the loans are not in default or if in default, the borrower must have made satisfactory repayment arrangements with the lender. Consolidation may occur during the repayment period or the grace period preceding repayment.

Limited deferments of principal are available. The variable interest rate is capped at 8.25%. Repayment terms may include graduated or income-sensitive repayment schedules. The repayment period is tied to the amount consolidated and may extend up to 30 years.

Interested borrowers should contact their lenders for additional information and referrals to participating agencies. Borrowers under the William D. Ford Federal Direct Loan program may contact the Servicing Center’s Consolidation Department or the University Office of Financial Aid.

**Outside Loan Programs**

Ohio Supplemental Student Loan Program (Ohio Loans for Ohio Students) Students, parents, or other individuals wishing to assist with educational costs for a student may borrow through this program. The student must enroll for at least two credit hours per academic year and pursue a degree or certificate program. The student must be the primary borrower or a co-signer of the loan. The borrower or co-signer must meet the established credit requirements which include a satisfactory credit history and debt/income ratio which does not exceed 40%. Loan amounts range from $1000 to the difference between the cost of attendance less other financial aid. Undergraduate students may borrow up to $45,000, and graduate students may borrow up to $90,000 (including undergraduate borrowing). Both variable and fixed rate options are available. The variable rate is adjusted quarterly and is based upon the 91-day Treasury Bill rate. The fixed rate for the 2000-2001 academic year is 8.5%. A variable rate option is also available. Loan origination fees range from 4.5% - 6.5% depending upon the repayment option selected. The loans provide for up to five years of in-school deferment of payments, a six-month grace period, and up to fifteen (15) years of repayment. Both standard and graduated repayment schedules are available.

For additional information and application forms, contact the University Office of Financial Aid. Several organizations offer low interest educational loans to students and/or parents. These loans are in addition to or alternatives to the William D. Ford Federal Direct Loan program or Federal Stafford Loan program. Interest rates may be fixed or variable, depending upon the loan program, and in most cases interest payments are required while the student is in school. Capitalization of interest may be possible, but this will result in a larger outstanding loan balance upon repayment. A number of college financing plans for parents involve a line of credit, and may be linked to a home mortgage plan. Among the private programs currently available are CitiAssist Loans; The Educational Resources Institute Supplemental Loan Program (TERI), which also sponsors the PEP loan program for graduate and professional students; the Pennsylvania Higher Education Assistance Agency Alternative Loan Program (PA residents only); the Access Programs for various disciplines; the Law Loans Program (law students only); MBA Loans Tuition Loan Program (students enrolled in Weatherhead School of Management only) and EXCEL and Grad EXCEL sponsored by the New England Loan Marketing Association (Nellie Mae); Dental Access; Medfunds; AADS DEAL (Dental students only) as well as those of many of the larger banks. Contact the University Office of Financial Aid or lender for further information. The following loans are available only to students enrolled in specific fields.

**FRANCES PAYNE BOLTON SCHOOL OF NURSING**

A loan is available through the Ohio League for Nursing. See above for information on this program.

**Ohio Nurse Education Assistance Loan Program (NEALP)**

This program was created to assist the State of Ohio in meeting nursing shortages by providing assistance to students enrolled in approved nurse education programs and to encourage these students to remain in Ohio as they enter the
nursing profession. These loans are available to students pursuing the B.S.N. and N.D. degrees.

Eligibility requirements include
1. Ohio residency
2. U.S. citizenship or permanent residency
3. Acceptance or enrollment in an approved R.N. nurse education program.
4. Demonstration of intent to practice nursing within the State of Ohio after graduation.
5. Owe no refund nor be in default on any state or Federal educational loan or grant.
6. Satisfactory academic record which places student in good academic standing.

NEALP loans are limited to $3,000 per year with an aggregate limit of $12,000. Financial need must be demonstrated through the filing of the Free Application for Federal Student Aid (FAFSA). Upon graduation, a student may be eligible for debt cancellation at the rate of twenty percent (20%) per year for a maximum of four years (80%) if the borrower is employed in the clinical practice of nursing within the State of Ohio.

Borrowers who complete the entire service obligation will be required to repay twenty percent (20%) of the loan plus interest. Borrowers who do not complete the service obligation must repay the entire outstanding loan balance plus interest. Applications are available from the University Office of Financial Aid. The application deadline is June 1st.

**STUDENT EMPLOYMENT**

Case Western Reserve University offers a variety of part-time employment opportunities to its students and recognizes that student employment is a valuable form of financial assistance as well as a practical learning experience. The University has made a commitment to utilize student employees whenever possible. To fulfill this commitment, the Office of Student Employment, a division of the Office of Financial Aid, has been established to centralize information about employment opportunities, provide standardized practices and procedures for employment, prevent discrimination, and increase the number and variety of available jobs on campus and in the community.

**FEDERAL COLLEGE WORK STUDY PROGRAM**

The Federal College Work Study Program is a federally sponsored employment program designed to aid students with financial need. A Federal Work-Study award is awarded as part of the financial aid package and provides the opportunity for job placement and a maximum level of earnings. The Office of Financial Aid determines a student’s eligibility and the amount of the work award. The employer pays a portion of the student’s salary and the Federal government subsidizes the remainder. Employment opportunities are available on campus and with not-for-profit agencies in the surrounding community.

**CAMPUS JOBS**

This program is funded by the University through departments on campus and offers part-time employment to students. Students not demonstrating financial need but interested in securing on-campus employment may apply to the Office of Student Employment. Students not on financial aid who obtain jobs on campus on their own initiative are permitted to work provided there is no student with a financial need qualified and willing to take the job offered. All students working on campus must clear their employment with the Student Employment Office.

**TUITION, ROOM, AND BOARD STABILIZATION**

Case Western Reserve University offers a plan through which students and/or parents are able to protect themselves against future increases in tuition and room and board by prepaying all or a portion of the current tuition and room and board (double room and Carte Blanche meal plan) for the remaining years until graduation. There are two options within the plan:

1. The participant may prepay the remaining years of tuition for the current degree program at the current rate. The tuition rate only in the examples below is for the 2000-2001 academic year and is subject to change:

   **Undergraduate**
   - 4 years @ $20,100 = $80,400
   - 3 years @ $20,100 = $60,300
   - 2 years @ $20,100 = $40,200

   **Sophomore**
   - 3 years @ $22,200 = $66,600
   - 2 years @ $22,200 = $44,400

   **Junior**
   - 2 years @ $22,200 = $44,400

   **School of Law**
   - 3 years @ $22,200 = $66,600
   - 2 years @ $22,200 = $44,400

   **Weathershead School of Management**
   - 2 years @ $28,100 = $56,200

2. Case Western Reserve University will lend the borrower the required amount to prepay the tuition or any portion thereof. The loan repayment schedule is based on the number of years for which tuition is stabilized, and the rate of interest is fixed for the life of the loan. The current rate is 8.00% but is subject to change.

Students who are receiving student financial aid may stabilize a portion of the tuition and fees which is equal to the current tuition and room and board charges less the grants, scholarships, and loans which the student will receive for the first year of the stabilization program, multiplied by the number of years remaining for the current degree program to be completed.

For further information about Tuition Stabilization, contact: Donald W. Chenelle, Director-Tuition Stabilization Plan, 216/368-3866 e-mail dwc2@po.case.edu.

**SATISFACTORY ACADEMIC PROGRESS FOR FINANCIAL AID**

Case Western Reserve University has established guidelines for determining whether students are making satisfactory academic progress for financial aid purposes.

Federal regulations require that in order to receive Title IV assistance, all students must maintain a standard of satisfactory academic progress, as determined
by the University. Title IV assistance comprises the following:

Federal Pell Grants, Federal Supplemental Educational Opportunity Grants, Federal Perkins Loans, Federal College Work Study awards, William D Ford Federal Direct Loans (subsidized and unsubsidized), Federal Stafford Loans (subsidized and unsubsidized), loans under the FPLUS program, and any state grants funded by the State Student Incentive Grant program.

A Case Western Reserve University undergraduate student must satisfy the minimum number of semester hours and earn the minimum cumulative grade point average listed in the table below. A half-time student must have successfully completed one half of the minimum number of semester hours with at least the minimum cumulative grade-point average in the table below:

<table>
<thead>
<tr>
<th>Year at CWRU</th>
<th>Semester Hours Completed</th>
<th>Cumulative Grade-Point Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>21</td>
<td>1.75</td>
</tr>
<tr>
<td>2</td>
<td>43</td>
<td>2.00</td>
</tr>
<tr>
<td>3</td>
<td>67</td>
<td>2.00</td>
</tr>
<tr>
<td>4</td>
<td>91</td>
<td>2.00</td>
</tr>
<tr>
<td>5</td>
<td>115</td>
<td>2.00</td>
</tr>
<tr>
<td>6</td>
<td>139</td>
<td>2.00</td>
</tr>
</tbody>
</table>

(If a student has an uneven number of semesters, then the mid-point between the necessary semester hours completed for the year before and the year after will be the appropriate expectation. For example, if a student has completed five semesters and a determination is required of hours completed, then 55 would be considered satisfactory, i.e., the midpoint between 43 and 67.)

Procedure: If, after two semesters at CWRU, the student fails to meet the criteria for satisfactory academic progress, the student is placed on financial aid warning. While on Financial Aid Warning, a student may continue to receive Title IV aid for one semester. At the end of that semester, if the student is still not meeting the criteria, he or she is placed on financial aid probation. While on Financial Aid Probation, a student may not receive any Title IV aid but may be eligible for other assistance, including university grants-in-aid. If, after a semester on financial aid probation, the student still does not meet the criteria for satisfactory academic progress, the student is removed from all institutional financial aid. A student will be restored to good standing if found to be making satisfactory academic progress at the end of a semester on warning, probation, or separation. However, aid may be restored only once following financial aid separation. Students in financial aid good standing will have their satisfactory academic progress reviewed at the end of the spring semester. Students below good standing will have their status reviewed each semester.

Appeals may be made on grounds of mitigating circumstances; such appeals should be addressed to the associate director of financial aid.

For further details of financial aid policy and procedure regarding Satisfactory Academic Progress, consult the University's Office of Financial Aid.

Graduate and Professional Students

Since each graduate/professional school of the University differs in length of program and in method of evaluation, there is a different method of measuring Satisfactory Academic Progress for Title IV aid for each school, although the same general principles and procedures apply as indicated above. For specific information about how satisfactory academic progress is determined for an individual school or program, please consult the University Office of Financial Aid.
Office of Student Affairs

110 Adelbert Hall
368-2020

The University Office of Student Affairs provides leadership in the development of services and programs that supplement the classroom experiences of university students and enrich student life. The staff of the Office of Student Affairs attempts to promote an environment which provides positive, developmental experiences for all students. Additionally, the office serves as an ombudsman, focusing attention on the rights and responsibilities of students within the university community. The Office of Student Affairs is a central source of information about university policies and procedures that affect student life and co-curricular programs and services. Students should feel free to contact the Office of Student Affairs for resolution of specific problems and for referral to other university offices and campus agencies. Services that the vice president’s office itself offers include orientation, minority affairs, cultural activity ticket drawings, crisis intervention, the judicial/disciplinary process, and needs of most students. Undergraduate residence halls are located on the north and south sides of campus and provide a homogeneous mix by floor with the exception of one hall that is designated all women.

UNDERGRADUATE RESIDENCES

Residence halls for undergraduates are clustered in two separate areas and vary in style and size.

North Residential Village

The North Village residence halls are situated just a few blocks from Cleveland’s renowned museums, cultural centers, and the humanities and social sciences classroom buildings. Eleven residence halls, together with their beautifully landscaped outdoor quad areas, recreational fields and dining commons, make up the North Residential Village and offer students a variety of living arrangements convenient to classes and community resources.

Norton, Raymond, Sherman, Smith, Taft and Tyler make up the Mather area. These buildings feature an open-corridor design in which each floor allows easy access to the community bathroom and floor lounge. These four-story buildings house students on the upper three floors with one floor of women and two floors of men, with the exception of Norton House which houses only women. The ground floor of the Mather buildings provides excellent space for community interaction. A comfortable TV lounge with cable TV, a kitchen and laundry room caters to a wide range of residents’ needs.

Cutler, Hitchcock, Pierce, and Storrs and Clarke Tower are located just east of the Mather complex in the residential area known as the Adelbert Quad. All of these buildings, with the exception of Clarke Tower feature a quad design on the upper three floors with four clusters of five rooms and two community bathrooms. As with the Mather complex, the singles are typically assigned to upper-
class students. Quads are paired with a common bathroom on the same side of the floor, allowing some floors to house both men and women. Just outside the entrance to each quad is a lounge. One is equipped with study tables and the other with couches and chairs. These floor lounges provide the residents with opportunities to socialize and to study. The ground floor of the Adelbert buildings feature a large TV lounge with cable TV in which many residents take time to relax or enjoy social and educational programs offered in the hall. A laundry room, kitchenette and a mailroom are located around the corner from the TV lounge.

Clarke Tower is an eleven-story building at the edge of the village. The floors are designed in a suite layout with four suites of four rooms per floor. Each suite includes two singles and two double rooms that share a living room, bathroom, and kitchenette (sink, small refrigerator, and microwave).

In the center of the North Village community, students can find Leutner Commons, which houses Leutner Dining Commons, where meals are served for all North Village residents, and a convenience store. Wade Commons houses a fireplace lounge in which students can study or meet with friends, a tutoring center, that is open for walk-in tutoring several nights each week and the Wade Area Office for the North Village. The Wade Area Office is the central location for package pickup, filing maintenance requests and room key distribution for the North Village residence halls. Wade World, a game room with video games, pool tables and a large screen TV, and Club W, a fitness room with weight and rowing machines, bicycles and stairmasters round out the Wade Commons facility.

South Residential Village

Seven residence halls, located on Murray Hill Road and Carlton Road, make up the South Residential Village. Glaser, Kusch and Michelson are three high-rise undergraduate halls located on Carlton Road and are known as the Carlton Quad. The three halls are similar in design, each building has six floors with four suites per floor. A suite has six private bedrooms that are arranged off a corridor. The suite shares a furnished living room with bathroom facilities located off the living area. Students gather in the lounges (located on the first floor of each building) to socialize, for programs or other hall activities and to watch cable TV. Additional facilities in each hall include a kitchen, vending machines and a laundry room. One of the greatest attractions to the Carlton Road buildings is the magnificent view of the Cleveland skyline.

Alumni, Howe, Staley, and Tippit are located on Murray Hill Road and are known as the Murray Hill Quad. Similar in structure, Howe and Staley have two suites on each of nine floors. The floor plan for each suite has the bathroom facilities in the center of the suite surrounded by six individual bedrooms and a furnished living room. Alumni and Tippit are the only low-rise buildings in the South Village. Each building has four floors with five suites per floor. Each suite has six private bedrooms that share a furnished living room area and bathroom. The six rooms are arranged in a corridor-style design with the bathroom located off the living room. The four Murray Hill buildings have entrances off a red brick courtyard. Each building has a lounge and recreation area on the first floor where students can gather to watch cable TV or participate in hall activities. Additional facilities include a kitchen, vending machines and a laundry room.

At the end of Murray Hill Quad is Fribley Commons, which houses Fribley Dining Commons, where meals are served for all South Village residents. Also located in the commons are the Fribley Area Office, a fireside lounge and convenience store. The Fribley Area Office is the central location for package pick-up, filing maintenance requests and distribution of room keys for South Village residents.

How to Apply

To apply for a room in the residence halls for the coming year, complete and return a housing application. New room assignments are made (and preferences considered) in the order in which applications are received. Therefore, it is important that once you make your decision to attend CWRU, you return the application as soon as possible. If your application is received after all rooms have been assigned, you will be offered a temporary assignment until a permanent assignment is available. If your plans change and you will not be attending Case Western Reserve University, we ask that you notify the Office of Housing and Residence Life. Your deposit is refundable if we receive written notification for refund by August 1.

Students with Disabilities

Should you have a disability requires special accommodations, contact the Coordinator of Disability Services at 216-368-5230.

Room Rates for 2000-2001

<table>
<thead>
<tr>
<th>Type of Housing</th>
<th>Single</th>
<th>Double</th>
</tr>
</thead>
<tbody>
<tr>
<td>North Village</td>
<td>$3,980</td>
<td>$3,680</td>
</tr>
<tr>
<td>Clarke Tower</td>
<td>$4,060</td>
<td>$3,680</td>
</tr>
</tbody>
</table>

Meal Plan Rates for 2000-2001

<table>
<thead>
<tr>
<th>Type of Housing</th>
<th>Points/semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carte Blanche</td>
<td>$2,835 per year</td>
</tr>
<tr>
<td>Carte Blanche + 100 points/semester</td>
<td>$2,435 per year</td>
</tr>
<tr>
<td>Carte Blanche + 200 points/semester</td>
<td>$2,635 per year</td>
</tr>
<tr>
<td>Carte Blanche + 300 points/semester</td>
<td>$2,835 per year</td>
</tr>
</tbody>
</table>

Graduate Housing

Traditionally, Clarke Tower has been CWRU’s graduate residence hall. Due to an increasing undergraduate student body, much of the graduate space in Clark Tower is now used by undergraduate students. Renovations in the summer of 1999 also decreased the building’s capacity, so graduate housing is very limited. Current projections indicate that approximately 52 spaces (3 1/2 floors) will be available for graduate students in the 2000-2001 academic year.

CWRU Housing & Residence Life

CWRU Residence Life offers a program that complements the rigorous
The lifestyle of the graduate and professional student. The graduate hall provides convenience, security, and social opportunities for residents, while living in an environment with fellow graduate students. Living on campus provides the student an opportunity to study late in the lab or library and take evening classes—all a short walk or a quick campus bus ride home.

Students come to appreciate the convenience of being close to classrooms, libraries, laboratories, and other campus facilities. Others enjoy the opportunity to meet new people and to develop a sense of community with other students.

**North Residential Village & Clarke Tower**

Ten undergraduate halls and Clarke Tower, their recreational fields and commons buildings, make up the North Residential Village. Clarke Tower is a short walk from Leutner and Wade Commons. Leutner houses one of the two residence hall food service facilities, while Wade features a recreation room, fitness center, and study areas.

Clarke Tower is an eleven-story building at the edge of the village. The floors are designed in a suite layout with four suites of four rooms per floor. Each suite includes two single and two large single rooms that share a living room, bathroom, and kitchenette (sink, small refrigerator, and microwave). The basement of Clarke Tower features a large kitchen where graduate students may prepare their meals, as well as a lounge and a laundry room. An optional board plan is also available.

All rooms are single occupancy, and are furnished with a bed (no linen), wardrobe, dresser, desk, and bookshelves. The University also provides basic cable and local telephone service (Students must provide telephone and television).

**CWRUnet Communications Network**

CWRUnet provides access to campus and world-wide information resources. Each student living in a residence hall is able to attach his/her own computer system to a CWRUnet faceplate, providing no-charge access to a host of data communications network services, and to departmental or laboratory computer systems. Off-campus electronic scholarly resources, available on the Internet, are also available to students through CWRUnet.

CWRUnet also provides access to CWRUvideo, the University’s Cable Television Service. The University provides each student a free Educational Package of 26 channels local Cleveland area network affiliates, independent and public broadcasting TV stations; educational, court and government channels; and local CWRU programming. In addition, a student may choose to receive, at a nominal monthly charge, an Entertainment Package of 13 channels of popular general entertainment, movies, sports, music, comedy, and science fiction channels; and/or a premium movie channel, i.e. HBO.

CWRUnet also connects the student to CWRUphone, the University’s Telephone Service. One no-charge feature of CWRUphone is individual voicemail service. A student may choose to participate in the University’s student long distance telephone program, which offers substantial savings over using calling cards and collect calls.

**Other Housing Options**

For students who have a family or prefer off-campus accommodations, the Office of Housing and Residence Life publishes the Off-Campus Housing Bulletin. The bulletin contains apartment and housing listings, roommate wanted advertisements, etc. that are located within a short distance from campus. The bulletin is updated each Friday at noon and can be viewed online by incoming graduate students.

**2000-2001 Room Rates**

<table>
<thead>
<tr>
<th>Room Type</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single Room</td>
<td>$4,170/year</td>
</tr>
<tr>
<td>Large Single Room (limited availability)</td>
<td>$4,670/year</td>
</tr>
</tbody>
</table>

**Availability Dates**

Clarke Tower opens to new residents on Saturday, August 19, 2000 at 900am. Students in programs that require them to arrive earlier may make arrangements to move in 48 hours before orientation begins by contacting our office. Clarke Tower closes at 3:00 p.m. on Monday, May 21, 2001 at 3:00 p.m. Graduate students that do not sign up for the 2001 Summer Housing program must move out of Clarke Tower by that time.

**How to Apply**

Graduate housing applications can be obtained from the Office of Housing and Residence Life. Applicants should read the Residence Hall Agreement and complete an application. The application must be completed, signed, and returned (no faxes) along with a US$275.00 deposit. Applications received unsigned or without the accompanying deposit will not be processed. A deposit refund is available if the Office of Housing and Residence Life receives written notification by August 1, 2000 for occupancy beginning with the fall semester and January 10, 2001 for spring semester. Applicants agree to occupy the assigned room for the entire academic year (or remainder thereof), unless the applicant ceases to be a student due to withdrawal or graduation.

Additional graduate housing information is available on the web site http://housing.cwru.edu/graduate.

**Facilities**

**THWING CENTER**

11111 Euclid Avenue
368-2660

From its prominent position in the very center of Cleveland’s University Circle, Thwing Center overlooks the campus of Case Western Reserve University and Euclid Avenue. The facility is named for Charles Franklin Thwing, who was president of Western Reserve University from 1890 until 1921. Thwing Center provides space for a variety of programs, services, and facilities. The center houses meeting rooms; Charlie’s Place, a cafeteria-style snack bar; the Mather Gallery; the University Bookstore; a postal substation; an elegant ballroom with a vaulted ceiling; lounges for study and programs; the commuter lounge; a share-a-ride board; and the Student Activities Office.
STUDENT ORGANIZATIONS AND ACTIVITIES

Publications
Students may practice journalism and management on any of seven different publications. The undergraduate student newspaper on campus, the Observer, is published weekly. Other campus publications include the yearbook; a literary magazine, Case Reserve Review; a technical magazine, the Engineering and Science Review; an online news magazine/forum, CWRU Triumph, and a humor magazine, the Athenian.

Broadcasting
The University’s student-operated radio station, WRUW-FM 91.1, which operates at 15,000 watts, offers opportunities for any student interested in radio broadcasting and engineering. The Amateur Radio Club also allows students to participate in radio.

The Arts
Students interested in the arts have numerous opportunities for involvement. Eldred Theater offers dance and drama activities. Students interested in the visual arts may work with the Mather Gallery Committee. Students with musical interests may participate in several performing organizations, including the Case Western Reserve University Marching Band, two jazz bands, the Wind Ensemble, the University Circle Chorale, the Collegium Musicum, the Glee Club, and the University Circle Chamber Orchestra. The Department of Music has information on auditions.

Athletics
A variety of intercollegiate and intramural activities is sponsored by the department. Intercollegiate sports for men are football, soccer, cross country, basketball, wrestling, swimming, fencing, golf, baseball, tennis, and track. Intercollegiate sports for women are volleyball, basketball, swimming, track, fencing, tennis, cross country, soccer, and softball. The University is a charter member of the University Athletic Association. Competition in all sports in the Association is available to men and women. The University Athletic Association includes Brandeis University, Carnegie Mellon University, Emory University, Johns Hopkins University, New York University, University of Chicago, University of Rochester, and Washington University. Archery, crew, volleyball, taekwondo, badminton, ultimate frisbee, skiing, racquetball, and ice hockey 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 the undergraduates participate for relaxation, physical fitness, or a chance to improve skills.

Religious Activities
The three staffed campus ministries recognized by the University are the Newman Catholic Campus Ministry, the Hillel Foundation, and the United Protestant Campus Ministries. These centers sponsor worship services and religious education activities, as well as general programs oriented to the interest of all students. In addition, the campus has several other religious organizations open to all students.

Films
An unusually large number of films is shown at the University. The Film Society shows outstanding motion pictures four times weekly, from popular films to foreign art films. The Film Society publishes a calendar of offerings each semester. The CWRU Film Society uses Strosacker Auditorium. It is one of the few university film societies to show films in 70 mm and Dolby stereo. Other student organizations also show films centering on their interests or for special events.

Campus Leadership
The Office of Student Activities has made a commitment to providing a variety of leadership opportunities to CWRU students. The Undergraduate Student Government holds elections each fall for student class representatives of residence hall, commuters, class officers, and fraternity and sorority constituencies. The student government acts as a liaison between the students and the faculty, administration, and other appropriate groups and fulfills legislative and executive functions. The Executive Committee plans the agenda for assembly meetings every other week and sets long-range goals. The Finance Committee recommends recognition and budget allocations for undergraduate student organizations. The Finance Committee also advises the student government on the management of special project funds. The Development Committee works to improve the quality of co-curricular life on campus and maintains a grievance process whereby students may express their opinions. An elected undergraduate representative serves as a voting member of the university-wide Faculty Senate. The Media Board supervises and reviews the operations of all undergraduate student publications and broadcast media. The Media Board, made up of students and faculty advisers, is coordinated by the Thwing Center Administrative Office. The University Program Board (UPB) presents all-campus social, educational, cultural, and recreational activities. Committees made up of undergraduate volunteers program activities in accord with their interests. The Entertainment Committee selects and sponsors singers, bands, and comedians at the Spot, Rough Rider Room, and Thwing Center. The Fine Arts Committee presents jazz, dance, visual arts, and other performing arts programs. The Lecture Committee plans and sponsors lectures by national speakers on topics of significance. The Diversity Programs Committee presents social and educational programs to increase cross-cultural understanding as well as cultural and educational programs concerning racial, sexual, and disabled minority interests. Traditional annual events such as Homecoming, and Family Weekend are planned and presented by the Special Events Committee. All-campus parties and major concerts are planned by the Concert Committee. The Recreation and Development Committee co-sponsors educational programs as well as tickets to major sporting attractions and our annual Hudson Relays weekend. The Interfraternity Congress/Panhellenic Council oversees the activities of the Greek social organizations on campus. In the spring, they plan Greek Week activities and an all-campus party. The Thwing Center Advisory Board serves as an adviser to the director of Thwing Center in making policy and developing facilities.
Students, staff, faculty, and alumni serve as members of the Advisory Board. Each undergraduate class elects officers to plan class activities, and each of the more than 100 student organizations also has officers. The undergraduate residence halls have governments which plan group activities and carry out other responsibilities.

Fraternities and Sororities

Greek life is the largest campus activity at CWRU, involving 30 percent of the undergraduate population in the 23 fraternity and sorority chapters. All of the chapters belong to one of the two umbrella organizations which govern the Greek community and link the chapters to the campus. The Panhellicenian Council coordinates the activities of the five sororities while the Interfraternity Congress governs the 18 fraternities. The Greek community also supports the Order of Omega, a society which recognizes outstanding Greek leaders, and Gamma Sigma Alpha, a scholastic honor society for Greeks with a grade point average above 3.60. The director of Greek life is a full-time staff member who offers administrative, supervisory, counseling and related services to all facets of Greek life. The four national sororities are Alpha Chi Omega, Alpha Phi, Alpha Xi Delta, and Phi Mu; and there is one local sorority, Sigma Psi. The 18 national fraternities are Beta Theta Pi, Delta Kappa Epsilon, Delta Tau Delta, Delta Upsilon, Phi Delta Theta, Phi Gamma Delta, Phi Kappa Psi, Phi Kappa Theta, Sigma Alpha Epsilon, Sigma Alpha Mu, Sigma Chi, Sigma Nu, Sigma Phi Epsilon, Theta Chi, Zeta Beta Tau, and Zeta Psi. Alpha Epsilon Pi and Phi Kappa Tau are colony members of the IFC. Eighteen chapters reside in houses on either the north or south campus. The other 5 chapters reside in residence halls.

Honorary Society

Case Western Reserve has four major undergraduate honoraries. Several more are based on specific fields of interest. Tau Beta Pi and Eta Kappa Nu are engineering honoraries. Mortar Board, a national honorary society for full-time senior students, recognizes scholarship leadership, and service. Phi Beta Kappa, a national honorary society, recognizes outstanding scholarship in the liberal arts and sciences. Outstanding students may qualify for election to membership in the second semester of the senior year. A few specially gifted students may be elected to membership as juniors.

Commuter Life

Commuter Assistants (CAs) contact all new undergraduate commuting students, plan regular programs to introduce commuting students to campus resources and to faculty, and send all commuters weekly electronic mail to keep them informed about campus events and academic deadlines. The Commuter Assistants also publish an Annual Commuter Guide, plan special orientation activities and an annual Commuter Appreciation Day. ESS provides computer access and CWRUnet instructions to undergraduate commuters through the ESS Plain Dealer Electronic Learning Center. The CWRU Commuter Club is funded through the Undergraduate Student Government. Club representatives participate in intramural sports, student government, and other campus activities. The Commuter Club meets in the Commuter Lounge, which provides a place for commuter students to relax and meet friends. The Commuter Lounge is located in Thwing Center West an exterior lounge door is located on the bookstore side of Thwing Center. All commuters are welcome to use the lounge, which includes lockers, a pool table, a television, and a kitchenette with a refrigerator, and a microwave oven.

Disability Services

Disability services are available through Educational Support Services, which serves as the resource center and ombudsman for CWRU students with disabilities. Students with physical disabilities, whether permanent or temporary, can be helped with appropriate supplies and with special arrangements including responsive transportation. Students with diagnosed learning disabilities, attention deficit disorder, and chronic illnesses are eligible for classroom accommodations as well as individual support and advising. The ESS Sight Enhancement Center provides adaptive equipment for students (and Kelvin Smith Library patrons) with visual impairments and learning disabilities.

Student Community Service

The Office of Student Community Service (OSCS) coordinates community service projects that promote student volunteerism and student service learning. The OSCS staff facilitates various service opportunities in the Cleveland community including individual placements, group projects, curricular options, community-based Work Study, and national service (AmeriCorps) opportunities. Supported by foundation, corporate, and federal funding, on-going OSCS projects focus on the environmental, health-related, and educational needs of the local community and frequently address these needs through partnerships with community-based agencies.

UNIVERSITY HEALTH SERVICE

2145 Adelbert Rd
(216)-368-2450

Hours

M,T,W,Fri 8:30 am - 4:30 pm
Thurs 9:30 am - 4:30 pm
Closed weekends and holidays
Appointments(216)-368-4539
On Call Phone(216)-368-2450

University Health Service (UHS) is served by health care professionals whose special interest is in college health. These include board certified nurse practitioners and physician-specialists (internal medicine, pediatrics, family practice), psychologists, psychiatrists, registered nurses, social workers and a licensed dietician.

All students registered for one or more credit hours may use any of the services offered within UHS at no charge. Students who choose to waive the Student Medical Plan are still eligible to use our services without charge. If laboratory tests or x-rays are ordered, then the student will receive a bill from the provider of these services (usually University Hospitals of Cleveland), and they must submit these bills to their own insurance for consideration of reimbursement.

Primary Care

Care for most episodic illnesses (infections, injuries, etc) is delivered by the
staff of the Primary Care Clinic. Students are seen by appointment (there are urgent, same day appointments available every day - the earlier a student calls, the more likely they can be seen the same day.) Whenever possible, we try to have the student receive care from the same provider at each visit, in order to improve continuity of care.

There are several specialty clinics available within UHS during the regular school year. These include Women’s Clinic (for annual gynecologic exams and comprehensive women’s health concerns), Skin Clinic (for treatment of acne, warts, mole removal, etc), and Allergy Clinic. If more subspecialized care is required, students are referred to appropriate physicians in the Cleveland metropolitan area.

Labs/X-ray/EMergency Room

For any of these services that are provided outside UHS (usually by University Hospitals of Cleveland), a student will receive a bill. They must submit a copy of the itemized bill to the CWRU Medical Plan or their own insurance for consideration of payment.

Medications

In some cases, over the counter medications or frequently prescribed drugs are provided without charge to students but only when part of the prescribed treatment plan (we’re not a pharmacy). In other cases, students may receive a written prescription for medications that they may fill at a nearby pharmacy of their choice. If they have the Student Medical Plan, they would pay for these drugs at the time of receipt, and file a claim for possible reimbursement via the Plan benefits.

Hospitalization

In those unusual situations when students require inpatient care, they will be referred to one of the multiple excellent facilities available in the Cleveland metropolitan area. Where this occurs will depend on their medical needs as well as their medical insurance requirements. In occasional instances following hospitalization, a student may be required to meet with a member of the University Counseling Service or UHS staff to determine their ability to return to full campus life.

Notification of Illness

UHS staff will notify a student’s immediate family in case of illness or injury after consent has been obtained from the student. Specific medical information about a student’s illness is confidential and privileged. In cases of life threatening emergencies, notification will be made without prior consent. In other cases, the UHS staff will work with the student to have the student notify their family members, whenever possible. At the student’s request, UHS will also notify the appropriate Dean’s Office about their illness.

On call/After Hours

A nurse, physician, and counselor are available by beeper, 24 hours a day, 7 days a week during the regular fall and spring semesters. They can be reached by calling the main UHS phone at (216)-368-2450. This will reach the Answering Service who can page them. The on-call staff assists students in making decisions about what situations are truly medical emergencies and where best they can access the services that they need. In case of obvious severe illness or injury, students should proceed directly to the nearest Emergency Room and then notify the Health Service later. Students will be billed directly for the services they receive. It is their responsibility to initiate insurance claims for these expenses. Assistance in filing claims for those enrolled in the Student Medical Plan is available within UHS.

Medical Records

Information from a student’s medical record is only available to staff within UHS and not to anyone outside of UHS, without the express written consent of the student. A parent may not access information in this record without the same express written consent of the student.

University Counseling Services records are maintained separately and are only released in accordance with their own policies and procedures. The student’s written authorization is required, except in the case of life-threatening emergencies.

Excuses

If a student must miss a class, a laboratory, or an exam because of illness, it is the student’s responsibility to notify the relevant faculty member directly. UHS does not issue excuses. In circumstances of prolonged illness or hospitalization, UHS (with the student’s permission) may notify the appropriate academic dean.

What We Need from Each New Student

Each new student should receive in the mail a copy of the Medical History and Immunization forms. They should complete these and return them to the Health Service by the deadline noted on the form. (It would be helpful to keep a copy of the Immunization History for your future records, for travel abroad, etc.) The Immunization History may be completed by a family physician, or students may send a copy of their school immunization record.

A tuberculin skin test (Mantoux) is required of all students in the healthcare professions (medicine, dentistry, nursing, applied social sciences, podiatry) as well as all international students. These will be provided without charge after arrival on campus, unless appropriate testing within the past 6 months is documented by a physician.

Students who have not been immunized because of illness or religious beliefs should document that for our records. In some instances, they might be excluded from classes and residence halls in the event of an outbreak of a vaccine-preventable disease.

Student Medical Plan

The Student Medical Plan provides coverage, within the stated guidelines, for medical services rendered outside the University Health Service (typically lab tests, x rays, prescriptions, hospitalization, etc). A fee for this Plan is automatically billed each fall and spring semester to all students enrolled for one or more credit hours. Students with alternative coverage for such expenses may waive the Student Medical Plan by indicating this as they register for courses online or by signing a waiver form, noting their insurance on the waiver form. Waivers may be obtained in the Student Accounts.
Receiveable(SAR) Office or at UHS. Waivers must be submitted each semester and received by SAR prior to the deadline stated for that semester.

When a student is enrolled for the Medical Plan in the spring semester, coverage automatically applies through the summer until mid August.

Students taking a leave of absence because of a personal medical condition may be eligible to extend that coverage one additional semester, if already covered by the Plan (inquire at UHS for further information 216-368-3050).

For additional information about the Student Medical Plan, go to the UHS website (www.cwru.edu) or telephone us at (216) 368-3050. All students should receive a brochure about the current Student Medical Plan yearly. Additional copies may be obtained by calling 216-368-3050.

**Dependent Coverage**

Information regarding optional medical coverage for dependent spouse, domestic partner, or children is available at UHS.

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**University Counseling Services**

**Sears Library Building, 2nd floor**

(216)368-5872  
**Mental Health Service**  
**University Health Service**

(216) 368-2510

University Counseling Services (UCS) provides individual, group and couples counseling, psychological/learning disabilities testing and referrals for all undergraduate, graduate, and professional school students and their spouses or partners. In general, these services are offered on a short-term basis (usually 12 or fewer sessions) to help students make adjustments in their personal, social, and educational areas of life.

There are two locations where appointments can be made. The Counseling Service in the Sears Library Bldg., 2nd floor (368-5872) or the Mental Health Service at the University Health Service (368-2510). Both services are staffed with professional social workers, counselors, psychologists, psychiatrists, and substance abuse intervention and prevention specialists who are experienced in helping college students with their concerns. In addition, the staff understands the need to maintain confidentiality. Therefore, the counselors at the UCS will not disclose information to any other party, e.g., faculty, parents, future employers; the release of information without the student's written consent would occur only in cases of imminent danger or harm to one's self or others and in emergency situations.

Free workshops and seminars are also offered each semester on topics including test anxiety management, stress reduction, couples enrichment, overcoming shyness, and eating disorders. Also, the annual Sex, Drugs, and Rock n' Roll Conference is a unique presentation of this office.

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**Educational Support Services**

105 Kelvin Smith Library  
216/368-5230  
216/368-8826 (fax)  
http://ess.cwru.edu

Educational Support Services (ESS) assists students in all phases of their academic development. Through advising, tutoring, group programs, and individual consultation, the ESS staff provides opportunities for academic assessment and self-improvement. ESS also coordinates programs addressing the academic and adjustment needs of specific student populations, first-year students, participants in CWRU’s Minority Scholars Program (MSP), commuting students, and students with special needs. ESS utilizes a large team of trained student paraprofessionals. Learning Assistants (LAs) serve as ESS representatives in the residence halls, working with Residence Life staff to provide special support and outreach to residential students. Technical Assistance Center (TAC) assistants lead programs and help residence hall students with computer-related questions. Commuter Assistants (Cas) address the needs of first-year commuting students through individual contacts, programs, and newsletters. Peer Assistants (PAs) work together to plan and coordinate activities for their assigned PA families, groups of first-year Minority Scholars Program students. In addition, ESS employs a large corps of carefully selected and trained student tutors who function as individual tutors, walk-in tutors, and supplemental instruction leaders.

The Office of Student Community Service (OSCS) coordinates community service projects that promote student volunteerism and student service learning.

The ESS Plain Dealer Electronic Learning Center (PDELC), a center in Kelvin Smith Library that houses fully networked computers and printers, is staffed by trained student assistants. The PDELC is open to all CWRU students, providing access as well as assistance. The PDELC student assistants are trained to be able to provide information and assistance on a range of software applications. Two student groups, students participating in MSP and students who commute to campus, are eligible to receive PDELC computing systems and to receive free academic printing.

The Office of Commuter Services serves undergraduate commuting students offering programs, activities, regular email correspondence, and a Commuter Lounge in Thwing Center.

Peer tutoring is offered, without charge, in all undergraduate course work. Tutors are CWRU undergraduate and graduate students. These student-tutors must demonstrate excellence in their academic subject area, have a faculty recommendation, and attend training sessions in basic study skill techniques, test-taking tips, and time management ideas. Individual tutoring is available in undergraduate courses. In many subjects, tutoring appointments can be scheduled on-line at http://ess.cwru.edu/tutor. Walk-in tutoring clinics, staffed by experienced tutors able to assist with selected core courses, operate evenings in the residence halls. In addition, ESS provides Supplemental Instruction (SI) sessions for designated courses. SI leaders are carefully selected student tutors who attend the assigned course and lead interactive review sessions.

Disability services are available through Educational Support Services, which serves as the resource center and ombudsman for CWRU students with disabilities.
Graduate testing at CWRU is overseen by ESS, which oversees computer-based testing for Educational Testing Service as well as various paper and pencil exams. ESS provides information and application materials for the GRE, GMAT, MCAT, LSAT, Miller Analogies Test, and the TOEFL.

ACES, the Academic and Computing Excellence Seminar, is a noncredit program developed by the Office of Educational Support Services. The course is offered in the summer and at the beginning of each semester and helps students develop effective study strategies and confidence using CWRU.net. The course includes assessment, classroom instruction, and use of the PDEL. Summer ACES is a residential program designed for incoming freshmen.

University Studies (UNIV) 400 is the non-credit course required for all graduate students who assume or will assume instructional responsibilities for any CWRU undergraduate course. Educational Support Services coordinates UNIV 400.

**UNIV 400A. Professional Development for Graduate Teaching Assistants (TAs).**
An orientation and a series of seminars for new TAs designed to develop skills in communication and teaching. Successful completion requires attend the campuswide TA orientation and a minimum of three of the seminars offered throughout the year. Required of students with graduate appointments that include instructional responsibilities.

**UNIV 400B. Professional Development for International Graduate Teaching Assistants (ITAs).**
In addition to satisfying the requirements of UNIV 400A, ITAs are required to attend a special half-day ITA orientation and to participate in an evaluation of spoken English, the SPEAK evaluation.

**UNIV 400C. ITA Communication Skill Development.**
Small group, interactive course that concentrates on American culture, pronunciation, idiomatic usage, and English grammar. Required of all new ITAs who do not meet the minimum requirements on the SPEAK evaluation.

**CAREER PLANNING AND PLACEMENT**
206 Sears Library Bldg.
216.368.4446
fax 216.368.4759
www.cwru.edu/staff/cpp

Career Planning and Placement (CP&P) offers individualized assistance and technologically advanced resources to enable students and alumni to develop lifelong career management skills, to obtain work experience, and to integrate academic and career plans. CP&P offers programs and resources to address career issues such as
- Identifying career interests and related options
- Learning more about specific career fields
- Choosing a major and setting career goals
- Applying for admission to graduate and professional studies
- Obtaining relevant work experience through Internships, Practica, and summer employment
- Targeting and researching prospective employers
- Preparing effective cover letters, résumés, and other written communications
- Identifying current job openings
- Preparing for interviews
Specific services and resources include
- Individual career counseling and job search guidance
- Career exploration programming and special services for 1st-year and undecided students
- Andersen Consulting Career Resource Library
- Occupational information, career references, computer workstations, and more
- www.cwru.edu/staff/cpp
- Comprehensive website of career/employment resources
- Career Search online database of nearly one million prospective employers nationwide
- JOBTRAK position listing service on the World Wide Web
- Videotaped mock interviews
- On-campus interviewing opportunities, resume referrals, and annual job fairs
- WILL Externship Program for women students
- Practicum and Internship Programs
- Credential files service for graduate/professional school or employment

**INTERNATIONAL STUDENT SERVICES**
Sears Library Building, 2nd floor
216/368-2517

The Office of International Student Services assists all foreign students with non-academic concerns. The office acts as a liaison with off-campus agencies, such as the U.S. Immigration and Naturalization Service, the U.S. Department of State, embassies, educational consular offices, the International Institute of Education, and Fulbright-Hays grant offices. The staff serves as advocates for international students, with the goal of ensuring that each student has the best possible educational, cultural, and personal experience at Case Western Reserve University. A goal of the office is to ensure that interchange occurs with all members of the academic community. A total of 83 different countries are represented on campus. A special orientation is held for newly arrived students every fall, and a year-long program enhances the life of the international student at the University. The office sponsors an International Club for all students, an annual international dinner, cross-cultural workshops, a student lounge and study room, field trips, and several social gatherings. A newsletter is published at least three times a year. A number of nationality-based student groups provide students with opportunities to meet other students with similar experiences. Case Western Reserve University has been authorized under federal law to enroll non-immigrant alien students on both F-1 and J-1 visas.
Minority Programs

116 Baker Building
368-2904

Minority Engineers Industrial Opportunity Program

The Minority Engineers Industrial Opportunity Program (MEIOP) is part of a national effort to increase the number of minority engineers. The pre-college phases of the program include an early exposure to engineering programs for 9th through 11th graders and a summer session for 11th graders that consists of intensive academic preparation, laboratory experience, and career exploration activities. The undergraduate phase of MEIOP provides participants with summer courses for incoming freshmen, study laboratories, workshops, counseling, and tutoring. Financial assistance and summer employment opportunities are offered to students selected by the industrial sponsors of MEIOP. Although the program cannot guarantee all participants a summer job or an industrial sponsor, most receive some form of financial assistance through the program or the Incentive Grants Program of the National Action Council for Minorities in Engineering (NACME, Inc.). Individual awards generally range from $250 to $2,000 per year. These grants are considered part of the student’s financial resources in the determination of his or her financial need. Details of available financial assistance can be obtained from the Office of Financial Aid. MEIOP provides a strong support system for its participants. Its goals are to attract talented minority students to the engineering profession and to ensure the academic success of those who pursue engineering degrees in the University.

Industrial Sponsorship

A company that chooses to sponsor a MEIOP student will provide:
1. Summer work experience in engineering.
2. Grants-in-aid of up to $1,000 during each of the first two years of the student’s study at Case Western Reserve University, and
3. Grants-in-aid of up to $2,000 during each of the student’s last two years; also support for one additional semester if required by the student to complete the B.S. degree.

Eligibility

Minority students enrolled in the 8th through the 11th grades who have strong academic records and a genuine interest in engineering are eligible for participation in the MEIOP early exposure and pre-college programs. For purposes of these programs, minority students are defined as African Americans (American Indians, African Americans, and Hispanics-those minority groups under-represented in engineering. Any minority student pursuing an engineering degree may apply for admission to the undergraduate phase of MEIOP. Information concerning application and admission to MEIOP can be obtained by writing to or by calling the Director of Multicultural Affairs, or telephoning 216-368-2904.

Minority Scholars Program

The Minority Scholars Program (MSP) is a University-wide strategy for minority recruitment, retention, and advancement into graduate and professional schools. MSP provides a network of student services available throughout the University, but centrally administered and coordinated to ensure that minority students’ interests and needs are addressed. The basic elements of the Minority Students Program include a pre-freshman summer program, fall orientation, educational support services, individual tutoring, master tutor study groups, a reading and learning strategies course, student tracking and referral, counseling, social and cultural enrichment programs, and professional career preparation. The Minority Scholars Program permeates the entire University. It involves students, faculty, administrators, and staff working together to create a campus environment that promotes intellectual development, independent thinking, self-confidence, and appreciation of racial and cultural diversity.

Eligibility

Members of minority groups under-represented in higher education (African Americans, Hispanics, Native Americans, Eskimos, and Pacific Islanders) are eligible for participation in the Minority Scholars Program. Any minority student applying for admission to the Undergraduate Colleges of Case Western Reserve University can also apply to the Minority Scholars Program. Further information about the program and MSP application materials can be obtained by writing to the Director of Multicultural Affairs, or telephoning 216-368-2904.

Access/TRIO Programs

(Upward Bound/SPPSHP and Talent Search)
131 Yost Hall
368-3750
368-6640

Upward Bound/SPPSHP

The Upward Bound/Special Program for Preprofessional Students in the Health Sciences (SPPSHP) is the oldest of the existing minority programs at Case Western Reserve University. Established in 1966, the program is designed to prepare low-income and potential first-generation college high school students for successful postsecondary studies directed toward professional health careers. High school students, grades nine through twelve, attending Cleveland and East Cleveland Public Schools are eligible for participation in the program. The program is year-round and includes a six-week summer residential component and a well developed academic year component.

During the summer, in a simulated college environment, students reside in University residence halls, receive intensive academic instruction in mathematics, natural sciences with laboratory, English, reading, study skills, computer science, and foreign languages, and participate in the Health Careers Internship Project (summer jobs at local health facilities) or a community service project. During the academic year, students participate in the Saturday Enrichment Program (academic courses), attend weekly tutorials, and participate in rap sessions directed toward personal growth and development. New students entering mid-year participate in the Health Careers Exposure Program (career exposure) and tutorials. College planning and placement assistance, the SAT/ACT Review Program (Math and English components), instruc-
ticipation of males is encouraged. Ser-
eligible youth, the recruitment and par-
strate a need for services provided by the
families. All participants must demon-
bachelor's degree) and from low-income
whom the student lives does not have a
college students (the parent(s) with
Cleveland and attend East Cleveland
middle and high school students (elemen-
tions.
The Project is funded to serve 600
students at Kirk Middle School. Services are
also offered to the District’s 9th through
12th graders at Shaw High School.
Project staff provide services on site in
the schools providing greater accessibility
to participants. Services will also be pro-
vided at Case Western Reserve Univer-

Student Rights and Responsibilities

The following rules are designed to pre-
sure freedom of expression and associa-
tion on the Case Western Reserve cam-
pus and to reaffirm the civil, personal,
and property rights of the University and
its members. University members who
violate one or more of these rules will be
subject to disciplinary action. Conduct
which is subject to University disciplinary
action includes
1. Interference with freedom of speech
or movement, or intentional disrup-
tion or obstruction of teaching, re-
search, administration, or other func-
tions on University property.
2. Actual or threatened physical or men-
tal HARM OR abuse of any person
on University premises or at functions
sponsored or supervised by the Uni-
versity.
3. Refusal to comply with the directions
of University officials, instructional or
administrative, acting in performance
of their duties.
4. Theft or vandalism of University prop-
erty or that of a member of the Uni-
versity community or a campus visitor.
5. All forms of dishonesty, including
cheating, plagiarism, knowingly fur-
nishing false information to the Uni-
versity, forgery, and the alteration or
misuse of University documents,
records, or instruments of identifica-
tion.
6. Unauthorized carrying or possession
on University premises of firearms or
of any weapon with which injury,
death, or destruction may be inflicted.
7. Violations of civil law on University
premises or in connection with Uni-
versity functions.
8. Violation of published University
rules and regulations.
There are also other specific rules and
regulations within the University and its
components, violations of which are
subject to disciplinary action. Any
member of the University community
accused of violating a rule or regulation is
entitled to adequate notice of all charges
and to a fair hearing. While the
University’s rules and regulations exist to
affirm the special values and functions of
the academic community, it should be
noted that, as citizens, all members of the
University are subject to civil laws, in-
cluding those governing the use of alco-
hol and drugs.

GUIDELINES ON ALCOHOL

The University will conform to all state
and local laws controlling the sale and
use of alcoholic beverages. It is illegal to
sell, provide, or serve beer, wine, or li-
quor to anyone who is under the legal age
(21). Servers of alcohol and sponsors of
social events must be aware of and com-
ply with all state statutes and with
CWRU policies and procedures. The fol-
lowing regulations apply to all events at
which students are present.
1. The sponsors of events where alcohol
is served must file a CWRU Alcohol
Use Permit in the Office of Student
Affairs at least three business days
prior to the event. A copy of this form
will be needed for student groups to
reserve any University facility for
events where alcohol is served.
2. Open containers of alcoholic bever-
gages are generally prohibited in public
places according to state law and are
specifically restricted in some Univer-
sity areas including Squire Valleevue
Farm, Harkness and Amasa Stone
Chapels, and at University athletic
events.
3. At all events where alcohol is served,
an effective procedure must be estab-
lished and adhered to for certifying
those legally of age to drink. To obtain
alcoholic beverages a valid driver’s li-
When beer is provided, it must be served in appropriately sized glasses.

When wine or liquor is provided, it must be served in containers of 16 ounces or less.

When alcohol is served, food must be provided by the sponsor of the event. The amount of alcoholic beverage provided should reflect the proportion of those attending the event who are legally eligible to drink; the amount of non-alcoholic beverages provided should be sufficient to serve the number of people attending the event who are too young to drink or choose not to drink alcohol.

When alcohol is sold, temporary F or F-2 permits will be required in accordance with state laws. The sale of alcohol is defined to include such methods for defraying the cost of the beverage or event as sale by the glass or container, advance ticket sales, and cover charges at the door.

At all events where alcohol is served, non-alcoholic beverages must be provided by the sponsor of the event. The amount of alcoholic beverage provided should reflect the proportion of those attending the event who are legally eligible to drink; the amount of non-alcoholic beverages provided should be sufficient to serve the number of people attending the event who are too young to drink or choose not to drink alcohol.

No one should be coerced, even subtly, to drink or overindulge, and the rights of those who choose to abstain must be respected.

When alcohol is served, food must be provided by the sponsor of the event in adequate amounts to last through the event.

The kind and amount of security required for an event will be determined according to the following factors: the nature of the event, the number of people attending the event, whether an alcoholic beverage is served, and whether cash will be on hand.

Social events which encourage drinking or drunkenness as themes and the advertisement of such events are considered inappropriate and will not be permitted. Neither the cost nor brand of alcoholic beverage may be advertised in Ohio.

When beer is provided, it must be served to individuals in single servings in containers of 16 ounces or less. Wine or liquor is provided, it must also be served in appropriately sized glasses.

The serving of alcohol must cease at least one-half hour before the scheduled end of an event.

When entertainment is included in the event, the type of entertainment and the duration must be listed on the Alcohol Use Permit.

The gift of alcohol as a reward for any student activity or contest is prohibited.

Individuals or groups violating state law or University student alcohol policy will be subject to disciplinary action. Additional information on the Student Alcohol Policy and the University’s commitment and expectation are included in the CWRU Student Services Guide.

Case Western Reserve University has established a mechanism whereby students of the University may express a grievance against the actions of other students or members of the faculty. Details of the grievance procedure are included in the CWRU Student Services Guide, an annual publication of the University Office of Student Affairs. Students who wish to have a specific problem reviewed should contact Student Affairs.

The University Appeals Board has jurisdiction over student appeals of disciplinary actions. Appeals to the board must be presented in writing to the Vice President of Student Affairs. The board normally reviews the case on the record alone.

CWRU has the responsibility to provide its students, employees, and the public with the safest environment possible. The University also has an interest in promoting the highest standard of health and welfare among its students, staff, and faculty. It is therefore the policy of Case Western Reserve University to discourage the use of controlled substances. The unlawful manufacture, distribution, dispensation, possession, or use of a controlled substance is prohibited in and on property owned or operated by Case Western Reserve University. Further information regarding the University’s drug policy is available in the CWRU Student Services Guide.

Case Western Reserve University is a community dependent upon trust and respect for its constituent members—students, faculty and staff. Sexual assault is a violation of that trust and respect—it will not be tolerated. The University strongly encourages persons who have been sexually assaulted to report the assault, to seek assistance and to pursue judicial action or sanctions for their own protection and that of the entire campus community. Complete details on the University’s policy and reporting procedure are included in the CWRU Student Services Guide, published annually by the University Office of Student Affairs.

As a matter of public policy, the University is dedicated to providing a safe and healthful environment. In addition, the University has substantial commitments to health-related research and teaching. Thus, the Case Western Reserve University community has a particular obligation to be sensitive to health-protection issues. Case Western Reserve University permits no smoking in its facilities with the exception of residence hall rooms. Smoking is permitted in residence hall rooms only if it is acceptable to all of the assigned occupants. It is permissible to smoke on campus grounds; smokers are asked to use urns provided for ash and butt disposal and to respect the rights of non-smokers at public gatherings on the grounds.

Case Western Reserve University will consider for admission highly qualified students who are not citizens of the United States. An international student who is admitted to study at the University generally aces problems of living in a different cultural environment under an unfamiliar academic system. It is anticipated that the student can solve he prob-
lems if he or she has an excellent academic record, understands rapidly spoken English and can speak, read, and write English with facility. In addition to completing the regular application materials, a student from another country must take several additional steps.

FINANCIAL RESOURCES

Each applicant must submit a financial plan itemizing sources of funds for education, including maintenance and expenses, exclusive of transportation, or a one-year period. Funds may come from scholarships, fellowships, assistantships, sponsoring agencies, the student’s family, or any other dependable source. As a guide to budgeting, the University has established a figure of $10,500 (U.S.) as the minimum needed to meet the total cost of one calendar year of study, not including tuition. At the present time, the only financial aid available to graduate students from other countries is a limited number of tuition grants and assistantships provided by certain departments or the University. These grants are made available only to unusually well-qualified students. A decision on these awards is made only after a decision on acceptance to the University. CWRU does not grant any financial assistance to undergraduate international students. An international student may want to arrange for a sponsor who will provide full financial assistance. Such a sponsor must document fully his or her ability to support the student, including the cost of tuition and fees, room and meals, books, incidentals, and travel expenses. The University cannot predict what individual expenses will be. Refer to the “Financial Information” section of this Bulletin. Costs for tuition and room and board are subject to change and do not reflect travel costs.

TRANSFER OF FUNDS

Before the student leaves his or her home country, it is very important to inquire about the regulations regarding the transfer of funds. In addition to expenditures for travel, the student should have at least $1,200 (U.S.) on arrival in Cleveland to meet initial expenses. Foreign bank drafts made out to Case Western Reserve University may take as long as one month to redeem (cash) at this university. It is advisable to draw a draft on a bank located in the United States. Traveler’s cheques are recommended in place of currency.

EMPLOYMENT

International students on F-1 or J-1 visas may work on campus provided they (1) maintain status and (2) do not work more than a total of 20 hours per week while school is in session. They may be employed on campus full-time during holidays and vacation periods provided they are eligible and intend to register for the next school term.

ENGLISH REQUIREMENT

Applicants from other countries must be able to speak, read, write, and comprehend English. A score of at least 550 on the Test of English as a Foreign Language (TOEFL) or completion of ELS Language Center, Level 109, at Case Western Reserve University is a mandatory requirement for admission and must be on file before registration will be permitted. Students may be retested on arrival at CWRU. The TOEFL test was introduced as a computer-based test in July 1998 in many parts of the world. Sylvan Learning Systems, Inc. administers the computer-based test year-round at permanent testing centers throughout the world. In addition, testing is offered at supplemental centers on specific dates or during specific time periods. For testing at supplemental centers, students must obtain the “Information Bulletin for Supplemental TOEFL Administrations” from TOEFL Services.

ToEFL Services
P. O. Box 6151
Princeton, New Jersey 08541-6151
U.S.A.
http://www.toefl.org

Information bulletins are also available overseas at the Institute of International Education overseas branch offices; at the American-Korean Foundation in Seoul, Korea; at many U.S. embassies, binational centers and USIS centers; and at many universities. Applicants are exempt from the TOEFL requirements if they (1) speak English as their native language; (2) have completed a bachelor’s degree or higher at a foreign university where the instruction was in English; (3) qualify for admission on the basis of U.S. high school graduation (rank in class and SAT scores); (4) have completed six semester hours of sophomore level English literature in a U.S. college or university; or (5) have earned a bachelor’s degree or higher in a U.S. college or a university with instruction in the English language. Applicants who are required to submit TOEFL scores may be tested again for English placement before they are permitted to register.

MEDICAL INSURANCE

All students must carry medical insurance. No exceptions are allowed. Refer to “University Health Service” for details.

PASSPORTS AND VISAS

When accepted by the University, the student will be sent a letter of admission and the appropriate form by which he or she may obtain a student visa for entry into the United States. The form for the U.S. visa will be issued by the Office of International Student Services only on receipt of a statement indicating sufficient financial support (for example, a letter of award of scholarship, a bank statement of deposited funds, or an affidavit of support) for one full year of tuition and living expenses. Students who are admitted as transfers from other U.S. colleges will be contacted by the Office of International Student Services as to the procedures to be followed. To meet U.S. government regulations, a graduate student on an F-1 or J-1 visa must take at least nine semester hours of University work for credit. An undergraduate must register for at least 12 credit hours.

APPLICATION

An application should be submitted by May 1st for Fall admittance and by November 1st for Spring admittance. Certified translations of academic credentials into English should be submitted with the official copies of all credentials. Initial undergraduate inquiries should be submitted to Office of Undergraduate Admissions Case Western Reserve University 10900 Euclid Ave. Cleveland, Ohio 44106-7055 U.S.A
THE ELS LANGUAGE CENTER

Case Western Reserve University has an ELS Language Center that offers intensive four-week sessions in English as a second language to college-bound students from other countries. Every week students receive a total of 30 hours of instruction, providing a rich language learning experience. The four-week duration of each session makes scheduling the programs easy and allows each person to enroll for as long as he or she needs four weeks, eight weeks, or more. Admission to courses is open to persons who can devote full time to an intensive language-learning program. Only persons who can give evidence of suitable academic background, adequate financial resources to cover living and school expenses, and seriousness of purpose will be approved for admission. The ELS Language Center is authorized to enroll non-immigrant foreign students. On approval of an application, a Form I-20 (Certificate of Eligibility) will be sent, which, upon receipt, should be taken to the nearest U.S. embassy or consulate to apply for a student visa. For more information check our web site athttp://www.els.com/clevelan.htm or e-mail us at Cle@els.com

Address mail inquiries to ELS Language Center Case Western Reserve University Stone Commons 10900 Euclid Ave. Cleveland, Ohio 44106-7059 U.S.A.

SPECIFIC SCHOOLS AND COLLEGES

Many of the schools and colleges of Case Western Reserve University have regulations regarding the admission of students from other countries in addition to those listed above.

Applied Social Sciences

Applicants from other countries follow the regular application procedure. The bachelor’s degree requirement may be waived if the school evaluates an applicant’s academic records as the equivalent of an American bachelor’s degree. The admission policy for students from other nations suggests that they have completed available social work training in their own countries and have had paid experience in the social welfare field in their countries before entering the professional degree program at the Mandel School of Applied Social Sciences. Applicants from other nations will be required to furnish evidence of their ability to speak, read, write, and comprehend English. The usual test is the Test of English as a Foreign Language (TOEFL) administered by the Educational Testing Service, Princeton, New Jersey, U.S.A. Results of this test must be forwarded to the Office of Student Affairs. 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. All students from other nations must pay the health service fee and purchase the medical insurance policy. No exceptions are allowed. The applicant must submit a financial plan itemizing sources of funds for education, including maintenance and transportation, for a two year period. As a guide in budgeting, the University has established a figure of $32,000 (U.S.) (including tuition) as the minimum needed for a graduate student to meet the total cost of one calendar year of study (summer tuition not included). At the present time, no financial aid is available from the school to students from other countries.

Management

Only those applicants from other countries who have an undergraduate educational equivalent to that required for a bachelor’s degree from an accredited institution in the United States will be considered for admission to the Weatherhead School of Management. Candidates with a three year bachelor’s degree will not be considered for admission unless they have also completed further education for which they have received a degree or diploma, or have completed significant professional work experience (minimum two years). The school requires the results of performance on the Graduate Management Admission Test and the Test of English as a Foreign Language. (TOEFL). The GMAT and the TOEFL are administered daily at testing centers throughout the world. Application forms and information bulletins can be obtained by writing to Graduate Management Admission Test 500 W. Washington St. Princeton, New Jersey 08540 or from their website at: http://www.gmat.org.

All applicants from other countries are required to pay the $350 application fee. Requests for application materials and all correspondence, transcripts, and documents supportive of an application should be forwarded to Admission Office 310 Enterprise Hall Weatherhead School of Management Case Western Reserve University 10900 Euclid Ave. Cleveland, Ohio 44106-7235 (216) 368-2030

Applicants to the J.D./M.B.A. program must meet all of the admission requirements of both the School of Law and the School of Management. These applicants should write the admission offices of both schools for bulletins and application forms and should indicate on both applications that they are applying for the joint J.D./M.B.A. program. Separate application fees of $50 (by the School of Management) and $40 (by the School of Law) are charged. Candidates must take the Law School Admission Test (LSAT) as well as the GMAT. The results of the LSAT are sent to the School of Law and the results of the GMAT are sent to the School of Management. Information about the LSAT may be obtained from Law School Admission Council Box 2000 Newtown, Pennsylvania 18940 or check their web site at http://www.lsac.org or from the School of Law.

Nursing

Students who hold baccalaureate degrees in the arts, humanities, social sciences, or natural sciences are eligible to apply to the Doctor of Nursing (N.D. program). A professional nurse who is licensed in another country and has an undergraduate education equivalent to a
B.S.N. from an NLN accredited institution in the United States may seek admission to the M.S.N. or Ph.D. program as a degree candidate or may study as a "special" student for one year. All applicants seeking degree and special student status must fulfill the admission requirements of specific programs presented in this bulletin. Additional requirements are as follow:

1. An application should be submitted approximately one year before the desired date of enrollment. English translations should be submitted with the official copies of all credentials. Deadlines for credentials are June 1 for fall, October 1 for spring, and March 1 for summer.

2. Each applicant must submit evidence of ability to speak, read, and write English by successfully completing the Test of English as a Foreign Language (TOEFL) administered by the Educational Testing Service, Box 899, Princeton, New Jersey 08540. This test is given at testing centers in many cities throughout the world. Testing dates are prescheduled for one year. Arrangements may be made to take the TOEFL by writing directly to the above address. Students whose native language is English are exempt. Preference is given to applications with a TOEFL score of 550 or higher.

3. Each applicant must present evidence of adequate financial resources to meet the expenses of full time study and to cover travel expenses to and from Cleveland. Financial assistance is not available from the Frances Payne School of Nursing. The student may need to arrange for a sponsor who will provide full financial assistance. The sponsor must document fully his or her ability to support the student, including the costs of tuition and fees, room and meals, books, incidentals, and travel expenses. Once an applicant is admitted to the school, he or she is provided with a student visa application form. For a student whose native language is not English, attendance at a language institute in the United States is highly recommended during the spring or summer preceding initial enrollment in the fall semester. For further information write to

Office of Student Services
Frances Payne Bolton School of Nursing
Case Western Reserve University
10900 Euclid Ave.
Cleveland, Ohio 44106
(216) 368-2529

Undergraduate
Whenever possible, the student should submit aptitude test results from either the Scholastic Aptitude Test or American College Test.
Academic Programs
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<th>Professional/Graduate</th>
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<td>Master of Accountancy/ Master of Business Administration</td>
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<td>in Accounting</td>
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<td>in Engineering</td>
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<td>Doctor of Philosophy8</td>
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<td>Banking and Finance</td>
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* Admission suspended
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<td>Clinical (Child) Psychology</td>
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<tr>
<td>Contemporary Dance</td>
<td>Master of Fine Arts</td>
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</table>

a. Joint program with Cleveland Institute of Art.
b. Available only as a second major.
c. Joint program with Cleveland Institute of Music.
d. Includes dietetics.
e. See clinical (child) psychology, clinical (adult) psychology, developmental psychology, experimental psychology, and mental retardation research psychology.
f. The Undergraduate Scholars Program provides for individually defined and structured curriculum and permits the awarding of a degree in a particular curriculum without such curriculum being formally established.
g. The Medical Scientist Training Program.
h. Combined degree by special arrangement for selected students who hold acceptances in the School of Medicine.
i. Degrees conferred jointly by the Mandel School of Applied Social Sciences and the Weatherhead School of Management.
j. Available as the undergraduate portion of the Bachelor of Science in Engineering/Master of Science program.
k. Available as the graduate portion of the Bachelor of Science in Engineering/Master of Science program.
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\(^a\)Doctor of Medicine
\(^b\)Doctor of Philosophy
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</table>

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</tbody>
</table>

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<th>Professional/Graduate</th>
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Undergraduate Studies
Undergraduate Studies

PROGRAMS, REQUIREMENTS AND REGULATIONS
Office of Undergraduate Studies
102 Baker Building
Phone 368-2928; FAX 368-4718
E-mail: xx142@po.cwru.edu
Web page: http://www.cwru.edu/provost/ugstudies/undstud.htm

ADMINISTRATION
Margaret B. Robinson, M.A. (State University of New York at Stony Brook)
Dean of Undergraduate Studies
Timothy M. Dodd, M.A. (Fordham University)
Associate Dean of Undergraduate Studies
Randall A. Williams, M.S. (University of Rochester)
Assistant Dean for Freshmen
Claudia C. Anderson, B.A. (Youngstown State University)
Director of Degree Audit and Data Services
Joanne Westin, Ph.D. (Cornell University)
Pre-Medical Adviser
JoAnne Urban Jackson, J.D. (Northwestern University)
Pre-Law Adviser

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 an undergraduate education that provides students with the cumulative learning achieved through the completion of a traditional disciplinary major accompanied by the establishment of an informed acquaintance with the natural sciences, literary and artistic achievements, historical and cultural roots, and the workings and development of modern society.

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. Freshman advisers, departmental advisers, other faculty, and deans assist students in selecting from approximately 60 alternative curricula and major concentrations a field of study suited to the students’ 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 the Undergraduate Scholars Program or 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 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 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.

Programs which allow for full-time work or off-campus study include the Cooperative Education Program, Junior Year Abroad, Washington Semester, and the Senior Year in absentia privilege. In addition, the University participates with other colleges and universities in the Cleveland area in a Cross Registration Program that permits undergraduate students to take at other colleges and universities in the area courses that are not offered at their own institution.

Students are encouraged to engage in independent study, practica, and research. Individual departments offer independent study opportunities to motivated and qualified students; and some departments offer courses which incorporate practical field experience. 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.

Degree Programs

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 (B.A.), and the Bachelor of Science (B.S.) degrees. These programs provide depth through concentrated study in a major field and breadth through the fulfillment of general education or core curriculum requirements, and free electives.

The B.A. is available in more than 40 fields in the humanities and arts, the social and behavioral sciences, and the natural sciences and mathematics. In addition, B.S. programs are offered in accounting, computer science, the natural sciences, mathematics, statistics, art education, music education, management, nursing, and nutrition. The B.S. in Engineering is available in 13 major fields.

The Bachelor of Music (B.M.) 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 B.M. enroll in the Cleveland Institute of Music.

Listed below are all the undergraduate degrees offered by the University.

Bachelor of Arts

Bachelor of Science in:
Accounting
Applied Mathematics
Art Education
Astronomy
Biochemistry
Biology
Chemistry
Computer Science
Geological Sciences
Management
Mathematics
Mathematics and Physics
Music Education
Nursing
Nutrition
### Majors/Minors/Sequences for CWRU Undergraduate Degrees

**Major**—program of ten or more courses (required)

**Minor**—program of five or six courses (optional)

**Sequence**—program of three, four, or five courses (required for degrees based on Engineering Core)

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<td>AMERICAN STUDIES (B.A.)</td>
<td>major or minor or HA sequence</td>
<td>A&amp;S</td>
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<td>ANTHROPOLOGY (B.A.)</td>
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<td>APPLIED MATHEMATICS (B.S.)</td>
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<td>ART EDUCATION (B.S.)</td>
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<td>ART STUDIO</td>
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<td>A&amp;S</td>
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<td>A&amp;S</td>
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<td>COMMUNICATION SCIENCES (B.A.)</td>
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* = available only as 2nd major for B.A.

HA—Humanities and Arts
SS—Social Sciences
Foundation—for each degree/major a student must complete the foundation curriculum required for that degree/major

A&S = based on Arts & Sciences General Education Requirements
EC = based on Engineering Core (new in 1998)
CA = based on Case Core

WSOM = based on Weatherhead General Education Requirements
FPB = based on Nursing General Education Requirements

With the exceptions of engineering physics and 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).
GENERAL REQUIREMENTS FOR ALL BACHELOR'S DEGREES

Every candidate for a baccalaureate degree from the University must:

1. Complete the English Composition Requirement, as described below. This is to be done in the first year.
2. Complete a core curriculum or general education requirements which include courses to develop quantitative, analytical, and communication skills, and a heightened awareness of human values, cultures, and institutions.
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
4. Earn in residence at Case Western Reserve University a minimum of 60 semester hours, including at least 30 hours after achieving senior status.
5. Complete two semesters of physical education. This is normally done in the first year through a combination of half and/or full semester offerings in Lifetime Sports Activities.

English Composition Requirement

The English Composition Requirement, incorporated into the general education and core curricula for all baccalaureate degree programs, should be completed in the first year of enrollment and must be met in one of the following ways:

1. Completion of ENGL 150, Expository Writing, with a grade of C or higher.
2. Achievement of a score of 4 or 5 on a College Board Advanced Placement Examination in English.
3. For transfer students, acceptance of transfer credit for ENGL 150 and then, either passing the English placement examination, or completing ENGL 180, Writing Tutorial, with a grade of C or higher.

Students who fail ENGL 150 will be required to repeat the course. Students who pass ENGL 150 with a grade of D will be required to complete ENGL 180, Writing Tutorial (1 credit) with a grade of C or higher.

ENGL 150, Expository Writing, with a grade of C or higher. ENGL 180 may be taken up to three times to achieve a C performance in English composition. On the basis of admission records or on the basis of the English placement examination for transfer students, students may be placed in ENGL 148, Introduction to Composition. Students placed in ENGL 148 must complete ENGL 148 with a grade of C or better in order to enroll in ENGL 150. A maximum of three hours of credit for ENGL 148 will count toward the requirements for a bachelor’s degree.

Definition of “C” competence in English 150.

“C” competence means that the student has demonstrated in the course of writing 7,000 words (an equivalent of 28 typed, double-spaced pages) that he or she can consistently produce an original paper which has, prior to revisions suggested by the instructor, the following characteristics: (1) Mechanics-The “C” paper is neat and free of repeated errors in spelling, verb, and pronoun form, agreement, sentence completion, punctuation, and capitalization. (2) Organization-The “C” paper clearly states a reasonably limited thesis on a subject appropriate to the assignment and continues to focus on the idea with some supporting detail (footnoted where necessary) and with transitions between sections that are clear, though not necessarily smooth. (3) Style-The “C” paper is generally clear and moderately concise, even though the word choice may be narrow and the emphasis awkward.

Physical Education Requirement

Two semesters of non-credit courses in physical education are required as part of all undergraduate curricula. Normally this requirement will be satisfied in the freshman year and must be met by all undergraduate students unless waived by the chairman of the Department of Physical Education or the Dean of Undergraduate Studies.

Requirements for specific degrees

BACHELOR OF ARTS DEGREE

(College of Arts and Sciences)

Candidates for the Bachelor of Arts 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 120 semester hours earned.
   a) No more than 42 hours beyond the 100 level in any one department may be applied to the 120 hour total.
   b) The 120 semester hours must include 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 or computer science. (Students completing both a B.A. and B.S. degree are exempted from 6 hours of the 90 hour arts and sciences requirement for the B.A.)
2. The General Education Requirements of the College of Arts and Sciences
3. A minimum of 30 semester hours of courses at the 300-400 level.
4. The requirements for a major as specified in this bulletin for each department or program. A major concentration 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 B.A. candidate must earn a minimum cumulative average of 2.00. 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 Available for the B.A.

American Studies*
Anthropology
Art History
Asian Studies (including Asian language)
Asian Studies (without Asian language)*
Astronomy
Biochemistry
Biology
Chemistry
Classics (Greek/Latin)

(* indicates may be taken only as a second major)
1. A minimum of 120-134 hours as specified by the requirements for each B.S. program.

2. A minimum of 30 semester hours of courses at the 300-400 level.

3. The Arts and Sciences General Education Requirements. For some B.S. programs, the Arts and Sciences General Education Requirements 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 B.S. from the College of Arts and Sciences must earn a minimum cumulative average of 2.00. 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 least half the hours required for the major.

Bachelor of Science degrees conferred by the College of Arts and Sciences are offered in the following fields:
- Applied Mathematics
- Art Education
- Astronomy
- Biochemistry
- Biology
- Chemistry
- Geological Sciences
- Mathematics
- Mathematics and Physics
- Music Education
- Nutrition
- Nutritional Biochemistry and Metabolism
- Physics
- Statistics

**Arts and Sciences General Education Requirements**

General Education Requirements of the College of Arts and Sciences provide a broad educational foundation for programs in humanities and arts, social and behavioral sciences, and mathematics and natural sciences, leading to the Bachelor of Arts or the Bachelor of Science degree. The areas in which courses are required are indicated below. In some areas students must complete an approved two-course sequence. Courses that are approved to serve as the first course in a sequence are shown in boldface. This information is subject to addition. An updated list is published annually in the Handbook for Undergraduate Students, and is available from the Office of Undergraduate Studies. Courses that can serve for completion of a sequence in the same department follow each such course in parentheses.

1. The English Composition Requirement (3 semester hours) as described above.

2. Natural and Mathematical Sciences (12 semester hours total) Students must complete at least three semester hours in area a) Mathematical Reasoning and Analysis, three semester hours in area b) Natural Sciences, and an additional course making an approved sequence in area a) or area b).

   An additional course taken to fulfill the 12 hour requirement may come from area a), b), or c) Science and Society.

   a) Mathematical Reasoning and Analysis (3 semester hours minimum): courses in which students engage in step-by-step reasoning and computation using mathematical methods for discovery and for solving problems

   MATH 121* or 123* or 125* (Each of these courses will usually be followed by a course identified as Part II to constitute a sequence. However, students not wishing to continue into a Part II course may complete a sequence through the use of any of the statistics courses listed below, or PHIL 201).

   STAT 201* or ANTH 319* or PSCL 282* (any of the above mathematics courses, or PHIL 201, or PSCL 375)

   PHIL 201 (any of the above mathematics courses, or any of the above statistics courses)

(*) indicates may be taken only as a second major.)

BACHELOR OF SCIENCE DEGREE

(With Honors Option)

Candidates for the Bachelor of Science 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 120-134 hours as specified by the requirements for each B.S. program.

2. Natural and Mathematical Sciences (12 semester hours total) Students must complete at least three semester hours in area a) Mathematical Reasoning and Analysis, three semester hours in area b) Natural Sciences, and an additional course making an approved sequence in area a) or area b).

   An additional course taken to fulfill the 12 hour requirement may come from area a), b), or c) Science and Society.

   a) Mathematical Reasoning and Analysis (3 semester hours minimum): courses in which students engage in step-by-step reasoning and computation using mathematical methods for discovery and for solving problems

   MATH 121* or 123* or 125* (Each of these courses will usually be followed by a course identified as Part II to constitute a sequence. However, students not wishing to continue into a Part II course may complete a sequence through the use of any of the statistics courses listed below, or PHIL 201).

   STAT 201* or ANTH 319* or PSCL 282* (any of the above mathematics courses, or PHIL 201, or PSCL 375)

   PHIL 201 (any of the above mathematics courses, or any of the above statistics courses)

(*) indicates may be taken only as a second major.)
b) Natural Sciences (3 semester hours minimum) courses that survey the identification, description, experimental investigation, and theoretical examination of physical or biological phenomena

ANTH 105 (ANTH 295, 301, 369, 393, 395)
ASTR 201 or 202 or 204 or 205 or 221 (second course from those listed here or ASTR 222)
BIOL 110 (BIOL 101 or 220)
CHEM 105 or CHEM 111 (CHEM 106)
GEOL 101 or 110 or 115 or 117 (second course from those listed here or GEOL 210 or 220)
PHYS 100 (101) or 115* (101 or 116) or 121* (101 or 122) or 123* (101 or 122 or 124)
c) Science and Society (0-3 semester hours): courses that broadly examine the social/cultural aspects or implications of science and/or technology

ANTH 215, 317, 337, 363; PHIL/RLGN/BETH 271; BIOL 103; ESCI 340; ESTD 387; GEOL 105, 202;
HSTY 151, 152, 201, 202, 395; PHIL 225, 309; PHYS/POSC 196; RLGN 206, 240

3. Arts and Humanities (12 semester hours total) Students must complete at least three semester hours in each of the areas below, and an additional three-hour course making an approved sequence in one of the areas.

a) The Arts (3 semester hours minimum): courses which serve as an introduction to art, music, and theater

ARTH any 100 or 200 level course (any other 100 or 200 level ARTH course)
MUSC 221 (MUSC 222)
THTR 123 or 124 (the other of these two)
b) History, Philosophy, and Religion (3 semester hours minimum): courses that cover historical change, philosophical or religious ideas and works, and the methods and concepts of these disciplines

AMST 117 (AMST 217)
CLSC 111 (CLSC 112, 202B, 302)
CLSC 112 (CLSC 304)
CLSC 201 (CLSC 302, 304)
HSTY 112 or 113 (HSTY 112 or 113, 125, 135, 151, 152, 200, 204, 210, 211, 212, 221, 222, 253, 255, 256, 257, 258, 260, 261, 262, 264, 265, 266, 268, 272, 281, 282, 285, 348)
PHIL 101 (PHIL 204, 302, 305, 330, 334, 345, 370); PHIL 205 (PHIL 304, 305)
RLGN 102 or 120 or 201 or 202 or 203 or 204 or 207 or 223 or 254 (any of those listed or RLGN 206, 217, 231, 235, 266, 300, 301, 303, 306, 309, 314, 325, 332, 341, 366)
c) Literature and Language (3 semester hours minimum): language courses beyond the first year level, and courses that serve as an introduction to important literary works and to the methods and concepts of literary study:

CLSC 203 or 204 (CLSC 203 or 204, 314, Greek 200-level or above, except 395, Latin 200-level or above except 395)
CMPL 211 or 212 (the other of these two)
CMPL 290 or 291 (the other of these two)
ENGL 200 or 255 or 256 (either of the remaining two)
Foreign Languages-any 200 or higher level course in a foreign language (any other 200 or higher level course in the same language)

4. Social Sciences (9 semester hours) Students must complete three semester hours in each area listed below, and an additional three-hour course making an approved sequence in one of the areas. Of the 9 hours, no more than 6 may be from a single department.

a) Social Institutions (3 semester hours minimum): courses that introduce students to the methods and concepts in the social sciences relevant to understanding individual or family functioning

ANTH 102 or 103 or 107 (either of the remaining two)
ECON 102 or 103 or 205 (either of the remaining two)
POSC 109 or 260 (POSC 308, 310, 320E, 321, 325, 326, 327, 328, 360B, 367, 370J, 386)

b) Human Behavior and Development (3 semester hours minimum): courses that introduce students to the methods and concepts in the social sciences relevant to understanding individual or family functioning

ANTH 102 (ANTH 304, 306, 309, 318, 340, 342, 345, 371, 375, 386)
COSI 100 (COSI 220, 236, 332, 336)
COSI 109 (COSI 211, 220, 313, 345)
PSCL 101 (PSCL 102, 230, 313, 315, 321, 352, 353, 355, 357)
SOCI 112A* or 112B* or 310 (SOCI 203, 208, 222, 361, 369)

5. Global and Cultural Diversity (3 semester hours) From approved courses designed to develop students’ awareness of their cultural assumptions and to expand their understanding of cultural issues, students must complete a three-hour course which focuses on a culture outside the United States and Europe or on ethnic or cultural differences and/or interactions within or outside the United States. ANTH 314, 322, 352, 353, 356, 357; ARTH 203; CMPL 215, 230, 275, 361; COSI 260; ECON 335, 375; ENGL 363H, 365E, 365N, 365Q, 366G; FRCH 375; HSTY 113, 135, 258, 260, 261, 262, 268, 281, 282, 285, 321; MUSC 337, 338; PHIL 356; POSC 360D, 360E, 366, 370K, 374, 379; RLGN 120, 204, 215, 217, 223, 254, 303, 314; SOCI 302, 326; SPAN 303, 339, 342, 343; any 200 or 300 level course in Chinese, Japanese, or Russian

Restrictions/Exceptions

No more than three courses from any one department may be used for the satisfaction of the Arts and Sciences General Education Requirements, and no single course may fulfill more than one requirement.

Students completing more than one major, or completing a major and one or more minors, classified under different general headings (natural sciences and mathematics, arts and humanities, social

* A student completing successfully any one of these two courses is not eligible to receive credit towards a degree for either of the other two.
sciences) are exempt from a maximum of six semester hours of arts and sciences general education requirements. Specifically, students who complete two majors are exempt from six hours of general education requirements in the area of one of the majors or from three hours of general education requirements in each of the areas of the two majors. Students completing a minor are exempted from six hours of general education requirements in the area of the minor.

**BACHELOR OF SCIENCE IN ENGINEERING DEGREE**

**(Case School of Engineering)**

Candidates for the Bachelor of Science in Engineering (B.S.E.) 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 129-133 hours as specified by the requirements for each B.S.E. program.
2. The 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 B.S.E.**

Bachelor of Science in Engineering degrees conferred by the Case School of Engineering are offered in the following fields:

- Aerospace Engineering
- Biomedical Engineering
- Chemical Engineering
- Civil Engineering
- Computer Engineering
- Electrical Engineering
- Engineering Physics
- Fluid and Thermal Engineering Sciences
- Materials Science and Engineering
- Mechanical Engineering
- Polymer Science and Engineering Systems and Control Engineering Engineering (undesignated)

With the exceptions of engineering physics and 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 127 hours.
2. The Engineering Core Curriculum, with the exception of ENGR 200, ENGR 210 and ENGR 225
3. The requirements for the computer science major as presented in this bulletin.

**Engineering Core Curriculum**

The 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.

1. **The English Composition Requirement** (3 semester hours) as described above.
2. **Mathematics** (14 semester hours): MATH 121, 122, 223, Calculus for Science and Engineering I, II, III, or equivalent; MATH 224, Elementary Differential Equations or equivalent or an approved course in Introduction to Dynamic Systems.
3. **Chemistry** (4 semester hours): CHEM 111, Principles of Chemistry for Engineers.
4. **Physics** (8 semester hours): PHYS 121, 122 General Physics I, II, or equivalent.
5. **Engineering** (18 semester hours):
   - ENGR 131, Elementary Computer Programming;
   - ENGR 145, Chemistry of Materials; ENGR 200, Statics and Strength of Materials; ENGR 210, Introduction to Circuits and Instrumentation, ENGR 225, Thermodynamics, Fluid Mechanics, and Heat and Mass Transfer.
6. **Natural Science, Mathematics, or Statistics Requirements** (3 semester hours) as designated by the major department.

7. **Humanities and Social Sciences**: 21 semester hours (usually 7 courses) in the humanities and social sciences, including:
   - a) ENGL 398N, Professional Communication for Engineers (3 hours)
   - b) An approved sequence of 9 hours (three courses) in a single department or program in the humanities or social sciences
   - c) A minimum of 6 hours (two courses) in the social sciences and 6 hours (two courses) in the humanities, not including the Professional Communications course.

For students who choose to complete a minor, up to 12 hours of these 21 hours may be used towards fulfillment of the minor requirements.

Note: Studio courses in art and music cannot serve toward the satisfaction of the humanities and social science requirement unless they are part of a sequence. A sequence including such work will normally require more than the four courses that ordinarily serve for this purpose and will require the approval of the sequence adviser in advance.

Two semesters of beginning work in a foreign language may be counted toward satisfaction of the requirement for a three-course sequence only when the sequence consists of three courses taken in a single foreign language. Credit for the first semester of beginning study (101 level) in a foreign language will not serve toward satisfaction of any degree requirement unless credit is earned for the second semester (level 102) as well.

*Departments and programs have been classified as follows:*

**Humanities**: American Studies, Art History, Art Studio, Artificial Intelligence (depending on the courses selected), Asian Studies, Chinese, Classics, Comparative Literature, English, Environmental Studies (depending on the courses selected), French, German, History, History and Philosophy of Science and Technology, History of Technology and Science, Japanese, Music, Philosophy, Pre-Architecture, Religion, Russian, Spanish, Theater Arts, and Women’s Studies (depending on the courses selected).
Social and Behavioral Sciences: Anthropology, Artificial Intelligence (depending on the courses selected), Communication Sciences, Economics, Environmental Studies (depending on the courses selected), Gerontological Studies, Human Development, Political Science, Psychology, Sociology, and Women’s Studies (depending on the courses selected).

For those programs which may serve either as a humanities, or a social and behavioral science sequence (artificial intelligence, environmental studies, and women’s studies) the program adviser shall assign a program to one category or the other on the basis of its content.

**BACHELOR OF SCIENCE IN NURSING DEGREE**

*(Frances Payne Bolton School of Nursing)*

Candidates for the Bachelor of Science in Nursing (B.S.N.) 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 122 hours.
2. The School of Nursing General Education Requirements.
3. A minimum of 50 semester hours of courses at the 300-400 level.
4. For all courses taken in nursing, a minimum grade of C.

**School of Nursing General Education Requirements**

The General Education Requirements of the Frances Payne Bolton School of Nursing are based upon the Arts and Sciences General Education Requirements, and provide a broad educational foundation for the Bachelor of Science in Nursing program.

1. The English Composition Requirement (3 semester hours) as described above.
2. Natural and Mathematical Sciences (17 semester hours total)
   a) Mathematical Reasoning and Analysis: STAT 201, Basic Statistics I or ANTH 319 or PSCL 282.*
   b) Natural Sciences: BIOL 110-Principles of Biology, BIOL 119 and BIOL 121 Concepts for a Molecular View of Biology I and II, BIOL 150 -Human Anatomy, and Physiology
3. Arts and Humanities (12 semester hours total) The requirement is the same as the Arts and Humanities requirement of the Arts and Sciences General Education Requirements (above), except that the courses need not form a sequence; the courses should all be selected from courses designated as first courses for a sequence if a sequence cannot be completed.
4. Social Sciences (6 semester hours total)
   a) Social Institutions: PSCL 101-General Psychology or ANTH 102-Being Human: An Introduction to Social and Cultural Anthropology or SOCI 112B-Introduction to Sociology: Human Interaction
   b) Human Behavior and Development: SOCI 203 or an approved course in human growth and development
5. Global and Cultural Diversity (3 semester hours) The requirement is the same as the Global and Cultural Diversity requirement of the Arts and Sciences General Education 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 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 program or department. 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 B.S. from the Weatherhead School of Management must earn a minimum cumulative average of 2.00. 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
- Business and Management Science; for management, 20 semester hours total)
- Natural and Mathematical Sciences (for accounting, 17 semester hours total; for management, 20 semester hours total) In addition to the specified mathematics and statistics courses, students must complete at least one course in area b) Natural Science and an additional course from area b) or from area c) Science and Society.

a) Mathematical Reasoning and Analysis: (11-14 semester hours): MATH 125-MATH 126 or equivalent courses in introductory calculus, and STAT 207- Statistics for Business and Management Science; management majors must also complete STAT 208
b) Natural Sciences: (minimum 3 semester hours) See Arts and Sciences General Education Requirements

c) Science and Society: (0-3 semester hours) See Arts and Sciences Gen-

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* A student completing successfully any one of these three courses is not eligible to enroll in or receive credit towards a degree for either of the other two
eral Education Requirements
3. Arts and Humanities (for accounting, 9 semester hours total; for management, 12 semester hours total) The requirement is the same as the Arts and Humanities requirement of the Arts and Sciences General Education Requirements (above), except that accounting majors are exempt from the 3-hour arts requirement.
4. Social Sciences (for accounting, 12 semester hours total; for management, 9 semester hours total)
   a) Social Institutions: (6 semester hours): ECON 102-Principles of Microeconomics and ECON 103-Principles of Macroeconomics;
   b) Human Behavior and Development: (3-6 semester hours) For management majors, the requirement is the same as that of the Arts and Sciences General Education Requirements. Accounting majors must complete two courses in this area: 1) COSI 100 or COSI 236, and 2) PSCL 101 or SOCI 112
5. Global and Cultural Diversity (3 semester hours) The requirement is the same as the Global and Cultural Diversity requirement of the Arts and Sciences General Education Requirements

DUAL UNDERGRADUATE DEGREE PROGRAMS
Undergraduates who wish to pursue study in two disciplines may combine degree programs. Possible combinations include:
1. Two different Bachelor of Science degrees. Examples of combinations are: computer engineering/electrical engineering, physics/music education, management/accounting
2. A Bachelor of Science degree and a Bachelor of Arts degree. Examples of combinations of majors are: computer science/English, chemical engineering/music, management/psychology
3. Either the B.A. or a B.S. and a Bachelor of Music (B.M.) degree offered in conjunction with the Cleveland Institute of Music.
   To qualify for two degrees, students must meet the requirements of each degree, and complete a minimum of 30 semester hours of study beyond the requirement for one of the degrees. Such programs usually require a minimum of five years, but may be completed in four years by an unusually industrious and capable student.
   Students completing both a B.A. and a B.S. degree are exempted from 6 hours of the 90 hour arts and sciences requirement for the B.A.
   Students interested in pursuing any of the degree combinations listed above should consult the Office of Undergraduate Studies. Students who seek a dual degree program that involves the B.M. must meet admission requirements of the Cleveland Institute of Music.

MINORS
For the degrees described above, minors are not required. However, students have the option of completing a minor in a discipline other than the major, in addition to the major. A minor concentration normally requires 15-18 semester hours, and will be indicated on a student’s transcript if the requirements, as outlined below, are fulfilled.

Minors for Students Majoring in Fields Other Than Engineering
1. A minor program shall consist of no fewer than 15 and no more than 18 semester hours of specified course work in a discipline other than the student’s major.
2. The responsibility for designating the requirements for a minor shall lie with the department offering the minor.
3. For all courses taken to satisfy minor requirements and for which grades are averaged, students pursuing degrees based on the General Education Requirements of the College of Arts and Sciences, the Weatherhead General Education Requirements, or the School of Nursing General Education Requirements, must earn a minimum cumulative average of 2.00. Transfer students who wish to complete a minor must complete at Case Western Reserve University at least half the requirements for the minor.

Minors for Engineering Majors
An engineering student’s academic work in a discipline other than the student’s major may be recognized as a minor. A student will be entitled to have the minor designation recorded on his/her transcript upon successful completion of a basic academic program in a discipline not within the student’s major. The completion of a minor academic program does not relieve the student of any requirements for his/her major degree. The following rules govern the minor program for an engineering student:
1. A minor program shall consist of no fewer than 15 and no more than 18 semester hours of course work.
2. The responsibility for designating the requirements for a minor shall lie with the department offering the minor.
3. With the exception of the humanities and social science requirement stated in section 4 below, no more than two courses taken for the minor may be used simultaneously to satisfy the requirements of the student’s major field, including department requirements, technical electives, and the Engineering Core.
4. An engineering student who chooses to do so may, by taking work that goes beyond the requirement for a three-course sequence in the humanities or social sciences, complete a minor concentration in either of these areas, and count towards the minor up to 12 hours of humanities/social science courses that are also being counted towards the 21 hour humanities/social sciences requirement of the Engineering Core.

Minor concentrations
Accounting
American Studies
Anthropology
Art History
Artificial Intelligence
Art Studio
Asian Studies
Astronomy
Biochemistry
Biology
Biomedical Engineering*
Chemical Engineering*
Chemistry
Childhood Studies
Chinese
Civil Engineering*
Classics (Greek/Latin)
Communication Sciences
Comparative Literature
Computer Engineering*
Computer Science (for B.A.)
Computer Science (for B.S.)*
Dance
Economics
Electrical Engineering*
Electronics (for B.A.)
English
Entrepreneurial Studies
Environmental Geology
Environmental Studies
French
French Studies
Geological Sciences
German
German Studies
Gerontological Studies
History
History of Technology and Science
Human Development
International Studies
Japanese
Management Information and Decision Systems
Materials Science and Engineering*
Mathematics
Music
Natural Sciences
Nutrition
Philosophy
Photography
Physical Education
Physics
Political Science
Pre-Architecture
Psychology
Public Policy
Religion
Russian
Sociology
Spanish
Statistics
Systems and Control Engineering*
Theater Arts
Women’s Studies

*Engineering minor based on Engineering Core

Academic Advising

Academic advising is an important component of the educational program at Case Western Reserve University. Academic advisers assist students in the exploration of academic opportunities at the University, and in the selection of courses. Advisers may refer students to other sources of information and assistance at the University. Students are expected to initiate and maintain regular contact with their advisers to address the student’s curricular and career concerns, and to review progress towards graduation. Students are responsible for obtaining required permissions and approvals relating to registration, major and minor declaration, and graduation.

FRESHMAN ADVISERS

All freshmen are assigned a faculty member or administrator who will assist them as they plan a course of study. Freshmen are encouraged to consult with their advisers about academic options, university rules and regulations, meeting effectively the challenges of college work, and study in graduate or professional school.

DEPARTMENTAL ADVISERS

Students are encouraged to select a major at the end of their freshman year. When formally declaring a major (and/or minor), a student will visit with the department chairperson or academic representative who will assign the student a faculty department adviser. Students with declared majors and minors should meet regularly with their department advisers to ensure that they are making satisfactory progress toward graduation and are being made aware of academic and professional opportunities in their field of study.

ADVISING IN THE OFFICE OF UNDERGRADUATE STUDIES

The deans in the Office of Undergraduate Studies are available to answer student and faculty questions about University rules, practices, programs, and resources and to meet with students who are interested in study abroad, accelerated undergraduate to graduate and professional school programs, academic awards, and fellowship and scholarship opportunities. All students who have not declared a major after the freshman year should consult with one of the deans for advising and schedule approval.

PRE-PROFESSIONAL AND SPECIAL PROGRAM ADVISERS

Students planning to study at the graduate or professional school level or who are interested in special undergraduate programs at the University are urged to consult the appropriate adviser. Please refer to the Handbook for Undergraduate Students for the listing of pre-professional and special program advisers.

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 University Undergraduate Faculty and the various committees responsible for the oversight of curriculum and academic standing. For the latest information consult the student handbook.

When circumstances so warrant, a student may submit to the Office of Undergraduate Studies a petition to waive a specific regulation or requirement.

ACADEMIC HONESTY

All students are expected to adhere to the standards of academic honesty consistent with the University Statement on Ethics. Any work submitted by a student must represent his or her own efforts. Any student engaging in cheating, plagiarism, or any other acts of academic dishonesty will be subject to disciplinary action.

ACADEMIC INFRACTIONS

If a faculty member suspects that an undergraduate student has presented the work of another as his or her own, or is otherwise guilty of academic dishonesty, the faculty member shall so advise the student and the department chair and consult with the Dean of Undergraduate Studies about the basis for those suspicions and appropriate disciplinary action. If the faculty member and dean agree that the evidence is not adequate to support a complaint the matter will be dropped and the student will be so notified. If they do not agree to drop the mat-
The infraction is a first offense the dean and the faculty member may agree to leave the disposition of the matter to the faculty member. The student and the Dean of Undergraduate Studies will be notified in writing and a confidential record of the event and action shall be put on file in the Office of Undergraduate Studies.

Alternatively, following consultation with the Dean of Undergraduate Studies, under any of the following circumstances the faculty member will transmit a report of the infraction to the Vice President for Student Affairs or his/her designate for judicial action:

1. The student pleads innocent to having committed an infraction, or pleads that the penalty is excessive.
2. It is the view of the faculty member and the Dean of Undergraduate Studies that the student’s first offense is of a nature and seriousness to justify such a referral.
3. The records maintained by the Dean of Undergraduate Studies show the student to have been guilty of one or more previous academic infractions.
4. The faculty member, after consultation with the dean, prefers such a referral to the alternative of assuming responsibility for the disposition of the matter.

In the event of any of the circumstances listed above the Vice President for Student Affairs will convene a University Judicial Board to hear the case as promptly as is feasible and fair. When hearing a case dealing with an academic infraction the University Judicial Board shall consist of: a representative of the Office of Undergraduate Studies, a representative of the Office of Student Affairs, and one student and one faculty member qualified to serve as a result of their participation in the Judicial Board training program. Should the Board find there was insufficient evidence to support the charge, the faculty member will be so informed and asked to evaluate the student’s performance for the assignment in question by his/her normal grading practices. If the Board upholds the complaint of the faculty member, the panel will transmit notification of its finding and action to both the faculty member and the Dean of Undergraduate Studies for implementation. Should the Board find there was insufficient evidence to support the charge the student and the faculty member may agree to leave the disposition of the matter to the faculty member.

In addition, the University is required to report to the funding agency the identity and misconduct of anyone, including a student, found guilty of falsification, fabrication or plagiarism in the performance of research that is receiving support from federal sources.

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.

In addition, the student must have filed a formal application for the degree in the Office of Undergraduate Studies by October 10 for January graduation, by December 2 for May graduation, and by July 15 for August graduation; and the student must have discharged all financial obligations to the University.

ATTENDANCE

Students are expected to attend classes regularly. Each instructor keeps his or her own record of student absences and is free to determine the extent to which absences affect the final grades of students.

An instructor who feels a student is jeopardizing his or her class work by absences reports this to the Dean of Undergraduate Studies for such action as the dean considers appropriate. An instructor who judges a student’s absences from his or her class to be excessive may exclude the student from class and assign a grade of F. Instructors taking such action must notify the dean in writing.

Absences from hour examinations must be explained satisfactorily to the instructor of the course.

AUDIT

A student may audit a course with the dean’s or adviser’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 LOAD

In order to be classified as a full-time student, a student must enroll for a minimum of 12 semester hours. The normal full-time load is 14-18 semester hours. Continuing students may carry 19-21 hours if they have a cumulative average of 3.20 or higher. To register for 22-23 hours a minimum average of 3.50 is required. A graduating senior who requires an overload in order to complete his or her degree program by the end of a given semester may receive approval for that overload without satisfying the grade point average requirement specified above. Any schedule of more than 18 semester hours requires dean’s approval after being approved by the student’s adviser.

COURSE REPETITION

Any student who has received an F or W in a course specifically required for his or her curriculum must retake that course at the next regular opportunity unless the student since has passed the course by proficiency examination.

A student desiring the opportunity to repeat a course because of dissatisfaction with the quality of an earlier performance is eligible to do so, but must advise the Office of Undergraduate Studies of his or her intention by completing a Course Repetition Form. Upon completion of the repeated course for an evaluative grade-A, B, C, D, or F-the grade received
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 direct the Office of the Registrar to 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.

Any student who receives proficiency credit for a course through a proficiency examination administered during a semester when the student is not registered for a full-time schedule (12 or more semester hours) at Case Western Reserve University is charged a fee equal to one-third of the present tuition charge for the course. No fee is charged if the student does not receive credit from the examination.

CROSS REGISTRATION

If approved by the Office of Undergraduate Studies, full-time undergraduates in good academic standing may cross-register through the Northeast Ohio Council on Higher Education (NEOCHEx program at Baldwin-Wallace College, the Cleveland Institute of Art, the Cleveland Institute of Music, Cuyahoga Community College, David Myers College (formerly Dyke College), Hiram College, John Carroll University, Lake Erie College, Lorain County Community College, Notre Dame College of Ohio, Oberlin College, University of Akron, and Ursuline College for one course per semester. Approval is normally limited to courses that are not offered at Case Western Reserve University. Cross-registration is not available to seniors in the final semester before graduation. To cross-register at the Cleveland Institute of Art, a student must have permission from the CWRU Director of Art Studios.

FINAL EXAMINATIONS

Final examinations are normally required in all courses and must be given during the final examination period at the time assigned by the Registrar. 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 will be assisted by 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 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, a student should be assigned a final grade that assumes a grade of zero on the final examination and is otherwise consistent with the grading policy for the course.

FOREIGN LANGUAGE AND MATHEMATICS CREDIT

Credit earned for the first semester of a beginning work (101 level) in a foreign language will not serve for satisfaction of any degree requirement until a student successfully completes the second semester (102 level) of such work.

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.

GRADING SYSTEM

See section on Registration. For freshman grading policy see section on Academic Standing.

INCOMPLETE GRADE

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 be-
fore 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 when: a) 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.

Changing the Incomplete Grade

The instructor shall submit to the Registrar a final evaluative grade to replace the Incomplete upon completion of the work outstanding by a date established for the student by the instructor. When a student fails to submit the work required for removing the Incomplete by the date established, the instructor shall transmit to the Registrar 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.

The amount of additional time allowed a 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 may establish a date for completion of courses with Incomplete grades.

PASS/NO PASS OPTION

Courses elected on a Pass/No Pass basis and completed with a grade of D or higher will be entered with a grade of P on a student’s transcript. Courses taken Pass/No Pass and for which a grade of F is earned will be entered on the transcript with the letter grade NP. Courses completed with letter grade P under this option will be counted for credit toward the baccalaureate. Courses completed with the grade NP do not earn credit. Courses completed with grades P and NP are not included in computing the grade point average.

The Pass/No Pass option is subject to the following regulations:
1. The Pass/No Pass option is exercised during the last three days on which classes are scheduled.
2. It is available only during regular fall and spring semesters to full-time students who are in good standing.
3. It can be exercised for only one course during any semester.
4. It cannot be used for courses taken for satisfaction of core requirements.
5. It cannot be used for courses taken for the satisfaction of requirements of a major or minor concentration.
6. Courses offered only on a Pass/No Pass basis with the approval of the curriculum committee do not affect the student’s use of the Pass/No Pass option.
7. Instructors are not notified of a student’s use of this option. They are required to submit evaluative grades for all students and these are converted to Pass/No Pass in the Registrar’s Office. The meaning of the grades P and NP will be noted on the transcript.

PETITIONS

Petitions for exceptions to undergraduate academic rules must be submitted to the Office of Undergraduate Studies for consideration by the deans committee, the curriculum committee, or the committee on academic standing, as appropriate to the subject of the petition.

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

The last two weekdays preceding the start of the final examination period are set aside as Reading Days to be used by students for completing assignments and preparing for final examinations. 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 Committee on Academic Standing.

SCHEDULE CHANGES (DROP/ADD)

Changes in course schedules must be submitted to the Registrar’s Office 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.

TRANSFER CREDIT

Students may receive credit by transfer from another accredited college, univer-
sity, or technological institute in the United States or from institutions of higher education outside the United States under the following conditions:

1. At the time of admission to Case Western Reserve University 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 allocation of transfer credit is determined by the Office of Undergraduate Studies in consultation with the appropriate department. The applicability of such transferred work toward the satisfaction of major or minor requirements will be determined by the major or minor department. Students who are eligible to receive transfer credit equivalent to ENGL 150, Expository Writing, are required to take the English placement examination for transfer students.

2. After enrollment in the University, only when approval has been secured in advance from the Office of Undergraduate Studies. After matriculation in the University, undergraduates are not permitted to earn more than 15 semester hours as transient students at other accredited institutions. Credit earned elsewhere after matriculation is not applied toward the 60 hour minimum required in residence. Work taken through the cross registration program (see below) is treated as transfer credit.

Credit is not awarded for work done at an unaccredited institution in the United States except by proficiency examination in those departments offering that opportunity. The award 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 dismissed for poor scholarship from any institution cannot receive credit by transfer for courses taken in the first two sessions after that dismissal without prior permission of the Dean of Undergraduate Studies.

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.

**WITHDRAWAL FROM COURSES**

After consultation with a dean in the Office of Undergraduate Studies, 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. After this date, a student who withdraws from a course normally will receive a grade of F. In unusual circumstances, the dean may permit a student to withdraw from a course after the final date and receive a W. A freshman who is subject to the freshman grading practices (see “Good Standing” under Academic Standing, below) may withdraw from a course after the end of the 11th week, but no later than the last day of classes.

Notice of a withdrawal from a course must be transmitted by the student to the Registrar on the appropriate form, signed by the student’s instructor, adviser and dean. 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.

A student who withdraws from the University or is dismissed during a semester will receive the grade of WD for each course for which he or she is registered at the time of withdrawal.

**Academic Standing**

**GOOD STANDING**

The Freshman Year: For the first two semesters of full-time enrollment students who are beginning their college studies will earn credit and grades only for those courses completed with a grade of D or higher. Any courses for which a grade of F, W or NP is assigned will not be included in the computation of the grade point average and will not be posted on the official transcript. This grading policy is not available to part-time or transfer students and does not apply to the summer session. In order to maintain good standing a freshman must earn at CWRU a minimum of 9 hours and an average of 1.70 or higher in the first semester and a total of 21 hours with a cumulative average of 1.75 or higher by the end of the second semester of full-time enrollment.

Thereafter: Following the freshman year grades of F will be posted on the transcript and will be used in the computation of the grade point average. Following the freshman year, the requirements for good standing are:

1) A semester grade point average of 1.75 or higher and
2) a cumulative grade point average as follows:
   a) for students with 22-40 hours earned, a cumulative grade point average of 1.80
   b) for students with 41-59 hours earned, a cumulative grade point average of 1.90
   c) for students with 60-89 hours earned, a cumulative grade point average of 1.95
   d) for students with 90 or more hours earned, a cumulative grade point average of 2.00

Students with incomplete grades may be placed on “probation (incomplete)” as described below.

Part-time and transfer students will be subject to the cumulative average requirements that are consistent with their hours earned.

**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 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 com-
Eligibility rules apply to all activities in which students represent the University in any way, official or otherwise. These include intercollegiate athletics, musical or dramatic clubs and performances, oratorical or debating teams, class offices, student government, committee memberships, and publication staffs. Students who are on probation for any reason are ineligible to participate in these activities.

Eligibility is based on full-time status (enrollment for 12 hours or more), and students carrying fewer than 12 semester hours are ineligible to participate in intercollegiate competitions. Eligibility is determined at the end of each session as of the last official date of that session.

Students must complete the work of the previous session with a 2.0 grade point average to be eligible for initiation into a social fraternity or sorority.

The dean or the appropriate committee may at any time declare as ineligible those students whose conduct, attendance, or academic standing is unsatisfactory, or whose participation in student activities is detrimental to their academic work.

**Special Programs**

**UNDERGRADUATE SCHOLARS PROGRAM**

The Undergraduate Scholars Program (UGSP) permits a small number of highly motivated and responsible undergraduates to pursue individually designed programs of study leading to the bachelor’s degree. Admission to the program as an Undergraduate Scholar exempts the student from normal credit hour requirements and other requirements for the bachelor’s degree, and imposes on the scholar a correspondingly greater personal obligation in defining and meeting intellectual and educational goals. All full-time undergraduates are eligible to apply for admission to the program at any time. Because of the unique nature of the program and the privileges which it conveys, only 12 undergraduates may actually be enrolled as active scholars at any given time. Students must demonstrate that their proposed programs of study can only or best be accomplished within the UGSP; those admitted must report every semester to the UGSP Faculty Committee on current and planned courses and related activities. A member of the committee is assigned as the
student’s adviser and works closely with non-committee faculty members to supervise the student’s program. Upon completion of the program of study, each scholar must make a formal report to the committee. The committee is responsible for certifying the scholar for graduation.

TEACHER LICENSURE
The undergraduate/graduate programs in art education and music education, and the graduate program in speech-language pathology meet the requirements for teacher licensure, grades pre-K-12. For further information, see departmental information in this bulletin for art history and art, music, and communication sciences.

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. Adolescence/Young Adult Teacher Licensure 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. The program requires 36 credit hours in professional education: 12 taken at Case Western Reserve University and 24 taken at John Carroll University. For program details, see section on Education in this bulletin.

INDEPENDENT STUDY
Most departments offer courses in independent study to their qualified majors. These are at an advanced level and require departmental approval.

DEPARTMENTAL HONORS PROGRAMS
A number of departments offer outstanding upperclassmen the opportunity to follow an honors program by pursuing independent research and special study in seminars. Those who qualify receive the bachelor’s degree “with departmental honors.”

MINORITY ENGINEERS INDUSTRIAL OPPORTUNITY PROGRAM (MEIOP)
The Case Minority Engineers Industrial Opportunity Program (MEIOP) is part of a national effort to increase the number of minority engineers. The program provides supplementary academic preparation, laboratory experience, and career exploration for talented minority students enrolled in secondary school (grades 7 - 12) or at the University. For this program, minority students are defined as Native Americans (American Indians), African Americans, and Hispanics—those minority groups underrepresented in engineering. Minority students enrolled in the 7th through the 11th grades who have strong academic records and a genuine interest in engineering are eligible for participation in the MEIOP early exposure and pre-college programs. Any minority student pursuing an engineering degree may apply for admission to the undergraduate phase of MEIOP. Selected undergraduate participants may qualify for summer employment with industrial firms which sponsor MEIOP. For further information, see the Student Affairs section of this bulletin, or write or call the Office of Multicultural Affairs, 116 Baker Building, (216) 368-2904.

THE MINORITY SCHOLARS PROGRAM
The Minority Scholars Program (MSP) provides a network of student academic and counseling services available throughout the University, but centrally administered and coordinated to ensure that minority students’ interests and needs are addressed. Members of minority groups underrepresented in higher education (African Americans, Hispanics, Native Americans, Eskimos, and Pacific Islanders) are eligible for participation in the Minority Scholars Program. Further information is available in the Student Affairs section of this bulletin, and from the Office of Multicultural Affairs, 116 Baker Building, (216) 368-2904.

THE BINARY (3-2) PROGRAM
Superior students who begin their academic careers at liberal arts colleges and fulfill the required mathematics and science courses may apply for admission to the Binary (3-2) Program. The Binary (3-2) Program assures liberal arts students a smooth transition into engineering programs and selected science programs (astronomy and biochemistry) at Case Western Reserve University. The combination of a liberal arts education-mathematics, science, humanities and social science—followed by a professional orientation in engineering gives the binary student a unique preparation for a career.

Binary applications should be submitted during the junior year. Binary students enter Case Western Reserve University at the end of their junior year as third-year engineering students. After completing the engineering degree requirements, the students are awarded a baccalaureate degree from their liberal arts college and a Bachelor of Science in Engineering from Case Western Reserve University. This dual-degree program normally requires three years of study at the liberal arts college and two years at Case Western Reserve University.

Academic Guidelines
Binary students normally complete 90 semester hours or 135 quarter credit hours in the first three years at a liberal arts institution.

Specifically, these courses should include the following:
1. Mathematics: Courses equivalent to two years of mathematics, i.e., MATH 121, 122, Calculus for Science and Engineering I, II; MATH 223, Calculus for Science and Engineering III; and MATH 224, Elementary Differential Equations.
2. Physics: Courses equivalent to one and one half years of physics, i.e., PHYS 121, Mechanics, with laboratory; and PHYS 122, Electricity and Magnetism, with laboratory.
3. Chemistry: Courses equivalent to one year of chemistry, i.e., CHEM 105, 106 States of Matter, Atomic and Molecular Structure, Thermodynamic Equilibrium and Kinetics.
4. Computer Programming: Courses covering subjects of elementary program-
ming with a laboratory for the development of programming skills in C++ (ENGR 131).

5. Natural Science, Mathematics, or Statistics course, as designated by major department for major student intends to pursue at Case Western Reserve University.

6. Humanities and Social Sciences: Binary students are required to fulfill the humanities/social science requirements of their liberal arts college, which must total at least 21 semester hours.

7. English Composition: Binary students who have met the English composition requirement of their college are exempt from the ENGL 150 competency requirement.

8. Physical Education: Binary students who have met the physical education requirement of their college are exempt from the CWRU physical education requirement.

Students may complete courses in one of the basic engineering science areas that will provide background to their studies at Case Western Reserve University. These courses should have the approval of the liaison officer and the director of the Binary Program.

Students who satisfactorily complete three years at the liberal arts institution with an overall 3.00/4.00 average, a 3.00/4.00 in mathematics and science courses, and who are recommended by their liaison officer will be admitted to the third year of the appropriate curriculum and can expect to complete their degree work in approximately two years.

**Participating Colleges**

Colleges and universities participating in the Binary Program in Engineering with Case Western Reserve University are:

- Albion College, Albion, Michigan
- Allegheny College, Meadville, Pennsylvania
- Baldwin-Wallace College, Berea, Ohio
- Bates College, Lewiston, Maine
- Bethany College, Bethany, West Virginia
- Bethel College, St. Paul, Minnesota
- Capital University, Columbus, Ohio
- Carthage College, Kenosha, Wisconsin
- Centenary College of Louisiana, Shreveport, Louisiana
- Clarion University, Clarion, Pennsylvania
- Colby College, Waterville, Maine
- College of Charleston, Charleston, South Carolina
- College of William and Mary, Williamsburg, Virginia
- College of Wooster, Wooster, Ohio
- Denison University, Granville, Ohio
- DePauw University, Greencastle, Indiana
- Dickinson College, Carlisle, Pennsylvania
- Duquesne University, Pittsburgh, Pennsylvania
- Earlham College, Richmond, Indiana
- Edinboro University, Edinboro, Pennsylvania
- Fordham University, Bronx, New York
- Franklin and Marshall College, Lancaster, Pennsylvania
- Goshen College, Goshen, Indiana
- Heidelberg College, Tiffin, Ohio
- Hiram College, Hiram, Ohio
- Hope College, Holland, Michigan
- Illinois Wesleyan University, Bloomington, Illinois
- John Carroll University, University Heights, Ohio
- Kenyon College, Gambier, Ohio
- Lebanon Valley College, Annville, Pennsylvania
- Marietta College, Marietta, Ohio
- Miami University, Oxford, Ohio
- Monmouth College, Monmouth, Illinois
- Muskingum College, New Concord, Ohio
- North Park College, Chicago, Illinois
- Notre Dame College, South Euclid, Ohio
- Oberlin College, Oberlin, Ohio
- Ohio Wesleyan University, Delaware, Ohio
- Otterbein College, Westerville, Ohio
- Rollins College, Winter Park, Florida
- State University of New York, Brockport, New York
- State University of New York, Cortland, New York
- State University of New York, Fredonia, New York
- State University of New York, Geneseo, New York
- Suffolk University, Boston, Massachusetts
- Texas Wesleyan College, Fort Worth, Texas
- Thiel College, Greenville, Pennsylvania
- Universidad Catolica De Puerto Rico, Ponce, Puerto Rico
- Washington and Jefferson College, Washington, Pennsylvania
- Waynesburg College, Waynesburg, Pennsylvania
- Western Illinois University, Macomb, Illinois
- Westminster College, New Wilmington, Pennsylvania
- Wheaton College, Wheaton, Illinois
- Wheeling College, Wheeling, West Virginia
- Whittier College, Whittier, California
- Wittenberg University, Springfield, Ohio

**PROGRAMS ALLOWING ACCELERATION TOWARD PROFESSIONAL DEGREES**

**Senior Year in Professional Studies at Case Western Reserve University**

B.A. candidates of superior ability and attainment who are admitted to professional studies in Case Western Reserve University by the end of the junior year are able 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 student’s undergraduate dean. The senior year in professional studies privilege is extended to students who attend the School of Dentistry, 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 B.A. To be eligible for the senior year in professional studies privilege, a student must:

1. Be accepted for admission to profes-
ional studies in Case Western Reserve University.

2. Meet the following degree requirements:
   a. Completion of the Arts and Sciences General Education Requirements and two semesters of physical education, unless excused from the latter.
   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.

In addition to meeting all requirements listed above, students qualifying for the senior year in professional studies privilege must have completed 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.

**Senior Year in absentia Privilege for Students of Medicine and Dentistry**

B.A. candidates of superior ability and attainment who are admitted to a medical or dental school other than Case Western Reserve University’s at the end of the junior year of studies are offered an opportunity to shorten the entire course by one year through the senior year in absentia privilege. Applications should be made during the second semester of the junior year through the student’s undergraduate dean. The senior year in absentia privilege is extended to students who attend medical schools in the United States and Canada approved by the American Association of Medical Schools or dental schools in the United States approved by the American Dental Association. (Students desiring such acceleration through enrollment at Case Western Reserve University’s Schools of Dentistry or Medicine should see the regulations pertaining to the Senior Year in Professional Studies).

A student granted the senior year in absentia privilege is permitted to substitute the work of the first year of the 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 B.A. To be eligible for the senior year in absentia privilege, a student must:
   1. Attain a cumulative grade point average of at least 3.20 in all courses attempted from the date of admission as an undergraduate.

2. Meet the following degree requirements:
   a. Completion of the Arts and Sciences General Education Requirements and two semesters of physical education, unless excused from the latter.
   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.

In addition to meeting all requirements listed above, students qualifying for the senior year in absentia privilege must have completed 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 Candidates for the B.S. in Accounting**

There are two programs, which integrate graduate and undergraduate work in accounting. These programs are strongly recommended for those individuals planning to become certified accounting professionals, particularly as CPAs (Certified Public Accountants).

**Joint B.S. in Accounting/Master of Accountancy (M.Acc.)**

This program allows students to begin graduate coursework while studying for the award of their undergraduate accounting degree. Undergraduate accounting majors accepted for this opportunity will be permitted to enroll for 6 credit hours of Weatherhead School graduate courses during the senior year. These hours will also be part of the undergraduate business elective requirements. These hours of credit will count toward the satisfaction of the M.Acc. degree program requirements, reducing the graduate program requirements from 36 to 30 hours. Before taking graduate coursework, the student must have completed all prerequisites for the course on the undergraduate level and have a “B” average in those prerequisites. Students will complete and be awarded their Bachelor of Science in Accounting degree prior to enrolling in the Master of Accountancy program.

**Accelerated B.S. in Accounting/Master of Accountancy (M.Acc.) program**

This program allows motivated students to accelerate their pursuit of both the B.S. and M.Acc. degrees. In addition to applying six credit hours of Weatherhead graduate coursework towards their undergraduate degree program, students in this program may begin taking more graduate coursework before completing all of their undergraduate degree requirements. To enroll in this program, students must have:
   1. Completed 90 hours of undergraduate coursework
   2. Completed all of the undergraduate Weatherhead 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 3.0 overall GPA

Students in this program will receive both the B.S. and the Master’s degree at the end of the program. For the first eight semesters of study, the student will register as undergraduates in Case Western Reserve University; thereafter, students will register in the graduate professional degree program in the Weatherhead School of Management.
PROGRAMS ALLOWING ACCELERATION TOWARD GRADUATE STUDY

Integrated Graduate Studies Program

The Integrated Graduate Studies (IGS) Program is intended for highly-motivated candidates for the B.A. whose objective is a degree at the master’s or doctor’s level. By closely integrating undergraduate and graduate studies, qualified students begin a program of graduate study in their senior year leading to the simultaneous completion of requirements for both the master’s and bachelor’s degrees, each within its specified framework.

Any department, division, or interdepartmental committee that offers a graduate program may, with the approval of the Dean of Graduate Studies, participate in the IGS Program.

A student desiring this opportunity will normally apply for admission to PHASE I of the program in the sophomore year.

PHASE I: Admission to the program is chiefly determined by the estimate of a student’s talents, motivation, and potential for graduate study and independent work. Students may apply for admission to Phase I of the IGS Program through their major department during the second semester of the sophomore year. Contingent upon their completion of 54 semester hours of study, students are admitted to Phase I at the beginning of the junior year on recommendation of the department, division, or interdepartmental committee to which they have applied. During the junior year, IGS students will take between four and six courses in the major field, as advised by their department, to prepare them for the work of Phase II. Students seeking admission to Phase I will be informed by their departments if their admission requirements differ from those specified here.

PHASE II: Admission to graduate study is facilitated by, but not dependent upon, participation in Phase I. On completion of no fewer than 90 semester hours (ordinarily at the end of the junior year), students may be accepted for admission to the School of Graduate Studies. Transfer students are subject to the College of Arts and Sciences residence regulations and must have completed at least 60 semester hours, including the last 30, in residence.

Admission to the graduate school will be approved if the student has met the criteria above, has completed all requirements for the bachelor’s degree except total number of hours, has completed three-fourths of the hours required for the major, and has completed the Arts and Sciences General Education Requirements, and two semesters of physical education, unless excused from the latter. In addition, the student must be recommended by the department, division, or interdepartmental committee to which he or she seeks admission.

Upon admission to the School of Graduate Studies, a student will begin a program of study leading to the master’s or doctor’s degree as approved by his or her department or committee and by the Dean of Graduate Studies.

The bachelor’s degree normally will be awarded at the commencement immediately following satisfactory completion of the year of graduate study and attainment of a total of 120 semester hours of credit. Participants in Integrated Graduate Studies are exempt from the Bachelor of Arts degree limit of 42 hours above 100 level in a single department. The master’s or doctor’s degree will be awarded upon satisfactory completion of the requirements for these degrees. In some instances, the bachelor’s and master’s degrees may be awarded simultaneously. The completion of the master’s degree, however, may require an additional semester or summer of course work.

For Candidates for the B.S. in Nutrition

Integrated B.S./M.S. in Nutrition and Toxicology

The integrated B.S./M.S. five-year program in nutrition and toxicology is jointly administered by the Departments of Nutrition and Environmental Health Sciences in the School of Medicine. Upon successful completion of the program, students earn the B.S. degree in Nutrition and the M.S. in Nutrition or Environmental Health Services. Admission to the program is subject to the same process and requirements as admission to the Integrated Graduate Studies Program described above.

For Candidates for the B.S. in Engineering, Computer Science, Mathematics, Natural Sciences, and Statistics

B.S./M.S. Program

The Integrated B.S./M.S. Program is intended for highly-motivated candidates for the B.S. whose objective is a degree at the master’s or doctor’s level. Application to the BS/MS program must be made after completion of 75 semester hours of coursework 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 more than two semesters of remaining BS requirements to complete. Applicants in engineering or computer science should consult the Associate Dean in the Case School of Engineering. Applicants in mathematics, natural sciences, or statistics 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 that will count towards both BS and MS requirements. The courses to be double-counted must be specified on the student’s MS Program of Study. Students for whom the master’s project or thesis is a continuation and development of the senior project should register for Exxx 651 Thesis (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 coursework 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.
PROGRAMS ALLOWING ENTERING STUDENTS CONDITIONALLY GUARANTEED ADMISSION TO CWRU PROFESSIONAL SCHOOLS

The Pre-Professional Scholars Programs in medicine, dentistry, law, and social work grant to a few outstanding entering freshmen 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. Students enrolled in the Engineering Core curriculum may have less flexibility in arranging to take some undergraduate courses identified as desirable by the professional schools.

The Six-Year Dental Program gives exceptionally able and committed entering freshmen the opportunity to accelerate their undergraduate and professional studies.

The Early Admission Decision Program in Law gives outstanding students who have completed two years of undergraduate study a conditional commitment of admission to the School of Law. The commitment is honored upon successful completion of the requirements established by the School of Law.

DENTISTRY

Pre-Professional Scholars Program in Dentistry

Each year, as many as 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 study in the University and four years at the School of Dentistry.

Pre-Professional Scholars in Dentistry are free to choose a major in an area of interest in the humanities, social sciences, or natural sciences, but must take the following courses to fulfill admission requirements of the School of Dentistry:

2. Biology: BIOL 110, Principles of Biology; BIOL 111, Introduction to Experimental Biology Laboratory; BIOL 220, Organismal Biology; and BIOL 205, Chemical Biology or BIOL 210, Cell and Molecular Biology.
3. Mathematics: MATH 125, Mathematics I.

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 3.0 or higher for all course work completed.

Pre-Professional Scholars Program in Law

Each year as many as 12 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 University 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 college, 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 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.

**MEDICINE**

**Pre-Professional Scholars Program in Medicine**

Each year, as many as 25 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 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 at 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:

2. Biology : BIOL 110, Principles of Biology; BIOL 111, Introduction to Experimental Biology Laboratory or BIOL 211, Laboratory in Biochemistry, Molecular and Cell Biology, or BIOL 221, Physiology Laboratory; BIOL 220, Organismal Biology; and one additional 200 or higher level biology course.
3. Mathematics : MATH 125, 126, Mathematics I, II.

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 32 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 CWRU 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 fourth semester, Pre-Professional Scholars in Medicine are expected to attain a cumulative overall grade point average of 3.60, 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 required courses in chemistry, biology, physics, and mathematics. By the end of the fourth semester, they should attain a cumulative grade point average of 3.60 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.

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 School of Medicine, including an application and an interview.

Participants who do not meet the required levels of performance may still be admitted into the School of Medicine, but such admission will be subject to review and approval by the School of Medicine’s Admissions Committee.

**SOCIAL WORK**

**Pre-Professional Scholars Program in Social Work**

Each year, as many as 10 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 3.0 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 in the application booklet.

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 January 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 March 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 and three College Board Achievement Tests), 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 15.

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.

Off-Campus Programs

COOPERATIVE EDUCATION PROGRAM

Cooperative Education (Co-op) enables students to integrate classroom theory into practice in a paid employment position coordinated with their major field of study. Students participating in the Co-op Program gain a better understanding of their career objectives through practical work experience in conjunction with academic course work.

The Cooperative Education Program is accredited by the Accreditation Board for Engineering and Technology (ABET) and maintains a strong academic focus.

Co-op is available to full-time undergraduate students in good academic standing in all engineering and science departments (except astronomy) and accounting and management majors.

Through the Cooperative Education Program, students can acquire positions in industry and government while completing their undergraduate degrees. Co-op assignments are full-time; typically for two seven-month periods consisting of a summer and the contiguous spring or fall semester. Employers prefer the duration of the seven month assignments since it allows students to become involved with longer term, challenging projects.

Students are eligible to co-op after the sophomore year, although schedules vary among the departments. The Co-op Program does not add additional course work, but merely rearranges the academic course load. One faculty member in each participating department serves as the co-op adviser, assisting students in scheduling courses and co-op assignments.

While the co-op experience is voluntary and non-credit, it can lead to credit for engineering senior projects with approval of the student’s major department.

Binary and transfer students must complete at least one semester of coursework at the University before admission to the Co-op Program. Binary students participating in the program are obligated to work only one seven-month co-op assignment.

Over 500 employers throughout the United States have expressed interest in participating in the Co-op Program, offering challenging academic assignments that often lead to offers of permanent employment after graduation. The salary for co-op experiences assists students in meeting financial obligations. Generally, companies pay co-ops about two-thirds of the starting salary of a new graduate.

In addition to financial compensation earned during the industrial co-op period, students often benefit from higher starting salaries and greater lifetime earnings that can result from the experience acquired in co-op assignments.

Typical Co-op Schedule

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<tr>
<th>Year</th>
<th>Fall</th>
<th>Semester</th>
<th>Summer</th>
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<tbody>
<tr>
<td>1</td>
<td>Classes</td>
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<tr>
<td>2</td>
<td>Classes</td>
<td>Classes</td>
<td>Co-op</td>
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<td>3</td>
<td>Co-op</td>
<td>Classes</td>
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<tr>
<td>4</td>
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<tr>
<td>5</td>
<td>Classes</td>
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Once a position is secured, students register for the Cooperative Education course (Co-op 001, 002, or 003) which is reflected on the transcript. Registration for co-op maintains full-time student status as it is an academic program and considered an extension of the classroom. In addition, enrollment in co-op defers repayment of student loans.

The Co-op Office is housed in the Office of the Dean, Case School of Engineering. Prior to obtaining a co-op assignment, students are assisted in identifying companies of interest, designing a professional resume, refining interviewing skills, and focusing on career direction. The Co-op staff will arrange interviews for the students with a variety of companies.

Assistance with pre-registration, financial aid, housing and health services are additional services provided by the staff while students are on assignment.

INTERNATIONAL EXCHANGE PROGRAMS

Qualified students may participate in international exchange programs which send CWRU students overseas and bring to CWRU visiting international students. Up to 36 semester hours of credit may be granted for study as an exchange student at an established foreign university with which CWRU has an exchange program. CWRU students participating in exchange programs pay tuition to CWRU and maintain CWRU student status during the period of the exchange.

Global Engineering Exchange Program (GE3)

Case Western Reserve University participates in the Global Engineering Education Exchange Program (GE3), an international exchange program administered by the Institute for International Education. The GE3 program provides opportunities for engineering students at member institutions to receive academic credit for courses taken at overseas member institutions, and to have an internship experience in a foreign setting. Information about the GE3 program is available from the study abroad adviser in the Office of Undergraduate Studies.

Bilateral Exchange Programs

Case Western Reserve University has bilateral exchange agreements enabling students from overseas institutions to attend CWRU as visiting students and permitting CWRU students to receive academic credit for study at the following institutions:

- University of Lancaster, UK (all majors)
- ESC de Montpellier, France (manage-
JUNIOR YEAR ABROAD

Full-time undergraduate students who have earned a 3.0 grade point average at the University are eligible to apply for the Junior Year Abroad. Up to 36 semester hours of credit may be granted for study at an established foreign university or for approved foreign study programs offered through accredited American universities. The selection of location and institution for study abroad is made in consultation with a study abroad adviser in the Office of Undergraduate Studies, and must be approved by the Office of Undergraduate Studies and the student’s major adviser. A fee is charged for participation in the Junior Year Abroad program (see schedule of fees). Financial aid may be applied to the Junior Year Abroad.

In recent years, Case Western Reserve University undergraduates have studied in Australia, Austria, Denmark, England, France, Germany, Israel, Italy, Japan, Kenya, New Zealand, Scotland, and Spain. Through a special arrangement, up to 20 students from the University may be accepted at the University of Lancaster, England, for the Junior Year Abroad.

PROFESSIONAL PRACTICUM PROGRAM

The Professional Practicum Program enables students pursuing majors and degrees in the College of Arts and Sciences or in the Weatherhead School of Management to include in their undergraduate program a workplace experience, the primary goal of which is the intellectual, personal and professional growth of the student. Occurring under the sponsorship or supervision of a mentor in the workplace, the practicum requires skills appropriate to the student’s year in college and provides the student with new skills, insights and experiences that are transferable back to the academic setting and/or to a future position in the workplace. The practicum may be either paid or unpaid.

Academic year practica consist of a full time placement for a minimum of fourteen weeks (or equivalent), which fall within an academic semester. Normally, no more than two semester-long practica may be done by a student. A student doing two practica must spend at least one intervening semester in residence at CWRU. Students may be required to complete pre-practicum requirements as well as a practicum report, journal or other final project. All requirements must be met no later than the last day of final exams in the semester in which the practicum is taken.

The academic year practicum program will be open to students who have successfully completed 60 credit hours at CWRU - or 30 credit hours for students who entered as transfer students (typically, at the end of the sophomore year). Constituent faculties may specify a minimum GPA for acceptance of their majors into the program. Any minimum GPA requirements must be met at the beginning of the semester of the practicum.

A student who has completed all graduation requirements is not eligible for a practicum.

Students who are engaged in an practicum during the academic year involving full time work for an entire semester will register for a non-credit practicum course (PRAC 001, PRAC 002). In general, this course will constitute the primary academic activity of the student. Registration in a PRAC course will maintain student status for purposes such as student loan repayment, maintenance of health insurance and visa status.

The Professional Practicum Program is coordinated in the Career Center. The academic year practicum of each student will be overseen by a faculty adviser. The practicum adviser will work with the student and appropriate Career Center staff, and will be in contact with the workplace mentor, who will be an employee or principal in the workplace, responsible for providing appropriate supervision and work related learning objectives. At the completion of the practicum, the practicum adviser will determine whether the student has satisfactorily completed the experience and will assign and submit a grade of Pass or No Pass. Satisfactory completion is based on an assessment that the student has completed all pre- and post-practicum requirements, journals, etc., and that the student has adequately performed in the workplace and has achieved the goals set for the workplace experience.

RESERVE OFFICER TRAINING CORPS (ROTC)

Reserve Office Training Corps (ROTC) programs are available to Case Western Reserve University students through cooperative arrangements with the University of Akron, for Air Force ROTC, and with John Carroll University, for Army ROTC. Each of these universities offers military studies, leadership and training courses. Participating CWRU students do not receive academic credit at CWRU for these courses, but 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. CWRU students enrolling in ROTC programs are eligible to compete for ROTC scholarships awarded by the Air Force or the Army. See section on Financial Aid for scholarship information.
Air Force ROTC

The Air Force Reserve Officer Training Corps (AFROTC) program provided by the University of Akron 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 the University of Akron allows full-time CWRU students to complete aerospace studies courses. The courses are held at the University of Akron, which is approximately 30 miles from CWRU, and are usually scheduled on one or two afternoons during the week. This arrangement allows CWRU students to participate in either the four-year 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 Department of Aerospace Studies, 9 Schrank Hall South, the University of Akron, Akron, Ohio 44325-0009; telephone: (330) 972-7653.

Army ROTC

The Army ROTC program is designed to prepare young college men and women 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.

Students may enroll in Army ROTC classes through cross-registration in the Department of Military Science at John Carroll University, which is approximately five miles from CWRU. Military science classes are taught at John Carroll University, with some activities also taking place at Cleveland State University or at CWRU.

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.

THE WASHINGTON STUDY PROGRAMS

Qualified students may participate in either of two programs which provides the opportunity to spend a term of study in Washington, D.C.

The Washington Semester Program (WASH 001)

A full semester’s credit can be earned for the satisfactory completion of specialized work with source materials and at governmental institutions. All work is conducted at American University, and includes two seminars, a half-time internship, and directed research in an area of the student’s interest.

The Washington Center Program (WASH 002)

Students receive up to 15 hours of credit for work supervised by the Washington Center. The emphasis is on practical experience in the form of a full-time internship (WASH 002A) which provides the opportunity for intensive research and the development of a portfolio (WASH 002B) in the student’s area of major interest. In addition, students participate in a seminar and attend a weekly lecture/discussion group (WASH 002C). 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).

The Washington Center also offers a variety of academic seminars and symposia during in the summer for which credit can be earned.

General Requirements

Students make application through the Department of Political Science. Applications also must have the approval of the Dean of Undergraduate Studies and the student’s major adviser. To be eligible for participation in either program a student must:

1. Be ranked as a junior or first-semester senior in the semester of enrollment in the program. Seniors should not apply for the privilege in the final semester of the senior year.
2. Have completed the Arts and Sciences General Education Requirements before enrollment. (Some exceptions may be made for a student enrolling in the program in the first semester of the junior year.)
3. Have earned a cumulative grade point average of 3.0 or better.
4. A letter grade for some or all work done in this program can be arranged by petition to the department.

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. Before enrollment, the transient student must present a statement of good standing from the registrar of his or her home college.

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 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.

Applications for enrollment as a transient student may be obtained from the Office of Undergraduate Studies, 102 Baker Building.

PRE-COLLEGE SCHOLARS

Students enrolled in high school who wish to take courses at Case Western Reserve University will be considered for
admission upon application to the Pre-College Scholars program and only with the endorsement of their high school principal or guidance counselor. This program is designed for those who have demonstrated a high degree of academic competence for study in all areas by doing consistent A and B work in an accredited high school curriculum.

Further information concerning the Pre-College Scholars program and the Post-Secondary Enrollment Option Program of the State of Ohio may be obtained by writing the Office of Undergraduate Studies or by calling (216) 368-2928.

NON-DEGREE STUDENTS
Adults 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 as academic standards as degree students.

Non-degree students may be eligible for admission to candidacy for a 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.

All non-degree students who do not already hold a bachelor’s degree register through the Office of Undergraduate Studies, 102 Baker Building, 368-2928.

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.

CONTINUING EDUCATION
The University provides academic, non-credit courses for those who seek self-enrichment and professional advancement. Courses are presented both on and off campus. Special workshops and seminars are designed and presented by faculty and in cooperation with various community groups throughout the academic year. Illustrations of two such programs follow.

Senior Scholars
This program is designed for men and women 50 years of age and older who seek non-credit, university-level courses and the intellectual stimulation provided by being on a college campus.

Two seminars are presented each semester. They are taught by University faculty and meet once a week for 10 consecutive weeks. In addition, Thursday Forums (lectures followed by a question-and-answer period), are offered on the second and fourth Thursdays of each month. These forums cover a cross section of the academic disciplines at the University.

Senior Scholars pay a single fee at the beginning of the academic year which entitles them to two semesters of specially designed seminars and forums. They may participate in all or any parts of the program they choose.

Registration for this program is handled by the Office of Continuing Education, 103 Guilford House, 368-2090.

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.

Participants in the Senior Scholars or Special Audit programs are considered students at the University and may obtain student ID cards which entitle them to use the University Libraries, receive a student discount at the bookstore, and take advantage of student rates at campus events. Part-time parking privileges in University assigned parking lots are also available.

Honors, Prizes, 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, NPs, or Incompletes during the same period. Students with a grade point average of 3.75 or higher will be placed on the Dean’s High Honors List. Students with a grade point average of at least 3.50 but less than 3.75 will be placed on the Dean’s Honors List.

COMMENCEMENT HONORS
[To take effect with the class graduating in 2002] 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

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 cumulative average in all work for which grades are averaged at the University.

DEPARTMENTAL HONORS
Students who participate in departmental honors programs and satisfy the requirements for such a distinction, as specified by the department, may qualify to receive the degree “with departmental honors.”

PHI BETA KAPPA
Phi Beta Kappa, a national honor society, recognizes outstanding scholarship in the arts and sciences. The Alpha Chapter of Ohio, one of the first ten established nationally, was established in Western Reserve College in 1847. 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 which recognizes full-time engineering students for outstanding scholarship, leadership, and service.

MORTAR BOARD
Mortar Board is a national honor society which recognizes full-time senior students for outstanding scholarship, leadership, and service.

PRIZES, AWARDS, AND SCHOLARSHIPS
Students are selected by departments or by the deans as recipients of the following awards, which are presented at the Honors Assemblies each spring. Awards made to graduating seniors are listed in the commencement program.

Departmental Awards

Accountancy
The Beta Alpha Psi Award for excellence in Accounting
The Ernst and Young Accounting Achievement Award
The Deloitte and Touche Award to an outstanding junior majoring in Accounting
The Conviser-Duffy Scholarship
The Beta Alpha Psi Scholars Recognition Award for outstanding scholarship among members of the Pi Chapter
The Louis Levy Meritorious Service Recognition Award for outstanding service to chapter, school and community
The Alcoa Financial Award
The Alcoa Foundation Award
The Arthur Andersen & Co. Award
The Cargill, Inc. Scholarship Award
The CBIZ-SMR & Company Award for an outstanding underclassman
The Price Waterhouse Coopers Scholarship Award
The KPMG Peat Marwick Scholarship Award
The Kopperman and Wolf Award
The Cohen & Co./Beta Alpha Psi Leadership Award
The Becker CPA Review Award
The Plant and Moran Award

Anthropology
The Ruth and Newbell Niles Puckett Award to a graduating senior for outstanding achievement in anthropology
The James Dysart Magee Award for the senior year to an outstanding student in social and behavioral sciences who is also enrolled in the Integrated Graduate Studies Program
The Callender Memorial Award for outstanding achievement in anthropology

Art History/Art Studios
The Hazel Gibbs Herbruck Prize for excellence in art education
The Doris Young Hartscock Prize for outstanding performance in art education
The Kennedy Prize for creative work in art
The William Grauer Award for excellence in art studio courses
The Arnold Philip Award for excellence in art
The Charles E. Clemens Prize for outstanding talent and accomplishment in art
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

Astronomy
The Jason J. Nassau Prize was established by the Cleveland Astronomical Society in 1965 in memory of Professor Emeritus Nassau, former head of the Department of Astronomy, who was a member of the faculty for 41 years. It is awarded annually to a senior student in astronomy selected by the faculty of the department.

Biochemistry
The Harland G. Wood Prize for outstanding performance by a graduating senior majoring in biochemistry who is a candidate for the B.S. in Biochemistry
The Merton F. Utter Prize to a candidate for the B.A. majoring in biochemistry for outstanding achievement

Biology
The Russell M. Lawall Prize in Biological Sciences for excellence in both academics and research in biology
The Francis Hobart Herrick Prize for outstanding biological research and academic excellence in biology
The Ralph A. Spengler, Jr. Award for excellence in plant science
The Michelson-Morley Undergraduate Research Prize in the Biological Sciences for outstanding research presentation, funded by the Howard Hughes Medical Institute
The J. Paul Visscher Memorial Award of the Cleveland Audubon Society to the senior or graduate student who demonstrates outstanding ability and promise in the field of ecology or environmental science
The Mather Alumnae Award in Biology for excellence in biology
The Daniel Burke Prize for excellence in both biology and chemistry

Biomedical Engineering
The Mark Bernstein Memorial Award to a senior in biomedical engineering for outstanding academic achievement and personal qualities
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, achievement in sports, and service to the biomedical engineering community
The Biomedical Engineering Research Award for outstanding performance in biomedical engineering research combined with outstanding academic achievement and outstanding achievement in sports
The J. Thomas Mortimer Cooperative Education Award
The Jose Ricardo Alcala Memorial Award for biomedical engineering research

Chemical Engineering
The Monroe J. Bahnsen Award was established by contributions of friends and associates in memory of Dr. M. J. Bahnsen, Case ’29. It is awarded annually to a senior for achievement in chemical engineering whose work in design and research projects has been outstanding.
The Carl F. Prutton Chemical Engineer-
The Charles F. Mabery Prize is awarded to the senior whose academic performance merits his or her selection as outstanding.
The William H. Schuette Memorial Award is given to a senior whose major field is chemical engineering and whose academic performance, character, and qualities of leadership merit election as outstanding. The award was established by friends and co-workers in memory of Mr. Schuette, '33, vice president and general manager of Dow Chemical Company.
The A. W. Smith Prize is presented to the senior in engineering whose major field is chemical engineering, and who has earned the highest record in the junior and senior years in chemical engineering courses. The prize was established by Dr. Carl F. Prutton, '20, former head of the Department of Chemistry and Chemical Engineering, in memory of Dr. Albert W. Smith, Case 1887, a member of the Case faculty for 40 years.
The Connie Ilcin Award to the student who exhibits outstanding performance in chemical engineering.

Chemistry

The W. R. Veazey Prize is awarded to a junior achieving the highest academic record in physical chemistry courses. This prize was established by Dr. Carl F. Prutton, Case ‘20, honoring W. R. Veazey, for 29 years a member of the Case faculty.
The Olin Freeman Tower Prize for excellence in physical chemistry
The Carl F. Prutton Prize for scholarship in chemistry to a student pursuing a B.S. degree
The Charles F. Mabery Prize is awarded to the undergraduate or graduate student presenting the best thesis on a subject connected with research in the Department of Chemistry. The prize was established in 1928 by Professor Charles F. Mabery, former head of the Department of Chemistry.
The Freshman Chemistry Achievement Award for the highest achievement in freshman chemistry
The Iota Sigma Pi/Frank Hovorka Prize to the woman chemistry major with the highest average after three semesters
The Eli Lilly Award to a sophomore or junior chemistry major pursuing the B.S. degree
The Merck Index Award to an excellent chemistry student
The Hippolyte Gruener Award for merit in chemistry
The Hypercube Scholar Award

Civil Engineering

The Kenneth M. Haber Award to the outstanding senior in Civil Engineering and Science
The Craig J. Miller Memorial Award was established in 1979 by family and friends in memory of Professor Miller. It is given to an undergraduate or graduate student in the general field of civil engineering who has shown outstanding academic achievement.
The Allison C. Neff Memorial Award was established by family and friends in memory of Mr. Neff, '25, former vice president and central division manager of Armco Drainage and Metal Products, Inc. The award is presented in recognition of high proficiency in professional studies and participation in professional activities to a junior in engineering whose major field is civil engineering.
The Roy Harley Prize to a senior or graduate student in civil engineering promising high potential in the practice of engineering

Classics

The Abraham Lincoln Fuller Prizes for excellence in the study of Greek or Latin
The Emma Maud Perkins Prize for excellence in classical studies
The Crawford Summer Scholarship to the American School of Classical Studies in Athens

Communication Sciences

The National Student Speech-Language-Hearing Association Award for outstanding leadership and achievement in communication 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 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
The H. W. Kniesner Prize to an outstanding senior in economics
The Gardiner Scholarship to a student majoring in economics and is also interested in finance

Electrical Engineering and Computer Science

The Chairman’s Award to a student in the Department of Electrical Engineering and Computer Science who shows exceptional academic or leadership potential
The Carolyn J. and John A. Massie ’66 Prize for Computer Engineering and Science awarded to the outstanding graduating senior in computer engineering and science based on performance in the Cooperative Education Program.
The Andrew R. Jennings Award to a senior for excellence in Computer Engineering and Sciences
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 National Electrical Engineering Consortium William L. Everitt Award to a student who has excelled academically in communications or computers
The Marconi Award for the best senior project in computer engineering and computer science
The Eta Kappa Nu-I.E.E.E. Award was established by I.E.E.E. and Eta Kappa Nu honorary fraternity. This award is given to the senior student judged by his or her fellow students to possess the qualities necessary for an outstanding professional career in a general field of electrical engineering.
The W. Bruce Johnson Award was established in 1969 in memory of Dr. W. Bruce Johnson, professor of engineering and head of the Division of Electrical Sciences and Applied Physics. This award is given to the senior who has demonstrated outstanding ability and shows unusual potential for future contributions in the area of electrical sciences and applied physics.

The Electrical Engineering Service Award is given to the senior performing outstanding service to his class.

The Michael L. Wolf Prize was established in 1974 by the family and friends of Michael L. Wolf, a Ph.D. candidate and teacher in electrical engineering.

The National Electrical Engineering Consortium William L. Everitt Award is given to a student who has excelled in electrical engineering studies.

The Marconi Award for the best senior project in electrical engineering or systems and control engineering.

The Donald P. Eckman Award was established by the American Automatic Control Council in memory of Dr. Donald P. Eckman, professor of mechanical engineering and first director of the Systems Research Center. It is given to the senior majoring in systems and control engineering with the best overall achievement in his or her undergraduate program.

The Undergraduate Alumni Capital Award in Systems Engineering to a senior for academic excellence and professional promise.

**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 papers written by upperclass students.

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 freshman.

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.

**Geological Sciences**

The Charles S. Bacon Award for an outstanding senior in geological sciences.

**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 excellence in history.

The History Department Award for outstanding achievement in history.

**Macromolecular Science and Engineering**

The Hal Loranger Award for Polymer Science was established in 1974 by friends as a memorial to Hal Loranger. This award is given to the outstanding senior in polymer science.

The Samuel Maron Memorial Award is given to an undergraduate for excellence in polymer research.

**Management**

The Roulston Performance Award for outstanding performance in management.

The Wall Street Journal Award to the outstanding senior in management.

The Financial Executive’s Institute Award.

The Nemet Scholarships for the demonstration of excellence in management science whose outstanding work in the general field of economics shows the greater promise of leadership. This prize was established by Professor Frank Tracy Carlton, Case ‘95, and his wife, Mrs. Nellie Chittenden Carlton.

The Kevin J. Semelsberger Prize for excellence in management.

**Materials Science and Engineering**

The Wesley P. Sykes Prize was established in 1961 by Dr. Wesley Pope Sykes, Case ’16. This prize is awarded to a senior majoring in metallurgy who shows outstanding ability in scientific research, especially as evidenced by the quality of his or her thesis.

The Professor Jack F. Wallace Award to the materials science and engineering student who embodies the dedication and spirit of Professor Wallace.

**Mathematics**

The Max Morris Prize was established in 1964 by family, friends, and former students in memory of Professor Max Morris to honor his contribution to the teaching of mathematics. This prize is presented to an outstanding undergraduate student in mathematics who is pursuing the B.S. degree.

The Webster Godman Simon Mathematics Award to a sophomore or junior pursuing a B.A. degree, for excellence in mathematics.

**Mechanical and Aerospace Engineering**

The Fred Hale Vose Prize was established by Elmer L. Lindseth, Case ’25, to honor Professor Emeritus Fred Hale Vose, former head of the Department of Mechanical Engineering. It is presented to the senior whose major field is mechanical engineering and who has demonstrated the greatest promise for professional leadership.

The Gustav Kuerti Award is given to the senior in mechanical and aerospace engineering who has demonstrated the highest level of scholarship.

The Robert and Leona Garwin Prize was established in 1977 by Richard L. Garwin, Case ’47. The student must have given evidence of combining theoretical scientific or engineering ability with experimental competence and inventive talent.
The Anish Shah ’91 Award to an outstanding senior in mechanical and aerospace engineering based on academic achievement, extra-curricular activities, and community service

**Modern Languages**
The Emile B. deSauze Award for attaining the highest honors in modern languages and literatures
The French Book Prize to a freshman for outstanding work in French
The Susie Scott Christopher Prize for excellent contributions to the French program
The German Undergraduate Book Prize for achievement in German
The Folberth German Prize for excellence in German language and literature
The Italian Undergraduate Book Prize for outstanding achievement in Italian
The Spanish Undergraduate Book Prize for achievement in Spanish
The Chinese Undergraduate Book Prize for achievement in Chinese
The Japanese Undergraduate Book Prize for achievement in Japanese
The Russian Undergraduate Book Prize for high achievement in Russian
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

**Music**
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 Arthur H. Benade Prize to a senior with a major other than music who has made a notable contribution to music on campus
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
The Lyman Piano Award

**Nursing**
The Bolton Scholar Award for Excellence in Psychiatric/Mental Health Nursing
The Bolton Scholar Award for Excellence in Critical Care
The Bolton Scholar Award for Excellence in Pediatric Nursing
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 Research
The Bolton Scholar Award for Excellence in Acute Care
The Bolton Scholar Award for Excellence in Community 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 made the most outstanding contribution to Case Western Reserve University through the athletic program
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 freshman, sophomore or junior who has demonstrated leadership, good sportsmanship, maintained good academic standing and made contributions to the department and university

**Physics**
The B.S. Chandrasekhar Prize in Physics is presented to the outstanding junior physics major.
The Dayton C. Miller Award was established by the late Herbert A. Erf, Case ’26, honoring this internationally renowned physicist who served as professor of physics for 50 years. It is given to the senior in physics who is judged by the faculty of the department to have written 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 Krumhansl Family Prize for accomplishments by women in physics
The Leslie L. Foldy Award to the outstanding senior in physics
The Senior Award for service and scholarship in physics

**Political Science**
The Mather Alumnae Award for excellence in political science
The James Dysart Magee Award for the senior year, to an outstanding student in social and behavioral sciences enrolled in the Integrated Graduate Studies Program

**Psychology**
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 enrolled in the Integrated Graduate Studies Program
The Mather Alumnae Award for excellence in psychology

**Religion**
The Ratner Family Prize to the graduating senior with the best academic record in religion

**Sociology**
The James Dysart Magee Award for the senior year, to an outstanding student in social and behavioral sciences enrolled in the Integrated Graduate Studies Program
The Schermerhorn Award for an outstanding student in sociology
The Mark Lefton Award for excellence in sociological studies
The Stella Berkeley-Friedman Award to a graduating senior for the highest academic achievement in the study of sociology

**Theater Arts**
The Dionysus Award for an outstanding contribution in theater to a student not majoring in theater
The Barclay Leathem/Nadine Miles Award for creativity and general excellence in theater
The Eldred-Mather Award to a talented and deserving undergraduate theater arts major for exceptional commitment to developing his/her craft
The Music and Drama Club Scholarship to a theater arts major for outstanding contributions to the production program with potential for professional work, given by the Music and Drama Club
The Lily Dreyfuss Memorial Award for excellence in dance

**Awards for Study Abroad**
The Brookes Friebolin Award to an outstanding student for study in France
The Alice Seagraves Award to outstanding students for study abroad
The Eva L. Pancoast Award to senior women in the College of Arts and Sciences or women students in the School of Graduate Studies for foreign travel or study

**Collegiate Awards**
The Peter Witt Scholarship to a deserving student who demonstrates a vital and active interest in the improvement of life in Cleveland
The Phi Beta Kappa Prize to sophomores in liberal arts programs with the best academic records at the end of three semesters
The Outstanding Sophomore Awards of the Case School of Engineering to sophomores pursuing the Bachelor of Science degree with the best academic records at the end of three semesters
The Harriet Levion Pullman Award of the College of Arts and Sciences to a sophomore outstanding in scholarship, leadership, and service
The Bolton Scholar Award for Excellence in Nursing for the student who has attained the highest academic record at the sophomore level
The Delta Phi Upsilon Alumnae Prize of the College of Arts and Sciences to a junior woman with the best academic record at the end of five semesters
The Junior Award of the College of Arts and Sciences to a junior with the best academic record at the end of five semesters
The Outstanding Junior Awards of the Case School of Engineering to juniors pursuing the Bachelor of Science degree with the best academic records at the end of five semesters
The Bolton Scholar Award for Excellence in Nursing for the student who has attained the highest academic record at the junior level
The Joseph Skigin Memorial Award to an outstanding premedical student for the senior year
The Louis K. Levy Prize for an outstanding junior in the College of Arts and Sciences
The George T. Hunt Awards to a junior and a senior outstanding in leadership, scholarship, and service
The Sylvia Green Rosenberg Award to a part-time or full-time non-traditional student
The Mather Alumnae Award for outstanding academic performance in the humanities
The George S. Traub Memorial Award to a student in the College of Arts and Sciences completing the best project and paper related to the economy of Cleveland or Northeast Ohio
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 Robert and Joyce Shaefer Prize to a student from the Case School of Engineering who has made a major contribution to campus publications
The Robert J. Adler Award to the senior student in the Case School of Engineering who best exemplifies the ideals and talents of Professor Robert J. Adler. The recipient will have demonstrated high scholarship and technical creativity. In addition, the recipient will have demonstrated concern for and provided service to his or her peers
The Robert L. Shurter Prize to a senior for leadership in extracurricular activities in the Case School of Engineering
The Case Alumni Association Prize for Achievement to the senior attaining the highest academic record in his undergraduate years in the Case School of Engineering
The Kent H. Smith Award was established in 1961 by Case students and presented by the Case Student Senate to honor Kent H. Smith, Case ’17, for his service as a member of the Board of Trustees and as acting president from 1958 to 1961. The award is presented to an outstanding senior displaying extraordinary leadership, character, and scholarship in the Case School of Engineering
The John Schoff Millis Award to the senior with the best academic record in the College of Arts and Sciences
The Russell A. Griffin Award to a senior who has made the most significant contribution to campus life in the College of Arts and Sciences
The Bolton Scholar Award of the Frances Payne Bolton School of Nursing for outstanding academic performance
The Bolton Scholar Award of the Frances Payne Bolton School of Nursing for outstanding academic performance
The Bolton Scholar Award of the Frances Payne Bolton School of Nursing for outstanding academic performance
The Weatherhead School of Management Award to a senior, for outstanding achievement in the Weatherhead School of Management
The Matthew Leskiewicz Award to a senior in the Weatherhead School of Management for outstanding leadership and service
The Edward J. “Ted” Corcoran Award to a senior for outstanding leadership, character and service
School of Graduate Studies
School of Graduate Studies

121 Baker Building
Phone 216-368-4390; Fax 216-368-4250
Derrick S. Best, Assistant Dean for Graduate Studies

The School of Graduate Studies is the unit through which Case Western Reserve University offers graduate programs in the humanities and social sciences, biological and physical sciences, engineering, and selected disciplines related to professional fields. These programs lead to the degrees of Master of Arts, Master of Fine Arts (theater and dance), Master of Science, Master of Public Health, Doctor of Musical Arts, and Doctor of Philosophy. Several programs offered jointly with the professional schools and local affiliated institutions lead to dual degrees such as M.A./J.D., M.S./M.D., M.A./M.S.N., M.S.S.A./Ph.D., and M.D./Ph.D. There are also two combined undergraduate and graduate programs, IGS (Integrated Graduate Studies) and B.S./M.S., which allows undergraduate students to enter graduate study before they complete their undergraduate programs. The School of Graduate Studies, overseeing university-wide standards of quality in admission and performance, presently awards graduate degrees in 70 basic disciplines with Ph.D. programs and 15 others in which the highest degree is the M.A., M.F.A., or M.S. Enrollment in the School of Graduate Studies for Fall 1999, excluding non-degree registrants, totaled 2078, of which 1112 were men, 966 were women, and 677 were international. Of those registrants 462 were new students, 912 were full-time students, and 1166 were part-time students. During the academic year 1998-99, the school awarded 374 master’s degrees and 163 doctorates.

GRADUATE COMMITTEE

General responsibility for overseeing programs of graduate study and for academic and other general regulations applicable to all graduate students and programs is delegated to the University Faculty Senate Committee on Graduate Studies. 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, assistant dean of graduate studies, nine faculty members elected by the University Faculty Senate and three graduate students elected by the Graduate Student Senate.

GRADUATE STUDENT SENATE

Students in the School of Graduate Studies are represented by a Graduate Student Senate, 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 INFORMATION

For financial aid information see the “Financial Information” section of this Bulletin.

APPLICATION TO GRADUATE STUDY

Applicants with good academic records from fully accredited universities and colleges will be considered for admission to graduate study 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.

APPLICATION PROCEDURE

An applicant for admission must submit complete credentials to the proposed department or program at least 30 days before the first day of classes for the semester admission is requested. (Allow at least 60 days when applying from outside the United States.) An applicant for admission and concurrent financial aid consideration must have the completed application forms on file generally by March 1 for fall semester or by November 1 for spring semester. Most departments award financial aid for the academic year, which begins in the fall semester. The credentials must include the following items:

1. Completed application forms, part A and B, with the nonrefundable application fee.
2. Official transcripts of all previous undergraduate and graduate courses taken for credit.
3. Graduate and/or undergraduate degree verification, which can be posted on the academic transcript or certified by the academic institution where the degree(s) has been awarded.
4. Three letters of recommendation from former professors or other persons familiar with the applicant’s ability and probable performance as a graduate student.
5. For departments and programs which require standardized tests, the results of the Graduate Record Examination, the Miller Analogies Test, or the Graduate Management Admission Test. (Contact the department for the tests that are required for the degree programs in that department.)
6. Certain programs require submission of writing samples, portfolios, scheduling of auditions and personal interviews. (Refer to departmental materials for details.)

Admission of International Students

The admissions 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 demonstrate English proficiency by taking the Test of English as a Foreign Language (TOEFL) exam and earn a minimum score of 550. Some departments require higher scores.
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 International Student's Office 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. More detailed information can be obtained from the International Student's Office and from the “Student Affairs” section of the Bulletin.

ADMISSION STATUS

Full Standing
To be admitted to full standing the applicant must meet all the admissions criteria without conditions or academic provisions. Applicants must have a good academic record, e.g., a B average or rank in the upper third of his or her graduating class at an institution whose status and programs are readily assessed. The applicant will be expected to meet essentially all of the undergraduate prerequisites for the proposed field of graduate study. In addition to evidence of admisibility from transcripts, grade records, letters of recommendation and TOEFL test (English proficiency test for international students only), certain departments require that the applicant submit satisfactory scores on the Graduate Record Examination, the Miller Analogies Test, or the Graduate Management Admission Test.

Provisional Standing
Applicants who have academic deficiencies and do not qualify for admission with full standing are occasionally admitted provisionally. A student may give evidence of ability in his or her chosen field that is sufficiently convincing to warrant provisional admission, but the quantity or quality of the student’s preparation may be difficult to determine with sufficient certainty for admission in full standing. The provisions will be specified by the department to which the student is admitted, and stated in the official letter of admission from the Dean of Graduate Studies. A provisional graduate student is expected to complete appropriate coursework and to meet the performance standards of the School of Graduate Studies within the first academic year of study. Although the provisional student’s records will be reviewed each semester, the student’s status will be reconsidered by the department no later than at the end of two semesters of study. At that time, if the student has satisfied the provisions associated with his or her admission in the judgment of the department and the Dean of Graduate Studies, the student will be given full standing; otherwise, he or she will be separated from further graduate study in that department.

Conditional Standing
Applicants who have missing documentation in their admissions file (such as an official academic transcript with degree posted or official copies of test scores), or who are required to attain higher achievement levels on standard tests such as the GRE or TOEFL, as specified by either the department or the School of Graduate Studies may be admitted conditionally. The condition(s) specified in the letter of acceptance must be satisfied prior to matriculation in the School of Graduate Studies.

POSTPONEMENT OF MATRICULATION
Applicants are guaranteed admission only for the term specified in the letter of admission. An applicant who is unable to enroll in the semester for which he or she was initially admitted may request to postpone matriculation up to two regular academic semesters. In such cases, the department to which the applicant has applied may accept or reject the applicant’s request, and the terms of re-admission may differ from the original offer. If a delay of more than two semesters is requested, the applicant’s file must be reviewed and reevaluated by the department. If more than two years elapsed since acceptance, the applicant must reapply in the same manner as a new applicant. Because applicant files are only kept for a maximum of two years, all documentation will have to be resubmitted.

NON-DEGREE STUDENTS

Individuals with earned bachelor’s degrees that 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 in the School of Graduate Studies. A student who wishes to register as a non-degree student should request the appropriate application form from the Office of Graduate Studies and submit evidence that a bachelor’s degree has been earned. Students may enroll in undergraduate and graduate level courses. However, for graduate (400 level and above) courses, written consent from the instructor must be obtained. Continuation in non-degree status is at the discretion of the Dean of Graduate Studies.

Applicants who are interested in transferring coursework 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 coursework taken will transfer into the program. Only 400 level and higher coursework should 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 coursework.

PLANNING THE STUDY PROGRAM
Graduate study presupposes a considerable maturity on the part of the student in planning and reaching his or her educational objectives. The effectiveness of the graduate program lies jointly with the individual student and the faculty adviser
or advisory committee through early, substantive planning discussions. The formal requirements set forth in these regulations are intended to aid in the maintenance of uniform minimum standards of performance, to form a basis for planning programs of graduate study, and to provide for efficient management and coordination.

For each graduate student, an official planned program of study consisting of the courses and other requirements for the M.A., M.F.A., M.S., M.P.H., D.M.A., or Ph.D. degrees should be established in consultation with the major faculty adviser or advisory committee. After the major faculty adviser and department chair have approved the program of study, it should be submitted to the Dean of Graduate Studies to be placed in the student’s file. At the latest, students enrolled in Master’s programs must submit an approved program of study along with an application to graduate. For doctoral students, it must be submitted when the student advances to candidacy. A revised program of study must be submitted when any change in the original plan occurs. For graduate engineering students, additional details regarding degree program requirements are given in the Engineering section of the Bulletin. The various departments and schools may make such additional regulations concerning programs of study as may be necessary to reach particular academic goals. These regulations must be in writing, with a copy filed in the Office of Graduate Studies.

THE ACADEMIC ADVISER

Each graduate student will have a faculty adviser or advisory committee assigned by the department or professional school to assist the student in planning the program of study best designed to enable the student to reach appropriate educational objectives.

ACADEMIC REQUIREMENTS FOR MASTER’S 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
M.A. or M.S. with a thesis based on individual research and a final oral examination.

Plan B
M.A., M.F.A., M.P.H., or M.S. without a thesis but requiring a comprehensive examination and/or a major project to be administered by the academic unit.

The Master’s Thesis (Plan A)
The minimum requirements for the master’s degree under Plan A are 18 semester hours of coursework plus a thesis equivalent to at least 9 semester hours of registration, or 21 semester hours of coursework 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 the thesis examination occurs. However, if a student is registered for coursework 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 coursework, including thesis, 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 can be obtained from the Office of Graduate Studies.

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, and the candidate’s thesis adviser 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 adviser 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 Office of Graduate Studies.

The Master’s Comprehensive (Plan B)
The minimum requirements for the master’s degree under Plan B are 27 semester hours of coursework, a comprehensive examination, and in some fields, an approved project. At least 18 semester hours of coursework 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, Comprehensive Examination, before taking the examination.

Engineering students are required to complete 3 to 6 semester hours of Special Problems (Project) coursework, 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 adviser 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.

Theater students in the M.F.A. 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 manner.

Curricular Requirements
Within the framework of these general regulations, it is expected that a relevant program of study will be planned for each candidate for the doctorate by the student and the faculty adviser 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. Teaching and/or research experience, as implemented by departmental requirements and approved by the Dean of Graduate Studies, is considered to be an integral part of obtaining the doctoral degree.

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, General/Qualifying Examination, 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 coursework and exam requirements are satisfied. For students admitted to graduate study with a baccalaureate degree only, the decision to advance to candidacy should be made at Case Western Reserve University, unless specified otherwise under written departmental regulations. Students are expected to make regular and continuous progress toward the degree. Advancement to candidacy in a Ph.D. program must 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 a limited number of additional courses in order to complete a 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 this point 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 at the discretion of the department and upon written notification to the Dean of Graduate Studies. Pre-Candidacy 701 hour(s) can only be taken concurrently with coursework. 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. This requirement is waived only if the student is enrolled for 702 credits.

Course 702 Requirements
Dissertation Fellowship and Post-Candidacy Research
Students who have been advanced to candidacy and have met all coursework requirements, including 18 credit hours of 701, and are within their five-year time limit for completion of the degree, but have not completed the dissertation, can register for Dissertation Fellowship (702) upon department recommendation and the approval of the School of Graduate Studies. The full-time appointment (9 credit hours of 702) is available for a maximum of four consecutive semesters, and tuition is charged at the rate of one
credit hour. If the dissertation is not completed and defended in the fourth semester of the fellowship, the fellow must resume registration for course 701 at a minimum of one credit hour each semester through the allowed five-year time limit. No other coursework can be taken in combination with 702 credits except zero credit department seminar courses.

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 Ph.D. degree must submit a written 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 written 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 Office of Graduate Studies.

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.

Two copies of each completed and acceptable dissertation will be deposited in the University library by the School of Graduate Studies unless the thesis is submitted for electronic display. In addition, the student must guarantee the reproduction of the dissertation through University Microfilms, Ann Arbor, Michigan, before certification for the doctorate. This includes the completion and submission of the annual “Survey of Earned Doctorates Awarded in the United States.” 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 adviser 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 thesis is submitted to the Office of Graduate Studies.

Dissertation Advisory Committee
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 adviser. The research adviser 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 adviser also assists with the selection of at least two other faculty to serve as members of the dissertation advisory committee.

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.

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 chair of the dissertation defense committee must be a regular Case Western Reserve University faculty member in the candidate’s program. The examining committee, which usually includes the members of the dissertation advisory committee, is responsible for certifying that the quality and suitability of the material presented in the dissertation meet acceptable scholarly standards. Each member must be physically present for the entire examination to vote on the acceptability of the student’s performance. A student will be certified as passing the final oral examination if no more than one of the voting members of committee dissents.

At minimum, the dissertation defense committee must consist of four members of the University faculty, including at least one whose primary appointment is outside the student’s program, department or school. Persons who are not members of the University faculty may serve as additional voting or non-voting members of the committee. The committee is appointed by the Dean of Graduate Studies on recommendation of the chair of the department, division, or curricular program committee. The student’s dissertation advisor must be a member of the dissertation advisory committee and may serve as chair. The chair of the committee must be a faculty member in the student’s program. Under special conditions, a former faculty member whose time of leaving the university has not exceeded 18 months may be approved as a voting university member.

The defense must be scheduled with the Office 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 10 days before the ex-
amination, so that the committee members have an opportunity to read and discuss it in advance. Scheduled defenses are made known through on-campus publication and any member of the university may be present at that portion of the examination predesignated as public by the chair of the examining committee. Others may be present at the formal defense only by invitation of that chair.

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” 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 11th week of the session following the one in which the I was received. 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 Office of Graduate Studies the completed “Arrangement to Resolve a Grade of Incomplete” form 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 coursework 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 coursework 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 coursework 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 three courses: 651 thesis research; 701, dissertation research; and 702, dissertation fellowship. 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.

Academic Policies

GRADUATE STUDENT RIGHTS AND RESPONSIBILITIES

It is the responsibility of the student to become familiar with the general rules and regulations of the University. 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 of the University 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 Office of Graduate Studies. The policies and procedures governing all other infractions are detailed in the university’s annual Student Services Guide and in the “Student Affairs” section of this Bulletin. The University Office of Student Affairs 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 adviser 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 noti-
MAINTENANCE OF GOOD STANDING

A student maintains 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 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 701/702. A student who receives a grade of U in thesis (Course 651) or dissertation research (Courses 701/702) 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 coursework.
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 the 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 3.00 is required for award of the Master’s degree, and a minimum cumulative quality-point average of 2.75 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.

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 advisers 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 adviser 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. 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 AND READMISSION**

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 coursework 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 Office of Graduate Studies.

**TRANSFER OF CREDIT**

Transfer of credit from another university toward master’s and doctoral degree requirements is awarded for appropriate coursework (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 Ph.D. degree except by petition, and no credit for the doctoral dissertation may be transferred from another university.

All transfer of credit requires approval from the student’s adviser, 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. Seniors 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.

**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 the 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 Office 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 contact the Office of Graduate Studies at the beginning of the semester in which they intend to graduate to obtain a packet of graduation materials. 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 Office 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.
Case School of Engineering
The Case School of Engineering
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, Case School of Applied Science (Founded in 1880) and the Case Institute of Technology (1947). The formation of the Case School of Engineering (CSE) is a re-commitment to the obligations of the gift of Leonard Case, Jr., to serve the citizens of Northern Ohio. The CSE has been a leader in many educational programs, being the first engineering school to offer undergraduate programs in computer engineering (1963), biomedical engineering (1972), polymer engineering (1967) and systems and control engineering (1963).

ADMINISTRATION
Robert F. Savinell, Ph.D. (University of Pittsburgh)
Interim Dean of the Case School of Engineering and Professor of Chemical Engineering
Donald L. Feke, Ph.D. (Princeton University)
Associate Dean of Academic Affairs and Professor of Chemical Engineering
Christine A. Ash, M.B.A. (Case Western Reserve University)
Assistant Dean of Administration and Budget
Carol L. Moss, M.S. (Ohio University)
Executive Director of Development and External Affairs

ENGINEERING DEGREES GRANTED
1. Bachelor of Science in Engineering degree with major designations as follows
   - Aerospace engineering
   - Biomedical engineering
   - Chemical engineering
   - Civil engineering
   - Computer engineering
   - Electrical engineering
   - Engineering physics
   - Fluid and thermal engineering science
   - Mechanical engineering
   - Materials science and engineering
   - Polymer science and engineering
   - Systems and control engineering

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 that the increasing role of technology in virtually every facet of our culture communications, transportation, construction, health care, the environment, and even our system of wealth distribution makes it vital that engineering-oriented students have access to progressive and cutting-edge programs stressing five areas of excellence:

- Mastery of fundamentals
- Creativity
- Societal awareness
- Leadership skills, and
- 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 emphasizes mathematics, natural sciences and engineering fundamentals to help graduates become proficient, life-long learners. Curricular programs are infused with engineering creativity, professionalism (including engineering ethics and the role of engineering in society) and professional communications and multi-disciplinary 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. Students are encouraged to develop as professionals through participation in the student chapters of professional societies, the Cooperative Education Program, and have opportunities to become involved in the research enterprise of the school. Graduates are prepared to pass the Fundamentals of Engineering examination, to be strong contributors to the workforce as practicing engineers, and to continue for advanced study in engineering.

At the graduate level, the Case School of Engineering focuses on strong preparation and engineering fundamentals combined with a rigorous independent research experience leading to significant research results appropriate for publication in an archival journal and/or presentation at leading technical conferences. Graduate students are expected to understand the importance of scientific integrity, engineering ethics, and communication skills.

For the practicing engineer, the Case School of Engineering provides opportunities for continuing education and career advancement through the practice-oriented Master of Engineering Program, as well as through a variety of short courses on specialized topics.

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 engineering 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, Case School of Applied Science (Founded in 1880) and the Case Institute of Technology (1947). The formation of the Case School of Engineering (CSE) is a re-commitment to the obligations of the gift of Leonard Case, Jr., to serve the citizens of Northern Ohio. The CSE has been a leader in many educational programs, being the first engineering school to offer undergraduate programs in computer engineering (1963), biomedical engineering (1972), polymer engineering (1967) and systems and control engineering (1963).
2. Bachelor of Science in Engineering without designation, for programs that emphasize interdisciplinary areas or for programs that include some emphasis on non-technical fields.
3. Bachelor of Science in Computer Science
4. Master of Engineering (practice-oriented program)
5. Master of Science with the following major field designations
   - Aerospace engineering
   - Biomedical engineering
   - Ceramics and materials science
   - Chemical engineering
   - Civil engineering
   - Computer engineering
   - Computing and information science
   - Electrical engineering
   - Engineering mechanics
   - Fluid and thermal engineering
   - Macromolecular science
   - Materials science and engineering
   - Mechanical engineering
6. Master of Science without designation.
7. The Doctor of Philosophy without designation (for all programs).

UNDERGRADUATE DEGREE PROGRAMS

In addition to the major department requirements, each engineering undergraduate degree program includes the Engineering Core, which provides a foundation in mathematics and sciences 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 elsewhere in this bulletin.

Details of the specific curricular requirements for the undergraduate majors are described in the departmental descriptions that follow.

ADVANCED DEGREE PROGRAMS

Master of Engineering Program

The Case School of Engineering, with the participation of the Weatherhead School of Management and major northeastern Ohio industry, offers a practice-oriented Master of Engineering Program to equip engineers in industry to continue along a technical career path but adds the dimensions of business, management, and teamwork skills. The program differs from a traditional Master of Science degree in engineering by concentrating on current industrial practice rather than on research and differs from a traditional Master of Business Administration degree by focusing on the business and technical environment of engineering industries.

The Master of Engineering Program prepares students to enhance their role as corporate leaders. The program 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.

Participants can complete a master’s degree within a two-year (six semester), part-time, program of study. Core courses aim at equipping participants with knowledge on how engineering is practiced in contemporary industry. Core courses are videotaped to accommodate unexpected absences and travel. Technical elective courses are held in the evening hours or provided on videotape through CWRU’s Instructional Television Network (ITN) to minimize disruption at the workplace and home. The program targets currently employed engineers who lend diversity, experience, and richness to the classroom environment. Because the program makes extensive use of computers, participants need to have access to computer facilities.

The Program

The program consists of a set of five core courses and a five 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. An in-residence retreat is required of all students on the weekend prior to the summer semester. Up to six transfer credits may be approved for graduate-level courses taken at CWRU or another accredited university.

Five Core Courses

- Applied Engineering Statistics (EPOM 405)
- Engineering Economics/Financial Analysis (EPOM 407)
- Business for Engineers (MGMT 421)
- Product/Process Design and Implementation (EPOM 403)
- Master of Engineering Capstone Project (EPOM 409)

These courses are described elsewhere in the bulletin.

Five Technical Electives

Four courses from the chosen technical concentration area and one from outside this area are required. The following technical concentration areas are offered currently

- Automation, Manufacturing, and Control Systems
- Chemical and Material Processing and Synthesis
- Computer Engineering
- Mechanical Engineering

MASTER OF SCIENCE DEGREE PROGRAMS

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 approved by the student’s advisor, the department chairman, and the dean of the School of Graduate Studies.

All Master of Science degree programs require the submission of a program of study which must be approved by the advisor, department chairperson and the dean of engineering and which must be submitted before registering for the last 9 course credits of the program.

Plan A - Thesis

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, as well as the dean of engineering.

2. Completion of nine hours of thesis work culminating in a thesis examination given by at least three professors, plus approval by the chairman 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.

Eighteen hours of course work, including the thesis, must be at the 400 level or higher.

**Plan B - Engineering Project**

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

1. Completion of 27 hours of graduate course work including a Special Problems course described in item 2. The program must be approved by the department offering the degree, as well as the dean of engineering.

2. Three to six hours of Special Problems course work, which must consist of an engineering project approved by the chairman of the department offering the degree, which may be carried out at the student’s place of employment with nominal supervision by a faculty advisor or in the division laboratories under direct supervision. The project must culminate in a written report and examination by at least three professors plus approval by the chairman 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. Eighteen hours of course work including the special problem must be at the 400 level or higher.

**UNDESCRIPTED MASTER OF SCIENCE DEGREE**

A student working toward an undescribed Master of Science degree in engineering must select a department. The student is responsible for submitting a program of study which must have the approval of the student’s advisor and department head and the dean of engineering and which must contain a minimum of nine 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.

**DOCTOR OF PHILOSOPHY DEGREE**

The student’s Ph.D. program should be designed to prepare him or her for a lifetime of creative activity in research and in professional engineering practice. Often 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 Ph.D. degree before approval of his or her program of study by the Advisory Committee, the department, and the dean of engineering. After this approval has been obtained, it is the responsibility of the student’s department to notify the dean of the School 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 B.S. level is two years 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 Ph.D. program of study
   a. All 400-, 500-, and 600-level courses, b. Those 300-level courses approved by the student’s department up to a maximum of three beyond the B.S. or a maximum of one beyond the M.S., and c. Approved graduate-level courses taken at other institutions

2. A minimum depth in basic science equivalent to six semester hours (for credit) is required. This requirement may 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.

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 doctor’s 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 M.S. 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 masters degree the examination should be taken no later than the end of the third semester at the University.

PROGRAM OF STUDY

Each student is required to submit a 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 program of study must be approved by the advisory committee, the department chairperson and the dean of engineering before registering for the last 18 credits hours of the program.

If the student is pursuing the Ph.D. degree without acquiring the M.S. degree, the program of study should be accompanied by a petition to the dean of engineering to waive the requirement of the M.S. degree. All required courses taken at the University beyond the B.S. degree should be shown on the program of study with the grade if completed. If the requirements are to be fulfilled in other than the standard ways described above, a memorandum requesting approval should be attached to the program of study.

The program of study must be submitted within one semester after passing the qualifying examination.

UNDERGRADUATE COURSES (ENGR)

ENGR 101. Freshman Engineering Service Project (2)
This course is intended to provide engineering freshman with an initial exposure to engineering problem solving and engineering design in a "field" or project-driven environment. Small groups of students will be attached to a particular service project, with the assignment of working out and implementing an engineering solution. Collaboration with the Case Engineering Service Group, as well as off-campus service organizations, will provide a source of "real world" problems, addressing needs within the greater community, for students to work on. Final engineering reports/presentations, as well as actual prototype solutions (possibly either hardware or software), will be expected of each group.

ENGR 131. Elementary Computer Programming (3)
An introductory course in algorithmic problem solving. C++ is used to illustrate how the programming concepts can be used to solve engineering and scientific problems.

ENGR 145. Chemistry of Materials (4)
Application of fundamental chemistry principles to materials. Emphasis on bonding and how this relates to the structure and properties in metals, ceramics, polymers and electronic materials. Application of chemistry principles to develop an understanding of how to synthesize materials. Prerequisite: CHEM 111 or equivalent.

ENGR 200. Statics and Strength of Materials (3)
An introduction to the analysis, behavior and design of mechanical/structural systems. Course topics include: concepts of equilibrium; geometric properties and distributed forces; stress, strain and mechanical properties of materials; and, linear elastic behavior of elements. Prerequisite: PHYS 121.

ENGR 210. Introduction to Circuits and Instrumentation (4)

ENGR 225. Thermodynamics, Fluid Dynamics, Heat and Mass Transfer (4)
Elementary thermodynamic concepts: first and second law, equilibrium. Basic fluid dynamics, heat transfer, and mass transfer: microscopic and macroscopic perspectives. Prerequisites: CHEM 111 and ENGR 145 and PHYS 121. Corequisite: MATH 223.

GRADUATE COURSES (EPOM)

EPOM 403. Product and Process Design and Implementation (3)
The course is taught through a series of lectures, class discussions, group projects and case studies. The course aim is to provide a solid understanding of the many aspects of the engineering design process and the management of technology. The course focuses on the engineering and management activities used to develop and bring to market new products and processes. The first part of the course focuses on the techniques used to develop new ideas, the second part focuses on the management of technology and innovation. Prerequisite: MGMT 421 or permission of instructor.

EPOM 405. Applied Engineering Statistics (3)
A combination of lectures, demonstrations, case studies, and individual and group computer problems provides an intensive introduction to fundamental concepts, applications and the practice of contemporary engineering statistics. Each topic is introduced through realistic sample problems to be solved first by using standard spreadsheet programs and then using more sophisticated software packages. Primary attention is given to teaching the fundamental concepts underlying standard analysis methods.

Money and profit as measures of "goodness" in engineering design are studied. Methods for economic analysis of capital investments are developed and the financial evaluation of machinery, manufacturing processes, buildings, R&D, personnel development, and other long-lived investments is emphasized. Optimization methods and decision analysis techniques are examined to identify economically attractive alternatives. Basic concepts of cost
Interdisciplinary Research Centers

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 LIQUID CRYSTALLINE OPTICAL MATERIALS (ALCOM)
212 Kent Hale Smith Building (7202)
phone 216-368-4176 fax 216-368-4171
Jack L. Koenig, Director
e-mail jlk6@po.cwru.edu

ALCOM, a consortium between CWRU, Kent State University, University of Akron, and the State of Ohio, conducts research and educational programs in liquid crystal (LC) technology. Thirty-four scientists from diverse fields collaborate to study the properties of LC materials and the application of LC technologies to optical displays. Other uses of LC include high-contrast flat panel displays, optical imaging devices, and thermometers. Future potential applications are flat-panel TV, optical computers, and integrated optical communications.

The center conducts symposia, workshops, and short courses to train scientists from other academic institutions and industrial firms in LC technology, and to facilitate the transfer of technology for commercialization. The eye-catching properties of LC devices are also useful for demonstrating physical principles to public school teachers and students. The center has recently established a World Wide Web (WWW) site to enhance the public’s understanding of the potentials of LC technology.

APPLIED NEURAL CONTROL LABORATORY (ANCL)
3480 Charles B. Bolton Building (4912)
phone 216-368-3973 fax 216-368-4872
J. Thomas Mortimer, Director
e-mail jtm3@po.cwru.edu

ANCL develops technology and devices to restore missing or impaired human body functions, and participates in transferring findings to industry for commercialization. The emerging technology of applied neural control, based on the electrical stimulation of neural tissue, makes possible the external electrical control of organs or body functions normally controlled by the nervous system. Applications focus on respiratory assists to patients with acute and chronic respiratory insufficiency; and restoration of limb control and bowel, bladder, and sexual functions in patients with spinal cord injury.

Biomedical engineers are trained at ANCL to gain a working knowledge of fundamental and design aspects of life sciences, material sciences, mechanical engineering, and electrical engineering, which have relevance to applied neural control. Through close association with the highly cross-disciplinary staff affiliated with the laboratory, students and researchers become able to work effectively with the nervous system.

The center conducts an annual research day, to which all interested persons in the community are invited.

CARDIAC BIOELECTRICITY RESEARCH AND TRAINING CENTER (CBRTC)
505 Wickenden Building (7207)
phone 216-368-4051 fax 216-368-4969
Yoram Rudy, Director
e-mail CBRTC@po.cwru.edu

CBRTC fosters interdisciplinary research and training in the fields of cardiac electrophysiology and electrocardiology, in order to enhance understanding of electrical activity and rhythm disorders (arrhythmias) of the heart. It is hoped that this work will lead to improved diagnostic methods and better prevention and treatment strategies. The ultimate aim is to bring about a reduction of fatalities due to arrhythmias (estimated at 400,000 per year in the U.S.) and improved quality of life for afflicted individuals.

Participants in the center include biophysicists, physiologists, biomedical engineers, cardiologists, and surgeons, working synergistically in the research and educational activities related to this field. The educational component builds on the graduate programs in the departments of Biomedical Engineering, and Physiology and Biophysics, and on the Fellowship Program in Clinical Cardiac Electrophysiology. Seminars, case presentations of diagnostic and treatment procedures, clinical lectures, and demonstrations of theoretical modeling of rhythm disorders.
are periodically conducted. Research is supported by private and government foundations, as well as by industry.

**CENTER FOR APPLIED POLYMER RESEARCH (CAPRI)**
422 Kent Hale Smith Building (7202)
phone 216-368-4186 fax 216-368-6329
Anne Hiltner, Director
e-mail pah6@po.cwru.edu

CAPRI performs interdisciplinary applied and basic research on structure-property relationships in polymer materials of interest to industry. Recent work of the center has focused on the attributes of polymer blends and alloys and ways to improve their performance, on processing of micro- and nano-layered materials and structures, on polymers for medical applications, and on new thermoplastics and polyolefin systems.

CAPRI conducts an annual symposium to showcase the center facilities and the research of center graduate and undergraduate students and postdoctoral research associates. CAPRI co-sponsors, with the U.S. Army Research Office, the annual ASILOMAR conference, which features discussions of cutting-edge issues related to polymers and their composites.

CAPRI is supported by several federal agencies, as well as industrial sponsors, 12 of whom serve on its advisory board.

**CENTER FOR AUTOMATION AND INTELLIGENT SYSTEMS RESEARCH (CAISR)**
517 Glennan Building (7221)
phone 216-368-6248 fax 216-368-6039
Stephen M. Phillips, Director
e-mail smp2@po.cwru.edu

CAISR integrates technologies from several engineering disciplines for basic and applied research in manufacturing, automation and intelligent systems. Basic research in signal processing, feedback control, robotics, nonlinear system analysis, materials science, chemical sensing, neural networks and related topics has been successfully applied to practical problems such as flexible manufacturing, rapid prototyping, rapid manufacturing, machinery diagnostics, torque sensing, lubricant monitoring, intelligent process control, feedback systems with MEMS arrays of sensors and actuators. Faculty and students from six engineering departments work with more than a dozen industrial project sponsors using the computational and laboratory facilities of the center. CAISR also has access to funding from the State of Ohio through the Applied Research Program of CAMP Inc., an Edison program center. Facilities include the Intelligent Systems Laboratory, Mechatronics Laboratory, Control Laboratory, Rotating Machinery facility, Agile Manufacturing facility and Computer Aided Manufacturing via Laminated Engineered Materials facility.

**CENTER FOR CARDIOVASCULAR BIOMATERIALS (CCB)**
500 Wickenden Building (7207)
phone 216-368-3005 fax 216-368-4969
Roger E. Marchant, Director
e-mail rxm4@po.cwru.edu

CCB, supported by CWRU, the University of Cincinnati, and the Cleveland Clinic Foundation, carries out research and development projects to investigate biomaterials and devices for use as cardiovascular implants in patients. The chemical and mechanical interface between the biomaterial and the host body are the focus of major study, with the goals 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; cardiovascular and neural tissue engineering, and long-term biodegradation of elastomeric biomaterials. Atomic force microscopy is being used for molecular-level studies on the structure and interactions of blood platelets, and plasma glycoproteins and collagen with biomaterials. Studies at the cell and molecular level assist our understanding of the underlying mechanisms, so that novel biomedical interfaces may be designed, prepared, and characterized. CCB was awarded major grants from the Whitaker Foundation and the Ohio Board of Regents to establish a graduate training program in cardiovascular biomaterials. Students conduct research in this field and pursue integrated engineering and medical science courses. The center plans annual symposia at which participating students discuss their work and outside speakers present topical lectures in the field of cardiovascular biomaterials.

**CENTER FOR SURFACE ANALYSIS OF MATERIALS (CSAM)**
High Resolution and Analytical Electron Microscopy
110 Glennan Building (7204)
phone 216-368-3868 fax 216-368-8932
Arthur H. Heuer, Director
e-mail ahh@po.cwru.edu

The Center for Surface Analysis of Materials and the High Resolution and Analytical Electron Microscopy Facilities provide a comprehensive solution to surface and near-surface microchemical analysis and microstructural characterization needs. The combined facility has 8 analytical instruments devoted to these purposes: 1) NEC 5SDH Ion Beam Accelerator for RBS, PIXE and NRA; 2) PHI 660 Scanning Auger and 3600 SIMS; 3) PHI 5600 ESCA (XPS) ; 4) Philips CM20 STEM with EDS and PEELS; 5) JEOL 4000EX HRTEM; 6) Hitachi S-4500 FEG-SEM; 7) Philips XL30 Environmental SEM with EDS, EBSP, and tensile, heating, and cooling stages; and 8) Scintag X1 Advanced X-Ray Diffractometer with high temperature camera. These instruments are available to campus users and industrial clients for solving a variety of research, development and failure analysis problems that are often encountered in both academia and the industrial environment.

**CENTER ON HIERARCHICAL STRUCTURES (CHS)**
420 Kent Hale Smith Building (7202)
phone 216-368-4203 fax 216-368-6329
Eric Baer, Director
e-mail exb6@po.cwru.edu

The aims of this center are to understand how the unique performance of natural materials arises from precise hier-
architectural organization, to apply lessons from biology to the design of new hierarchical material systems, and to develop new processes for building complex hierarchical structures. Biological hierarchical paradigms will be used to satisfy societal needs and to solve existing problems.

EDISON POLYMER INNOVATION CORPORATION (EPIC)

Kent Hale Smith Building (7202)
phone 216-368-6366 fax 216-368-4028
Jerome B. Lando and Anne Hiltner, Co-Directors
e-mail jbl2@po.cwru.edu or pah6@po.cwru.edu

EPIC, a partnership between CWRU, the University of Akron and Ohio State University, carries on research and development in the field of polymers and provides technical service and support, training and education, and problem solving to other academic institutions and to industry. EPIC facilitates the transfer of research results to companies for advanced development and commercialization.

Current EPIC projects include studies of composites and blending, adhesion, polymer films for microelectronics, mechanisms of fatigue and abrasion in rubber and elastomers, three-dimensional flow simulations, and general polymer microstructure studies. EPIC brings together CWRU faculty from the departments of macromolecular science, physics, chemistry, electrical engineering, and chemical engineering.

ELECTRONIC DESIGN CENTER (EDC)

112 Bingham Building (7200)
phone 216-368-2934 fax 216-368-8738
Chung-Chiu Liu, Director
e-mail cxl9@po.cwru.edu

EDC carries research and development of advanced chemical and biological sensors for various industrial applications. The center focuses on the applications of microfabrication and micromachining technology to the production of sensor prototypes and other devices. Both silicon and non-silicon materials are used in these development. The center is a multi-disciplinary educational and research center. Both undergraduate and graduate students use the facility in the center to carry out their research or special projects. Recent microsensor development by researchers in EDC include Schottky diode based hydrogen sensor, high temperature oxygen sensor, nanostucture tin oxide sensor and others. Applications of micromachining techniques to the fabrication of unique microdevices, such as micro-fuel cell and micro-chemical reactor, are also undertaken.

ERNST B. YEAGER CENTER FOR ELECTROCHEMICAL SCIENCES (YCES)

124 A.W. Smith Building (7218)
phone 216-368-6525 fax 216-368-3016
Robert F. Savinell, Director
e-mail rfs2@po.cwru.edu

The Ernst B. Yeager Center for Electrochemical Sciences (YCES) promotes and coordinates research and education in electrochemistry at Case Western Reserve University. Electrochemistry and the technologies derived from it are by their nature highly interdisciplinary. They require expertise in fields as widely divergent as surface physics, solid and liquid state physics, electronics, applied mathematics, polymer science, chemical engineering, and, of course, chemistry.

The center facilitates the undertaking of research projects in electrochemistry of a highly interdisciplinary nature, requiring resources and expertise beyond that of any one faculty research group, and usually involving faculty from several of the participating departments. Eight academic departments of CWRU participate in the center. Approximately 35 faculty from these departments are affiliated with the center as regular members. The center fosters interactions and collaborations among all of the students within these departments who are involved in electrochemical research.

The center serves as an international focal point for electrochemical education. Besides the traditional educating of graduate and postdoctoral students, it offers annual workshops for educating and updating industrial and governmental scientists and engineers. Numerous seminars, special topic symposia and lectureships keep the faculty, students, and the technical community aware of the most recent advances in the field. The center attracts visiting scientists, postdoctoral research associates, and graduate students from the world’s leading academic institutions and industrial and governmental laboratories. The center is to be viewed as a national resource to which industry and government can turn for research and education in electrochemistry.

MICROELECTROMECHANICAL SYSTEMS (MEMS)

Bingham Building (7200)
phone 216-368-0755 fax 216-368-0346
Mehran Mehregany, Director
e-mail mxm31@cwru.edu

Microelectromechanical systems (MEMS) technology provides a microprocessor-compatible means for perception and control at increasingly smaller scales, higher sensitivities, higher throughputs, and lower cost. The associated fabrication technology enables the development of small, functionally sophisticated micromechanical devices (e.g., pressure sensors, inertial sensors, miniature displays, micromechanical light modulators, microvalves, micropumps, etc.) that can be mass-produced at low unit cost.

The CWRU MEMS research program is interdisciplinary, and targets process and materials technology to develop devices that enable application advancements. Unique silicon carbide MEMS technology strengths are available and are being explored in addition to silicon technology. Application thrusts include: (i) healthcare; (ii) industrial control, automation and fault detection; (iii) portable power generation; and (iv) functional materials and structures.

The Microfabrication Laboratory (MFL), a state-of-the-art facility that provides the latest in micromachining processes, supports the MEMS program involving approximately 10 faculty, several post-doctoral researchers, and approximately 25 graduate students. The MFL is supporting a state-wide network, Ohio
for design, scientists will become intimately involved at an earlier stage of the hardware development process. To promote free-flow of information, NCMR will hold directed in- and out-reach workshops with industry that will bring together systems engineers, hardware builders and scientists.

Department of Biomedical Engineering

Wickenden Building 319 (7207)
phone 216-368-4063 fax 216-368-4969
Patrick E. Crago, Chair
e-mail xx220@po.cwru.edu
http://bme.cwru.edu

BACKGROUND

Biomedical engineering (BME) uniquely advances human health and the biological sciences by creating and applying technology based on phenomena described by the biological and physical sciences. 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.

Biomedical engineering was established in 1968 at Case Western Reserve University. As one of the pioneer programs in the world, we now have 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 our program, which has been emulated by many other institutions. Quantitative engineering for biomedical applications remains the cornerstone of our program and distinguishes it from biomedical science programs. In addition to dealing with biomedical problems at the tissue and organ-system level, and 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 programs lead to the B.S., M.S., combined B.S./M.S., Ph.D., and MD/Ph.D. in biomedical engineering. In all of the BME programs at CWRU, 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 located in close proximity on the same campus. The Biomedical Engineering faculty carry joint appointments in the two schools and participate fully in the teaching, research, and decision-making committees of both schools. The department is in close proximity to several major medical centers (University Hospitals, Cleveland Clinic Foundation, The VA Medical Center, and MetroHealth Medical Center). As a result, we have an unusually free flow of academic exchange and collaboration in research and education among the Schools and Institutions. Our BME programs take full advantage of faculty cooperation among CWRU departments, which adds significant strength to our programs. The educational philosophy is to develop in students

Mastery of Fundamentals

- Acquire a strong integrated background in the fundamentals of mathematical, chemical, physical, and biomedical sciences and engineering.
- Become knowledgeable in a special discipline of biomedical engineering such as biomaterials, tissue engineering, biomechanics, instrumentation, biomedical imaging, biomedical sensors, modeling, and biomedical systems.
- Measure phenomena relevant to medicine and biology using state-of-the-art instrumentation.
- Describe biomedical phenomena by mathematical modeling

Creativity

- Design devices, materials, instruments, models, and software for biomedical science and health applications.
- Expand the knowledge base through innovative approaches to biomedical research
Societal Awareness
- Understand issues presented by the biomedical community, and translate them into solvable engineering problems.
- Recognize the role of biomedical engineering in developing technology for commercial application and economic development of society.

Leadership Skills
- Communicate technical information to both technical and non-technical audiences.
- Work effectively in a team setting with others of differing backgrounds.

Professionalism
- Recognize and respond to biomedical ethical issues.
- Acquire skills for self-instruction and life-long learning.

FACULTY

Primary Appointments

Patrick E. Crago, Ph.D. (Case Western Reserve University)
Professor and Chairperson; Allen H. and Constance T. Ford Professor
Control of neuroprotheses for motor function; neuromuscular control systems

Ravi V. Bellamkonda (Brown University)
Assistant Professor
Biomaterials; neural tissue engineering; 3D hydrogel based scaffolds; gene and protein delivery vehicles; vascular grafts and nerve regeneration

Jianmim Cui, Ph.D. (State University of New York - Stony Brook)
Assistant Professor
Molecular and biophysical mechanisms of ion channel function and modulation; the role of ion channels in cardiac excitation and arrhythmias

Dominique Durand, Ph.D. (University of Toronto, Canada)
Professor
Neural engineering; neuroprostheses; neural dynamics; electric and magnetic stimulation of the nervous system; neural interfaces with electronic devices; analysis and control of epilepsy

Steven J. Eppell, Ph.D. (Case Western Reserve University)
Assistant Professor
Nanoscale instrumentation for biomaterials; bone and cartilage

Igor Efimov, Ph.D. (Moscow Institute of Physics & Technology)
Elmer W. Lindseth Associate Professor of Biomedical Engineering
Fast fluorescent imaging of the heart. Mechanisms of arrhythmogenesis and antiarrhythmic therapies. Mechanisms of stimulation and defibrillation of the heart

Jinming Gao, Ph.D. (Harvard University)
Assistant Professor
Biomolecular engineering; imaging-guided drug delivery; controlled-release drug delivery; elastic biomaterials

Miklos Gratzel, Ph.D. (Technical University of Budapest, Hungary)
Associate Professor
Biophysical sensors; fine chemical manipulation of microdroplets and single cells; cancer research and neurochemistry at the single cell level; cost-effective biochemical diagnostics in microliter body fluids

Warren M. Grill, Ph.D. (Case Western Reserve University)
Elmer W. Lindseth Assistant Professor of Biomedical Engineering
Neural engineering and neural prostheses; modeling and simulation of stimulation and electrodes; neural control of genitourinary and motor function; anatomy and neurochemistry of neural circuits

Joseph Izatt, Ph.D. (Massachusetts Institute of Technology)
Assistant Professor
Biomedical optical imaging and optical spectroscopy; optical coherence tomography (OCT); endoscopy technology; biomedical sensors; ultrasonic and optical image processing

Robert F. Kirsch, Ph.D. (Northwestern University)
Assistant Professor
Functional neuromuscular stimulation; biomechanics and neural control of human movement; modeling and simulation of musculoskeletal systems; identification of physiological systems

J. Lawrence Katz, Ph.D. (Polytechnic Institute of Brooklyn)
Professor
Bone biomechanics and biomaterials; bone mineral crystallography; ultrasonic wave propagation; scanning acoustic microscopy; dental and orthopaedic implants

Dmitri E. Kourennyi, Ph.D. (Moscow Institute of Physics & Technology)
Assistant Professor
Synaptic transmission and networking in the retina; ion channels; biophysics, pharmacology, modulation; second messengers in neurons; nitric oxide functional and pathological roles; signal processing in the retina

Roger Marchant, Ph.D. (Case Western Reserve University)
Professor
Director, Center for Cardiovascular Biomaterials
Surface modification of cardiovascular devices; molecular level structure and function of plasma proteins; liposome drug delivery systems; mechanisms of bacterial adhesion to biomaterials

J. Thomas Mortimer, Ph.D. (Case Western Reserve University)
Professor
Director, Applied Neural Control Laboratory
Neural prostheses; electrical activation of the nervous system; bowel and bladder assist device; respiratory assist device; selective stimulation and electrode development; electrophysiological aspects of electrical stimulation

Nicola F. Otani, Ph.D. (University of California, Berkeley)
Associate Professor
Cardiac bioelectricity and excitable tissues; simulation of cardiac action potential propagation; nonlinear dynamics applied to excitable tissues; improved drug therapies and electrical intervention strategies for arrhythmias

P. Hunter Peckham, Ph.D. (Case Western Reserve University)
Professor
Director, Functional Electrical Stimulation Center
Neural prostheses, implantable stimulation and control; control of movement; rehabilitation engineering

Yoram Rudy, Ph.D. (Case Western Reserve University)
Professor
Mass & heat transport and metabolic analysis in cells, tissues, & organs; mathematical modeling, simulation, parameter estimation; optimal experimental design; metabolic dynamics; minimally invasive thermal tumor ablation; slow release drug delivery

David L. Wilson, Ph.D. (Rice University)
Associate Professor
Medical image processing; image segmentation, registration, and analysis; quantitative image quality of X-ray fluoroscopy and fast MRI; interventional MRI treatment of cancer

Secondary Appointments

James M. Anderson, Ph.D. (Oregon State University), M.D. (Case Western Reserve University)
Professor, Pathology, University Hospitals Biocompatibility of implants

Marco Cabrera, Ph.D. (Case Western Reserve University)
Assistant Professor, Pediatric Cardiology
Modeling and control of metabolic processes; metabolic regulation in hypoxia, ischaemia and exercise
Ronald L. Cechner, Ph.D. (Case Western Reserve University)  
Associate Professor, Anesthesiology, University Hospitals Microsurgical 3-D imaging of tissue

John Chae, M.D. (New Jersey Medical School)  
Assistant Professor, Physical Medicine and Rehabilitation  
Application of neuroprotheses in hemiplegia

Hillel J. Chiel, Ph.D. (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

David Dean, Ph.D. (City University of New York)  
Assistant Professor, Neurosurgery and Anatomy, University Hospitals Morphometrics; craniofacial imaging

Louis F. Dell’Osso, Ph.D. (University of Wyoming)  
Professor, Neurology, VA Medical Center  
Neurophysiological and ocular motor control systems

Pedro J. Diaz, Ph.D. (Case Western Reserve University)  
Assistant Professor, Radiology, MetroHealth Medical Center  
Magnetic resonance imaging; image processing

Jeffrey L. Duerk, Ph.D. (Case Western Reserve University)  
Associate Professor, Radiology, University Hospitals  
Magnetic resonance imaging; flow visualization

Michael W. Keith, M.D. (Ohio State University)  
Professor, Orthopaedic Surgery, MetroHealth Medical Center  
Restoration of motor function in hands

Kenneth R. Laurita, Ph.D. (Case Western Reserve University)  
Assistant Professor, Cardiology, MetroHealth Medical Center  
Optical imaging in cardiac electrophysiology

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

E. Byron Marsolais, M.D., Ph.D. (University of Iowa)  
Professor, Orthopaedics, University Hospitals  
Neural prostheses for leg movement and walking

Raymond F. Muzic, Jr., Ph.D. (Case Western Reserve University)  
Assistant Professor, Radiology, University Hospitals  
Experiment design and analysis for positron emission tomography

David S. Rosenbaum, M.D. (University of Illinois, Chicago)  
Associate Professor, Medicine, MetroHealth Medical Center  
Optical imaging in cardiac electrophysiology

Mark S. Rzeszotarski, Ph.D. (Case Western Reserve University)  
Assistant Professor, Radiology, MetroHealth Medical Center  
Radiological imaging; magnetic resonance imaging, ultrasound

Ronald J. Triolo, Ph.D. (Drexel University)  
Assistant Professor, Orthopaedics, VA Medical Center  
Restoration of lower extremity function

Clayton L. Van Doren, Ph.D. (Syracuse University)  
Assistant Professor, Orthopaedics, MetroHealth Medical Center Kinesthetic and tactile function; sensory feedback for prostheses

Albert L. Waldo, M.D. (State University of New York)  
Professor, Cardiology, University Hospitals  
Cardiac electrophysiology and cardiac excitation mapping

Michael Wendt, Ph.D. (University of Witten/Herdecke, Germany)  
Assistant Professor, Radiology, University Hospitals  
Interventional magnetic resonance imaging; wavelet encoding

Nicholas F. Ziajka, Ph.D. (Case Western Reserve University)  
Assistant Professor, Pathology, University Hospitals  
Vascular grafts; vascular cells; blood vessels

Adjunct Appointments

Brian Davis, Ph.D. (Pennsylvania State University)  
Adjunct Assistant Professor of Biomedical Engineering (Biomedical Engineering, Cleveland Clinic Foundation)  
Human locomotion and biomechanics

Mark D. Grabiner, Ph.D. (University of Illinois)  
Adjunct Assistant Professor of Biomedical Engineering (Biomedical Engineering, Cleveland Clinic Foundation)  
Neuromotor control of human performance

Hiroaki Harasaki, Ph.D., M.D. (Kyushu University, Japan)  
Adjunct Associate Professor of Biomedical Engineering (Biomedical Engineering, Cleveland Clinic Foundation) Artificial heart; blood-surface interactions

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

David Huang, Ph.D. (Massachusetts Institute of Technology), M.D. (Harvard University)  
Adjunct Assistant Professor of Biomedical Engineering (Ophthalmology, Cleveland Clinic Foundation)  
Optical coherence tomography of the eye, laser vision correction, corneal wound healing, corneal topography

Jill W. Kawalec, Ph.D. (Case Western Reserve University)  
Adjunct Assistant Professor of Biomedical Engineering (Research Director, Ohio College of Podiatric Medicine)  
Biomaterials and biomechanics of foot prostheses

Kevin L. Kilgore, Ph.D. (Case Western Reserve University)  
Adjunct Assistant Professor of Biomedical Engineering (Orthopaedics, MetroHealth Medical Center)  
Functional electrical stimulation; hand prostheses

Kandice Kottke-Marchant, Ph.D., M.D. (Case Western Reserve University)  
Adjunct Associate Professor of Biomedical Engineering (Hematology, Cleveland Clinic Foundation)  
Interaction of blood and materials

William Landis, Ph.D. (Massachusetts Institute of Technology)  
Adjunct Professor of Biomedical Engineering (Department of Biochemistry and Molecular Pathology, Northeastern Ohio Universities College of Medicine)  
Mineralization of vertebrates, effect of mechanical force on mineralization, calcium transport in mineralization, tissue engineering

Todor Mazzaglia, Ph.D. (Leningrad Order of Lenin Electrotechnic Institute, St. Petersburg, Russia)  
Adjunct Assistant Professor of Biomedical Engineering (Cardiology, Cleveland Clinic Foundation)  
Mechanisms of atrioventricular nodal conduction and its role in controlling ventricular rate during atrial fibrillation

Kimeryl Powell, Ph.D. (Ohio State University)  
Adjunct Associate Professor of Biomedical Engineering (Biomedical Engineering, Cleveland Clinic Foundation)  
Image post-processing for detection and diagnosis of breast cancer and quantitative microscopy

Jean A. Tkach, Ph.D. (Case Western Reserve University)  
Adjunct Assistant Professor of Biomedical Engineering (Radiology, Cleveland Clinic Foundation)  
Magnetic resonance angiography

Ivan Vesely, Ph.D. (University of Western Ontario, Canada)  
Adjunct Associate Professor of Biomedical Engineering (Biomedical Engineering, Cleveland Clinic Foundation)  
Micromechanics of heart valves; fatigue of soft tissue

Geoffrey D. Vince, Ph.D. (University of Liverpool Medical School, United Kingdom)  
Adjunct Assistant Professor of Biomedical Engineering (Biomedical Engineering, Cleveland Clinic Foundation)  
Image and signal processing of intravascular ultrasound images, mechanics of coronary plaque rupture, cellular aspects of atherosclerosis
## BACHELOR OF SCIENCE IN ENGINEERING DEGREE
### MAJOR IN BIOMEDICAL ENGINEERING

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<th>Fall Semester</th>
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<td>ENGR 210, Intro to Circuits &amp; Instrumentation</td>
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### BME SPECIALTY SEQUENCE CLASSES

To ensure depth in a particular area, students take one of the seven specialty sequences listed below. Students should consult the website of the Department of Biomedical Engineering to learn more about the educational program and to determine the best order for taking courses in a particular sequence.

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a This is a typical program. Specialty sequences 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 Courses are chosen depending on the BME specialty sequence as listed below.

d Students take at least one additional math or science course approved by BME department.

e STAT 312, STAT 333, or STAT 332 fulfill the statistics requirement. Check with sequence advisor to determine the most appropriate class.
2. Measure physical phenomena relevant to medicine and biology using state-of-the-art instrumentation,
3. Design electronic instruments useful to the medical community,
4. Understand problems presented by the medical community, and translate them into solvable engineering problems,
5. Write effectively in a technical style,
6. Speak effectively to both technical and non-technical audiences, and
7. Work effectively in a team setting.
To be successful in developing the subset of skills technical in nature in the list above:
8. Students must be well-trained in biological, mathematical, scientific, and engineering fundamentals.
Students, upon graduating from our program, should be:
9. Aware of real-life contemporary biomedical problems,
10. Sensitive to biomedical ethical issues,
11. Knowledgeable in one of the specialty areas central to the discipline of biomedical engineering.

Some B.S. 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 Specialty Sequence. The Engineering Core provides a broad background in mathematics, sciences, and engineering. A typical program of study is shown in the table. The BME Core integrates engineering with biomedical science to solve biomedical problems.

Hands-on experience in BME is developed through the undergraduate laboratory and project courses. In addition, by choosing a BME specialty sequence, the student can learn in depth about a specific area. 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.

### Biomedical Engineering Specialty Electives
Common BME specialties are biomaterials (orthopaedic and polymeric), biomechanics (prosthetics and tissues), biomedical instrumentation (devices & sensors), biomedical computing and imaging, and biomedical systems & control. Courses for these specialties are presented in the table. Complete descriptions and suggested schedules for approved specialties are available on the

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**UNDERGRADUATE PROGRAMS**

The CWRU undergraduate program leading to the Bachelor of Science degree with a major in biomedical engineering was established in 1972. The B.S. program in BME is fully accredited by the Accreditation Board of Engineering and Technology.

The educational objective of our undergraduate program is to develop in our students problem-solving skills, the ability to think independently, and the ability to assess ideas with an open mind, which will allow them to be successful as they go on in careers in biomedical engineering, to medical school, or to graduate school in biomedical engineering. Specifically, our goal is to develop in students the ability to
1. Construct models of biomedical systems, and solve them using a combination of modern computer applications and theory,
2. Measure physical phenomena relevant to medicine and biology using state-of-

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**BME SPECIALTY SEQUENCE CLASSES (CONT.)**

**Biomaterials (orthopedic)**

<table>
<thead>
<tr>
<th>Course</th>
</tr>
</thead>
<tbody>
<tr>
<td>EMSE 201, ECIV 310, EMSE 303, and EMAC 270; and technical electives from EBME 405, EMSE 316, EBME 416, EMSE 202, EMSE 270, EMSE 313, EMSE 411, EMAE 372, EMAC 276, EMAC 250, EBME 303, EBME 311, EBME 406, EBME 408, EMAE 415</td>
</tr>
</tbody>
</table>

**Biomedical Computing & Imaging**

<table>
<thead>
<tr>
<th>Course</th>
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</thead>
<tbody>
<tr>
<td>ECES 233, ECES 337, ESCI 313, and EBME 320; and technical electives from ECES 281, EBME 431, ECES 375, EBME 324, ECES 340, ECES 391, MIDS 329, EBME 461, ECES 375, ECES 341, ECES 338, and MATH 304</td>
</tr>
</tbody>
</table>

**Biomedical Instrumentation (devices)**

<table>
<thead>
<tr>
<th>Course</th>
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</thead>
<tbody>
<tr>
<td>EEAP 245, ECES 281, ESCI 313, and EEAP 344; and technical electives from EEAP 382, EEAP 309, EBME 403, EBME 320, EBME 324, EEAP 321, EEAP 311, EBME 418, and PHYS 326</td>
</tr>
</tbody>
</table>

**Biomedical Instrumentation (sensors)**

<table>
<thead>
<tr>
<th>Course</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 301, CHEM 302; and technical electives from EEAP 282, EEAP 322, EBME 403, EEAP 344, EEAP 311, EBME 418, ECHE 370, ECHE 380, and ECHE 381</td>
</tr>
</tbody>
</table>

**Biomedical Systems & Control**

<table>
<thead>
<tr>
<th>Course</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESCI 304, ESCI 313, ESCI 322, and EMAE 181; and technical electives ESCI 306, MATH 201, EBME 324, OPRE 345, EBME 402, EBME 407, EBME 320, MATH 201, OPRE 345, EBME 461, EMBE 307, and ESCI 346</td>
</tr>
</tbody>
</table>

**Notes**

This gives 129 credits. Varies from sequence to sequence.
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 allows research projects ranging from basic science through engineering design and clinical application.

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

**M.S. Programs**

The M.S. 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 M.S. requires a minimum of 30 credit hours. With an M.S. research thesis (Plan A), a minimum of 21 credits hours is needed in regular coursework and 9 hours of thesis research (EBME 651). With an M.S. project (Plan B), a minimum of 27 credits hours is needed in regular coursework, and three hours of project research (EBME 601).

**Ph.D. Program in Biomedical Engineering**

For those students with primary interest in research, the Ph.D. 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 Ph.D. program requires a minimum of 14 courses beyond the B.S. degree. There are four required core courses (EBME 403, 409, 451, 452). The balance of the courses can be chosen with significant flexibility to meet the career goals of the student, and to satisfy requirements of depth and breadth. Programs of study must include three graduate level courses in biomedical sciences and two courses whose content is primarily mathematical. Two semesters of departmental seminar attendance (EBME 611, 612) and three semesters of teaching experience (EBME 400T, 500T, 600T) are also required. Ph.D. programs of study are reviewed and must be accepted by the Graduate Education Committee and the department chairperson. Eighteen hours of EBME 701 registration are required. Ph.D. candidacy requires passing certain milestones. The first is the department qualifying exam. The second is writing a research proposal and defending it in an oral exam. Ph.D. candidacy also requires completion of the M.S. degree, or a waiver of the M.S. requirement based on the acceptance of a peer-reviewed scientific manuscript. The Ph.D. is completed when the dissertation has been written and defended, and when at least two manuscripts have been submitted for publication and at least one of the two is accepted.

**Ph.D. Program in Biophysics-Bioengineering**

This program, which is administered through the School of Medicine is jointly sponsored with the Department of Physiology and Biophysics. A full description is available in the section on the School of Medicine.

**Ph.D. Program in Neuroscience-Bioengineering**

This program, which is administered through the School of Medicine is jointly sponsored with the Department of Neurosciences. A full description is available in the section on the School of Medicine.

**Ph.D./M.D. Program**

A small number of students with outstanding qualifications are admitted to the Ph.D./M.D. program through the School of Medicine. This intensive program requires approximately 7 years of intensive study after the B.S.

**RESEARCH AREAS**

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 hospitals bring a broad range of opportunities, expertise, and perspective to student research projects.

Biomaterials/tissue engineering

Materials for implantation, including neural and cardiovascular tissue engineering, biomimetic materials, liposomal drug delivery, and biocompatible polymer surface modifications. Analysis of synthetic and biologic polymers by AFM, nanoscale structure-function relationships of orthopedic biomaterials.

Biomedical image processing and analysis

MRI, PET, cardiac electrical potential mapping, human visual perception, image guided intervention.

Biomedical Sensing

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

Cardiac Bioelectricity

Cardiac electrophysiology (at ion-channel, cell, and tissue levels), models of cellular activity, mechanisms of cardiac arrhythmias, optical imaging of electrical propagation in the heart, noninvasive electrocardiographic imaging.

Neural Engineering and Neural Prostheses

Neuronal mechanisms; neural interfacing for electric and magnetic stimulation and recording; neural dynamics, ion channels, second messengers, nitric oxide, signal processing in the retina; neural prostheses for control of limb movement, bladder, bowel, and respiratory function.

Transport and metabolic systems engineering

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

FACILITIES

The administrative offices of the Department of Biomedical Engineering are located in the Wickenden Building, which houses many BME research laboratories as well as the Center for Cardiovascular Biomaterials (CCB) and the Cardiac Bioelectricity Research and Training Center (CBRTC). Within the CCB are the laboratories for biomaterials microscopy, biopolymer & biomaterial interfaces, and molecular simulation. Other biomaterials related laboratories include Cell and Tissue Engineering and Biomaterials Protein Engineering. The CBRTC includes laboratories for High-Performance Cardiac Simulation and Display, Cardiac Cell Experiments, Cardiac Cell Imaging, and Cardiac Optical and Electrical Mapping. Optical laboratories deal with Microspectroscopic Diagnostics and Fiberoptic Biosensors. Diagnostic optical and electrochemical techniques are developed in the laboratory for Microchemical Sensors. The laboratory for Biomedical Image Processing and Analysis works on images from the molecular level to the tissue-organ level. Primary BME faculty are also directors of laboratories in other locations. The Endoscopy Research Laboratory is the center for work on Optical Computed Tomography. The Applied Neural Control Laboratory is a major facility for basic research and animal experimentation in the development of neural prostheses. The Neural Engineering Center focuses on the interaction between electrical and magnetic fields with neural tissue. The Functional Electrical Stimulation Center develops techniques for restoration of movement in paralysis, control of the nervous system, and implantable technology. Also, it promotes technology transfer and disseminates information about biomedical electrical stimulation. The Rehabilitation Engineering Center evaluates clinical functionality of neuroprostheses.

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

Biomedical Engineering (EBME)

UNDERGRADUATE COURSES

EBME 105. Introduction to Biomedical Engineering (3)
Biomedical engineering fields of activity. Research, development, and design for biomedical problems, diagnosis of disease, and therapeutic applications.

EBME 201. Physiology-Biophysics I (3)

EBME 202. Physiology-Biophysics II (3)
Biological control systems. Cardiovascular, renal, respiratory, gastrointestinal, and immune systems.

EBME 303. Structure of Biological Materials (3)
Structure of proteins, nucleic acids, connective tissue and bone from molecular to microscopic levels. Principles and applications of instruments for imaging, identification, and measurement of biological materials. Prerequisite: EBME 202. Cross-listed as EMAC 303.

EBME 306. Introduction to Biomedical Materials (3)
Applications of biomaterials in different tissue and organ systems. Relationship between physical and chemical structure of materials and biological system response. Choosing, fabricating and modifying materials for specific biomedical applications. Prerequisites: EBME 201 and EBME 202.

EBME 307. Biomechanical Prosthetic Systems (3)
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.

EBME 308. Biomedical Signals and Systems (4)
Quantitative analysis of biomedical signals and physiological systems. System
EBME 310. Principles of Biomedical Instrumentation (3)
Physical, chemical and biological principles for biomedical measurements. Modular blocks and system integration. Sensors for displacement, force, pressure, flow, temperature, biopotentials, chemical composition of body fluids and biomaterial characterization. Patient safety. Prerequisite: EBME 308.

EBME 311. Artificial Organs (3)

EBME 313. Biomedical Engineering Laboratory I (2)
Experiments for measurement, assisting, replacement, or control of various biomedical systems. Prerequisites: EBME 201, EBME 202 and ENGR 210. Corequisite: ENGL 398N.

EBME 314. Biomedical Engineering Laboratory II (2)
Continuation of EBME 313. Prerequisites: EBME 201, EBME 202 and ENGR 210.

EBME 320. Medical Imaging Fundamentals (3)
Physical principles of medical imaging. Imaging devices for x-ray, ultrasound, magnetic resonance, etc. Image quality descriptions. Patient risk. Prerequisites: EBME 201, EBME 202, EBME 308 and EBME 310 or equivalent.

EBME 324. Laboratory Computing in Biomedical Engineering (3)
Hardware and software aspects of computer systems for laboratory application. Analog and digital interfacing. Signal conditioning and sampling requirements. Computer control of laboratory instruments and data acquisition. Biomedical applications. Prerequisites: EBME 201, EBME 202 and EBME 308.

EBME 359. Biomedical Computer Simulation Laboratory (1)
Computer simulation and mathematical models of biomedical systems. MATLAB software tools are used to demonstrate the basic properties of dynamical systems, numerical methods and their application to biomedical problems. Corequisite: EBME 309.

EBME 360. Biomedical Instrumentation Laboratory (1)
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. Corequisite: EBME 310.

EBME 380. Design for Biomedical Engineers (3)
Design a useful product with potential commercial value. This course offers a design experience that builds on the fundamentals of biomedical engineering through the effective use of teams and team design. Prerequisite: EBME 310.

EBME 396. Special Topics in Undergraduate Biomedical Engineering I (1-18)
(Credit as arranged.) Prerequisite: Consent of instructor.

EBME 398, 399. Senior Project Laboratory I and II (3)

GRADUATE COURSES
EBME 400T. Graduate Teaching I (0)
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. Students in this course may be expected to perform both contact (C) and non-contact (NC) teaching in this course sequence. Examples are: develop teaching or lecture materials (NC); run recitation groups (C); provide laboratory assistance (C) or (NC); present individual lectures (C); tutor (C); prepare and grade exams/ quizzes/homework (NC). Prerequisite: Ph.D. student in biomedical engineering.

EBME 402. Muscles, Biomechanics, and Control of Movement (4)
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, receptors and reflexes 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. Prerequisite: EMAE 181 or equivalent. Cross-listed as EMAE 402.

EBME 403. Biomedical Transducers (3)
Analysis and design of transducers: optical, photo-electric, electrochemical, electrical, mechanical, electromechanical, and thermoelectric. Applications to biomedical systems. Prerequisites: EBME 310 and EBME 360 or consent of instructor.

EBME 405. Materials for Prosthetics and Orthotics (3)

EBME 406. Polymers in Medicine (3)
Distribution of plastic implants in the body, including history and statistics; chemical and physical characteristics of biomedical polymers, including general implant requirements, reactions of the host to implants, reactions of implants to physiological conditions, physiological and biomechanical basis for soft-tissue implants; plastic materials used in medicine and surgery; frontiers in biomedical polymers (current topics directed to the design and development of new biomedical polymers). Prerequisite: Consent of instructor. Cross-listed as EMAC 471.
EBME 407. Applied Neural Control (3)
Fundamental concepts related to electrical stimulation of the nervous system. Cable equation, currents in volume conductors, electrical models of axons, interaction between axons and electrical fields, tissue damage of electrical stimulation, electrochemistry of electrical stimulation, electrodes for electrical stimulation, applications to neuromuscular, sensory, and other physiological systems. Prerequisites: EBME 451 and EBME 409.

EBME 408. Tissue and Cellular Engineering (3)
Tissue engineering approach for augmentation or replacement of compromised tissue function in nerve, microvessels, skin and cartilage. Integrative exploration of the use of three-dimensional polymeric scaffolds and drug delivery vehicles, and gene therapy and cellular engineering for functional repair of injured tissues. Prerequisite: Consent of instructor.

EBME 409. Systems and Signals in Biomedical Engineering (3)

EBME 410. Medical Imaging Fundamentals (3)
Physical principles of medical imaging. Imaging devices for x-ray, ultrasound, magnetic resonance, etc. Image quality descriptions. Patient risk. Prerequisites: EBME 308 and EBME 310 or equivalent.

EBME 411. Artificial Organs (3)
Engineering for replacement or augmentation of tissues (e.g., nerve or vascular) and organs (e.g., kidney and heart). Chemical, electrical, mechanical, materials, pathological and surgical aspects. Prerequisites: EBME 451 and EBME 452.

EBME 412. Biomedical Signal Processing (3)

EBME 414. Laboratory Computing in Biomedical Engineering (3)
Hardware and software aspects of computer systems for laboratory application. Analog and digital interfacing. Signal conditioning and sample requirements. Computer control of laboratory instruments and data acquisition. Biomedical applications. Prerequisite: EBME 308 or equivalent.

EBME 416. Biomolecular Engineering (3)
Fundamental principles in design and engineering of molecular architectures of biomaterials for biomedical applications. Structure-function relationships at the molecular level. Tailoring the surface and bulk structures for applications in drug delivery, tissue engineering, and biomedical imaging. Prerequisite: EBME 303 or EMAC 303. Corequisite: EBME 306.

EBME 418. Electronics for Biomedical Engineering (3)

EBME 422. Biomedical Image Processing and Analysis (3)
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. Prerequisite: EBME 308.

EBME 431. Physics of Imaging (3)
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. Prerequisite: PHYS 122 or PHYS 124 or EBME 410. Cross-listed as PHYS 431.

EBME 447. Rehabilitation for Scientists and Engineers (3)
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. Prerequisite: Consent of department.

EBME 451. Physiological Processes I (3)

EBME 452. Physiological Processes II (3)
Heart and vascular system. Respiratory, renal, and regulatory systems. Gastrointestinal system and metabolism. Prerequisite: Consent of instructor.

EBME 460. Advanced Topics in NMR Imaging (3)
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. Prerequisite: EBME 431 or PHYS 431. Cross-listed as PHYS 460.

EBME 461. Biomedical Image Processing and Analysis (3)
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. Prerequisite: EBME 409 or equivalent.

EBME 478. Computational Neuroscience (3)
Computer simulation 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 circuits, as well as to cable theory, passive and active
compartmental modeling, numerical integration methods, models of plasticity and learning, models of brain systems, and their relationship to artificial neural networks. Term project required. Two lectures per week. Cross-listed as BIOL 478 and ECES 478.

EBME 479. Seminar in Computational Neuroscience (3)
Readings and discussion in the recent literature on computational neuroscience, adaptive behavior, and other current topics. Cross-listed as BIOL 479.

EBME 500T. Graduate Teaching II (0)
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 student. Students in this course may be expected to perform both contact (C) and non-contact (NC) teaching in this course sequence. Examples are: develop teaching or lecture materials (NC); run recitation groups (C); provide laboratory assistance (C) or (NC); present individual lectures (C), tutor (C); prepare and grade exams/quizzes/home work (NC). Prerequisite: Ph.D. student in biomedical engineering.

EBME 501. Bioelectric Phenomena (3)

EBME 502. Cardiac Excitation, Rhythm, and Control (3)

EBME 504. Transport Process of Biomedical Systems (3)

EBME 507. Motor System Neuroprostheses (3)
Design and implementation of neuroprostheses. Transformation of muscle action into limb movement. Musculoskeletal modeling and simulation. Control of the musculoskeletal system by neural stimulation. Prerequisite: Consent of instructor.

EBME 513. Biomedical Optical Diagnostics (3)
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. Prerequisite: EBME 403 or PHYS 326 or consent.

EBME 517. Quantitative Neurophysiology (3)
This course provides a unique opportunity to gain advanced knowledge in the area of neurophysiology, neuroscience, and cellular biophysics/physiology from the quantitative point of view. The instructors are from different departments which will give students the rare opportunity to learn and understand the material from various angles. The mathematical load varies depending on the topic, however the familiarity with or willingness and ability to learn basic important mathematical concepts such as differentiation, probability or matrices is essential. The course will start by studying the laws of physics that govern the behavior of ions in biological solutions and near the cell membrane. The next part of the course deals with the voltage-gated ion channels of the excitable cell: activity, structure, functions and models. The third part is devoted to modeling electrical activity of a neuron. The fourth part describes the synaptic interaction between neurons, from presynaptic calcium dynamics to postsynaptic membrane and ligand-gated channels. The last part applies the acquired knowledge to understanding a neuronal network (hippocampus). Along with the lectures, the students will prepare a model of the neuron using the NEURON software. This project will be in constant development during the course, i.e., the complexity of the model will increase as long as new material is learned.

EBME 519. Parameter Estimation for Biomedical Systems (3)
Linear and nonlinear parameter estimation of static and dynamic models. Identifiability and parameter sensitivity analysis. Statistical and optimization methods. Design of optimal experiments. Applications to cells, tissues, and organs. Prerequisite: EBME 409 or consent of instructor.

EBME 523. Chemical and Optical Sensors (3)
Fundamental electrical, electrochemical, and optical measurement techniques. Sensitive and selective biological membranes based on ion, enzyme, and immuno-reactions. Sensor stability and response time. Prerequisite: EBME 403.

EBME 600T. Graduate Teaching III (0)
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 student. Students in this course may be expected to perform both contact (C) and non-contact (NC) teaching in this course sequence. Examples are: develop teaching or lecture materials (NC); run recitation groups (C); provide laboratory assistance (C) or (NC); present individual lectures (C), tutor (C); prepare and grade exams/quizzes/homework (NC). Prerequisite: Ph.D. student in biomedical engineering.

EBME 601. Research Projects (1-18)
EBME 602. Special Topics (1-18)
Prerequisite: Consent of instructor.

EBME 611. BME Departmental Seminar I (0)
Required of all first-year graduate students in BME.

EBME 612. BME Departmental Seminar II (0)
Continuation of EBME Departmental Seminar I. Required of all first-year graduate students in BME.

EBME 621. BME Research Rotation I (0)
Opportunity for trainees to participate in BME research under supervision of faculty.
EBME 622. BME Research Rotation II (0)
Opportunity for trainees to participate in BME research under supervision of faculty.

EBME 651. Thesis M.S. (1-18)
EBME 701. Dissertation Ph.D. (1-18)
Ph.D. candidates only.

EBME 702. Appointed Dissertation Fellow (9)

Department of Chemical Engineering

118 Smith Building (7217)
phone 216-368-4182 fax 216-368-3016
Nelson Gardner, Chair
e-mail: nxg3@po.cwru.edu
http://cheme.cwru.edu

The profession of chemical engineering involves the analysis, design, operation and control of processes which convert matter and energy to more useful forms, encompassing processes at all scale 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, and law (mainly for patent law). The Bachelor of Science degree is accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology.

The department 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 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. In addition, for students with a strong interest in polymer engineering, a minor in macromolecular science can be integrated with the chemical engineering curriculum. All 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 from the chapter president or the chapter advisor. There are thirteen full-time faculty members, all of whom are pursuing active research programs. The research of the faculty is aimed at advanced and cutting-edge areas of chemical engineering.

FACULTY

Nelson C. Gardner, Ph.D. (Iowa State University)
Associate Professor and Chair
High-gravity separations, sulfur removal processes

Stuart B. Adler, Ph.D. (University of California, Berkeley)
Assistant Professor
Electrochemical ceramics and solid-state electrochemistry

John C. Angus, Ph.D. (University of Michigan)
Kent Hale Smith Professor of Engineering
Chemical vapor deposition of diamond, redox equilibria

Coleman B. Brosilow, Ph.D. (Brooklyn Polytechnic Institute)
Professor
Modular multivariable, nonlinear model-predictive, and adaptive control, simulation of large scale dynamic systems

Robert V. Edwards, Ph.D. (Johns Hopkins University)
Professor
Catalysis and reactor design, enhanced oil recovery, novel polymeric materials

Jeffrey T. Glass, Ph.D. (University of Virginia), M.B.A. (Duke University)
Joseph S. Toor Professor of Engineering
Plasma processing and materials characterization of thin films, measurement of device properties

Howard L. Greene, Ph.D. (Cornell University)
Principal Researcher
Catalysis and reactor design

Uziel Landau, Ph.D. (University of California, Berkeley)
Professor
Electrochemical engineering, modeling of electrochemical systems, electrodeposition

Chung-Chiun Liu, Ph.D. (Case Institute of Technology)
Professor
Surface phenomena, interfacial dynamics, light scattering

Philip W. Morrison, Jr., Ph.D. (University of California, Berkeley)
Associate Professor
Materials synthesis, in-situ diagnostics of thin film and particle formation processes

Seyed Qutubuddin, Ph.D. (Carnegie Mellon University)
Professor
Surfactant and polymer solutions, separations, enhanced oil recovery, novel polymeric materials

Robert F. Savinell, Ph.D. (University of Pittsburgh)
Professor and Associate Dean of Engineering
Electrochemical engineering, electrochemical reactor design and simulation, electrode processes, batteries and fuel cells

UNDERGRADUATE PROGRAMS

The Case School of Engineering prepares and challenges its students to take leadership positions in engineering and computer science. The increasing role of technology in virtually every facet of our culture — communications, transportation, construction, health care, the environment, and even our system of wealth distribution — makes it vital that engineering-oriented students have access to progressive and cutting-edge programs stressing the following five areas of excellence:

• Mastery of Fundamentals
• Creativity
• Societal Awareness
• Leadership Skills
• Professionalism
  The Chemical Engineering Department expands these more general objectives as follows:

  Mastery of Fundamentals
  • A strong background in the fundamentals of chemistry, physics, and mathematics.
  • A sound education in chemical engineering fundamentals, including mass and energy balances, separation processes, reaction engineering, thermodynamics, transport processes, and control.

## BACHELOR OF SCIENCE IN ENGINEERING DEGREE

### MAJOR IN CHEMICAL ENGINEERING

<table>
<thead>
<tr>
<th>Fall Semester</th>
<th>Class/Lab/Credit Hours</th>
<th>Spring Semester</th>
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</thead>
<tbody>
<tr>
<td><strong>FRESHMAN</strong></td>
<td></td>
<td><strong>FRESHMAN</strong></td>
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<tr>
<td>PHYS 121 General Physics I Mechanics ................................................. (4-3-4)</td>
<td></td>
<td>PHYS 122 General Physics II Electricity &amp; Magnetism a .......................... (4-3-4)</td>
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<tr>
<td>CHEM 111 Principles of Chemistry I ....................................................... (4-0-4)</td>
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<td>ENGR 145 Chemistry of Materials ....................................................... (4-0-4)</td>
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<tr>
<td>MATH 121 Calculus for Science and Engineering I ...................................... (4-0-4)</td>
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<td>ENGR 131 Elementary Computer Programming ......................................... (2-2-3)</td>
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<td>MATH 224 Differential Equations ....................................................... (3-2-3)</td>
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<td>ENGR 225 Thermodynamics, Fluids, Heat &amp; Mass Transfer .......................... (4-0-4)</td>
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<td>STAT 313 (or STAT 312) Statistics for Experimenters ................................ (3-0-3)</td>
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<td>ECHE 260 Introduction to Chemical Systems ........................................... (3-0-3)</td>
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<td>ECHE 361 Separation Processes ......................................................... (3-0-3)</td>
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<td>ECHE 367 Process Control ........................................................................ (4-0-4)</td>
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<td>ECHE 365 Measurements Laboratory ...................................................... (0-3-3)</td>
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<td>ENGR 210 Circuits &amp; Instrumentation ...................................................... (2-2-4)</td>
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<td>ENGL 398N Professional Communications ............................................ (3-0-3)</td>
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<td>ECHE 364 Chemical Reaction Processes .............................................. (3-0-3)</td>
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<td>CHEM 302 Introductory Physical Chemistry II ....................................... (3-0-3)</td>
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<td>Materials Elective c .............................................................................. (3-0-3)</td>
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<td>ENGR 200 Statics and Strength of Materials ......................................... (3-0-3)</td>
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<td>Breadth Elective Sequence II d ............................................................ (3-0-3)</td>
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| Total ........................................................................................................... (18-0-18) |

### Notes:

- a Selected students may be invited to take PHYS 125, 126 General Physics I, II Honors in place of PHYS 121,122.
- b Science Elective I and II. Students must take any two of the following courses—PHYS 221 General Physics III. Modern (F), CHEM 224/324 Organic Chemistry II (Sp), or BIOL 205 Microbiology (Sp).
- c One materials elective is required. Suggested courses include EMAC 270 Introduction to Polymer Science (F, Sp), EMAC 276 Polymer Properties and Design (F, Sp), EMSE 314 Electrical, Magnetic, Optical Properties of Materials (F), EMSE 316 Applications of Ceramic Materials, or course approved by the chemical engineering faculty.
- d A three course (9 credit hours minimum) breadth sequence (approved by the Chemical Engineering faculty). Preapproved sequences include biochemical engineering, biomedical engineering, computing, electrochemical engineering, electronic materials processing, environmental engineering, management, polymer science, systems and control, and advanced study (B.S./M.S.).

Hours required for graduation: 131-133 (depending on breadth elective sequence).
Training in computers as tools of the profession, including experience with spreadsheets, simulators, computer-aided design software, and mathematics/statistics packages.

### Creativity
- Comprehensive design experiences involving problem definition, literature searching, synthesis, economics, communications, teamwork, project management, equipment choice, and safety.
- Laboratories that provide hands-on experience with equipment, design of experiments, data/statistical analysis, and reinforcement of fundamental physical concepts.
- Opportunities for individualized research experiences.

### APPROVED BREADTH ELECTIVE SEQUENCES

<table>
<thead>
<tr>
<th>Biochemical Engineering (Advisor: Dr. Qutubuddin) Semester</th>
<th>Biochemical Engineering (Advisor: Dr. Qutubuddin) Semester</th>
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<tr>
<td>BIOC 307, General Biochemistry (4) Fall, junior</td>
<td>BIOC 307, General Biochemistry (4) Fall, junior</td>
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<tr>
<td>BIOL 343, Microbiology (3) Spring, junior</td>
<td>BIOL 343, Microbiology (3) Spring, junior</td>
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<tr>
<th>Biomedical Engineering (Advisor: Dr. Liu)</th>
<th>Biomedical Engineering (Advisor: Dr. Liu)</th>
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<tr>
<td>EBME 201, Physiology-Biophysics I (3) Fall, junior</td>
<td>EBME 201, Physiology-Biophysics I (3) Fall, junior</td>
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<td>EBME 202, Physiology-Biophysics II (3) Spring, junior</td>
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<tr>
<td>EBME 309, Modeling of Biomedical Systems (3)</td>
<td>EBME 309, Modeling of Biomedical Systems (3)</td>
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<tr>
<td>EBME 310, Biomedical Instrumentation (3) Spring, senior</td>
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<tr>
<th>Computing (Advisor: Dr. Brosilow)</th>
<th>Computing (Advisor: Dr. Brosilow)</th>
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<tr>
<td>EEAP 282, Intro to Microprocessors (4) Fall, junior</td>
<td>EEAP 282, Intro to Microprocessors (4) Fall, junior</td>
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<td>ECES 333, Introduction to Data Structures (4) ... Spring, junior</td>
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<td>ESYS 346, Engineering Optimization (3) Fall, senior</td>
<td>ESYS 346, Engineering Optimization (3) Fall, senior</td>
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<tr>
<th>Chemical Engineering (Advisor: Dr. Landau)</th>
<th>Chemical Engineering (Advisor: Dr. Landau)</th>
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<tr>
<td>ECHE 380 Electrochemical Technology (3) Fall, junior</td>
<td>ECHE 380 Electrochemical Technology (3) Fall, junior</td>
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<tr>
<td>ECHE 381 Electrochemical Engineering (3) Spring, junior</td>
<td>ECHE 381 Electrochemical Engineering (3) Spring, junior</td>
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<td>ECHE 383 Chemical Engineering Applied to Microfabrication and Devices (3) Fall, senior</td>
<td>ECHE 383 Chemical Engineering Applied to Microfabrication and Devices (3) Fall, senior</td>
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<td>Properties of Materials (3) Fall, senior</td>
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<tr>
<td>EEAP 309 Electromagnetic Fields I (3) Fall, Spring</td>
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<td>EEAP 321 Physical and Solid State</td>
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<td>EMSE 411, Environmental Effects on Materials Behavior (3)</td>
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<th>Electronic Materials (Advisor: Dr. Morrison)</th>
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<td>EMSE 314 Electronic, Magnetic, and Optical Properties of Materials (3) Fall, senior</td>
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<td>ECIV 362, Solid and Hazardous Waste Management (3)</td>
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<td>ACCT 303/403, Survey of Accounting (3) ... Fall, senior</td>
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<td>MKMR 301, Marketing Management (3) ... Spring, junior</td>
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<td>ECHE 651 Master’s Thesis (3) Fall, senior</td>
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* In these sequences, coordinate your choice of breadth electives with your choice for the Materials Elective.

* This sequence is designed for students entering the five-year B.S./M.S. program. Students taking this sequence should rearrange the scheduling of the elective sequence and humanities/social science courses in the junior and senior years to accommodate these courses.
Societal Awareness
- Understanding of the technological and human resource needs of the industry, government, and society.
- A sufficiently broad education to understand the impact of engineering on society.
- Opportunities to explore other cultures and learning environments through a Junior Year Abroad program and a summer Chemical Engineering Laboratory course at University College London.

Leadership Skills
- Multiple and integrated opportunities to develop written and oral communication skills.
- Develop specialized knowledge in a series of breadth electives, such as biomedical engineering, biochemical engineering, computing, electrochemical engineering, electronic materials, environmental engineering, management/entrepreneurship, polymer science, and control, or research.
- Leadership roles in group-based course activities encouraging a “can do” positive attitude and developing skills in teamwork.

Professionalism
- A commitment to excellence and unquestioned integrity.
- An understanding of safety and ethical issues, and the environmental consequences of the practice of chemical engineering.
- Opportunities for professional development through the Cooperative Education Program.

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. Nine elective sequences have standing departmental approval in biomedical engineering, biomedical engineering, computing, electrochemical engineering, electronic materials, environmental engineering, management/entrepreneurship, polymer science, and systems and control. There is also an advanced study sequence for combined B.S./M.S. students.

Minor in Polymer Engineering
For students wanting to pursue an interest in polymers, but major in chemical engineering, two five-course minor sequences, Polymer Processing and Characterization, and Polymer Production are available.

Polymer Processing and Characterization
- EMAC 270, Introduction to Polymer Science (F, Sp)
- EMAC 276, Polymer Engineering (F, Sp)
- EMAC 277, Polymer Processing (F)
- EMAC 372, Polymer Processing and Testing Laboratory (Sp)
- EMAC 375, Polymer Rheology

Polymer Production
- EMAC 270, Introduction to Polymer Science (F, Sp)
- EMAC 272, Polymer Analysis Laboratory (Sp)
- EMAC 276, Polymer Properties and Design (Sp)
- EMAC 378, Polymer Production and Technology (Sp)
- EMAC 398, Polymer Sci. & Engr. Project (F, Sp)

Minor Sequence in Chemical Engineering
A minor sequence in chemical engineering is available for students majoring in engineering, chemistry, or physics. A minimum of 15 credits must be completed, and must include
- ECHE 260 Introduction to Chemical Systems
- ENGR 225 Thermodynamics, Fluid Mechanics, Heat and Mass Transfer (F, Sp)
- ECHE 360 Transport Phenomena for Chemical Systems (F)
- and any two of the following
- ECHE 361 Separation Processes (Sp)
- ECHE 363 Thermodynamics of Chemical Systems (Sp)
- ECHE 364 Chemical Reaction Processes (Sp)

ECHE 365 Measurements Laboratory (Sp)
ECHE 367 Process Control (F)

Five-Year Combined B.S./M.S. Program
This program offers outstanding undergraduate students the opportunity to obtain an M.S. degree, with a thesis, in one additional year of study beyond the B.S. degree. (Normally, it takes 2 years beyond the B.S. to earn an M.S. degree.) In this program, an undergraduate student can take up to nine credit hours that simultaneously satisfy undergraduate and graduate requirements. Typically, students in this program start their research leading to the M.S. 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 B.S. degree is awarded at the completion of the senior year. Application for admission to the five year B.S./M.S. program is made after completion of five semesters of course work. Minimum requirements are a 3.2 grade point average and the recommendation of the department. Interested students should contact Professor Morrison.

Five-and-a Half Year Cooperative B.S./M.S. Program
The cooperative bachelor’s/master’s program enables outstanding students who are enrolled in the cooperative program to earn an M.S. in one semester beyond the B.S. degree. Student completes six credits of a graduate project (ECHE 660) during the second co-op period and follows 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. At the end of the fifth year, the student receives the B.S. degree. Upon completion of an additional 12 credits of graduate work the following semester, the student receives the M.S. degree (non-thesis). Application for admission to the five-and a-half-year co-op B.S./M.S. program is made during the second semester of the junior year (this semester is taken in the fall of the fourth year). Minimum requirements are
a 3.2 grade point average, good performance in the previous co-op assignment, and the recommendation of the department. Interested students should contact Professor Morrison.

GRADUATE PROGRAMS

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

Plan A
Students electing Plan A take 19 hours of graduate-level course work (six courses plus ECHE 401, Chemical Engineering Communications) and complete at least 9 credit hours of M.S. thesis research.

Plan B
Part-time students, and those in the 5-1/2-year B.S./M.S. 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 M.S. 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 M.S. students are required to take the following courses: ECHE 460, Thermodynamics of Chemical Systems (3); ECHE 461, Transport Phenomena (3); ECHE 462, Chemical Reaction Engineering (3); and ECHE 475, Chemical Engineering Analysis (3) or an equivalent graduate-level math course. 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. All full-time M.S. students are expected to do some teaching 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. In this program, students complete a core program consisting of five courses, and select a four-course sequence in an area of interest. 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 comprehensive understanding of related subjects together with a demonstration of the ability to perform independent investigations, to suggest new areas for research, and to communicate results in an acceptable manner. The minimum course requirements for the Ph.D. degree in chemical engineering are as follows.

Depth Courses
All programs of study must include ECHE 401, Chemical Engineering Communications (1), ECHE 460, Thermodynamics (3), ECHE 461, Transport Phenomena (3), and ECHE 462, Chemical Reaction Engineering (3), plus a minimum of three other chemical engineering courses.

Breadth and Basic Science Courses
A minimum of six courses outside the department must be taken. These can be chosen from other engineering departments and the departments of mathematics, chemistry, physics, biology, and geological sciences. A minimum of two elective courses must be in mathematics.

Comments on Ph.D. 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 thermodynamics course at another school. In these cases, the student must attach a statement to the program of study justifying the departure from the guidelines. It should be noted that the above guidelines are a minimum requirement. Only in rare circumstances will programs of study be approved with only 12 courses (36 credit hours). A total of 15 courses (45 credit hours) is typical for the Ph.D. degree. It is expected that the elective courses will form a coherent whole with a concentration in one area, e.g., systems, polymers, surface science, etc., rather than a smattering of introductory courses in many diverse subjects. All programs are chosen with the approval of the student’s faculty advisor.

Other Requirements for the Ph.D. Degree
Students who wish to enter the Ph.D. program must pass a written general examination covering material through the beginning graduate level courses. A thesis proposal and an independently generated research proposal are also required. All Ph.D. students must satisfy the residency requirements of the university and the Case School of Engineering. Some teaching is also required. 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 Ph.D. requirements and a time schedule for their completion.

CURRENT RESEARCH TOPICS
The department’s research is funded from a number of federal agencies and private industrial sponsors. Current projects include

Electrochemical engineering
- Bipolar discrete electrodes
- Microelectronic materials, fabrication and processing
- Solid-state electrochemical and biomedical sensors
- Modeling of electrochemical systems, batteries and fuel cells
- Electrodereposition, particle incorporation, and surface texturing
- Fluidized beds
- Porous, polymer-coated and diamond electrodes
- Electronic materials
- Alloys and compounds
- Corrosion protection
- Membranes for electrochemical applications
- Electrochemistry in surfactant systems
Light scattering
- Volumetric transport phenomena using anemometric and quasi-elastic techniques
- Surface light scattering, Raman spectroscopy, and Brewster angle microscopy
- Statistical data analysis and parameter estimation

Materials engineering
- Low-pressure growth of diamond, synthesis of wide band gap nitrides
- Combustion and plasma synthesis of films
- Computation of phase diagrams
- In situ spectroscopic techniques
- Aerosol synthesis, fine-particle processing strategies
- Dispersive mixing phenomena
- Microemulsion techniques for novel polymers and blends and nanoparticles
- Ultrathin films

Process control
- Multivariable, nonlinear and adaptive control

Reaction engineering
- Thermochemistry of complex redox systems
- Catalysis for environmental applications
- Reactive flow modeling

Separations
- Acoustic separation processes
- Process intensification using centrifugal fields
- Separations using microemulsions

Surface and colloidal phenomena
- Stability phenomena
- Rheology of emulsions and coatings, microemulsions and micelles
- Polymeric surfactants and polymer-substrate interactions
- Langmuir-Blodgett multilayers
- Structure and dynamics of monolayers
- Spreading phenomena
- Image-force microscopy

FACILITIES
The department is housed in the Albert W. Smith Building on the Case Quadrange. Professor Smith was chairman 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 two classrooms, one designed for computer and television instruction; the undergraduate Unit Operations Laboratory; a high bay area for process-related research; three reinforced concrete, vertically vented chambers for hazardous and high-pressure research; a constant temperature and humidity room; an instrument room; and the normal complement of offices and research laboratories. The department has unusually strong experimental capabilities in chemical vapor deposition, in laser applications, surface studies, and in electrochemical engineering. In addition, a full range of analytical instrumentation is available within the Department of Chemical Engineering, the Department of Chemistry, and the Materials Research Laboratory.

Chemical Engineering (ECHE)

UNDERGRADUATE COURSES
ECHE C100. Co-op Seminar I for Chemical Engineering (1)
Professional development activities for students returning from cooperative education assignments. Prerequisite: COOP 001.

ECHE C200. Co-op Seminar II for Chemical Engineering (2)
Professional development activities for students returning from cooperative education assignments. Prerequisites: COOP 002 and ECHE C100.

ECHE 151. Introduction to Chemical Engineering at Case (0)
Introduction to the faculty and their research as well as a description of the various elective sequences available to chemical engineering majors. All students should attend lectures in this class before their junior year.

ECHE 250. Honors Research I (1-3)
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)
(See ECHE 250.) Prerequisite: ECHE 250.

ECHE 260. Introduction to Chemical Systems (3)
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.

ECHE 340. Biochemical Engineering (3)
Chemical engineering principles applied to biological and biochemical systems and related processes. Microbiology and biochemistry linked with transport phenomena, kinetics, reactor design and analysis, and separations. Specific examples of microbial and enzyme processes of industrial significance. Prerequisites: BIOC 307 and BIOL 343 and ECHE 364.

ECHE 360. Transport Phenomena for Chemical Systems (4)
Viscous and turbulent fluid flow; heat and mass transport. Microscopic and macroscopic transport of mass, momentum, and energy including conduction and convection as well as interfacial and radiative heat transport. Design of piping networks, pumps, packed/liquidized beds, and heat exchangers. Diffusion and interfacial mass transfer. Heat and mass transfer analogies. Vector/tensor analysis and dimensional analysis used throughout. Prerequisites: MATH 223 and ENGR 225.

ECHE 361. Separation Processes (3)
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. Prerequisites: ECHE 260 and ECHE 363.

ECHE 362. Chemical Engineering Laboratory (4)
Experiments in the operation of separations and reaction equipment, methods of analysis, calculations. Distillation, chemical reactor, liquid-liquid extraction, heat transfer, and gas stripping. Prerequisites: ECHE 360, ECHE 361, and ECHE 363.

ECHE 362L. Chemical Engineering Laboratory in London (4)
A version of ECHE 362 taught during the summer at University College of London. Prerequisites: ECHE 360, ECHE 361, and ECHE 363.

ECHE 363. Thermodynamics of Chemical Systems (3)
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. Prerequisites: ECHE 260 and ENGR 225. Corequisite: MATH 224.

ECHE 364. Chemical Reaction Processes (3)
Design of homogeneous and heterogeneous chemical reactor systems. Relationships between type of reaction and choice of reactor. Methods of obtaining and analyzing kinetic data. Relationship between mechanism and reaction rate and brief introduction to catalysis. Prerequisite: ECHE 360.

ECHE 365. Measurements Laboratory (3)
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. Prerequisite: ECHE 360.

ECHE 367. Process Control (4)
Feedback control of chemical processes. The course involves extensive use of computer software and all exams are taken using the computer. 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. Prerequisite: MATH 224.

ECHE 380. Electrochemical Technology (3)
Fundamentals of modern electrochemical technology and the engineering principles involved. Basics of classical electrochemistry; thermodynamics and kinetics. Engineering aspects of transport phenomena, scaling, and design as applied to electrochemical industries. Practical examples from metal finishing, batteries and fuel cells, electrolytic industries, and metal refining. Prerequisite: ECHE 260.

ECHE 381. Electrochemical Engineering (3)
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. Prerequisite: ECHE 260 or permission of instructor. Cross-listed as ECHE 480.

ECHE 383. Chemical Engineering Applied to Microfabrication and Devices (3)
Silicon based microfabrication and micromachining processes require many chemical engineering related technologies. Microfabricated devices such as sensors are also directly related to chemical engineering. In this course, the applications of chemical engineering principles to the microfabrication and micromachining will be introduced. Oxidation processing, chemical vapor deposition, etching and patterning techniques, electroplating and other technologies will be discussed.

ECHE 396. Special Topics in Chemical Engineering (3)
Five-year B.S./M.S. students use this course for thesis research.

ECHE 397. Special Topics in Chemical Engineering (3)
Five-year B.S./M.S. students use this course for thesis research.

ECHE 398. Process Analysis and Design (3)

ECHE 399. Chemical Engineering Design Project (3)
A capstone course for chemical engineering seniors. Uses material taught in previous and concurrent courses in an integrated fashion to solve chemical process design problems. Emphasis is placed on applying modern computer based design tools. Practicality, economics, scheduling, decision making with uncertainty, and proposal and report preparation. Numerous small exercises and one comprehensive process design project done by the class. Prerequisite: ECHE 398.

GRADUATE COURSES

ECHE 400T. Graduate Teaching I (0)
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. Prerequisite: Entering Ph.D. student in chemical engineering.

ECHE 401. Chemical Engineering Communications (1)
Introductory course for a program of communications skills enhancement for chemical engineering graduate students. It focuses on the creation of the first proposal for the student’s thesis project.

ECHE 460. Thermodynamics of Chemical Systems (3)
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. Prerequisite: ECHE 363.

ECHE 461. Transport Phenomena (3)
ECHE 462. Chemical Reaction Engineering (3)
Steady and unsteady state mathematical modeling of chemical reactors from conservation principles. Interrelation of reaction kinetics, mass and heat transfer, flow phenomena. Catalytic and chemical vapor deposition reactors. Determination of kinetic parameters. Includes catalytic and chemical vapor deposition reactors. Prerequisite: ECHE 364.

ECHE 463. Techniques of Model-based Control (3)
Strategies of process control centered around the use of process models in the control system. Topics include single loop, feedforward, cascade and multivariable internal model control. Tuning controllers to accommodate process uncertainty. Treatment of control effort and output constraints in model predictive control and modular-multivariable control. Prerequisite: ECHE 367. Cross-listed as ESCI 463.

ECHE 464. Surfaces and Adsorption (3)
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 reaction. Prerequisite: CHEM 335 or equivalent.

ECHE 465. Catalysis (3)
Nature of catalytic processes, chemisorption, catalyst pore structure and surface area, role of lattice imperfections, geometric and electronic factors, dynamics and selectivity, typical reaction mechanisms, design of catalytic reactors.

ECHE 466. Colloid Science (3)

ECHE 467. Statistical Theories of Materials (3)
The classic ensembles of statistical thermodynamics will be developed and used to compute molecular properties, properties of fluids, liquids and solids. Molecular dynamics for computing properties will be explained and illustrated. Monte Carlo techniques will be discussed. An introduction to the theory of transport coefficients will be given. Applications will include interfacial systems, polymer systems and electrochemical systems.

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

ECHE 475. Chemical Engineering Analysis (3)
Mathematical analysis of problems in transport processes, chemical kinetics, and control systems. Examines vector spaces and matrices and their relation to differential transforms, series techniques (Fourier, Bessel functions, Legendre polynomials). Prerequisite: MATH 224.

ECHE 480. Electrochemical Engineering (3)
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. Prerequisite: ECHE 260 or permission of instructor. Cross-listed as ECHE 381.

ECHE 483. Chemical Engineering Applied to Microfabrication and Devices (3)
Silicon-based microfabrication and micromachining processes require many chemical engineering related technologies. Microfabricated devices such as sensors are also directly related to chemical engineering. In this course, the applications of chemical engineering principles to the microfabrication and micromachining will be introduced. Oxidation processing, chemical vapor deposition, etching and patterning techniques, electroplating and other technologies will be discussed. Graduate students will submit an additional final project on some technical aspect of microfabrication technology or devices. Prerequisites: ECHE 363 and ECHE 371.

ECHE 500T. Graduate Teaching II (0)
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. Prerequisite: Ph.D. student in chemical engineering.

ECHE 560. Advanced Chemical Thermodynamics (3)
Chemical and phase equilibria in complex, multi-phase systems. Review of relevant theory. Sources of thermochemical data, methods of calculation and applications to phase diagrams, materials synthesis, electrochemistry, corrosion, water chemistry, silicon processing, chemical vapor deposition. Prerequisite: ECHE 460 or equivalent.

ECHE 561. Advanced Transport Phenomena (3)
(Extension of ECHE 461.) In-depth examination of methods of solving transport problems. Emphasis on coupled systems where two or more transport processes interact. Prerequisite: ECHE 461.

ECHE 575. Advanced Chemical Engineering Analysis (3)
Advanced analytical techniques for exact and approximate engineering analysis. Scale analysis and recursion techniques; asymptotic analysis of ordinary differential equations (regular and singular perturbations, WKB theory); approximation of integrals; method of characteristics; shocks; application to heat, mass and momentum transfer. Prerequisite: ECHE 475.

ECHE 600T. Graduate Teaching III (0)
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. Prerequisite: Ph.D. student in chemical engineering.

ECHE 651. Thesis M.S. (1-18)
ECHE 660. Special Problems (1-18)
ECHE 701. Dissertation Ph.D. (1-18)
ECHE 702. Appointed Dissertation Fellowship (9)
Department of Civil Engineering

Bingham Building (7201)  
phone 216-368-2950; fax 216-368-5229  
Robert L. Mullen, Chair  
rlm@po.cwru.edu  
http://ecivwww.cwru.edu/civil/  

Programs in Environmental, Geotechnical, and Structural Engineering, Construction Engineering and Management and Engineering Mechanics

Civil engineering is concerned with the environment and with the planning, design, and construction of facilities for meeting the needs of modern society. 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, colloid behavior in environmental systems, and contaminated sediment dynamics.

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.

FACULTY

Robert L. Mullen, Ph.D. (Northwestern University), P.E.  
Professor and Chairman  
Computational mechanics; finite elements; boundary elements

Roberto Ballarini, Ph.D. (Northwestern University)  
Professor  
Elasticity; fracture mechanics; contact mechanics; stress analysis; mechanics of composite materials and microelectromechanical systems; biomechanics

J. Ludwig Figueroa, Ph.D. (University of Illinois, Urbana-Champaign), P.E.  
Professor  
Dynamic behavior of soils and transportation materials, pavement evaluation; computer application to geotechnical and transportation materials engineering

Adel S. Saada, Ph.D. (Princeton University), P.E.  
Frank H. Neff Professor  
Mechanics of materials; static and dynamic mechanical behavior of soils; foundation engineering

SECONDARY FACULTY

Thomas P. Kicher, Ph.D. (Case Institute of Technology)  
Professor of Mechanical and Aerospace Engineering  
Elastic stability; plates and shells; composite materials; dynamics and optimization

UNDERGRADUATE PROGRAM

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, environmental, 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 requires the student

Aaron A. Jennings, Ph.D. (University of Massachusetts), P.E.  
Professor  
Environmental and geo-environmental engineering, groundwater contamination, hazardous waste management, uncertainty analysis for environmental models

Vassilis P. Panoskaltsis, Ph.D. (University of California, Berkeley)  
Associate Professor  
Constitutive modeling of civil engineering materials; thermomechanics of solids; viscoelasticity; plasticity; damage mechanics; fatigue; computational mechanics
to spend two full semesters working full-time in an engineering capacity with a contractor, consulting engineer, architect, or materials supplier during the course of his or her education. The aim of the program is to enable students to make their education more meaningful by gaining familiarity with the industry they will work in after graduation and to help students finance their education.

The accredited undergraduate program in civil engineering at Case Western Reserve University 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. A minimum of 15 credit hours is required. The approval of the department is required.

Most classes at Case Western Reserve University are small, and the student has close contact with the faculty. Students

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### BACHELOR OF SCIENCE IN ENGINEERING DEGREE

#### MAJOR IN CIVIL ENGINEERING

<table>
<thead>
<tr>
<th>Fall Semester</th>
<th>Class/Lab/Credit Hours</th>
</tr>
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<tbody>
<tr>
<td><strong>FRESHMAN</strong></td>
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<tr>
<td>Open elective or Humanities/Social Science a</td>
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</tr>
<tr>
<td>CHEM 111 Principles of Chemistry for Engineers</td>
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<tr>
<td>CMPS 131 Elementary Computer Programming</td>
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<tr>
<td>ENGL 150 Expository Writing</td>
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<tr>
<td>MATH 121 Calculus for Science and Engineering I</td>
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<tr>
<td>PHED 101 Physical Education Activities</td>
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<td>(15-2-16)</td>
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<td><strong>SOPHOMORE</strong></td>
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<tr>
<td>Humanities or Social Science Sequence I</td>
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<tr>
<td>ECIV 160 Surveying and Computer Graphics</td>
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</tr>
<tr>
<td>ENGR 200 Statics and Strength of Materials</td>
<td>(3-0-3)</td>
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<tr>
<td>MATH 223 Calculus for Science and Engineering III</td>
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<tr>
<td>PHYS 122 General Physics II</td>
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<tr>
<td>Humanities or Social Science Sequence III</td>
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<tr>
<td>ECIV 211 Civil Engineering Materials</td>
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<tr>
<td>ECIV 320 Structural Analysis I</td>
<td>(3-0-3)</td>
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<tr>
<td>ENGR 210 Introduction to Circuits and Instrumentation</td>
<td>(3-0-3)</td>
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<tr>
<td>ENGL 208 Professional Communications</td>
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<tr>
<td>ENGR 225 Thermodynamics, Fluid Mechanics, Heat and Mass</td>
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<td><strong>SENIOR</strong></td>
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<tr>
<td>Humanities or Social Science Elective</td>
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<tr>
<td>ECIV 340 Construction Management</td>
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<tr>
<td>ECIV 398 Civil Engineering Senior Project</td>
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<table>
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<th>Spring Semester C</th>
<th>Class/Lab/Credit Hours</th>
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<td>MATH 122 Calculus for Science and Engineering II</td>
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<td>PHED 102 Physical Education Activities</td>
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<td>PHYS 121 General Physics I</td>
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<td>Humanities or Social Science Sequence II</td>
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<td>ECIV 310 Strength of Materials</td>
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<tr>
<td>EMAE 181 Dynamics</td>
<td>(3-0-3)</td>
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<tr>
<td>ENGR 210 Introduction to Circuits and Instrumentation</td>
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<tr>
<td>MATH 224 Elementary Differential Equations</td>
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<td>(15-2-16)</td>
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<td><strong>JUNIOR</strong></td>
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<td>ECIV 322 Structural Design I</td>
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<td>ECIV 351 Hydraulics and Hydrology</td>
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<td>ECIV 368 Environmental Engineering</td>
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<td>Total</td>
<td>(13-6-16)</td>
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<tr>
<td><strong>SENIOR</strong></td>
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<tr>
<td>Humanities or Social Science Elective</td>
<td>(3-0-3)</td>
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<tr>
<td>ECIV 360 Civil Engineering Systems</td>
<td>(3-2-3)</td>
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<tr>
<td>PHYS 221 or approved Natural Sciences substitute</td>
<td>(3-0-3)</td>
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<tr>
<td>Approved Elective b</td>
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</tr>
<tr>
<td>Total</td>
<td>(15-2-15)</td>
</tr>
</tbody>
</table>

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* Hours required for graduation: 129

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a One of these courses must be a humanities/social science course
b Must be part of an approved sequence
c May substitute EMAE 250
Samples of Courses from which Elective Sequences could be Chosen

The approved electives constitute a sequence of four courses in one of the major areas of civil engineering. They are chosen by the student to coincide with his or her interests.

### Structural Engineering

- ECIV 321 Structural Analysis II (3)
- ECIV 322 Structural Design II (3)
- ECIV 410 Advanced Strength of Materials (3)
- ECIV 415 Structural Modeling and Experimental Methods (3)
- ECIV 420 Introduction to the Finite Element Method (3)
- ECIV 421 Advanced Reinforced Concrete Design (3)
- ECIV 422 Advanced Structural Steel Design (3)
- ECIV 423 Prestressed Concrete Design (3)
- ECIV 430 Foundation Engineering (3)

### Geotechnical Engineering

- ECIV 322 Structural Design II (3)
- ECIV 410 Advanced Strength of Materials (3)
- ECIV 411 Elasticity, Theory and Applications (3)
- ECIV 420 Introduction to the Finite Element Method (3)
- ECIV 430 Foundation Engineering (3)
- ECIV 431 Special Topics in Geotechnical Engineering (3)
- ECIV 433 Soil Dynamics (3)
- GEOL 110, 119, Physical Geology (3), Lab (1)
- GEOL 330 Geophysical Field Methods (4)

### Engineering Mechanics

- ECIV 410 Advanced Strength of Materials (3)
- ECIV 411 Elasticity, Theory and Applications (3)
- ECIV 412 Constitutive Modeling Theories (3)
- ECIV 420 Introduction to the Finite Element Method (3)
- ECIV 433 Soil Dynamics (3)
- EMAE 372 Relation of Materials to Design (3)

### Environmental Engineering

- ECIV 361 Water Resources Engineering (3)
- ECIV 362 Solid and Hazardous Waste Management (3)
- ECIV 370 Unit Operations and Processes in Environ. Engineering (3)
- ECIV 450 Environmental Engineering Chemistry (3)
- ECIV 460 Environmental Remediation (3)
- GEOL 220 Environmental Geology (3)
- GEOL 321 Hydrogeology (3)

### Construction Engineering & Management

Two of the four elective courses must be from within civil engineering.
- ACCT 303 Accountancy Principles and Practices (3)
- BAFI 355 Corporation Finance (3)
- BLAW 329 Business Law (3)
- ECIV 340 Construction Management (3)
- ECIV 341 Construction Scheduling and Estimating (3)
- EMAE 372 Relation of Materials to Design (3)
- ECON 361 Managerial Economics (3)
- LHRP 251 Labor and Human Resources Analyses & Practice (3)
- LHRP 311 Labor Problems (3)

### 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:

#### Required Course

- ENGR 200 Statics and Strength of Materials (3)

Select a minimum of 12 credit hours from one of the following areas (approval of the department is required):

#### Solid Mechanics

- ECIV 310 Strength of Materials (3)
- ECIV 410 Advanced Strength of Materials (3)
- ECIV 411 Elasticity, Theory, & Applications (3)
- ECIV 412 Constitutive Modeling Theories (3)
- ECIV 415 Structural Modeling & Experimental Methods (3)
- ECIV 420 Introduction to the Finite Element Method (4)

#### Structural & Geotechnical Engineering

- ECIV 320 Structural Analysis I (3)
- ECIV 321 Structural Analysis II (3)
- ECIV 322 Structural Design I (3)
- ECIV 323 Structural Design II (3)
- ECIV 330 Soil Mechanics (4)
- ECIV 430 Foundation Engineering (3)
- ECIV 433 Soil Dynamics (3)

#### Construction Engineering and Management

Two of the courses must be:
- ECIV 340 Construction Management (3)
- ECIV 341 Construction Scheduling and Estimating (3)

Two or more courses chosen from ACCT 303, BAFI 355, BLAW 329, ECON 361, LHRP 251, LHRP 311.

### MINOR IN ENVIRONMENTAL ENGINEERING

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

#### Environmental Engineering

- ENGR 225 Thermodynamics, Fluid Mechanics, Heat & Mass Transfer (4)
- GEOL 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 366 Environmental Engineering (3)
- ECIV 370 Unit Operations/Processes in Environ. Engineering (3)
- ECIV 450 Environmental Engineering Chemistry (3)
- ECIV 460 Environmental Remediation (3)

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.
have an opportunity to gain practical experience as well as earn a supplemental income by assisting faculty members on consulting work during vacation periods.

Educational Objectives

Mastery of Fundamentals:
- Graduates will master the fundamentals of mathematics and the sciences that form the basis for engineering.
- Graduates will have a thorough knowledge of the technical requirements for the practice of the profession of civil engineering and be prepared for advanced scholarship.

Creativity:
- Graduates will be proficient in state of the art analytical and computational techniques for the modeling, analysis and design of civil engineering systems.

Societal Awareness:
- Graduates will have an understanding of the legal, social economic and environmental constraints within which the civil engineering profession must operate.
- Graduates will be aware of the special role the profession of civil engineering plays in the protection of the public health, safety and welfare.

Leadership Skills:
- Graduates will be aware of the moral and ethical standards expected of leaders in the profession of civil engineering.
- Graduates will be able to function effectively and lead professional teams as well as work independently.

Professionalism:
- Graduates will be aware of the moral and ethical standards expected of the leaders in the profession of civil engineering
- Graduates will be prepared for and aware of the necessity for a lifetime of learning and continued professional growth including professional registration.

GRADUATE PROGRAM IN CIVIL ENGINEERING

The graduate program in structural 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 at Case Western Reserve University. Recent advanced degree recipients have found positions in universities, consulting firms, petroleum companies, plant design firms, and aerospace firms, among others.

Each student’s program of course work and research is tailored to his or her interests, in close consultation with the faculty adviser. For students working toward the Master of Science degree there are two possible plans, A and B. In plan A, a research thesis is required. In plan B, a project and additional course work are substituted for the thesis. For students working toward the Doctor of Philosophy degree a research thesis is required.

GRADUATE PROGRAM IN ENGINEERING MECHANICS

The graduate program in engineering mechanics is managed jointly by the Department of Civil Engineering and the Department of Mechanical and Aerospace Engineering. It prepares the students for a career in research and analysis in solid mechanics. Courses in elasticity, plasticity, damage mechanics, viscoelasticity, viscoplasticity, stability, dynamics, finite elements and boundary integral methods, constitutive methods, fracture mechanics, plates and shells give the student the necessary knowledge and skill to study the behavior of modern materials and structures as well as advance the state of the art. For more information contact the chairman of the Department of Civil Engineering.

FACILITIES

Bingham Structures Laboratory

The major component of this laboratory is a 14-foot by 60-foot structural test slab, which is the top flange of a 12-foot deep reinforced concrete box girder. Load and tiedown points are provided by 3-inch diameter holes spaced at 2-foot centers. Loading is accomplished by hydraulic jacks. The laboratory also contains 200k, 50k, 25k universal testing machines, and two (2) 55k MTS hydraulic actuators with a controller and a separate hydraulic service manifold system.

Fracture Mechanics Laboratory

This laboratory is equipped with two (2) MTS servo-hydraulic test systems. Capabilities include: fracture toughness evaluation of various materials, crack growth kinetics under different loading histories, and microstructural damage analysis and micromechanics studies. The second MTS unit is capable of applying simultaneous axial and torsional loads. An environmental chamber is available. There is equipment available for fracture surface characterization and image analysis and a grinding-polishing unit.

Structures and Materials Models Laboratory

This laboratory is a facility for both instructional and research use. Small-scale models made of different materials (steel, concrete, wood, plastic) are tested to study the response of the prototype structural elements and/or assemblies. It is equipped with four 42-inch by 72-inch steel testing tables and aluminum reaction frames, and a series of portable strain indicators and companion switch and balance units.

Bingham Concrete Laboratory

A well-equipped concrete laboratory is available for undergraduate instruction. A 100 percent humidity room is available for curing concrete specimens. Other equipment includes a concrete mixer, screening equipment, an air entrainment meter, facilities for prestressing specimens, and a 400k axial compression machine.

Environmental Engineering Laboratory

This laboratory is one in a suite of new 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 Stan-
standard Methods analysis of water, wastewater, soil, solid waste and air samples (pH meters, furnaces, ovens, incubators, hoods, etc.) 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 sophisticated 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/M.S. analysis system for organic and inorganic pollutant analysis. Where appropriate, machines have been equipped with autosamplers to improve productivity.

**Remediation Research and Colloid Science Laboratory**

This laboratory is designed to support physical research on the applied science and design of remediation engineering and the analysis of colloidal particles. 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 instantly evaluated by data acquisition-computer systems. Also available is a longitudinal and torsional resonant column device. The laboratory has a SP2000 high speed camera to study dynamic phenomena and a Bioquant surface analyzer to study fabric. A 20 g-tons fully automated centrifuge is in operation. A controlled climate room is in regular use.

**The Asphalt Concrete Laboratory**

This laboratory is properly equipped to prepare and test (following ASTM standard specifications) both cylindrical and beam asphalt concrete specimens.

Engineering and material properties of asphalt concrete specimens, such as Marshall stability, resilient modulus, Poisson’s ratio, fracture toughness, and fatigue characteristics, among others, can be determined in a controlled temperature environment between 20° F and 100° F.

**Image Processing Laboratory**

The department has a New Image Processing Laboratory for development of automatic visual inspection methods for pavements, structures and other materials. Equipment available includes:

- Spectral Dynamics Corp. SD330A Real Time Spectrometer
- Ariel DSP-16 2-channel, 16-bit A/D system with 2 megabytes of memory/50kHZ conversion rate
- Ariel TMS320025 Processing Board for real time FFT
- Matrox MVP-AT Display System with 1024 x 1024 pixel display with 16.7 million simultaneous colors (with NP accelerator)
- PC/AT 486 and Pentium class computers with interconnection to Data Acquisition equipment
- HP Scanner
- Spin Physics SP2000 High speed video camera and recorder. Maximum recording speed of 12000 frames/second. Over 30 various video cameras with both CCD and tube sensors and a wide range of image speeds and luminosity requirements are available. Both color and black/white systems in standard RS-170, NTSC, RGB, and high resolution formats are used in the lab.

**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. The Neff Laboratory has Pentium class computers running Windows/NT operating system. 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.

**Computational Mechanics Laboratory**

This laboratory includes seven (7) Ultra 1 and Ultra 2 SUN workstations running UNIX, for graduate instructional and research use. The workstations are connected to the network via a fiber optic link.

**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:

- **Structures**
  - Random vibration
  - Engineering materials
  - Behavior of reinforced and prestressed concrete
  - Wind engineering
  - Small-scale modeling under static and dynamic loads
  - Earthquake analysis and design of structures
  - Fatigue strength of reinforced concrete bridge decks
  - Finite element methods
  - Boundary element method
  - Passive and active control of the vibration of structures
  - Transient response of nonlinear structures
  - Blast loading of structures

- **Engineering Mechanics**
  - Adaptive finite element and boundary element methods
  - Transient response of nonlinear layered composites
  - Modeling of micro electromechanical systems
  - Finite element and boundary element modeling of piezoelectric material
  - Biomechanics of the human mid face and
Civil Engineering (ECIV)

UNDERGRADUATE COURSES

ECIV 160. Surveying and Computer Graphics (3)
Principles and practice of surveying; error analysis, topographic mapping, introduction to photogrammetry and GIS; CAD. Laboratory.

ECIV 211. Civil Engineering Materials (3)

ECIV 310. Strength of Materials (3)

ECIV 320. Structural Analysis I (3)
Static, linear, structural analysis of trusses and frames for member force and deflections. Stiffness and flexibility formulations. Behavior of statically determinate and indeterminate systems. Prerequisite: ECIV 310 or ENGR 200.

ECIV 321. Structural Analysis II (3)
Stiffness and flexibility formulations for plane frames, grids, and space frame with classical and matrix methods. Introduction to nonlinear analysis and stability. Structural behavior of arches, cable networks, and other structural systems. Prerequisite: ECIV 320.

ECIV 322. Structural Design I (3)

ECIV 323. Structural Design II (3)
Continuation of ECIV 322. 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, prestressed concrete design and wood design. Design laboratory. Prerequisites: ECIV 320 and ECIV 322.

ECIV 330. Soil Mechanics (4)
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, embankments, retaining walls, and footings. Standard laboratory tests performed for the determination of the physical and mechanical properties of soils. Laboratory. Prerequisite: ECIV 310.

ECIV 340. Construction Management (3)
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)
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. Prerequisites: ECIV 340 and consent of instructor.

ECIV 351. Engineering Hydraulics and Hydrology (3)
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 hydraulics, hydrograph analysis and hydraulic routing will also be introduced. Prerequisites: ENGR 225 (or concur) and consent of instructor.

ECIV 360. Civil Engineering Systems (3)

ECIV 361. Water Resources Engineering (3)
Water doctrine, probabilistic analysis of hydrologic data, common and rare event analysis, flood forecasting and control, reservoir design, hydrologic routing, syn-
thletic stream flow generation, hydroelectric power, water resource quality, water resources planning. Prerequisite: ECIV 351.

**ECIV 362. Solid and Hazardous Waste Management (3)**

**ECIV 368. Environmental Engineering (3)**
Prerequisite: Ph.D. student in civil engineering.

**ECIV 370. Unit Operations and Processes in Environmental Engineering (3)**
Physical, chemical, and biological operations and processes for the treatment of water supplies and municipal, industrial, and hazardous waste streams. Emphasis will be given to theoretical understanding and analysis of the involved processes and the design of treatment operations. Laboratory. Prerequisite: ECIV 368.

**ECIV 396. Civil Engineering Special Topics I (1-3)**
Special topics in civil engineering in which a regular course is not available. Conferences and report. Prerequisite: Consent of instructor.

**ECIV 398. Civil Engineering Senior Project (3)**
A project emphasizing research and/or design must be completed by all civil engineers.

**GRADUATE COURSES**

*See also related mechanics courses in Mechanical and Aerospace Engineering (EMAE).

**ECIV 400T. Graduate Teaching I (0)**
This series of three courses will provide Ph.D. student 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. Prerequisite: Ph.D. student in civil engineering.

**ECIV 410. Advanced Strength of Materials (3)**
Selected topics in strength of materials including elasticity, thick cylinders, rotating discs, elementary theory of plate flexure, membranes, strength theories, fatigue, fracture, theory of shells, energy methods and theorems, curved beams, unsymmetrical bending and shear center, stress concentrations, and introduction to the finite element method. Solution of practical stress analysis problems. Prerequisite: ECIV 310.

**ECIV 411. Elasticity: Theory and Applications (3)**

**ECIV 412. Constitutive Modeling Theories (3)**

**ECIV 415. Structural Modeling and Experimental Methods (3)**
Types of structural behavior, structural modeling, dimensional analysis and similarity requirements. Experimental stress analysis review. Fabrication, instrumentation and testing of small-scale models (steel, plastic, aluminum, wood). Materials and techniques. Case studies of models in design. Prerequisites: ECIV 211, ECIV 320 and consent of instructor.

**ECIV 420. Introduction to the Finite Element Method (3)**
Matrix and energy methods of structural analysis for discrete structures including trusses and frames. Introduction to finite element methods and applications in plane stress and strain, axisymmetric and plate and shell structures. Structural problem solving using the digital computer. Prerequisites: ECIV 310 and consent of instructor.

**ECIV 421. Advanced Reinforced Concrete Design (3)**
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. Prerequisites: ECIV 322 and consent of instructor.

**ECIV 422. Advanced Structural Steel Design (3)**
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. Prerequisite: ECIV 322.

**ECIV 423. Prestressed Concrete Design (3)**
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. Prerequisites: ECIV 323 or ECIV 421 and consent of instructor.

**ECIV 424. Structural Dynamics (3)**
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. Prerequisites: ECIV 321 and consent of instructor.

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

ECIV 426. Structural Reliability (3)

ECIV 427. Theory of Structural Stability (3)

ECIV 430. Foundation Engineering (3)
Subsoil exploration. Various types of foundations for structures, their design and settlement performance, including spread and combined footings, mats, piers, and piles. Design of sand-drain installations and earth-retaining structures including retaining walls, sheet piles, and cofferdams. Case studies. Prerequisite: ECIV 330.

ECIV 431. Special Topics in Geotechnical Engineering (3)
Static and dynamic horizontal loading of piles; dynamics of pile driving; behavior of a group of piles including yielding. Soil-foundation-structure interaction due to static loading. Slope stability analysis using circular and non-circular failure surfaces. Use of available computer programs in analysis and design. Prerequisite: ECIV 430.

ECIV 432. Mechanical Behavior of Soils (3)
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. Prerequisites: ECIV 330 and consent of instructor.

ECIV 433. Soil Dynamics (3)
I-DOF and M-DOF dynamics; wave propagation theory; dynamic soil properties. Foundation vibrations, design of machine foundations. Seismology; elastic and elastoplastic response spectra, philosophy of earthquake-resistant design. One- and two-dimensional soil amplification, liquefaction, dynamic settlement. Soil-structure interaction during earthquakes. Prerequisites: ECIV 330 and consent of instructor.

ECIV 435. Rock Mechanics and Design (3)
Physical properties and classification of intact rock and rock masses, rock exploration, engineering properties of rock, stresses in rock near underground openings. Rock tunneling, rock slope stability, bolting, blasting, grouting and rock foundation design. Prerequisite: ECIV 330.

ECIV 437. Pavement Analysis and Design (3)
Analysis and design of rigid and flexible airfield and highway pavements. Pavement evaluation and rehabilitations, overlay design. Prerequisite: ECIV 330.

ECIV 450. Environmental Engineering Chemistry (3)
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. Prerequisite: ECIV 368 or consent of instructor.

ECIV 460. Environmental Remediation (3)
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. Prerequisites: ECIV 368 and consent of instructor.

ECIV 500T. Graduate Teaching II (0)
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. Prerequisite: Ph.D. student in civil engineering.

ECIV 510. Advanced Topics in Finite Elements (3)
Continuation of ECIV 420. Complementary and hybrid energy formulations, material and geometrically nonlinear analysis, thick plate and shell analysis, applications of finite elements to fracture mechanics and other fields. Prerequisites: ECIV 420 and consent of instructor.

ECIV 520. Random Processes in Engineering (3)
Random vectors and second moment theory. Time and frequency domain characterization of random processes and fields. Poisson and Markov processes. Random vibration. The first passage problem. Digital simulation of random processes and analysis of time series. Applications focus on stochastic models for phenomena such as earthquakes, wind turbulence, ocean waves, traffic flow, and others related to civil engineering. Prerequisite: Consent of instructor.

ECIV 521. Stochastic Materials Behavior (3)
Applications of random processes to characterization of material structure; elements of quantitative stereology; micromechanical stochastic modeling of stress-strain behavior and static strength; modeling of fatigue strength and crack growth; stochastic simulation of material structure and deformation processes. Prerequisites: ECIV 410 or ECIV 411 and ECIV 520 and consent of instructor.

ECIV 530. Advanced Topics in Soil Statics (3)
Failure criteria and their validity in soil mechanics. Slip line theory, Sokolovsky’s equations and their application to problems of bearing capacity, earth pressure and slope stability. Current research topics. Prerequisites: ECIV 432 and consent of instructor.

ECIV 550. Environmental Interfacial Phenomena (3)
This course takes a fundamental approach to understanding important envi-
ronmental processes at the solid/liquid interface. Topics will include coordination chemistry at the oxide/water interface, development of surface charge and electric double layer, interfacial tension, hydration and hydrophobic forces, and other interfacial phenomena. Fundamental interactions will be applied toward understanding important environmental processes such as adsorption, precipitation, mineral dissolution, particle-particle interactions, the surface chemistry of soils, filtration and membrane separation technologies, bacterial adhesion, and heterogeneous photooxidation reactions. Prerequisite: ECIV 450. Corequisite: ECHE 464 or consent of instructor.

**ECIV 560. Environmental Engineering Modeling (3)**

**ECIV 561. Groundwater Analysis (3)**
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 582. Advanced Theory of Elasticity (3)**
Tensor definition and properties; stress and strain tensors; finite deformations; complex variable methods for plane problems of isotropic and anisotropic materials; thermoelasticity; direct and indirect potential methods and boundary-integral methods for two and three-dimensional problems; applications to finite and infinite bodies with flaws; equivalent inclusion method; energy methods. Prerequisites: ECIV 411 and consent of instructor.

**ECIV 583. Theory of Plates and Shells (3)**
Analysis of flat plates subjected to various load and boundary conditions; coupled bending membrane response resulting from both material properties and large deformations; momentless theory of shells, classical bending analysis of shells of revolution, and higher order shell theory. Prerequisite: ECIV 411.

**ECIV 584. Theory of Plasticity and Damage Mechanics (3)**

**ECIV 585. Fracture Mechanics (3)**
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. Prerequisites: ECIV 411 and consent of instructor.

**ECIV 586. Rate Effects in Solid Mechanics (3)**

**ECIV 600T. Graduate Teaching III (0)**
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. Prerequisite: Ph.D. student in civil engineering.

**ECIV 601. Independent Study (1-18)**
Distinguished outside speakers present current research in various topics of civil engineering. Graduate students also present technical papers based on thesis research.

ECIV 651. Thesis M.S. (1-18)
ECIV 660. Special Topics (1-18)
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.

**ECIV 701. Dissertation Ph.D. (1-18)**
ECIV 702. Appointed Dissertation Fellowship (9)

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**Department of Electrical Engineering and Computer Science**

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The Department of Electrical Engineering and Computer Science spans the technologies which are at the forefront of our economy and our society. Professionals in these fields are responsible for developing microprocessors and personal computers, and the operating systems, computer software, and Internet applications which run on them. Almost every modern device contains an integral computer chip. New developments in such areas as medical electronics, automotive safety and control, automated manufacturing, and entertainment electronics continue to provide opportunities for our graduates.

The Department of Electrical Engineering and Computer Science (EECS) is structured into four programs: Electrical engineering, computer engineering, systems & control engineering, and computer science. Each program offers a degree program which leads to the Bachelor of Science degree. All engineering programs in the department are ABET accredited. 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 and information sciences.

HISTORY

The Electrical Engineering component of the department taught its first electrical engineering class in 1886 making it one of the oldest in the nation. The department has always been innovative and first in many things. The Systems & Control Engineering program was the first of its kind to be accredited by ABET and grew out of the Systems Research Center, originally founded in 1959. The computer engineering program was the nation’s first ABET accredited computer engineering program.

EDUCATION

The EECS department is dedicated to producing high-quality graduates who will take positions of leadership in the professions of engineering and computer science. Recognizing that the increasing role of technology in virtually every facet of our culture — communications, transportation, health care, the environment, and even our system of wealth distribution — makes it vital that engineering-oriented students have access to progressive and cutting-edge programs stressing excellence in
• Mastery of fundamentals
• Creativity
• Societal awareness
• Leadership skills and
• Professionalism.

Emphasizing these core values will help ensure that tomorrow’s 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.

Statement of Educational Philosophy

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 the field of electrical engineering and computer science.

To achieve this goal the department offers a wide range of technical specialties consistent with the breadth of electrical engineering & computer science, including recent developments in the field. Because of the rapid pace of technological development in these fields our degree programs emphasize a broad technical background to deal with future technological development. As a result, 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. The department prepares students for careers in engineering with degrees in electrical engineering, computer engineering, or systems & control engineering and offers degrees in computer science for those students who prefer additional emphasis upon software systems and the theory of computing.

The department programs emphasize a mastery of fundamentals which will enable students to deal with new technological developments and interact with professionals in other fields. This is achieved by ensuring that our graduates have:
• a strong background in the fundamentals of chemistry, physics, mathematics, and computing
• an ability to design and construct engineering models by applying fundamental knowledge of mathematics, science, and engineering
• an ability to analyze engineering models using utilizing modern engineering techniques, skills, and tools such as computer simulation
• an ability to design and construct experiments to collect data, and to analyze and interpret the resulting data to develop and verify engineering models
• a broad education necessary to understand the impact of electrical engineering solutions in a modern society.

Technological development continues to result in new technologies and/or new problems. We ensure that our graduates are creative and able to apply their engineering knowledge to new problems by
• training them in the modeling, behavior, and specification of engineering components, systems, and/or processes
• training them in the planning, design, implementation, and operation of systems, components, and/or processes that meet engineering constraints
• providing significant design experience which involves problem definition, research, solution formulation, economics, communications, teamwork, and project management.

We live in a complex technological society which requires that our graduates have a broad education necessary to understand the consequences of engineering solutions in the broader context of their impact upon people and the environment. We ensure that our graduates are socially aware by
• requiring that they have an extensive education in the humanities and social sciences
• by providing opportunities for and encouraging them to pursue additional studies in the humanities, social sciences and business.

We expect our students to become leaders in creating and applying new technologies by
• developing their written and oral communication skills, including the use of modern electronic tools such as presentation software, the World Wide Web, and e-mail.
• providing group activities which develop teamwork and communications skills,
• teaching them how to find technical information and research engineering problems, especially using electronic resources
• going outside the boundaries of individual textbooks as a preparation for life-long learning.
• providing opportunities for students to develop and demonstrate leadership in professional organizations, engineering and research.

We develop our students as professionals by developing their communications and leadership skills and additionally by
• training them to understand professional and ethical responsibility
• committing them to the highest standards of such responsibility and excellence in all their professional endeavors.
• providing them with opportunities for professional development through the Co-Operative Education Program.

FACULTY

Frank Merat, Ph.D. (Case Western Reserve University, PE (Ohio))
Associate Professor and Interim Department Chair
Computer vision; industrial inspector; neural network signal and image processing; optical sensors; agile manufacturing

David H. Auston, Ph.D. (University of California, Berkeley)
Professor
Lasers and nonlinear optics; solid state materials. Higher education administration

Randall D. Beer, Ph.D. (Case Western Reserve University)
Associate Professor
Computational neuroscience, autonomous robotics

Michael S. Branicky, Sc.D. (Massachusetts Institute of Technology)
Assistant Professor
Intelligent systems and control; hybrid systems; learning; real-time and distributed control over networks; applications to robotics and flexible manufacturing

Marc Buchner, Ph.D. (Michigan State University)
Associate Professor
Computer simulation of complex systems; control of industrial systems; analysis of discrete event and combined systems

Vira Chankong, Ph.D. (Case Western Reserve University)
Associate Professor
Large-scale and multi-objective optimization and its application to engineering problems; manufacturing and production systems; improvement of magnetic resonance imaging, decision theory; and risk analysis

Funda Ergun, Ph.D. (Cornell University)
Assistant Professor
Program testing/verification, networking protocols, randomized algorithms, learning theory, cryptography

George W. Ernst, Ph.D. (Carnegie Institute of Technology)
Associate Professor
Learning problem solving strategies; artificial intelligence; expert systems; program verification

Steven L. Garverick, Ph.D. (Massachusetts Institute of Technology)
Associate Professor
Mixed-signal integrated circuit design, microelectromechanical system integration, sensor/actuator interfacing, data conversion, wireless communication, analog neural network circuits, medical instrumentation

Dov Hazony, Ph.D. (University of California, Los Angeles)
Professor
Director, Hans Jaffe Ultrasonics Laboratory; network syntheses, ultrasonics, communications

Wei Lin, Ph.D. (Washington University)

Nonlinear dynamic systems and geometric control theory, discrete-time control systems; H-infinity and mixed H-2/H-infinity and robust control, adaptive control; system parameter estimation; adaptive and nonlinear control for robotics manipulators and induction motors; fault diagnosis and detection; control of nonholonomic mechanical systems and biomedical systems

Kenneth Loparo, Ph.D. (Case Western Reserve University)
Professor
Stability and control of nonlinear and stochastic systems, analysis and control of discrete event systems, intelligent control systems and failure detection. Recent applications work focuses on the control and failure detection of rotating machines

Behnam Malakooti, Ph.D. (Purdue University)
Professor
Industrial, systems, manufacturing, production, management, and operational engineering. Multiple objective, decision making, and interactive optimization. AI, neural networks, clustering. Facility layout, group technology, machining

Mohran Mehregany, Ph.D. (Massachusetts Institute of Technology)
Professor
Silicon and silicon carbide microelectromechanical systems (MEMS), micromachining and microfabrication and related integrated circuits, materials, and modeling issues

Mihajlo D. Mesarovic, Ph.D. (Serbian Academy of Science)

Computer simulation of complex systems; control of industrial systems; analysis of discrete event and combined systems

Wyatt Newman, Ph.D. (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

Gultekin Ozsoyoglu, Ph.D. (University of Alberta, Canada)
Professor
Databases, multimedia computing, digital libraries

Z. Meral Ozsoyoglu, Ph.D. (University of Alberta, Canada)
Professor
Database theory; logic databases; database query and optimization

C.A. Papachristou, Ph.D. (Johns Hopkins University)
Professor
VLSI design and CAD; computer architecture and parallel processing; design automation; embedded system design

Stephen M. Phillips, Ph.D. (Stanford University), PE (Ohio)
Associate Professor

Director of Center of Automation and Intelligent Systems
Andrew Podgurski, Ph.D. (University of Massachusetts at Amherst)
Associate Professor
Software architecture and design; software engineering; distributed and real-time systems; flexible manufacturing systems; software testing and reliability assessment

Daniel Saab, Ph.D. (University of Illinois at Champaign-Urbana)
Associate Professor
Computer architecture; VLSI system design and test; CAD design automation

S. Cenk Sahinalp, Ph.D. (University of Maryland)
Assistant Professor
Design, analysis and experimental evaluation of algorithms for pattern matching and indexing, data compression, communication networks and computational molecular biology

David A. Smith, Ph.D. (Massachusetts Institute of Technology)
Professor
Semiconductor material and device characterizations; optical signal processing; novel devices; spectroscopy and low temperature measurements

N. Sreenath, Ph.D. (University of Maryland)
Associate Professor
Large scale systems; policy analysis; sustainable development; integrated assessment, global and environmental issues (water resources and global climate change); control theory applications and medical informatics

Massood Tabib-Azar, Ph.D. (Rensselaer Polytechnic Institute)
Associate Professor
Semiconductor material and device characterizations; optical signal processing; novel high-frequency and high-power devices and circuits; spectroscopy and low temperature measurement; novel super-resolution near-field imaging probes; quantum computing

Robert J. Trew, Ph.D. (University of Michigan)
Professor
Microwave electronic devices

Lee J. White, Ph.D. (University of Michigan)
Professor
Software testing; current projects include regression testing, study of domain testing, specification-based testing and testing of object-oriented software

Darrin Young, Ph.D. (University of California, Berkeley)
Assistant Professor
Micromachined sensors, high-Q passive components and integrated low-power analog circuits for wireless communications

ASSOCIATED FACULTY

SECONDARY FACULTY

Coleman B. Brosilow, Ph.D. (Brooklyn Polytechnic Institute)
EMERITUS FACULTY

Paul C. Claspy, Ph.D. (Case Institute of Technology)  
Emeritus Associate Professor  
Communications, and imaging; lasers and electro-optics

Robert E. Collin, Ph.D. (Imperial College, University of London, England)  
Emeritus Professor  
Electromagnetic theory; antennas; propagation; microwave components and systems

Sheldon Gruber, Sc.D. (Massachusetts Institute of Technology)  
Emeritus Professor  
Signal processing, machine vision and industrial inspection

Wen H. Ko, Ph.D. (Case Institute of Technology)  
Emeritus Professor  
Solid state sensors and devices; biomedical implants; telemetry

Irv Lefkowitz, Ph.D. (Case Institute of Technology)  
Emeritus Professor  
Automation and computer control of industrial processes

Osman K. Mawardi, Ph.D. (Harvard University)  
Emeritus Professor  
Plasma Physics; energy conversation and storage; applied superconductivity

Harry W. Mergerl, Ph.D. (Case Institute of Technology)  
Emeritus Professor  
Digital systems; systems engineering; logical design computer control; metrology

Yoh-Han Pao, Ph.D. (Pennsylvania State University)  
Emeritus Professor  
Pattern recognition, signal and image processing; computational intelligence, intelligent systems

Frederick J. Way III  
Emeritus Professor

RESEARCH ACTIVITIES

EECS programs at CWRU encompass a wide spectrum of activities. Some of the major activities include biorobotics and computational intelligence, automation and robotics, solid-state devices and MEMS, global and large-system modeling, software engineering, and databases and multimedia. Much of this research is multi-disciplinary in nature involving faculty members from Materials Science and Engineering, Biology, Psychology, Civil Engineering, and Mechanical and Aerospace Engineering.

The faculty of the department actively pursue research in the areas described below. Students pursue their thesis research under the supervision of a faculty member who is a recognized authority in his field. Support for thesis research comes from a related research project or program under the direction of the faculty. For further information on research opportunities, the department chairman should be contacted.

Algorithms - Professors Ergun and Sahinalp
Research activities include quality of service routing, random graphs for network modeling, and packet filtering and classification.

Automation, Sensing, Actuation and Machine Intelligence - Professors Newman, Branicky, Pao, Phillips, Merat, Loparo, Malakooti
Research activities include neural network applications; pattern recognition; artificial intelligence; hybrid systems, process automation; intelligent machine tool control; in-process gauging and control; adaptive learning methods applicable to robotics; system identification and adaptive control; intelligent control; the application of artificial intelligence to robotics systems and manufacturing; compliant control of robotics systems; non-contact inspection of production quality; machine vision for robotics applications; agile manufacturing systems; machine vision and image processing; rapid prototyping of computer-generated 3-D objects in engineering materials; computational intelligence, principles and applications; distributed computational intelligence in network client/server mode; computational intelligence and associative memories.

Circuits, Signal Processing, and Computer-Aided Design - Professors Garverick, Young, Merat
Research activities include neural network signal and information processing, image processing, SIC circuits, and mixed-signal CMOS integrated circuit design for applications in MEMS, biomedical instrumentation, and robotics, MEMS RF high-Q tuning components for mobile communication circuits, MEMS sensors for biomedical and inertial sensing applications, microfabrication and integrated circuits process development

Computer Networks - Professors Ergun and Sahinalp
Basic theoretical and applied work in randomized algorithms, program testing and correcting, learning theory, multivariate optimization, pattern matching and data compression, parallel computation and circuit layouts, and computational molecular biology.

Computational Neuroscience and Autonomous Robotics - Professor Beer
Using computer simulation and theoretical analyses of models of complete neural/body/environment systems, this research pursues two objectives. First, it seeks to better understand the neural mechanisms of behavior in animals. Second, it seeks to apply biological control principles to the design of autonomous robots with the flexibility and robustness of animals. The tools employed in this work include continuous-time recurrent neural networks, evolutionary algorithms, and dynamical systems theory. This research is highly interdisciplinary, and includes collaborators from the Dept. of Biology and the Dept. of Mechanical and Aerospace Engineering.
Control Applications - Professors Loparo, Lin, Buchner, Phillips, Branicky

Topics include: (1) The development of anti-lock braking systems using fuzzy logic control methods; (2) Development of methods of automotive control and computer assisted tools for engineering analysis and design (e.g., development of computer based tools for system level failure mode effect analysis); (3) Developing technology for advanced power train, energy management, sensing and control strategies for electric vehicles; (4) the use of methods of control engineering to solve problems involving industrial and manufacturing processes; (5) developing advanced analysis and design tools for robotic assembly, agile manufacturing, and control over networks.

Control And Filtering Theory - Professors Loparo, Lin

Topics include: (1) nonlinear control theory work addressing questions regarding the behavior, stability and control of dynamic systems that are inherently nonlinear in the relationships between their inputs, outputs, and internal states; (2) stochastic control theory work involving the study of the behavior, stability and control of dynamic systems that possess a element of randomness in their operation over time; (3) stochastic filtering theory work, investigating the extraction of information about internal variables of a system on the basis of (possibly noise corrupted) measurements of system outputs.

Database Systems - Professors M. Ozsoyoglu, G. Ozsoyoglu

This research area focuses on performance issues in relational databases, database query processing and distributed database query processing, file allocation in distributed databases, database design, object-oriented databases, statistical database security problems, and relational interfaces for non-relational databases.

Design Methodologies and Design Automation - Professors Saab, Papachristou

This research area is concerned with the development of behavioral and structural level design methodologies and tools for the creation of VLSI-based systems and for multiple-processor architectures. Central to this work is the continued development of a third-generation design automation system for VLSI.

Electromagnetics, High Frequency Communications and Devices - Professors Smith, Trew, Hazony, Kinman

Research activities include electromagnetic propagation and scattering, multiple-wavelength optical communications systems, integrated optics, optical amplifiers, optical filters and wavelength routing switches for acoustic-optic filters, and switches for wavelength-division multiplexed systems; design, analysis and modeling of high-frequency semiconductor devices and circuits, high frequency acoustic circuits, generation and detection of extremely sharp pulses, in situ monitoring in aggressive environments.

Space Communications: efficient utilization of radio spectrum for space communications, performance modeling of radio communications using advanced coding schemes, Doppler and range measurements to space vehicles.

Expert Systems - Professors Ernst, Beer, Merat, Pao

The research on expert systems is primarily concerned with using artificial intelligence techniques to represent and reason about knowledge. This research is mostly applied since it focuses on a number of different challenging applications, such as fault diagnosis in discrete event systems. Most of these applications are based on knowledge which has been extracted from experts in the application domains.

Fault Detection and Diagnosis - Professors Loparo, Lin

Research combining advanced theoretical topics with solutions to industrial problems of high relevance and economic importance. Topics include: (1) the detection specific identification of failure events in systems and, when possible, the detection of incipient failures, through the use of nonlinear filtering of measured system inputs and outputs; (2) the use of nonlinear dynamics and chaos theory for failure detection, the use of chaos concepts and other advanced model-based methods for vibration signature analysis.

Global Systems Analysis and Sustainable Development - Professor Mesarovic, Sreenath

This research addresses one of the most challenging tasks of systems science and systems engineering, i.e., to understand the world as a system and develop methods to assess the evolution of the system. In order to advance understanding of the global system, two principle obstacles are being addressed: complexity by using a multi-level, hierarchical architecture and uncertainty by interactive human-computer reasoning support process. The focus of the research is on interaction between global issues which represents a distinguishing characteristic of the global future (referred to as the global problematic). A range of issues are considered—from demographic transition and aging to carrying capacity, prospects for global climate change, impact of financial markets on development, etc. Collaborative research with a global network of universities is underway through the UNESCO Global-problematique Education Network Initiative (Genie). The Network is made up of fifteen universities from countries around the world strategically select in order to provide a global coverage. Joint research with member institutions is conducted via the Internet. The research ranges from modeling and methods of complex systems analysis under true uncertainty analysis of specific issues such as global coordination of greenhouse gas emission reduction policies, water resources and health carrying capacity of Africa, etc.

Identification and Adaptive Control - Professor Lin

Research directed towards specific application problems and the development of new theory. Topics include: (1) adaptive control of nonlinear systems, adaptive control of multi-input, multi-output systems having unknown and time varying input-output delays; (2) predictive adaptive control of non-minimum phase systems and the development computationally efficient methods of predictive control; (3) development and application of methods for real-time identification of parameters for linear systems having unknown input-output delays, and for nonlinear systems.

Industrial, Production, Operational, Management Systems - Professors Malakooti, Chankong

Optimization, multiple criteria decision making, and artificial intelligence techniques are used to improve quality, pro-
Applications. Topics include: (1) Multi-objective optimization theory; (2) Algorithms for machine part formation problems; (3) Clustering algorithms for data compression; (4) Algorithms and tools for VLSI design; (5) Algorithms and methods for facility location and layout in manufacturing systems; (6) the use of systems analysis and decision theory methods to solve problems of the electric utility industry, such as quantification of the implications of transmission constraints for generation costs and resource planning; (7) methods for the design of magnetic resonance imaging (MRI) pulse sequences, for clinical MR images, to allow for the removal of motion artifacts (e.g., in images of the liver) and enhancements of images specific tissue types; (8) the application of systems analysis and decision theory methods to problems of information flow and control in health care.

Software Architecture and Design - Professors White, Podgurski

The objective of this research is to develop, specify, and analyze prototypical or reference architectures for important families of software applications, such as those used in Internet commerce, manufacturing, biomedical control, and avionics, and to derive general principles and methodologies for architectural design of complex software systems.

Software Testing and Reliability - Professors White, Podgurski

This research focuses on improving the quality of software. One approach to testing software is to identify and correct defects. Another approach is to use statistical sampling techniques to assess software reliability.

FACILITIES

Computer Facilities

The department uses UNIX (primarily Sun workstations) and Pentium-based NT computer workstations for its educational and research labs. The department maintains centralized file servers and administrative support for these machines which are physically located in many laboratories, primarily in the Olin, Glennan and Smith buildings and interconnected through CWRUnet.

CWRUnet is a state-of-the-art high-speed fiber optic campus-wide local area computer network which interconnects laboratories, faculty and student offices, classrooms, and student dormitories at CWRU. CWRUnet is one of the largest fiber-to-desktop networks anywhere. The data portion of the cabling is 100% fiber, so that with appropriate optical electronics and software, it is possible to attach devices, including high performance workstations and associated print and file servers to CWRUnet. Much of the network uses ATM running at 155 MBPS (OC-3). The backbone is ATM running at 622 MBPS (OC-12). The remainder of the network is 10 MBPS Ethernet with plans to upgrade it to 10/100 switched Ethernet with provisions for future gigabit Ethernet. Through this network, users have access to a variety of on-campus and off-campus resources. It allows Internet access for all machines on campus. Access to major programming languages and application packages is available over the network. On-line databases such as EUCLID (the University Libraries’ circulation and public access catalog), Lexus-Nexus™ and CD-ROM based dictionary, thesaurus and encyclopedias are available. Many regional and national institutional library catalogs are accessible over the network as well.

Laboratory

Advanced Optical and Electronic Devices Laboratory (AOEDL)

Primarily funded by grants from the Air Force and NSF, this laboratory is equipped with optical, microwave and electrical measurement facilities that can be used to characterize materials and devices over a wide spectral range from d.c.
up to optical frequencies. Automated network analyzers, spectrum analyzers, high and low-frequency capacitance-voltage measurements, source measure units, and all the instrument necessary to perform very low current and voltage measurements are all integrated with data acquisition systems to enable highly accurate measurement and analysis. Important characterization methods, such as electron beam induced current measurements (EBIC), deep-level transient spectroscopy (DLTS), and Interface Trap Density Characterization (ITD) along with state of the art methods such as Eavescent Microwave Microscopy (EMM) are done in this laboratory.

**Autonomous Robotics Laboratory**
This teaching laboratory has been supported by the Case Alumni Association and has a variety of microcomputers, desktop computers, and robotic kits which are used in the autonomous robotics classes.

**Autonomous Agents Laboratory**
Primarily funded by ONR, DARPA, NSF, HFSP and other federal sources, this laboratory has a number of computer workstations and robots which are used to conduct research into robotics, autonomous agents and biological simulation.

**Database and multimedia laboratory**
Primarily funded by NSF equipment grants, this laboratory provides specialized equipment for research into multimedia and database systems.

**Dynamics and Control Laboratory**
Supported by industry, this teaching and research laboratory contains mechanical, pneumatic and electrical laboratory experiments; PLCs, motors and robotics systems.

**Electronic Circuits Lab**
This teaching laboratory has been primarily supported by the Hewlett-Packard Company and is the basic resource for students taking analog, digital and mixed-signal electronics classes. All instrumentation in the lab is computer interfaced and students can even conduct experiments from their dorm rooms.

- **Analog workstations - NT workstations**
  - NT workstations have GP-IB instrument interfaces connected to Hewlett-Packard 546xx oscilloscopes, 33120A Waveform Generators, 34401A Digital Multimeters, and E3631A power supplies.
- **Digital workstations - NT workstations and Sun Workstations**
  - NT workstations and Sun Workstations support Xilinx FPGA hardware/software and Synopsis design software.
- **Additional instrumentation includes a Hewlett-Packard 4155B semiconductor parameter, Hewlett-Packard 54616TC mixed-signal test stations, Hewlett Packard logic analyzers, and Hewlett-Packard high-frequency oscilloscopes.**

**Global Systems Laboratory**
This laboratory consists of various PC and Sun Sparc workstations containing databases from the UN, World Watch Institute, World Resources Institute, U.S. Government, etc., and policy and scenario analysis software.

**Hans Jaffe Ultrasonics Laboratory**
This research laboratory is dedicated to the study and fabrication of specialized ultrasonic transducers. Facilities include pulser receivers, specialized scopes, precision signal generators, and piezoelectric devices.

**Integrated Circuit Design/Test Lab**
This research laboratory is equipped with PC design workstations and a variety of integrated circuit test equipment.

**Integrated Optics Research Laboratory**
This research laboratory contains design facilities for integrated-optic devices; laser sources for multi-wavelength communication, RF and optical spectrum analyzers, optical amplifiers, integrated-optic device evaluation facilities, and a light-duty lithium niobate device processing lab.

**Jennings Windows NT Laboratory**
Supported by the Jennings Foundation and Microsoft this teaching laboratory contains various SPARC workstations, all operating under UNIX. All are connected to the university fiber optic network.

**Jester J. Kern Computational Laboratory**
This laboratory is used by students enrolled in EEAP 310 Electromechanical Energy Conversion, as well as for research in robotics and mechatronics. The laboratory facilities include four (4) lab stations for demonstrating machine characteristics and basic steady-state and dynamic system performance, four (4) Sun SPARC UNIX workstations, and real-time data acquisition systems for interaction with lab experiments and control of machines.

**Micro-electronic Device Modeling and Characterization Lab**
Affiliated with our MicroFabrication Laboratory MFL, this research laboratory is equipped with dc measurement capabilities for evaluating semiconductor device performance. Device modeling is done on Sun SPARC and HP workstations.

**Process Control Laboratory**
This teaching and research laboratory contains process control pilot plants, computerized hardware for process control and demonstration/research facilities. This wet lab has access to steam and compressed air for use in the pilot plants.

**Smith Computer Lab**
The Smith Computer Lab provides general purpose computer facilities for undergraduate work. It contains 40 Windows NT PCs, 8 Sun Ultra 5 workstations and 5 Apple G4s.

**VLSI Design Laboratory**
Supported by the Semiconductor Research Corporation and industry, this research laboratory has a number of UNIX workstations which run CAD software for VLSI design. This laboratory is currently used to develop testing techniques for digital design.

The department also participates in the following multi-department research facilities.
Center for Automation and Intelligent Systems Research

Supported in part by CAMP, Inc. through the State of Ohio’s Thomas Edison research center program, this educational and research center contains multiple laboratories including the Mechatronics Laboratory, the Intelligent Systems Laboratory, the Multimedia and Intelligent Systems Laboratory, and the Control and Signal Processing Laboratories.

These laboratories are equipped with a diverse range of modern scientific and CAD workstations, computer controlled robots, materials handling devices, image processing and computer vision systems. These laboratories support research activities in robotics, agile manufacturing, multimedia Internet applications to manufacturing, rotating machinery diagnostics, optical sensing and process control.

MicroFabrication Laboratory

This laboratory has been funded by many agencies including the State of Ohio and DARPA. The MicroFabrication Laboratory (MFL) is a state-of-the-art clean room facility for the fabrication of microelectromechanical systems (MEMS) and microelectronic devices. The Class 100 facility supports the University’s strong interdisciplinary MEMS research program by providing on-campus fabrication capabilities for a broad range of research projects by investigators from a number of departments within the university; it is also accessible by external organizations for prototype fabrication and R&D. The MFL offers a broad spectrum of micromachining processes, including bulk and surface micromachining, wafer bonding, and micro-molding. These capabilities are augmented by a 2-micron CMOS process for the fabrication of integrated microsensors/microactuators.

COMPUTER ENGINEERING PROGRAM

The department offers a fully accredited Bachelor of Science in Engineering degree in computer engineering (the nation’s first program in this field). At the graduate level the department offers the Master of Science and the Doctor of Philosophy degrees in computer engineering.

UNDERGRADUATE PROGRAMS

Majors

The Bachelor of Science program in computer engineering is designed to give a student a strong background in the fundamentals of mathematics, physics, and computer engineering and science. A graduate of this program should be able to use these fundamentals to analyze and evaluate computer systems, both hardware and software. A graduate should also be able to design and implement computer systems, both hardware and software, which are state of the art solutions to a variety of computing problems. This includes systems which have both a hardware and a software component whose design requires a well defined interface between the two and the evaluation of the associated engineering trade-offs. In addition to these program specific objectives, all students in the EECS department are exposed to societal issues, professionalism, and have the opportunity to develop leadership skills.

Minor in Computer Engineering

The following two courses are required for a minor in computer engineering:

- ECES 281 Logic Design and Computer Organization (or equivalent)
- ECES 333 Introduction to Data Structures

A two-course sequence is also required. The hardware sequence is:

- ECES 321 Digital Systems Design
- ECES 322 Computer Architecture
- The software sequence is:
- ECES 337 Systems Programming
- ECES 338 Introduction to Operating Systems

In addition to these two standard sequences, the student may design his/her own 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 large overlap in these subjects.

COOPERATIVE EDUCATION PROGRAM

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 gone from campus for two semesters.

B.S./M.S. PROGRAM

Students with a grade point average of 3.2 or higher are encouraged to apply to the B.S./M.S. program which will allow them to get both degrees in five years. The B. S. 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.

GRADUATE PROGRAMS

Graduate study in computer engineering leads to the Master of Science and the Doctor of Philosophy degrees. Computer engineering is the focus of the course work for these degrees. The research component of the graduate degrees can be in any research area of the EECS department, listed above. However, normally dissertation topics are in some area of computer engineering. General academic requirements for the graduate degrees are given in this bulletin. Detailed regulations are given in the EECS Graduate Student Handbook, available from the department office, which supersedes the general engineering regulations. Prime Fellowships and research assistanships are available, on a competitive basis, for the full support of highly qualified students.

COMPUTER SCIENCE PROGRAM

The Computer Science Program at CWRU offers students the opportunity to
study computer science through both a Bachelor of Science program and a Bachelor of Arts program. At the graduate level the department offers the Master of Science and the Doctor of Philosophy degrees in computing and information sciences.

### UNDERGRADUATE PROGRAMS

**Majors**

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

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### BACHELOR OF SCIENCE IN ENGINEERING DEGREE

#### MAJOR IN COMPUTER ENGINEERING

<table>
<thead>
<tr>
<th>Fall Semester</th>
<th>Class/Lab/Credit Hours</th>
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</thead>
<tbody>
<tr>
<td><strong>FRESHMAN YEAR</strong></td>
<td></td>
</tr>
<tr>
<td>Open elective or HM/SS elective (^a)</td>
<td>(3-0-3)</td>
</tr>
<tr>
<td>CHEM 111 Chemistry I</td>
<td>(4-0-4)</td>
</tr>
<tr>
<td>MATH 121 Calculus I</td>
<td>(4-0-4)</td>
</tr>
<tr>
<td>ENGR 131 Elementary Computer Programming</td>
<td>(3-0-3)</td>
</tr>
<tr>
<td>ENGL 150 Expository Writing</td>
<td>(3-0-3)</td>
</tr>
<tr>
<td>PHED 101 Physical Education</td>
<td>(0-3-0)</td>
</tr>
<tr>
<td>Total</td>
<td>(17-3-17)</td>
</tr>
</tbody>
</table>

| **SOPHOMORE YEAR**                                |                        |
| HM/SS Sequence I                                  | (3-0-3)                |
| PHYS 122 Physics II: Electricity & Magnetism      | (4-0-4)                |
| MATH 223 Calculus III                             | (3-0-3)                |
| ENGR 200 Statics & Strength of Materials          | (3-0-3)                |
| ECES 233 Introduction to Data Structures           | (3-2-4)                |
| Total                                              | (16-2-17)              |

| **JUNIOR YEAR**                                   |                        |
| HM/SS Sequence III                                | (3-0-3)                |
| MATH 304 Discrete Mathematics                     | (3-0-3)                |
| ECES 337 Systems Programming                      | (3-2-4)                |
| ENGR 225 Thermodynamics, Fluids, Transport        | (4-0-4)                |
| Technical elective \(^c\)                          | (3-0-3)                |
| Total                                              | (16-2-17)              |

| **SENIOR YEAR**                                   |                        |
| HM/SS elective                                    | (3-0-3)                |
| ECES 318 VLSI/CAD \(^d\)                          | (3-2-4)                |
| or                                                 |                        |
| Technical elective \(^d\)                         | (3-0-3)                |
| Technical elective \(^c\)                         | (3-0-3)                |
| Statistics elective \(^e\)                        | (3-0-3)                |
| Open elective                                      | (3-0-3)                |
| Total                                              | (15-2-16) or (15-0-15) |

\(^a\) One of these must be a humanities/social science course

\(^b\) This course may be delayed to the junior or senior year with the consent of the advisor.

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

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<table>
<thead>
<tr>
<th>Spring Semester</th>
<th>Class/Lab/Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FRESHMAN YEAR</strong></td>
<td></td>
</tr>
<tr>
<td>HM/SS elective or open elective (^a)</td>
<td>(3-0-3)</td>
</tr>
<tr>
<td>ENGR 145 Chemistry of Materials</td>
<td>(4-0-4)</td>
</tr>
<tr>
<td>PHYS 121 Physics I: Mechanics</td>
<td>(4-0-4)</td>
</tr>
<tr>
<td>MATH 122 Calculus II</td>
<td>(4-0-4)</td>
</tr>
<tr>
<td>PHED 102 Physical Education</td>
<td>(0-3-0)</td>
</tr>
<tr>
<td>Total</td>
<td>(15-3-15)</td>
</tr>
</tbody>
</table>

| **SOPHOMORE YEAR**                                |                        |
| HM/SS Sequence II                                 | (3-0-3)                |
| MATH 224 Differential Equations                   | (3-0-3)                |
| ENGR 210 Circuits and Instrumentation             | (3-2-4)                |
| ECES 251 Numerical Methods \(^b\)                 | (3-0-3)                |
| ECES 281 Comp. Organization Logic Design           | (3-2-4)                |
| Total                                              | (15-4-17)              |

| **JUNIOR YEAR**                                   |                        |
| ENGL 398N Prof. Communications                    | (3-0-3)                |
| ECES 301 Digital Laboratory                       | (0-4-2)                |
| ECES 322 Computer Architecture                    | (3-0-3)                |
| ECES 321 Digital Systems Design                   | (3-2-4)                |
| ECES 338 Intro to Operating Systems \(^d\)        | (3-2-4)                |
| or                                                 |                        |
| Technical elective \(^d\)                         | (3-0-3)                |
| Total                                              | (12-8-16) or (12-6-15) |

| **SENIOR YEAR**                                   |                        |
| HM/SS elective                                    | (3-0-3)                |
| ECES 399 Comp. Eng. Design Project                | (0-6-3)                |
| Technical elective \(^c\)                         | (3-0-3)                |
| Open elective                                     | (3-0-3)                |
| Open elective                                     | (3-0-3)                |
| Total                                              | (12-6-15)              |

**GRADUATION REQUIREMENT**: 129 hours total

\(^d\) The student must take either ECES 318 VLSI/CAD (Fall Semester) or ECES 338 Intro. to Operating Systems (Spring Semester), AND a three credit hour technical elective.

\(^e\) 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, and STAT 333 Uncertainty in Engineering and Science.
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 EECS department are exposed to societal issues, professionalism, and have the opportunity to develop leadership skills.

The Bachelor of Arts program in computer science is a liberal arts program emphasizing competency in computer science, and it provides the student with sufficient flexibility to major in a discipline in the humanities or social sciences, or alternatively to get a broader education in several other disciplines.

**Minor in Computer Science (B.S. or B.S.E.)**

For students pursuing a B.S. or B.S.E. degree, the following three courses are required for a minor in computer science:

- ECES 233 Introduction to Data Structures
- ECES 340 Algorithms and Data Structures
- ECES 338 Introduction to Operating Systems

**Minor in Computer Science (B.A.)**

For students pursuing B.A. degrees, the following four courses are required for a

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### BACHELOR OF ARTS DEGREE

#### COMPUTER SCIENCE

<table>
<thead>
<tr>
<th>Fall Semester</th>
<th>Class/Lab/Credit Hours</th>
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</thead>
<tbody>
<tr>
<td><strong>FRESHMAN YEAR</strong></td>
<td></td>
</tr>
<tr>
<td>Open elective</td>
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<tr>
<td>MATH 125 Mathematics I</td>
<td>(4-0-4)</td>
</tr>
<tr>
<td>ENGR 131 Elementary Computer Programming</td>
<td>(3-0-3)</td>
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<tr>
<td>GER course</td>
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<tr>
<td>ENGL 150 Expository Writing</td>
<td>(3-0-3)</td>
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<tr>
<td>MATH 126 Mathematics II</td>
<td>(4-0-4)</td>
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<tr>
<td>GER course</td>
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<td>GER course</td>
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<tr>
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<tr>
<td>PHED 102 Physical Education</td>
<td>(0-3-0)</td>
</tr>
<tr>
<td>Total</td>
<td>(15-3-16)</td>
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</tbody>
</table>

| **SOPHOMORE YEAR** |                          |
| ECES 281 Comp. Organization Logic Design | (3-2-4)   |
| GER course | (3-0-3)                |
| Open elective | (3-0-3)                |
| Open elective | (3-0-3)                |
| Total | (15-2-16)               |

| **JUNIOR YEAR** |                          |
| ECES 337 Systems Programming | (3-2-4)    |
| GER course | (3-0-3)                |
| Open elective | (3-0-3)                |
| Total | (12-2-13)               |

| **SENIOR YEAR** |                          |
| ECES 340 Algorithms and Data Structures | (3-0-3)   |
| Technical elective | (3-0-3)      |
| GER course | (3-0-3)                |
| Open elective | (3-0-3)                |
| Total | (15-0-15)               |

---

* Must be a ECES, MATH or STAT course

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GRADUATION REQUIREMENT 120 hours total
minor in computer science
- ENGR 131 Elementary Computer Programming
- ECES 233 Introduction to Data Structures
- MATH 125 Mathematics I
- Two additional ECES courses are also required for this minor.

### BACHELOR OF SCIENCE DEGREE

**MAJOR IN COMPUTER SCIENCE**

<table>
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<tr>
<th>Fall Semester</th>
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<tbody>
<tr>
<td><strong>FRESHMAN YEAR</strong></td>
<td></td>
</tr>
<tr>
<td>Open elective or HM/SS elective</td>
<td>(3-0-3)</td>
</tr>
<tr>
<td>CHEM 111 Chemistry I</td>
<td>(4-0-4)</td>
</tr>
<tr>
<td>MATH 121 Calculus I</td>
<td>(4-0-4)</td>
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<tr>
<td>ENGR 131 Elementary Computer Programming</td>
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<td>(0-3-0)</td>
</tr>
<tr>
<td>Total</td>
<td>(17-3-17)</td>
</tr>
</tbody>
</table>

| **SOPHOMORE YEAR**            |                        |
| HM/SS Sequence I              | (3-0-3)                |
| PHYS 122 Physics II Electricity & Magnetism | (4-0-4)          |
| MATH 223 Calculus III         | (3-0-3)                |
| Technical elective           | (3-0-3)                |
| ECES 281 Comp. Organization Logic Design | (3-2-4)         |
| Total                         | (16-2-17)              |

| **JUNIOR YEAR**               |                        |
| HM/SS Sequence III            | (3-0-3)                |
| ECES 340 Algorithms and Data Structures | (3-0-3)         |
| ECES 337 Systems Programming  | (3-2-4)                |
| Statistics elective           | (3-0-3)                |
| Technical elective           | (3-0-3)                |
| Total                         | (15-2-16)              |

| **SENIOR YEAR**               |                        |
| ENGL 398N Professional Communication | (3-0-3)           |
| ECES 398 Software Engineering  | (3-0-3)                |
| Technical elective           | (3-0-3)                |
| Open elective                | (3-0-3)                |
| Open elective                | (3-0-3)                |
| Total                         | (15-0-15)              |

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<td>HM/SS elective or open elective</td>
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</tr>
<tr>
<td>ENGR 145 Chemistry of Materials</td>
<td>(4-0-4)</td>
</tr>
<tr>
<td>PHYS 121 Physics I: Mechanics</td>
<td>(4-0-4)</td>
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<tr>
<td>MATH 122 Calculus II</td>
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<tr>
<td>Total</td>
<td>(15-3-15)</td>
</tr>
</tbody>
</table>

| **SOPHOMORE YEAR**            |                        |
| HM/SS Sequence II             | (3-0-3)                |
| MATH 224 Differential Equations | (3-0-3)             |
| ECES 251 Numerical Methods    | (3-0-3)                |
| MATH 304 Discrete Mathematics | (3-0-3)               |
| ECES 233 Intro Data Structures | (3-2-4)            |
| Total                         | (15-2-16)              |

| **JUNIOR YEAR**               |                        |
| HM/SS elective                | (3-0-3)                |
| ECES 345 Programming Language Concepts | (3-0-3)        |
| ECES 343 Theoretical Computer Science | (3-0-3)       |
| ECES 322 Computer Architecture | (3-0-3)             |
| ECES 338 Intro to Operating Systems | (3-2-4)      |
| Total                         | (15-2-16)              |

| **SENIOR YEAR**               |                        |
| HM/SS elective                | (3-0-3)                |
| ECES 341 Intro. to Database Systems | (3-0-3)         |
| ECES 391 Intro. to Artificial Intelligence | (3-0-3)      |
| Technical elective           | (3-0-3)                |
| Open elective                | (3-0-3)                |
| Total                         | (15-0-15)              |

**GRADUATION REQUIREMENT**  127 hours total

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

* ENGR 210 is recommended because it provides flexibility in choice of major and advanced EECS courses.


* Course other than mathematics or computer science.
BACHELOR OF SCIENCE IN ENGINEERING DEGREE
MAJOR IN ELECTRICAL ENGINEERING

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<td>CHEM 111 Chemistry I ........................................</td>
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<td>MATH 121 Calculus I ...........................................</td>
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<td>PHYS 122 Physics II Electricity &amp; Magnetism ..............</td>
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<td>MATH 223 Calculus III .........................................</td>
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<tr>
<td>ENGR 210 Circuits and Instrumentation ......................</td>
<td>(3-2-4)</td>
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<tr>
<td>ECES 281 Computer Organization, Logic Design ............</td>
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<tr>
<td>HM/SS Sequence II ...............................................</td>
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<tr>
<td>ENGR 200 Statics &amp; Strength of Materials ...................</td>
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<tr>
<td>EEAP 246 Signals &amp; Systems ....................................</td>
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<td>STAT 332 Statistics of Signal Processing c .................</td>
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<tr>
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<tr>
<td>EEAP 398 Senior Project Lab I f, g ..........................</td>
<td>(0-8-4)</td>
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<tr>
<td>ENGL 398N Professional Communications .....................</td>
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<td>HM/SS Sequence I ...............................................</td>
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<tr>
<td>ENGR 225 Thermo, Fluids, Transport ..........................</td>
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<td>MATH 224 Differential Equations ..............................</td>
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<td>EEAP 245 Electronic Circuits ....................................</td>
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<td>EEAP 309 Electromagnetic Fields I ............................</td>
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<td>HM/SS Sequence III ..............................................</td>
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<tr>
<td>EEAP 321 Semiconductor Elect. Devices ........................</td>
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<td>Applied Statistics Req. e .....................................</td>
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GRADUATION REQUIREMENT: 128 hours total

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a Although not required students may elect to take ENGR 101 Freshman Engineering Field Service Project as their open elective in the freshman year.

b Selected students may be invited to take PHYS 123, 124 in place of PHYS 121 and PHYS 122.

c Students may replace this class with STAT 333 Uncertainty in Engineering and Science if approved by their advisor.

d Technical electives will be chosen to fulfill the depth requirement and otherwise increase the student’s understanding of electrical engineering. Courses used to satisfy the depth requirement must come from the department’s list of depth areas and related courses. Technical electives not used to satisfy the depth requirement are more generally defined as any course related to the principles and practice of electrical engineering. This includes all EEAP courses at the 200 level and above and can include courses from other programs. All non-EEAP technical electives must be approved by the student’s advisor.

e Co-op students may obtain design credit for one semester of Senior Project Lab 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 senior project instructor.

f B.S./M.S. students may also utilize EEAP 398/399 to fulfill eight credits of M.S. thesis provided their thesis has adequate design content to meet the requirements of EEAP 398/399. B.S./M.S. students should see their thesis advisor for details.
systems and control engineering. General academic requirements for the graduate degrees are given in this bulletin. Detailed regulations are given the EECS Graduate Student Handbook, available from the department office, which supersedes the general engineering regulations. Prime Fellowships and research assistantships are available, on a competitive basis, for the full support of highly qualified students.

### BACHELOR OF SCIENCE IN ENGINEERING DEGREE

#### MAJOR IN SYSTEMS AND CONTROL ENGINEERING

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</table>

| **SOPHOMORE YEAR** |                          |
| PHYS 122 Physics II: Electricity & Magnetism b | (4-0-4) |
| MATH 223 Calculus III | (3-0-3) |
| ENGR 210 Circuits and Instrumentation | (3-2-4) |
| ECES 281 Computer Organization | (3-2-4) |
| Total | (13-4-15) |

| **JUNIOR YEAR** |                          |
| HM/SS Sequence I | (3-0-3) |
| ECES 246 Signals and Systems | (3-2-4) |
| ESCI 352 Engr. Econ. and Dec. Analysis | (3-0-3) |
| MATH 201 Linear Algebra | (3-0-3) |
| ESCI 340 Introduction to Global Issues | (3-0-3) |
| Total | (15-2-16) |

| **SENIOR YEAR** |                          |
| HM/SS elective | (3-0-3) |
| ESCI 398 Senior Project Lab d | (0-8-4) |
| ENGL 398N Professional Communications | (3-0-3) |
| ESCI 322 Simulation Methods for Engineers | (3-0-3) |
| Approved technical elective e | (3-0-3) |
| Total | 12-10-16 |

| **Approved Technical Elective e** |                          |
| Approved Technical Elective e | (3-0-3) |
| Total | (12-8-16) |

#### UNDERGRADUATE PROGRAMS

The systems and control engineering B.S. program provides the student with the basic concepts, analytical tools, and engineering methods which are useful in analyzing and designing complex technological and non-technological systems. Problems relating to modeling, decision-making and implementation are presented through course work. The senior project lab is designed to provide a practical experience for students. Systematic work is required in the project, and assignments are designed to give students significant experience with the practical aspects of systems design. Students take courses in statistics, probability, and computer science. General academic requirements for the graduate degrees are given in this bulletin. Detailed regulations are given the EECS Graduate Student Handbook, available from the department office, which supersedes the general engineering regulations. Prime Fellowships and research assistantships are available, on a competitive basis, for the full support of highly qualified students.

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a Although not required, students may elect to take ENGR 101, Freshman Engineering Seminar, as their open elective during the freshman year.
b Selected students may be invited to take PHYS 124 in place of PHYS 121 and 122.
c Choose from STAT 312, STAT 332, STAT 333.
d Co-op students may obtain credit for the first semester of Senior Project Lab if their co-op assignment includes significant design responsibility. This credit can be obtained by submitting a suitable written report and making an oral presentation on the co-op work in coordination with the senior project instructor.
e Technical electives from an approved list.
making, control, and optimization are studied. Some examples of systems problems which are studied include computer control of industrial plants, development of 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 their individual contributions to achieve the overall goal of the system. What may be best for an individual component of the system may not be the best for the system as a whole.

There are three elective sequences available within our B.S. degree curriculum. Control Systems, Systems Analysis and Industrial and Manufacturing Systems. The Control Systems sequence is directed toward developing skills in dynamic system modeling, analysis, automation, remote control, real-time data acquisition and feedback control. The Systems Analysis sequence focuses on modeling, optimization, decision making and planning methods. The Industrial and Manufacturing Systems sequence provides education in the application of systems analysis, decision making and automation methods to industrial production and manufacturing problems. All three sequences use concepts of modeling, data analysis, computer simulation, and optimization. Computers play a central role in the systems and control curriculum, not only for engineering and mathematical computation, but also for computer simulation, automatic control, real-time data acquisition and signal processing.

Graduates of our B.S. program find positions in both the private and in the public (governmental) sector. About half enter graduate school. Our graduates are valued because of the general purpose engineering problem solving skills that they possess and because they are especially capable of adapting to new technology changes. A five-year Bachelor of Science (engineering or mathematics), Master of Science (systems and control engineering) program is available for qualified students. A minor in Systems and Control Engineering is also available.

**Minor Program 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 nine credit hours must be selected from:

- ESCI 212 Signals, Systems and Control (3)
- ESCI 214 Signals, Systems and Control Lab (1)
- ESCI 304 Control Engineering I with Laboratory (3)
- ESCI 346 Engineering Optimization (3)
- ESCI 352 Engineering Economics and Decision Analysis (3)

The remaining credit hours can be chosen from ESCI courses with the written approval of the faculty member in charge of the minor program in the Systems and Control Program. A list of suggested ESCI courses to complete the minor is:

- ESCI 110 Problem Solving & Systems Engineering (3)
- ESCI 322 Simulation Methods in Engineering (3)
- ESCI 331 Signal Processing (3)
- ESCI 306 Control Engineering II (3)
- ESCI 350 Production and Operational Systems (3)
- ESCI 360 Manufacturing and Integrated Systems (3)

**COOPERATIVE EDUCATION PROGRAM**

There are many excellent Cooperative Education (co-op) opportunities for systems and control 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 engineering project. The co-op program takes five years to complete because the student is typically gone from campus for two semesters.

**B.S./M.S. PROGRAM**

The department encourages students with at least a 3.2 grade point average to apply for admission to the five-year bachelor's/master's program in the junior year. This integrated program, which permits substitution of M.S. 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.

**GRADUATE PROGRAMS**

Graduate programs in systems and control engineering include the following areas of concentration: control theory (adaptive control, stochastic filtering and control, nonlinear control), optimization and decision theory (multi-objective and large scale system theory), control of industrial and manufacturing systems (facilities layout, flexible manufacturing), energy systems (power distribution and production planning, load forecasting), and global and environmental system analysis and control (resource constraints, water, energy etc., carrying capacity and global climate change).

Research funds are used to provide assistantships that support the thesis research of graduate students. Current research funding is provided by Elsa-Bailey, Rockwell Automation, the Ford Motor Company, the Cleveland Advanced Manufacturing Program (CAMP), the Electric Power Research Institute (PERI), the National Institutes of Health (NIH), National Institute of Nursing Research (NINE), the National Science Foundation (NSF), the Office of Naval Research (ONR), the U.S. Agency for International Development (US-AID) and United National Education, Scientific Cultural Organization (UNESCO).

**ELECTRICAL ENGINEERING PROGRAM**

The Electrical Engineering program offers the Bachelor of Science, Master of Science, and Doctor of Philosophy degree in electrical engineering. The program offers a minor in electrical engineering for bachelor’s degree students in other engineering disciplines as well as a minor in electronics for bachelor’s degree students enrolled in the College of Arts and Science.
UNDERGRADUATE PROGRAMS

The undergraduate program in electrical engineering, which leads to the Bachelor of Science in Engineering degree, provides a broad foundation in electrical engineering through combined classroom and laboratory work and prepares the student for entering the profession of electrical engineering as well as for further study at the graduate level.

Core courses provide the student with a strong background in mathematics, physical sciences and the fundamentals of engineering. Each electrical engineering student must take the following core courses:

- ENGR 131 Elementary Computer Programming
- ENGR 210 Circuits & Instrumentation
- ECES 281 Logic Design Computer Organization
- EEAP 245 Electronic Circuits
- EEAP 246 Signals and Systems
- EEAP 309 Electromagnetic Fields I
- STAT 332 Statistics of Signal Processing

EEAP 321 Semiconductor Electronic Devices
EEAP 332 Integrated Circuits and Electronic Devices

Area IV - Solid State
- EEAP 321 Semiconductor Electronic Devices
- EMSE 314 Electrical, Optical and Magnetic Properties of Matter
- EEAP 322 Integrated Circuits and Electronic Devices

Area V - Control
- ESCI 304 Control Engineering I
- EEAP 310 Electromechanical Energy Conversion
- EEAP 382 Microprocessor Applications to Control
- ESCI 346 Engineering Optimization
- EEAP 396 Hybrid Systems

Area VI - Circuits
- EEAP 245 Electronic Circuits
- EBME 310 Biomedical Instrumentation
- EEAP 344 Electronic Circuit Design
- EEAP 382 Microprocessor Based Design
- EBME 418 Biomedical Electronics
- EEAP 426 MOS Integrated Circuit Design

Area VII - Computer Hardware
- ECES 281 Logic Design and Computer Organization
- EEAP 382 Microprocessor Based Design
- ECES 301 Computer Design Lab
- ECES 321 Digital Systems Design
- ECES 322 Computer Architecture

In consultation with a faculty advisor, the student completes the program by selecting technical and open elective courses that provide in-depth training in one or more of a variety of specialties such as digital and microprocessor-based control, communications and electronics, solid state electronics and integrated circuit design and fabrication. With the approval of their advisors students may emphasize other specialties by selecting elective courses from other programs or departments.

Many courses have integral or associated laboratories in which students gain “hands-on” experience with electrical engineering principles and equipment. Students have ready access to the laboratory facilities and are encouraged to work in the various laboratories during nonscheduled hours in addition to the regularly scheduled laboratory sessions. Opportunities also exist for undergraduate student participation in many of the wide variety of research projects being conducted within the program.

Minor in Electrical Engineering

Students enrolled in degree programs in other engineering departments can have a minor specialization by completing the following courses:

- EEAP 245 Electronic Circuits I (4)
- EEAP 246 Signals and Systems (4)
- ECES 281 Logic Design and Computer Organization (4)
- EEAP 309 Electromagnetic Fields I (3)
- Approved Technical Elective (3)

Minor in Electronics

The department also offers a minor in electronics for students in the College of Arts and Science. This program requires the completion of 29 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 Mathematics I (4)
- MATH 126 Mathematics II (4)
- PHYS 115 Introductory Physics I (4)
- PHYS 116 Introductory Physics II (4)
- ENGR 131 Elementary Computer Programming (3)
- ENGR 210 Circuits and Instrumentation (4)
- EEAP 246 Signals and Systems (4)
- ECES 281 Logic Design and Computer Organization (4)

COOPERATIVE EDUCATION PROGRAM

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.
B.S./M.S. PROGRAM
The department encourages students with at least a 3.5 grade point average to apply for admission to the five-year bachelors/master’s program in the junior year. This integrated program, which permits substitution of M. S. 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.

GRADUATE PROGRAMS
The electrical engineering program offers graduate study leading to the Master of Science and Doctor of Philosophy degrees. The programs are comprehensive and basic, emphasizing four major areas in which the faculty are actively engaged in research: (1) automation, sensing, intelligence and actuation; (2) solid state electronics; (3) electromagnetic, high frequency communications and devices; and (4) circuits, signal processing, and computer-aided design. Academic requirements for graduate degrees in engineering are as specified for the Case School of Engineering in this bulletin. All current rules and regulations for this department are detailed in a graduate student handbook, available from the department office, which supersedes any rules contained here. A number of teaching and research assistantships are available, on a competitive basis, for the full support of qualified students. In addition, a limited number of tuition assistantships are also available for partial support of graduate students.

Computer Engineering and Science (ECES)

UNDERGRADUATE COURSES
ECES 233. Introduction to Data Structures (4)
The programming language C++; pointers, files, variant records, 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. Laboratory. Prerequisite: ENGR 131.

ECES 251. Numerical Methods (3)
Introduction to basic concepts and algorithms used in the numerical solution of common problems including solving nonlinear 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. Prerequisites: ENGR 131 and MATH 122.

ECES 281. Logic Design and Computer Organization (4)
Fundamentals in 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. Prerequisite: ENGR 131.

ECES 300. Computer Engineering and Science Research (0)
The faculty of the CES department give an overview of their research to aid five-year M.S./B.S. students to select project advisors.

ECES 301. Digital Logic Laboratory (2)
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 Machine, register based design, and arithmetic computational block. Prerequisite: ECES 281.

ECES 317. Computer Design Laboratory (2)
Sequence of laboratory projects provide practical experience in computer-aided design techniques for computer and digital system design. Hardware system modeled and simulated at register transfer and switching transistor level.

ECES 318. Computer-Aided Design (4)
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 with state-of-the-art computer-aided design tools. Prerequisites: ECES 281 and ECES 321.

ECES 321. Digital Systems Design (4)
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 layout, 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. Prerequisite: ECES 281.

ECES 322. Computer Architecture (3)
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. Prerequisite: ECES 281.

ECES 329. Design of Object-Oriented Systems (3)
This course provides an opportunity to gain an understanding of the concepts and technology of object-oriented systems and learn system design techniques that take full advantage of this technology. Students also develop competence in programming with the object-oriented features of C++. Prerequisite: ECES 233.

ECES 337. Systems Programming (4)
Lexical analyzers; symbol tables and their searching; assemblers, one-pass and two-pass, conditional assembly, and macros; linkers and loaders; interpreters, pcodes, threaded codes; introduction to compilation, grammar, parsing, and code genera-
tion; preprocessors; text editors, line-oriented and screen-oriented; bootstrap loaders, ROM monitors, interrupts, and device drivers. Laboratory. Prerequisites: ECES 233 and ECES 281.

ECES 338. Introduction to Operating Systems (4)
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. Prerequisite: ECES 337.

ECES 340. Algorithms and Data Structures (3)
Efficient sorting algorithms, external sorting methods, internal and external searching, efficient string processing algorithms, geometric and graph algorithms. Prerequisites: ECES 233 and MATH 304.

ECES 341. Introduction to Database Systems (3)
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. Prerequisite: ECES 233.

ECES 343. Theoretical Computer Science (3)
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. Prerequisite: ECES 233.

ECES 345. Programming Language Concepts (3)
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. Prerequisite: ECES 233.

ECES 350. Domain Theoretic Methods for Artificial Intelligence (3)

ECES 375. Autonomous Robotics (3)
Introduction to the design, construction and control of autonomous mobile robots. The first half of the course consists of focused exercises on mechanical construction with Legos, characteristics of sensors, motors and batteries, and control strategies for autonomous robots. In the second half of the course, students design, build and program their own complete robots that participate in a public competition. All work is performed in groups. Biologically-inspired approaches to the design and control of autonomous robots are emphasized throughout. Prerequisite: Consent of instructor. Cross-listed as BIOL 375.

ECES 391. Introduction to Artificial Intelligence (3)
Overview of artificial intelligence, knowledge representation, search, game-playing, logic rule-based systems, AI programming languages, learning, neural networks, evolutionary algorithms, natural language understanding, planning, robotics. Prerequisite: ENGR 131.

ECES 394. Senior Project I (3)

ECES 396. Special Topics: Computer Science (1-9)

ECES 398. Software Engineering (3)
Issues in the development of complex software systems. Software lifecycle models. Software engineering methodology, requirements, analysis and specification design implementation, validation, and maintenance. Team development of a significant applications program. Prerequisite: ECES 337.

ECES 399. Computer Engineering Design Project (3)
Capstone course for computer engineering seniors. Material from previous and concurrent courses used to solve hardware and/or software design problems. Formal presentations of the projects scheduled during last week of classes.

GRADUATE COURSES

ECES 400T. Graduate Teaching I (0)
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 homework, quizzes, and exams, having office hours for students, tutoring students. Prerequisite: Ph.D. student in computer science or engineering.

ECES 405. Data Structures and File Management (3)
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. Prerequisites: ECES 233 and MATH 304.

ECES 411. Introduction to Logic Programming (3)

ECES 420. Computer System Architecture (3)
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. Prerequisite: ECES 338.
ECES 423. Principles of Operating Systems (3)
Various types of operating systems. Concurrent processes, mutual exclusion, process communication, cooperation, deadlocks. Distributed OS algorithms, UNIX, NFS, NIS. Examples from several operating systems. Prerequisite: ECES 338.

ECES 425. Computer Communications Networks (3)
Covers computer network architecture. Topics include: network applications; types of networks; network architecture; OSI, TCP/IP and ATM reference models; transmission media; the telephone system; ISDN and ATM error detection and correction; data link protocols; channel allocation; LAN protocols; bridges; routing; congestion control; inter-networking; transport services and protocols; TCP/IP and ATM protocols; socket programming; security; Domain Name System; Simple Network Management Protocol; email, WWW; Java; Corba; distributed multimedia. Prerequisite: ECES 338.

ECES 430. Object-Oriented Software Development (3)
Covers advanced methodology for the design of large software systems. Topics include: object-oriented analysis and design; encapsulation; inheritance; subtype and parametric polymorphism; object-oriented programming languages; design patterns; application frameworks; software architecture; user-interfaces; concurrent and distributed objects.

ECES 431. Software Engineering (3)
Design of software systems working from specifications; top-down decomposition using stepwise refinement; object-oriented methods; prototyping. Software metrics and testing; software quality and reliability; maintenance; human factors. Homework involves working in teams on large software projects. Prerequisite: ECES 337.

ECES 432. Compiler Construction (3)
Top-down and bottom-up recognizers for context-free grammars; LR(k) parsers, error recovery, semantic analysis, storage allocation for block structured languages, optimization, code generation. Homework involves writing a compiler for a block structured language. Prerequisite: ECES 337.

ECES 433. Database Systems (3)

ECES 434. Advances in Databases (3)
Advanced topics in databases will be covered in this course. Query optimization in object-oriented databases, temporal databases, issues in multimedia databases, databases and Web, graphical query interfaces. Basic knowledge in databases is required. Prerequisite: ECES 433.

ECES 440. Automata and Formal Languages (3)
Cross-listed as MATH 410.

ECES 450. Domain Theoretic Methods for Artificial Intelligence (3)
(See ECES 350.) Cross-listed as MATH 450.

ECES 454. Analysis of Algorithms (3)
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. Prerequisites: MATH 304 and (ECES 340 or ECES 405). Cross-listed as OPRE 454.

ECES 466. Computer Graphics (3)
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 grave shaded graphics. Laboratory. Prerequisite: ECES 233.

ECES 473. Multimedia and Web Computing (3)
Multimedia is an important application area that will be at the center for next-generation computer systems and software design. It is a fast-changing technology, and, already, in the industry, there is a significant demand for computer scientists/engineers with multimedia system design knowledge. The objective of ECES 473 is to present design issues for multimedia systems from specification to software implementation and testing. This will include multimedia basics, data capture/models/compression, synchronization models, multimedia servers, OS support for multimedia, multimedia communication systems, and multimedia user interfaces. There will be a project about designing and implementing a multimedia system. Students are expected to know Unix systems programming (System V IPCs, fork, exec, etc.), RPC, thread and socket programming. Prerequisites: ENGR 131, ECES 233, and ECES 338.

ECES 475. Autonomous Robotics (3)
Introduction to the design, construction and control of autonomous mobile robots. The first half of the course consists of focused exercises on mechanical construction with Legos, characteristics of sensors, motors and batteries, and control strategies for autonomous robots. In the second half of the course, students design, build and program their own complete robots that participate in a public competition. All work is performed in groups. Biologically-inspired approaches to the design and control of autonomous robots are emphasized throughout. Prerequisite: Consent of instructor. Cross-listed as BIOL 475.

ECES 478. Computational Neuroscience (3)
Computer simulation 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 circuits, as well as to cable theory, passive and active compartmental modeling, numerical integration methods, models of plasticity and learning, models of brain systems, and their relationship to artificial neural networks. Term project required. Two lectures per week. Cross-listed as BIOL 478, EMBE 478, and NEUR 478.

ECES 479. Seminar in Computational Neuroscience (3)
Readings and discussion in the recent literature on computational neuroscience, adaptive behavior, and other current topics. Cross-listed as BIOL 479.
ECES 484. Computational Intelligence I: Basic Principles (3)
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. Cross-listed as EEAP 484.

ECES 485. VLSI Systems (3)
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.

ECES 486. Research in VLSI Design Automation (3)
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.

ECES 488. Embedded Systems Design (3)
Objective: to introduce and expose the student to methodologies for systematic design of embedded systems. The topics include, but are not limited to, system specification, architecture modeling, component partitioning, estimation metrics, hardware software codesign, diagnostics.

ECES 491. Intelligent Systems I (3)
This course is concerned with a number of basic concepts and methods which are used in the development of a variety of artificial intelligence (AI) applications. Although the course has an expert systems orientation, the concepts and methods are presented in a more general context to show their diversity, as well as their limitations. There are 3 major topics in the course: The first is concerned with various search methods which underlie virtually all methods for reasoning and problem solving. The second is an introduction to Lisp programming which is used to gain insight into implementing AI methods. The third is an introduction to the representation of knowledge and its use in reasoning about various aspects of an application. The underlying theory for this is predicate calculus and fundamental methods of logical inference and simplification are presented. The mechanization of these methods provides a general basis for intelligent processing of knowledge. Prerequisite: ENGR 131. Cross-listed as EEAP 491.

ECES 500T. Graduate Teaching I (0)
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 homework, quizzes, and exams, having office hours for students, running recitation sessions, providing laboratory assistance. Prerequisite: Ph.D. student in computer science or computer engineering.

ECES 591. Intelligent Systems II (3)
Cross-listed as EEAP 591.

ECES 600. Special Topics (1-18)
ECES 600T. Graduate Teaching III (0)
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: running recitation sessions, providing laboratory assistance, developing teaching or lecture materials, presenting lectures. Prerequisite: Ph.D. student in computer science or computer engineering.

ECES 601. Independent Study (1-18)
(Credit as arranged.)

ECES 602. Advanced Projects Laboratory (1-18)

ECES 651. Thesis M.S. (1-18)

ECES 701. Dissertation Ph.D. (1-18)

ECES 702. Appointed Dissertation Fellowship (9)

Electrical Engineering (EEAP)

UNDERGRADUATE COURSES

EEAP 245. Electronic Circuits (4)

EEAP 246. Signals and Systems (4)

EEAP 290. Special Topics (1-18)
Limited to sophomores and juniors. Prerequisite: Consent of instructor.

EEAP 309. Electromagnetic Fields I (3)
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 magneto-quasistatics, simple boundary value problems, correspondence between fields and circuit concepts, energy and forces. Prerequisites: MATH 223 and PHYS 122. Corequisite: MATH 224.

EEAP 310. Electromechanical Energy Conversion (4)
Electromechanical dynamics, modeling and control. Forces in quasistatic magnetic systems. Energy conversion properties of rotating machines. Analysis and control of DC servomotors, AC servomotors, reluctance machines, inductance machines, and magnetic bearing. Analysis of electromagnetic sensors. Electronic communication, torque linearization through computer controls and flux-vector control. Electromechanical properties are measured in the lab and high-performance controls are constructed and tested. Prerequisite: EEAP 309.

EEAP 311. Electromagnetic Fields II (3)
Boundary value problems, guided electromagnetic waves, rectangular and circular waveguides, strip lines, losses in waveguiding structures, scattering, wave optics and wave propagation in anisotropic media, ferrites and plasmas, resonant systems, cavities, microwave networks, multiport networks, scattering matrix formulation, radiation and antennas, radiation from dipoles, apertures and simple arrays. Prerequisite: EEAP 309.

EEAP 321. Semiconductor Electronic Devices (4)
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. Laboratory experiments to characterize some of the above devices. Prerequisite: EEAP 309.

EEAP 322. Integrated Circuits and Electronic Devices (3)
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. Prerequisite: EEAP 321.

EEAP 344. Electronic Analysis and Design (3)
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. Prerequisite: EEAP 245.

EEAP 345. Network Synthesis (3)
Design techniques for the construction of filters, delayers, filters, analog computer networks, and necessary and sufficient requirements for the realization of practical networks. Prerequisite: EEAP 246 or equivalent.

EEAP 351. Communications and Signal Analysis (3)
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. Prerequisite: EEAP 246 or equivalent.

EEAP 352. Digital Communications (3)

EEAP 355. RF Communications (3)
Coverage of modern communications circuits and systems with a particular emphasis upon mobile communications. Cellular communications, modulation methods, user access schemes. Individual system components: tuned small signal amplifiers and power amplifiers, mixers, detectors, and frequency synthesizers. Low-power design considerations. Prerequisite: EEAP 351.

EEAP 356. Microwave Engineering (3)
Transmission lines and circuit analysis, waveguides, modes of propagation, impedance matching techniques, scattering matrix, waveguide components, striplines, resonators, microwave theory, filters, microwave solid state devices. Prerequisite: EEAP 311.

EEAP 382. Microprocessor-Based Design (3)
Microprocessor architectures, memory design, timing, polled and interrupt driven I/O, microprocessor support devices, microcontrollers, integrated hardware/software design considerations. Prerequisites: ENGR 210 and ECES 281.

EEAP 383. Microprocessor Applications to Controls (3)
Digital control and its implementation using microprocessors. Z-transforms. Time response characteristics, steady-state error, mapping from the s-plane to the z-plane. Digital controller design-stability testing methods, gain and phase margins, PID controllers, digital filter structures. Prerequisite: EEAP 246 or equivalent.

EEAP 396. Special Topics (1-6)
(Credit as arranged.) Limited to juniors and seniors.

EEAP 397. Special Topics in Electrical Engineering (1-6)
(Credit as arranged.) Limited to juniors and seniors. Prerequisite: Consent of instructor.

EEAP 398. Senior Project in Electrical Engineering I (4)

EEAP 399. Senior Project in Electrical Engineering II (4)
Prerequisite: EEAP 398 (or concur).

GRADUATE COURSES

EEAP 400T. Graduate Teaching I (0)
This course will provide the Ph.D. candidate with experience in teaching undergraduate or graduate students. The experience is expected to involve direct 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 homework, quizzes, and exams, having office hours for students, tutoring students. Prerequisite: Ph.D. student in electrical engineering.

EEAP 412. Electromagnetic Fields III (3)

EEAP 416. Ultrasonic Engineering (3)
Acoustic waves in fluids and solids, surface acoustic waves, transmission phenomena, radiators, transducers, filters, flow measurements, pulse echo techniques, flaw detection, sonar, imaging, holography.

EEAP 420. Solid State Electronics I (3)

EEAP 422. Solid State Electronics II (3)

EEAP 424. Integrated Circuit Technology I (3)
Review of semiconductor technology. Device fabrication processing, material evaluation, oxide passivation, pattern transfer technique, diffusion, ion implantation, metallization, probing, packaging, and testing. Design and fabrication of passive and active semiconductor devices. Prerequisite: EEAP 322.

EEAP 426. MOS Integrated Circuit Design (3)

EEAP 431. Computer Processing of Images (3)
Introduction to computer vision methodologies. Includes the imaging systems: optics and detectors and geometric relationships between scene and image. 3-D scene scanning and imaging techniques including stereovision and laser rangefinders. Digital signal processing in 2-D and optical preprocessing of images. Real-time digital transmission of dynamic images and HDTV. Hardware issues in processing of vision information.

EEAP 432. Optical Communication (3)
In this course, suitable for graduate students or advanced undergraduates interested in photonics, a broad range of topics will be covered in the field of optical communication, with an aim to provide a sophisticated perspective of current technology and trends in optical communication components, systems, and networks. Prerequisite: EEAP 309.

EEAP 434. Microfabricated Silicon Electromechanical Systems (3)
Topics related to current research in microelectromechanical systems based upon silicon integrated circuit fabrication technology: fabrication, physics, devices, design, modeling, testing, and packaging. Bulk micromachining, surface micromachining, silicon to glass and silicon-silicon bonding. Principles of operation for microactuators and microcomponents. Testing and packaging issues. Prerequisite: EEAP 322 or EEAP 424.

EEAP 452. Random Signals (3)

EEAP 456. Microwave Engineering (3)

EEAP 463. Research Topics in Lasers and Optics (3)
Topics related to current research, e.g., laser theory, coherent optics, optical information processing.

EEAP 483. Data Acquisition and Control (3)
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.

EEAP 484. Computational Intelligence I: Basic Principles (3)
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. Cross-listed as ECES 484.

EEAP 485. Computational Intelligence II (3)
This course is concerned with the combined use of the methods of computational intelligence in the performance of complex real-world tasks. Tasks considered include learning models of ‘opaque’ systems, design and operation of fuzzy control systems, neural-net computing control of systems, optimal control, adaptive learning of time-variant time series, data compression, classification, self-or-
organization of objects into categories, inductive reasoning, decision-making interpretation of signal and images. Prerequisite: EEAP 484.


EEAP 500. Electrical Engineering and Applied Physics Colloquium (0) Lecture program covering current research in various areas of electrical engineering. Attendance by graduate students required.

EEAP 500T. Graduate Teaching II (0) 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: running recitation sessions, providing laboratory assistance, developing teaching or lecture materials, presenting lectures. Prerequisite: Ph.D. student in electrical engineering.

EEAP 501. Independent Study (1-18) Note that credits can be transferred to EEAP 701 only in the semester in which student advances to candidacy.

EEAP 503. Thesis M.S. (1-9) (Credit as arranged.)

EEAP 504. Dissertation Ph.D. (1-18) (Credit as arranged.)

EEAP 505. Appointed Dissertation Fellowship (9)

EEAP 510. Problem Solving and Systems Engineering (ESCI) Undergraduate Courses


ESCI 212. Signals, Systems, and Control (3)
Characterization of continuous-time signals and systems. Laplace transforms, constant coefficient differential equations. Modeling of dynamical systems. Introduction to control system analysis and design. Prerequisite: MATH 224.

ESCI 214. Signals, Systems, and Control Laboratory (1)
A laboratory course based on the material in ESCI 212. Analysis and simulation using MATLAB/Simulink. Laboratory experiments involving signal processing and control. Corequisite: ESCI 212.

ESCI 216. Fundamental System Concepts (3)
Develops framework for addressing problems in science and engineering that require an integrated, interdisciplinary approach, including the effective management of complexity and uncertainty. Introduces fundamental system concepts in an integrated framework. Properties and behavior of phenomena regardless of the physical implementation through a focus on the structure and logic of information flow. Systematic problem solving methodology using systems concepts. Prerequisite: MATH 224.

ESCI 304. Control Engineering I with Laboratory (3)
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. Prerequisite: ESCI 212.

ESCI 306. Control Engineering II with Laboratory (3)
Advanced techniques for control of dynamic systems. State-space modeling, analysis, and controller synthesis; introduction to nonlinear control systems: phase plane methods, bang-bang control, time-optimal control; describing function analysis and design techniques; discrete time systems and controllers. Advanced control design methods implementation. Prerequisite: ESCI 304.

ESCI 313. Signal Processing (3)

ESCI 322. Simulation Techniques in Engineering (3)
Discrete event systems and simulation concepts. Discrete event simulation with batch and interactive languages. Corequisite: ENGL 398.

ESCI 340. Introduction to Global Issues (3)
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.

ESCI 346. Engineering Optimization (3)
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. Prerequisite: MATH 201.

ESCI 350. Industrial and Production Systems Engineering (3)
Time and motion study, human factors and safety engineering, man-machine systems, quality control and reliability, project management, scheduling, sequencing, inspection and maintenance of industrial processes.

ESCI 351. Manufacturing Systems Laboratory (1)
Application of techniques developed in ESCI 350 using available software packages, small scale robots and equipment, and real-time mini- and micro-computer facilities. Prerequisite: ESCI 350.

ESCI 352. Engineering Economics and Decision Analysis (3)

ESCI 355. Production Engineering Laboratory (2)
Development of experimental techniques for measuring costs, human activities, and the physical characteristics of industrial systems. Hands-on experience with industrial and manufacturing computer software packages to solve simulated and real-world problems. Experimental design and error analysis. Field trips to selected local industries to provide exposure to modern machines, tools, and manufacturing systems. Prerequisites: ESCI 350 and ESCI 351.

ESCI 360. Manufacturing, Operations, and Automated Systems (3)

ESCI 396. Special Topics (1-18)

ESCI 398. Engineering Projects I (3)
Project experience in the application of course material to practical systems engineering problems. Identification of project, literature review, and proposal preparation for ESCI 399.

ESCI 399. Engineering Projects II (3)
ELECTIVE PROJECTS WITH EMPHASIS ON ENGINEERING DESIGN. Capstone engineering project. Prerequisite: ESCI 398.

GRADUATE COURSES

ESCI 400T. Graduate Teaching I (0)
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 homework, quizzes, and exams, having office hours for students, tutoring students. Prerequisite:
Ph.D. student in systems and control engineering.

**ESCI 401. Digital Signal Processing (3)**

**ESCI 404. Digital Control Systems (3)**
Analysis and design techniques for computer based control systems. Sampling, hybrid continuous-time/discrete-time system modeling; sampled data and state space representations, controllability, observability and stability, transformation of analog controllers, design of deadbeat and state feedback controllers; pole placement controllers based on input/output models, introduction to model identification, optimal control and adaptive control. Prerequisite: ESCI 304.

**ESCI 408. Introduction to Linear Systems (3)**
Analysis and design of linear feedback systems using state-space techniques. Review of matrix theory, linearization, transition maps and variations of constants formula, structural properties of state-space models, controllability and observability, realization theory, pole assignment and stabilization, linear quadratic regulator problems, observers, and separation theorem. Prerequisite: ESCI 304.

**ESCI 409. Discrete Event Systems (3)**
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 Petri-nets, perturbation analysis, and Min-Max algebras.

**ESCI 414. Complex Systems Modeling and Analysis (3)**
The concept of a complex system as a relation of identifiable subsystems. Modeling of large-scale systems by aggregation, perturbation, via system identification and by the use of fuzzy logic. The structural properties of large-scale systems. A hierarchical, multi-level approach to large-scale systems analysis and synthesis. Coordination by the interaction balance and by interaction prediction principles. Decentralized decision making and control of large-scale systems. Near optimum system design. Structure and stability of fuzzy control systems.

**ESCI 416. Optimization Theory and Techniques (3)**
Underlying theory of linear, nonlinear, multilevel, and multiobjective optimization. Techniques include linear programming and extensions, quadratic programming, dynamic programming, decomposition coordination schemes for multilevel optimization. Methods for generating Pareto optimal solutions in multiobjective optimization. Applications to engineering problems. Prerequisite: MATH 201 or equivalent.

**ESCI 417. Introduction to Stochastic Control (3)**
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. Prerequisite: ESCI 408.

**ESCI 418. System Identification and Adaptive Control (3)**

**ESCI 421. Optimization of Dynamic Systems (3)**

**ESCI 427. Risk and Reliability Methods for Engineers (3)**
Probabilistic models and methods for risk, reliability, and quality engineering; Markov decision processes; stochastic dynamic programming; stochastic programming and other methods for risk analysis; failure models; qualitative fault analysis; reliability analysis of systems; life data analysis and accelerated life testing; design of experiments for quality engineering; statistical quality control; and acceptance sampling for quality control.

**ESCI 450. Integrated Production/Manufacturing Systems (3)**
Fundamental theories and techniques, decision making, and artificial intelligence for solving production/manufacturing problems. Formulation, modeling, planning, and control of production problems at three levels: strategic, tactical, and operational (long term, medium, and short term). Specific problems include aggregate planning, project planning, scheduling, line balancing, sequencing, and machine set-up. Special emphasis will be given on decomposition and control of computer integrated systems, on-line and off-line supervisory planning, and man/machine systems.

**ESCI 460. Manufacturing Operations and Automated Systems (3)**
The course is designed primarily for graduate engineering students who wish to know about the fundamentals and modeling of production/automation/manufacturing systems. The course provides a survey of various topics in production automation and computer-aided and integrated manufacturing with emphasis on decision making, optimization, and modeling. Topics include computerized process planning, on-line and off-line supervisory computer control, computerized discrete production systems, numerical control, monitoring and planning flexible manufacturing systems, group technology, materials handling sys-
tems, man/machine systems and requirements, design and analysis of assembly systems, and computerized facility layout design problems. The course presents a step-by-step and cohesive account of concepts, theories and procedures for solving modern manufacturing and production problems with emphasis on computer applications. Prerequisite: Consent of instructor.

ESCI 463. Techniques of Model-based Control (3)
Strategies of process control centered around the use of process models in the control system. Topics include single loop, feed forward, cascade and multi-variable internal model control. Tuning controllers to accommodate process uncertainty. Treatment of control effect and output constraints in model predictive control and modular-multivariable control. Prerequisite: ESCI 304. Cross-listed as ECHE 463.

ESCI 489. Robotics I (3)
Prerequisite: EMAE 181. Cross-listed as EEAP 489 and EMAE 489.

ESCI 500T. Graduate Teaching II (0)
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 homework, quizzes, and exams, having office hours for students, running recitation sessions, providing laboratory assistance. Prerequisite: Ph.D. student in systems and control engineering.

ESCI 515. Decision Theory with Applications (3)

ESCI 516. Large Scale Optimization (3)
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. Prerequisite: ESCI 416.

ESCI 518. Nonlinear Systems: Analysis and Control (3)

ESCI 519. Differential Geometric Nonlinear Control (3)
This advanced course focuses on the analysis and design of nonlinear control systems, with special emphasis on the differential geometric approach. Differential geometry has proved to be an extremely powerful tool for the analysis and design of nonlinear systems, similar to the roles of the Laplace transformation and linear algebra in linear systems. The objective of the course is to present the major methods and results of nonlinear systems and provide a mathematical foundation, which will enable students to follow the recent developments in the constantly expanding literature. This course will also benefit those students from electrical, mechanical, chemical and biomedical engineering, who are doing research in the fields that involve nonlinear control problems. Prerequisite: ESCI 408 or equivalent.

ESCI 523. Multiobjective and Hierarchical Systems (3)
This course covers basic concepts of hierarchical, multi-level systems. Lagrangian decompositions, and coordination principles. Fundamentals and recent advances in theory, methodology and applications of multiple criteria decision making (MCDM) with single and multiple decision makers are included as are: interactive MCDM methods; multiple objectives for discrete and continuous models; multi-objective programming methods, hierarchical overlapping coordination with single and multiple objectives; multi-objective, multi-stage impact analysis; and applications to large-scale systems and to decision support systems. Cross-listed as OPRE 523.

ESCI 600T. Graduate Teaching III (0)
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. Prerequisite: Ph.D. student in systems and control engineering.

ESCI 601. Independent Study (1-18)
ESCI 620. Special Topics (1-18)
ESCI 621. Special Projects (1-18)
ESCI 651. Thesis M.S. (1-18)
ESCI 701. Dissertation Ph.D. (1-18)
ESCI 702. Appointed Dissertation Fellowship (9)

Degree Program in Engineering, Undesignated

312 Glennan Building (7082)
phone 216-368-8760 fax 216-368-6939
Donald L. Feke
e-mail dlf4@po.cwru.edu

The Undesignated Engineering 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, transpor-
tation, 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 Undesignated Engineering program allows student to acquire some engineering background, and combine it with a minor in such programs as management, history of technology and science, or economics.

UNDERGRADUATE PROGRAM

A student electing an undesignated degree must submit both a proposed course schedule and a clear statement of career goals and of the way in which the proposed program will meet those goals. These documents are to be submitted to the office of the associate dean for academic affairs of the Case School of Engineering. The program must be approved by the dean of engineering or designate in consultation with representatives of the major and minor departments. A total of at least 128 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
   a. Thermodynamics or Physical Chemistry (EMAE 150, EMAC 171 and 172, CHEM 301 and 302, or ECHE 363)
   b. Signals, systems or control (ESCI 212, ESCI 304, ECHE 367)
   c. Materials science (EMSE 201, EMAC 270, EMSE 314, EBME 306, or EAP 320)
   d. Economics, production systems or decision theory (ESYS 250, ESCI 352, OPRE 345)

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
- Fluid and thermal engineering sciences
- 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. Suggested minors for students pursuing the undesignated degree program in engineering are the following. Other minors are available with approval of the Office of Undergraduate Studies.

Engineering
A minor program may be chosen in any engineering field that differs from the major and that, when combined with the major, fulfills a specific purpose or career plan. The purpose of a minor program is to allow more breadth, with less depth in any one engineering area. For example, such a program may appeal to the student who prefers a broad design-oriented background or the student who wishes to couple knowledge in systems and control engineering with knowledge in a field such as civil engineering, chemical processing, or computer engineering. Other major and minor combinations that may be of interest are the coupling of a civil engineering major with a metallurgy or materials minor or a combination of electrical and materials science and engineering.

Science
A minor field may be chosen in any field of science wherein the major-minor combination fulfills a unique purpose. Many engineering majors and science minors can be successfully combined. For example, a major in civil engineering coupled with a minor in geology leads to a program aimed at geophysical sciences or oceanography. The student with electrical engineering interests in lasers, optics, solid state, plasmas, and the like may profit by coupling an electrical engineering major with a physics minor. In particular, an engineering major coupled with a minor in biological sciences or in biomedical engineering (plus chemistry) leads to a biomedical engineering background for the student interested in pre-medicine, pre-dentistry, pre-nursing, or pre-biomedical engineering. This combination also provides a unique background for a student interested in biomaterials or a student who wishes to explore the bioelectronics area or biomechanics, systems biology, or a combination that deals with information processing and the computer in biomedical applications.

Management
Many students enter the engineering program at CWRU in preparation for industrial management careers. Generally, their plan is to work in an engineering capacity and gradually assume management responsibilities. Some of these students plan to take a graduate program in management, such as the Master of Business Administration degree. However, others rely on a combination of undergraduate elective courses, job experience, and industrial training programs for this career preparation.

To serve engineering students whose career goals involve management, a minor program has been developed in cooperation with the Weatherhead School of Management. This program gives the student the options of direct entry into industry in either an engineering or a management tracking program or entry into graduate school to earn the Master of Science degree in engineering or the Master of Business Administration degree.

A management minor requires the following courses
- ACCT 303, Survey of Accountancy (3)
- BAF 355, Corporation Finance (3)
- OPMT 350, Operations Management (3)
- plus any two of the following
  - LHRP 251, Industrial Relations and Administrative Practices (or LHRP 311, Labor Problems)
  - MIDS 308, Management Information Systems I (3)
  - MKMR 301, Marketing Management (3)
  - OPRE 201, Introduction to Operations Research I (3)
- ORBH 250, Introduction to Organizational Behavior and Management (3)

**History of Technology and Science**
The purpose of coupling an engineering major with a minor in the history of technology and science is primarily to prepare for entry into the field of history of technology. Beyond this, however, knowledge of the history of technology may be invaluable to engineers who take decision-making roles during their careers. This minor provides a much needed emphasis on the consequences of technology and technological decisions on society and the importance of historical insight in such decisions.

The minor program can be tailored to individual interests, based on the following offerings:
- HSTY 266, The Engineer in America (3)
- HSTY 306, Engineering in History (3)
- HSTY 307, Development of Chemistry and Chemical Engineering (3)
- HSTY 366, Science, Technology, and Government (3)
- HSTY 377, Nuclear Weapons and Arms Control (3)

**Economics**
The field of economics is moving rapidly toward a more quantitative approach and is an important field for engineers. The economics minor requires the following courses:

### BACHELOR OF SCIENCE IN ENGINEERING DEGREE

#### MAJOR IN ENGINEERING (UNDENGINIZED)

<table>
<thead>
<tr>
<th>Fall Semester</th>
<th>Class/Lab/Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FRESHMAN</strong></td>
<td></td>
</tr>
<tr>
<td>Open elective or Humanities/Social Science a</td>
<td>(3-0-3)</td>
</tr>
<tr>
<td>CHEM 111 Principles of Chemistry for Engineers</td>
<td>(4-0-4)</td>
</tr>
<tr>
<td>ENGR 131 Elementary Computer Programming</td>
<td>(2-2-3)</td>
</tr>
<tr>
<td>ENGL 150 Expository Writing</td>
<td>(3-0-3)</td>
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<tr>
<td>MATH 121 Calculus for Science and Engineering I</td>
<td>(4-0-4)</td>
</tr>
<tr>
<td>PHED 101 Physical Education Activities</td>
<td>(0-3-0)</td>
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<th>Spring Semester</th>
<th>Class/Lab/Credit Hours</th>
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<tbody>
<tr>
<td><strong>FRESHMAN</strong></td>
<td></td>
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<tr>
<td>Humanities/Social Science or open elective a</td>
<td>(3-0-3)</td>
</tr>
<tr>
<td>ENGR 145 Chemistry of Materials</td>
<td>(4-0-4)</td>
</tr>
<tr>
<td>MATH 122 Calculus for Science and Engineering II</td>
<td>(4-0-4)</td>
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<tr>
<td>PHED 102 Physical Education Activities</td>
<td>(0-3-0)</td>
</tr>
<tr>
<td>PHYS 121 General Physics I</td>
<td>(4-0-4)</td>
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<tr>
<th><strong>SOPHOMORE</strong></th>
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<tbody>
<tr>
<td>Humanities or Social Science Sequence I</td>
<td>(3-0-3)</td>
</tr>
<tr>
<td>ENGR 200 Statics and Strength of Materials</td>
<td>(3-0-3)</td>
</tr>
<tr>
<td>MATH 223 Calculus for Science and Engineering III</td>
<td>(3-0-3)</td>
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<tr>
<td>ECES 251 Numerical Methods</td>
<td>(2-2-3)</td>
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<tr>
<td>PHYS 122 General Physics II</td>
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<td>Total</td>
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<tr>
<td>Humanities or Social Science Sequence III</td>
<td>(3-0-3)</td>
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<tr>
<td>Major Concentration Course</td>
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<tr>
<td>Major Concentration Course</td>
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<tr>
<td>Minor Concentration Course</td>
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<tr>
<td>Engineering elective</td>
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<tr>
<td>Open elective</td>
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<td>Humanities or Social Science elective</td>
<td>(3-0-3)</td>
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<tr>
<td>Exxx 398 Engineering Senior Project</td>
<td>(0-6-3)</td>
</tr>
<tr>
<td>Major Concentration Course</td>
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<tr>
<td>Minor Concentration Course</td>
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<tr>
<td>Minor Concentration Course</td>
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<td>Total</td>
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</tbody>
</table>

### Notes:
- One of these courses must be a humanities/social science course.

**Hours required for graduation 128**
• ECON 102, Principles of Microeconomics (3)
• ECON 103, Principles of Macroeconomics (3)

The following electives in economics are suggested
• ECON 341, Money and Banking (3)
• ECON 326, Econometrics (3)
• ECON 342, Public Finance (3)
• ECON 369, Economics of Industrial Production and Technology (3)
• ECON 386, Urban Economics (3)
• ECON 361, Managerial Economics (3)

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BACHELOR OF SCIENCE IN ENGINEERING DEGREE

Major in Engineering Physics

Fall Semester  Class/Lab/Credit Hours

**FRESHMAN**

CHEM 111 Principles of Chemistry for Engineers .......... (4-0-4)
CHEM 113 Principles of Chemistry Laboratory ............. (1-3-2)
MATH 121 Calculus for Science and Engineering I* ........ (4-0-4)
PHYS 121 General Physics I. Mechanics ........................ (4-3-4)
ENGL 150 Expository Writing .................................... (3-0-3)
PHED 101 Physical Education Activities ...................... (0-3-0)
Total ........................................................................ (16-9-17)

**SOPHOMORE**

MATH 223 Calculus for Science & Engineering III* .......... (3-0-3)
PHYS 221 General Physics III – Modern Physics .......... (3-0-3)
ENGR 200 Statics and Strength of Materials ............... (3-0-3)
ENGR 210 Circuits & Instrumentation ......................... (3-2-4)
Humanities/Social Science Elective ............................. (3-0-3)
Total ........................................................................ (15-2-16)

**JUNIOR**

PHYS 313 Thermodynamics and Statistical Mechanics ... (3-0-3)
PHYS 317 Engineering Physics Lab I ......................... (2-4-4)
PHYS 331 Introduction to Quantum Mechanics I .......... (3-0-3)
Engineering Concentrationa ......................................... (3-0-3)
Humanities/Social Science Elective ............................. (3-0-3)
Total ........................................................................ (14-4-16)

**SENIOR**

PHYS 315 Introduction to Solid State Physics ............... (3-0-3)
PHYS 325 Electricity and Magnetism II ....................... (3-0-3)
PHYS 353 Senior Engineering Physics Project ............ (0-6-3)
Engineering Concentrationa ......................................... (3-0-3)
Humanities/Social Science Sequence II ....................... (3-0-3)
Total ........................................................................ (12-6-15)

Spring Semester  Class/Lab/Credit Hours

**FRESHMAN**

MATH 122 Calculus for Science and Engineering II* ....... (4-0-4)
PHYS 122 General Physics II. Electricity & Magnetismb .. (4-3-4)
ENGR 131 Elementary Computer Programming ............ (2-2-3)
ENGR 145 Chemistry of Materials .............................. (4-0-4)
PHED 102 Physical Education Activities ...................... (0-3-0)
Total ........................................................................ (14-8-15)

**SOPHOMORE**

MATH 224 Differential Equationsa ............................... (3-0-3)
PHYS 208 Instrumentation and Signal Analysis Lab ....... (2-4-4)
PHYS 250 Mathematics, Physics and Computing .......... (3-0-3)
PHYS 310 Classical Mechanics .................................... (3-0-3)
ENGR 225 Thermodynamics, Fluids, Heat & Mass Transfer (4-0-4)
Total ........................................................................ (15-4-17)

**JUNIOR**

PHYS 318 Engineering Physics Lab II ......................... (2-4-4)
PHYS 324 Electricity and Magnetism I ....................... (3-0-3)
ENGR 398N Professional Communications .................. (3-0-3)
Humanities/Social Science Sequence I ....................... (3-0-3)
Engineering Concentrationa ......................................... (3-0-3)
Total ........................................................................ (14-4-16)

**SENIOR**

PHYS 353 Senior Engineering Physics Project ............ (0-6-3)
Applied Quantum Mechanicsd .................................. (3-0-3)
Engineering Concentration ........................................ (3-0-3)
Humanities/Social Science Elective ............................. (3-0-3)
Humanities/Social Science Sequence III .................... (3-0-3)
Total ........................................................................ (12-6-15)

Hours required for graduation: 127
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.

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 in the concentration discipline is required. The project includes a written report and participation in the senior symposium.

Details of the engineering physics program can be found under the department of Physics in the College of Arts and Sciences section.

**Department of Macromolecular Science and Engineering**

314 Kent Smith Building (7202)  
phone: 216-368-4172;  
fax: 216-368-4202  
Alexander Jamieson, Chair  
email amj@po.cwru.edu  
http://www.scl.cwru.edu/cse/emac

Macromolecular science 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) can all be classified as 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 B.S., M.S., or Ph.D. degrees.

**FACULTY**

Alexander M. Jamieson, D. Phil. (Oxford University, England)  
Professor and Chairman  
Quasielastic laser light scattering; relaxation and transport of macromolecules in solution and bulk; structure-function relationships of biological macromolecules.

Eric Baer, D. Eng. (The Johns Hopkins University)  
The Herbert Henry Dow Professor of Science and Engineering  
Irreversible microdeformation mechanisms; pressure effects on morphology and mechanical properties; relationships between hierarchical structure and mechanical function; mechanical properties of soft connective tissue; polymer composites and blends; polymerization and crystallization on crystalline surfaces; viscoelastic properties of polymer melts; damage and fracture analysis of polymers and their composites.  
Structure-property relationships in biological systems.

John Blackwell, Ph.D. (University of Leeds, England)  
F. Alex Nason Professor  
Determination of the solid state structure and morphology of polymers. X-ray analysis of the structure of thermotropic copolymers, copolyimides, polyurethanes, polysaccharides; supramolecular assemblies, fluoropolymers; molecular modeling of semi-crystalline and liquid crystalline polymers; rheological properties of polysaccharides and glycoproteins.

Anne Hiltner, Ph.D. (Oregon State University)  
Professor  
Structure-property relationships; irreversible deformation, crack propagation and fracture of polymers, blends and composites; microlayer processing of polymers; structure-function relationships in collagenous tissues; biostability of biomaterials.

Steven D. Hudson, Ph.D. (University of Massachusetts)  
Associate Professor  
Development of polymeric materials with novel structure and properties; electron microscopy; diffraction; coalescence, aggregation, phase inversion, nanocomposites, liquid crystals, and supramolecular assemblies.

Hatsuo Ishida, Ph.D. (Case Western Reserve University)  
Professor  
Processing of polymers and composite materials; structural analysis of surfaces and interfaces; molecular spectroscopy of synthetic polymers.

Jack L. Koenig, Ph.D. (University of Nebraska, Lincoln)  
The Donnell Institute Professor  
Polymer structure-property relationships using infrared, Raman, NMR spectroscopy and spectroscopic imaging techniques.

Jerome B. Lando, Ph.D. (Polytechnic Institute of Brooklyn)  
Professor  
Solid state polymerization; X-ray crystallography of polymers; electrical properties of polymers; ultra-thin polymer films.

Morton Litt, Ph.D. (Polytechnic Institute of Brooklyn)  
Professor  
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.

Ica Manas-Zloczower, D.Sc. (Israel Institute of Technology)  
Professor  
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.

Sergei Nazarenko, Ph.D. (Academy of Sciences, Moscow)  
Assistant Professor  
Diffusion and transport properties of polymeric materials; barrier structures; macromolecular interdiffusion; non-equilibrium behavior of polymer glasses.

Stuart Rowan, Ph.D. (University of Glasgow, UK)  
Assistant Professor  
Organic chemistry, synthesis, supramolecular chemistry, conducting polymers, interlocked macromolecules (polyrotaxanes and polycatenanes), peptide nucleic acids, supramolecular polymerization, reversible ‘dynamic’ chemistry and combinatorial libraries.

Shi-Qing Wang, Ph.D. (University of Chicago)  
Professor  
Rheology and dynamics of polymeric and...
### BACHELOR OF SCIENCE IN ENGINEERING DEGREE

#### MAJOR IN POLYMER SCIENCE

**Fall Semester**

<table>
<thead>
<tr>
<th>Course</th>
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<tr>
<td>Open elective or Humanities/Social Science b</td>
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<tr>
<td>CHEM 111 Principles of Chemistry for Engineers</td>
<td>(4-0-4)</td>
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<tr>
<td>ENGR 131 Elementary Computer Programming</td>
<td>(2-2-3)</td>
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<td>MATH 121 Calculus for Science and Engineering I</td>
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**Sophomore**

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<td>MATH 223 Calculus for Science and Engineering III</td>
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<td>CHEM 290 Chemistry Laboratory Methods for Engineers *</td>
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<td>ENGR 200 Statics and Strength of Materials</td>
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<tr>
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<td>EMAC 377 Polymer Processing</td>
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* Approved Natural Science electives: PHYS 221 or 223, General Physics III, BIOL 210, Molecular Cell Biology, BIOL 205, Chemical Biology, STAT 312, Basic Statistics for Engr. & Sci., PHYS 349, Methods of Mathematical Physics, BIOL 307, General Biochemistry.
* One of these courses must be a humanities/social science course.
* Engineering Core Courses.
* Preparation for the polymer science project should commence in the previous semester.
* Technical sequence must be approved by department adviser.

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**Spring Semester**

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<td>Humanities/Social Science or open elective b</td>
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<tr>
<td>ENGR 145 Chemistry of Materials</td>
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<td>MATH 222 Calculus for Science and Engineering II</td>
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**Sophomore**

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<td>EMAC 276 Polymer Properties and Design</td>
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<td>MATH 224 Elementary Differential Equations</td>
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**Junior**

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<tr>
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<td>EMAC 272 Polymer Analysis Laboratory</td>
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<td>EMAC 376 Polymer Engineering</td>
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<tr>
<td>ENGL 398N Professional Communication</td>
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**Senior**

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Hours required for graduation: 128
**Professor of Macromolecular Science, Pathology, and Biomedical Engineering**

**Development of polymers for medical and dental applications**

Donald Feke, Ph.D. (Princeton University)  
Professor of Chemical Engineering, and Macromolecular Science  
Fine-particle processing; colloidal phenomena; dispersive mixing; acoustic separation methods

LeRoy Klein, Ph.D. (Boston University), M.D. (Case Western Reserve University)  
Professor of Orthopaedics, Biochemistry  
Collagen physiology

J. Adin Mann, Jr., Ph.D. (Iowa State University)  
Professor of Chemical Engineering  
Surface phenomena; interfacial dynamics; light scattering; stochastic processes of adsorption and molecular rearrangement at interfaces

Roger Marchant, Ph.D. (Case Western Reserve University)  
Professor of Biomedical Engineering  
Biopolymers; polymer surface coatings; properties and characterization of polymer surfaces on implants and sensors

Syed Qutubuddin, Ph.D. (Carnegie-Mellon University)  
Professor of Chemical Engineering  
Colloids; polymers and interfacial phenomena; laser light scattering; enhanced oil recovery

Charles Rosenblatt, Ph.D., (Harvard University)  
Professor of Physics  
Experimental condensed matter physics; liquid crystal physics

Kenneth Singer, Ph.D., (University of Pennsylvania)  
Professor of Physics  
Nonlinear optical properties of polymers; contributions of molecular order to the nonlinear optical response in polymers; optical probes of polymer relaxation; formation of and propagation of light in polymer waveguides

Masood Tabib-Azar (Rensselaer Polytechnic Institute)  
Associate Professor of Electrical, Systems, Computer Engineering and Science  

Philip Taylor, Ph.D. (Cambridge University, England)  
Perkins Professor of Physics  
Phase transitions and equations of state for crystalline polymers; piezoelectricity and pyroelectricity

**Adjunct Faculty**

Giancarlo Capaccio, Ph.D. (University of Rome)  
Adjunct Professor

**Structural and morphological characterization of polyolefins; structural origins and control of the mechanical and thermal properties of polymers**

Edward A. Collins, Ph.D. (University of Manitoba, Canada)  
Adjunct Professor  
Colloid and surface science and rheology; characterization and morphology of polymers

Frank N. Kelley, Ph.D. (University of Akron)  
Adjunct Professor (University of Akron)  
Polymer structure-property relationships; rheology; material characterization; fracture; life prediction

Scott E. Rickert, Ph.D. (Case Western Reserve University)  
Adjunct Professor  
Conducting polymers; microdevices; polymer electrodes; polymer adsorption

John C. Weaver, Ph.D. (University of Cincinnati)  
Internal Adjunct Professor  
Coatings science and technology

James L. White, Ph.D. (University of Delaware)  
Adjunct Professor (University of Akron)  
Polymer melt-solution rheology and fluid mechanics; elastomers; polymer liquid crystals and aromatic polyamides

Theodore Williams, Ph.D. (University of Connecticut)  
Adjunct Professor (College of Wooster)  
Bioanalytical chemistry with special interest in human eye tissues and teeth

**UNDERGRADUATE PROGRAM**

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 Case School of Engineering is proud that this 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., polymer materials, chemical engineering, biopolymers, 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 B.S. 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 B.S./M.S. 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 provided with opportunities for significant research experience, capitalizing on the strength of our graduate program. Specifically, the undergraduate program provides (these educational objectives)

**Mastery of Fundamentals**

1. Ability to apply knowledge of mathematics, science, and engineering, in general, and synthetic chemistry, poly-
mer processing and structure property relationships of polymeric materials, in particular.

2. Ability to design and conduct experiments (safely and efficiently), to analyze and interpret data, and to critically evaluate hypotheses, by providing experience with synthetic chemistry, polymer processing and measurement techniques.

3. Practical ability to use analytical techniques, computers, information databases and tools for electronic communication.

Creativity

4. Ability to identify, formulate and solve engineering problems that involve materials selection or improvement.

5. Ability to design a polymeric material or process to meet desired needs.

Societal Awareness

6. Broad education necessary to understand the environmental and economic impact of engineering solutions in a global and societal context.

7. Knowledge of contemporary economic, political, scientific and industrial issues.

Leadership Skills

8. Proficiency in oral and written communication, being able to describe clearly either the results of a project or the need for a proposed one.

9. Awareness of the multidisciplinary nature of macromolecular science and engineering, including, synthetic chemistry, polymer fabrication and processing, biomaterials and biomimicry, and mechanical, fluid, electrical, optical and sensing properties of polymers.

10. Ability to function in teams.

Professionalism

11. Exposure to the issues of professional and ethical responsibility.

12. Recognition of the need for, and an ability to engage in life-long learning.

GRADUATE PROGRAM

Courses leading to the Master of Science and Doctor of Philosophy 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 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 M.D./Ph.D. 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.

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 electron microscopes are located in the basement. Electronic classrooms are being installed on the ground floor. Laboratories and instrumentation include the X-ray Laboratory, with diffraction and fluorescence equipment; the Electron Microscopy Laboratory, with transmission and scanning electron microscopes; the Molecular Spectroscopy Laboratory, with a complete range of spectroscopic equipment including FTIR, high resolution solution and solid-state NMR (including imaging), computerized laser Raman spectrophotometers, and a high speed/high sensitivity polymer analysis system; and the Biological Materials Laboratory, with facilities for characterization of certain aspects of structure, size, and shape of biological materials. The Polymer Microdevice Laboratory operates in an ultra-clean environment and uses the Langmuir-Blodgett technique of film deposition. There are also facilities for polymer characterization, optical microscopy, scanning calorimetry, and for testing and evaluating the mechanical properties of materials. The C. Richard Newpher polymer composite processing laboratory includes a high temperature Rheometrics RMS-800 dynamic mechanical spectrometer, a Bomem DA-3 FTIR with FT-Raman capabilities, a pultrusion machine, several RIM machines, a compression molding machine, a Brabender plastocorder, 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. The laboratory also has an Acoustic Emission analyzer which ultrasonically evaluates failure and fracture of polymers under stress. The EPIC Molecular Modeling Center contains high-end and low-end Silicon Graphics Computers and various software packages for molecular modeling of polymers.

RESEARCH

The research activities of the department span the entire scope of macromolecular science and polymer technology.

Synthesis

New and novel types of macromolecules including liquid crystalline polymers, self-assembled supramolecular structures, are being made in the department’s synthesis laboratories.
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 spectroscopy, thermal analysis determination of structure and morphology by x-rays and electron microscopy, and investigation of molecular weights and conformation by light scattering.

Mechanical Behavior and Analysis

Polymers 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.

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 permselective membranes for use in kidney dialysis, polymers that are stable at high temperatures for fire-retardant construction materials, high temperature polymer electrolytes for use in advanced fuel cells, and high-strength nonreactive polymers for use as biological implants.

Biopolymers

Living systems are composed primarily of macromolecules, and research is in progress on several projects of medical relevance. The department has a longstanding 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 application as biomaterials.

Macromolecular Science and Engineering

UNDERGRADUATE COURSES

EMAC C100. Co-op Seminar I for Macromolecular Science and Engineering (1)
Professional development activities for students returning from cooperative education assignments. Prerequisite: COOP 001.

EMAC C200. Co-op Seminar II for Macromolecular Science and Engineering (2)
Professional development activities for students returning from cooperative education assignments. Prerequisites: COOP 002 and EMAC C100.

EMAC 176. Polymer Materials (3)
Material properties associated with the use of synthetic and natural polymers in films, fibers, composites, rubbers, paper, food, etc. described and correlated with physical and chemical structures. Limited to freshmen.

EMAC 270. Introduction to Polymer Science and Engineering (3)
Science and engineering of large molecules. Correlation of molecular structure and properties of polymers in solution and in bulk. Control of significant structural variables in polymer synthesis. Analysis of physical methods for characterization of molecular weight, morphology, rheology, and mechanical behavior. Prerequisite: ENGR 145.

EMAC 276. Polymer Properties and Design (3)
Engineering properties of polymers and their evaluation in terms of selection and design procedures. Relation of properties to the chemical and physical structures of polymers and application conditions. Prerequisite: ENGR 145.

EMAC 303. Structure of Biological Materials (3)
This course on the structure of biological materials is designed to provide students with: (i) a fundamental understanding of the structure of biologic materials including globular and structural proteins, connective tissue and bone, from the molecular to the microscopic levels of structure (approx. 65% of course); (ii) an introduction to the basic principles and applications of instruments for imaging, identification and measurement of biologic materials (approx. 25% of course) and (iii) an introduction to methods of bioengineering, biological materials, and novel biomaterials (approx. 10% of course). Prerequisites: EBME 201 and EBME 202. Cross-listed as EBME 303.

EMAC 351. Physical Chemistry for Engineering I (3)
Principles of physical chemistry and their application to systems involving physical and chemical transformations. Gases, liquids, solids and solutions; first, second and third laws of thermodynamics; thermodynamics; physical and chemical equilibria. Prerequisite: ENGR 145 or MATH 223 or PHYS 122 or consent of instructor.

EMAC 352. Physical Chemistry for Engineering II (3)
Continuation of EMAC 351. Phase rule, electrochemistry, kinetics of chemical reactions, surface phenomena, contact catalysis, and colloids. Prerequisite: EMAC 351.

EMAC 355. Polymer Analysis Laboratory (3)
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. Prerequisite: EMAC 270 or MATH 224 or MATH 234.

EMAC 372. Polymer Processing and Testing Laboratory (3)
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. Prerequisite: EMAC 377.

EMAC 375. Introduction to Fundamentals and Practice of Rheology (3)
Elementary coverage of principles and concepts pertaining to a basic description of rheological (flow) behavior of polymeric and colloidal systems. Rheometry and rheological measurements of viscoelastic fluids. Modern theories of poly-
mer dynamics and suspension rheology. Molecular theories of polymer processing behavior. Prerequisite: ENGR 225.

EMAC 376. Polymer Engineering (3) Mechanical properties of polymer materials as related to polymer structure and composition. Visco-elastic behavior, yielding and fracture behavior including irreversible deformation processes. Prerequisite: EMAC 276 and ENGR 200.

EMAC 377. Polymer Processing (4) 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. Prerequisite: ENGR 225.


EMAC 396. Special Topics (1-18) (Credit as arranged.)

EMAC 397. Special Topics (1-18) (Credit as arranged.)

EMAC 398. Polymer Science and Engineering Project I (1-9) (Senior project) Research under the guidance of staff, culminating in thesis.

EMAC 399. Polymer Science and Engineering Project II (1-9) (Senior project) Research under the guidance of staff, culminating in thesis.

GRADUATE COURSES

EMAC 400T. Graduate Teaching I (0) 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 undergraduate classes. The individual assignments will depend on the specialization of the students. The activities include grading, recitation, lab supervision and guest lecturing. Prerequisite: Ph.D. student in macromolecular science.

EMAC 470. Macromolecular Synthesis (3) Organic chemistry of macromolecules; mechanism of polyreactions; preparation of addition, condensation, and biopolymers; the chemical reactions of polymers. Prerequisite: EMAC 270. Cross-listed as CHEM 470.

EMAC 471. Polymers in Medicine (3) Distribution of plastic implants in the body, including history and statistics; chemical and physical characteristics of biomedical polymers, including general implant requirements, reactions of the host to implants, reactions of implants to physiological conditions, physiological and biomechanical basis for soft-tissue implants; plastic materials used in medicine and surgery; frontiers in biomedical polymers (current topics directed to the design and development of new biomedical polymers). Prerequisite: Consent of instructor. Cross-listed as EBME 406.

EMAC 472. Physical Chemistry of Macromolecules (3) Major areas of physical chemistry of macromolecules; theories and experimental methods of polymer solutions, physical methods for determination of chemical structure, configuration. Prerequisite: EMAC 270.

EMAC 473. Biopolymers (3) Application of physical techniques (X-ray, electron microscopy, infrared and Raman spectroscopy, circular dichroism, etc.) to the characterization of biopolymers, including polypeptides, polysaccharides, and polynucleotides. Prerequisite: EMAC 270.


EMAC 475. Introduction to Fundamentals and Practice of Rheology (3) (See EMAC 375.)

EMAC 476. Polymer Engineering (3) Mechanical properties of polymer materials as related to polymer structure and composition. Visco-elastic behavior, yielding and fracture behavior including irreversible deformation processes. A term paper is required. Prerequisites: EMAC 276 and ECIV 110.

EMAC 477. Polymer Processing (3) Rheological, molecular, structural, engineering, and compounding factors affecting processibility and properties of polymers; principles and procedures for mixing, extrusion, melting, calendering, injection molding, and other primary processing methods. Pertinent mechanisms and theories; the application of theory to practice. Prerequisite: EMAC 376.

EMAC 479. X-ray Crystallography (3) Scattering of X-rays by crystalline and semi-crystalline solids, including polymers. Techniques of structure analysis.

EMAC 480. Polymer Morphology (3) The morphology of semicrystalline and amorphous polymers, fibers, blends, liquid-crystalline polymers, and composites; and the physical and chemical mechanisms that control morphology. Practical knowledge of optical and electron microscopy; lab experiments and a project are included. Prerequisite: EMAC 474.

EMAC 482. Fundamentals of Adhesives, Sealants, and Coatings (3) Film formation, application methods, and related fabrication factors and procedures. Relevant adhesion theories and practices, aspect of rheological treatments, and factors which affect these applications. Properties of constituent polymer materials, pigments, solvents, and other additives.

EMAC 500T. Graduate Teaching II (0) 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. Prerequisite: Ph.D. students in macromolecular science.
EMAC 570. Macromolecular Synthesis II (1-18)
A series of advanced topics in methods and mechanisms of polymerization of synthetic and biopolymers. Coordination, emulsion, ionic, and topochemical polymerization. Novel polymerization methods. Prerequisite: EMAC 470.

EMAC 600T. Graduate Teaching III (0)
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. Prerequisite: Ph.D. student in macromolecular science.

EMAC 601. Independent Study (1-18)
(Credit as arranged.)

EMAC 651. Thesis M.S. (1-18)
(Credit as arranged.)

EMAC 652. Thesis M.S. (1-18)
(Credit as arranged.)

EMAC 653. Thesis M.S. (1-18)
(Credit as arranged.)

EMAC 677. Colloquium in Macromolecular Science (0)
Lectures by invited speakers on subjects of current interest in polymer science.

EMAC 678. Characterization of Macromolecules (3)
Laboratory experience through synthesis and characterization of polymers. Methods include light scattering, viscosity, infrared, and NMR spectroscopy. Solid samples characterized by x-ray diffraction, electron and optical microscopy, thermal analysis, and physical properties. Prerequisites: EMAC 470 and EMAC 472.

EMAC 690. Special Topics in Macromolecular Science (1-18)
EMAC 691. The Scientist in the Industrial Environment (0)
A seminar focusing on how research and development management plans, justifies, and operates within the corporate structure and the areas research and development encounters in so doing finance, law, purchasing, manufacturing, marketing, and environmental control.

EMAC 701. Dissertation Ph.D. (1-18)
(Credit as arranged.)

Department of Materials Science and Engineering

312 White Building (7204)
phone: 216-368-4230; fax: 216-368-3209
Gary Michal, Chairman
http://vulcan.mse.cwru.edu/emse

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 of the Case School of Engineering 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.

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, 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. Ultimately, however, materials is an engineering discipline, bringing basic science tools to bear on the technological challenges related to materials products and their manufacture.

FACULTY
Gary M. Michal, Ph.D. (Stanford University)
LTV Steel Professor and Chair

Physical metallurgy; rapid solidification technology; application of rapid annealing to nonequilibrium precipitation reactions; transmission electron microscopy; surface science; composite materials; interfacial phenomena

James D. Cawley, Ph.D. (Case Western Reserve University)

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; ceramic matrix composites

Mark R. DeGuire, Ph.D. (Massachusetts Institute of Technology)
Associate Professor
Synthesis and properties of electrical ceramics in bulk and thin-film form, including dielectrics, ferroelectrics, semiconductors, superconductors, and ferries; high-temperature phase equilibrium; defect chemistry

Arthur H. Heuer, Ph.D., D.Sc. (University of Leeds, England)
Kyocera Distinguished Professor
Transformation toughening and plastic deformation of ceramics; phase transformations in ceramics; biological ceramics; interphase interfaces in advanced structural composites; high resolution and analytical electron microscopy

Peter Lagerlof, Ph.D. (Case Western Reserve University)
Associate Professor
Electron microscopy; high temperature mechanical properties of single crystal and polycrystal oxide and nitride ceramics; oxygen diffusion in oxide ceramics
John J. Lewandowski, Ph.D. (Carnegie-Mellon University)
Professor
Mechanical behavior of materials; micromechanisms of deformation and fracture; composite materials; ductile phase toughening of brittle materials; high-pressure deformation and fracture studies; hydrostatic extrusion

David H. Matthiesen, Ph.D. (Massachusetts Institute of Technology)
Associate Professor
Crystal growth; electronic materials; materials processing in microgravity; effect of growth conditions on the microstructures and electrical properties of semiconductors; fluid dynamics and heat, mass, and momentum transport

Joe H. Payer, Ph.D. (Ohio State University)
Professor
Electrochemistry and corrosion; reliability and life prediction; corrosion monitoring and sensors; polymer/metal adhesion

P. Pirouz, Ph.D. (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

Gerhard E. Welsch, Ph.D. (Case Western Reserve University)
Professor
Metallic materials; titanium, tungsten, steels and metal-matrix composites; mechanical and high-temperature properties; ion implantation for surface modification integral structure design

John Wallace (Massachusetts Institute of Technology)
Professor
Alexander Troiano (Harvard University)
Professor

John Angus, Ph.D. (University of Michigan)
Professor of Chemical Engineering
Roberto Ballarini, Ph.D. (Northwestern University)
Professor of Civil Engineering
Russell Wang, D.D.S. (University of Toronto)
Assistant Professor of Dentistry

Arnon Chait
Professor
NASA Glenn Research, Brookpark, Ohio
Marc Constantinno
Professor
Lawrence Livermore Laboratory, Livermore, CA
George Fischer
Professor
IVAC Technologies, Cleveland

Peter M. Hazzledine
Professor
UES, Inc., Dayton, Ohio

N. J. Henry Holroyd
Professor
Alcan International Ltd., Oxon, England

Warren H. Hunt, Jr.
Professor
Aluminum Consultants Group, Inc., Murrysville, PA

Jennie S. Hwang
Professor
H-Technologies Group, Cleveland

Terence Mitchell
Professor
Los Alamos National Laboratory, Los Alamos, NM

Gary Ruff
Professor
Internet Corp., Troy, Michigan

Roll Steinbrech
Professor
University of Dortmund, Germany

Peter F. Wieser
Professor
Wieser & Associates, Cleveland, OH

Wendell S. Williams (Retired)
Professor

UNDERGRADUATE PROGRAMS

The goal of the undergraduate program is to prepare our graduates for challenging and productive careers related to the science and engineering of materials, especially metals, ceramics, electronic materials, and composites. The primary means of accomplishing this mission is our undergraduate curriculum and associated activities, through their emphasis on

1. 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.

2. 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.

3. Graduates will be proficient in the oral, written, and electronic communication of their ideas.

4. Graduates will be proficient in the use of computer technology and computer-based information systems.

5. Graduates will be able to function effectively in groups of peers and independently.

6. Graduates will be informed of the impact of engineering on society and of the professional, ethical, safety, and environmental responsibilities that entail.

7. Graduates will regard professional development and education as processes that should continue hand-in-hand throughout their academic and professional careers.

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 students 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 EMSE 201 (3) and four of the following courses

- EMSE 202, Phase Diagrams and Phase Transformations (3)
- EMSE 203, Applied Thermodynamics (3)
- EMSE 260, Transport Phenomena (4)
- EMSE 301, Fundamentals of Materi-
### BACHELOR OF SCIENCE IN ENGINEERING DEGREE

#### MAJOR IN MATERIALS SCIENCE & ENGINEERING

<table>
<thead>
<tr>
<th>Fall Semester</th>
<th>Class/Lab/Credit Hours</th>
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<tbody>
<tr>
<td><strong>FRESHMAN YEAR</strong></td>
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<tr>
<td>CHEM 111 Principles of Chemistry for Engineers</td>
<td>(4-0-4)</td>
</tr>
<tr>
<td>ENGR 131 Elementary Computer Programming</td>
<td>(3-0-3)</td>
</tr>
<tr>
<td>ENGL 150 Expository Writing</td>
<td>(3-0-3)</td>
</tr>
<tr>
<td>MATH 121 Calculus for Science and Engineering I</td>
<td>(4-0-4)</td>
</tr>
<tr>
<td>PHYS 122 General Physics II - Electricity &amp; Magnetism</td>
<td>(3-0-4)</td>
</tr>
<tr>
<td>Humanities/Social Science Elective</td>
<td>(3-0-3)</td>
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<tr>
<td><strong>Total</strong></td>
<td>(14-4-15)</td>
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<thead>
<tr>
<th><strong>SOPHOMORE YEAR</strong></th>
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<tbody>
<tr>
<td>CHEM 301 Introduction to Physical Chemistry c</td>
<td>(3-0-3)</td>
</tr>
<tr>
<td>EMSE 102 Materials Science Seminar</td>
<td>(1-0-1)</td>
</tr>
<tr>
<td>EMSE 201 Introduction to Materials Science &amp; Engr</td>
<td>(3-0-3)</td>
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<tr>
<td>MATH 223 Calculus for Science and Engineering III</td>
<td>(3-0-3)</td>
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<tr>
<td>PHYS 122 General Physics II - Electricity &amp; Magnetism</td>
<td>(3-0-3)</td>
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<td>Humanities/Social Science Elective</td>
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<td><strong>Total</strong></td>
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<th><strong>JUNIOR YEAR</strong></th>
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<tr>
<td>EMSE 280 Materials Laboratory II</td>
<td>(0-3-2)</td>
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<tr>
<td>ENGR 210 Introduction to Circuits and Instrumentation</td>
<td>(3-2-4)</td>
</tr>
<tr>
<td>EMSE 203 Applied Thermodynamics</td>
<td>(3-0-3)</td>
</tr>
<tr>
<td>EMSE 314 Electronic, Magnetic, and Optical Properties of Materials</td>
<td>(3-0-3)</td>
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<tr>
<td>Humanities/Social Science Sequence II</td>
<td>(3-0-3)</td>
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<tr>
<td><strong>Total</strong></td>
<td>(12-5-15)</td>
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<table>
<thead>
<tr>
<th><strong>SENIOR YEAR</strong></th>
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</thead>
<tbody>
<tr>
<td>EMSE 301 Fundamentals of Materials Processing</td>
<td>(3-0-3)</td>
</tr>
<tr>
<td>EMSE 302 Fundamentals of Materials Processing Lab</td>
<td>(0-3-1)</td>
</tr>
<tr>
<td>EMSE 310 Applications of Diffraction Principles</td>
<td>(0-2-1)</td>
</tr>
<tr>
<td>EMSE 312 Diffraction Principles</td>
<td>(3-0-3)</td>
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<tr>
<td>EMSE 398 Senior Project in Materials I</td>
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<td>Humanities/Social Science Elective</td>
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<tr>
<td>Technical elective</td>
<td>(3-0-3)</td>
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<td><strong>Total</strong></td>
<td>(12-7-15)</td>
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</table>

### Hours required for graduation: 128

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Prof. Mark DeGuire (506 White; x-4221) is the academic advisor for this program and will assist students with their course selection.

Cooperative Education in Materials Science and Engineering

The Cooperative Education program at CWRU began in the Materials Science and Engineering Department and the department’s faculty continue to strongly support student participation. Over the past ten years approximately three-quarters of the students graduating with an M.S.E. degree have completed at least one cooperative education assignment. Most students complete the recommended two assignments. 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.

The department offers two academic courses, EMSE C100 and EMSE C200, that may be taken for credit upon return from the first and second experience respectively.

Five-Year Combined B.S./M.S. Program

This program offers outstanding undergraduate students the opportunity to obtain an M.S. degree, with a thesis, in one additional year of study beyond the B.S. degree. (Normally, it takes 2 years beyond the B.S. to earn an M.S. degree.) In this program, an undergraduate student can take up to nine credit hours that si-

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 Number</th>
<th>Course Title</th>
<th>Fall</th>
<th>Spring</th>
<th>Annual</th>
<th>Bi-Annual</th>
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<tr>
<td>ECIV 210</td>
<td>Strength of Materials</td>
<td>X</td>
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<td>ECIV 410</td>
<td>Advanced Strength of Materials</td>
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<td>X</td>
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<td>ECIV 420</td>
<td>Finite Element Structural Analysis</td>
<td>X</td>
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<td>X</td>
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<tr>
<td>EEAP 245</td>
<td>Circuits, Signals and Systems I</td>
<td>X</td>
<td></td>
<td>X</td>
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<tr>
<td>EEAP 246</td>
<td>Circuits, Signals and Systems II</td>
<td>X</td>
<td></td>
<td>X</td>
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<tr>
<td>EEAP 309</td>
<td>Electromagnetic Fields I</td>
<td>X</td>
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<tr>
<td>EEAP 321</td>
<td>Semiconductor Electronic Devices</td>
<td>X</td>
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<tr>
<td>EMAC 270</td>
<td>Introduction to Polymer Science</td>
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<tr>
<td>EMSE 307</td>
<td>Foundry Metallurgy</td>
<td>X</td>
<td></td>
<td>X</td>
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<tr>
<td>EMSE 316</td>
<td>Applications of Ceramic Materials</td>
<td>X</td>
<td></td>
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<tr>
<td>EMSE 360</td>
<td>Transport Phenomena</td>
<td>X</td>
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<tr>
<td>EMSE 401</td>
<td>Transformations in Materials</td>
<td>X</td>
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<td>EMSE 403</td>
<td>Modern Ceramic Processing</td>
<td>X</td>
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<td>EMSE 404</td>
<td>Diffusion Processes in Solids and Liquids</td>
<td>X</td>
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<td>EMSE 405</td>
<td>Dielectric, Optical, &amp; Magnetic Properties of Materials</td>
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<td>EMSE 407</td>
<td>Solidification of Materials</td>
<td>X</td>
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<tr>
<td>EMSE 409</td>
<td>Deformation Processing of Metals</td>
<td>X</td>
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<tr>
<td>EMSE 410</td>
<td>Numerical Modeling of Materials Forming Processes</td>
<td>X</td>
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<tr>
<td>EMSE 411</td>
<td>Environmental Effects on Materials Behavior</td>
<td>X</td>
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<tr>
<td>EMSE 417</td>
<td>Properties of Materials at High Temperatures</td>
<td>X</td>
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<td>X</td>
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<tr>
<td>EMSE 418</td>
<td>Oxidation of Materials</td>
<td>X</td>
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<tr>
<td>EMSE 419</td>
<td>Phase Equilibria &amp; Microstructures of Materials</td>
<td>X</td>
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<tr>
<td>EMSE 420</td>
<td>Powder Processing</td>
<td>X</td>
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<td>EMSE 421</td>
<td>Fracture of Materials</td>
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<td>EMSE 426</td>
<td>Semiconductor Thin Film Science &amp; Technology</td>
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<tr>
<td>EMSE 427</td>
<td>Dislocations in Solids</td>
<td>X</td>
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<tr>
<td>EMSE 429</td>
<td>Crystallography &amp; Crystal Chemistry</td>
<td>X</td>
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<td>X</td>
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<tr>
<td>PHYS 331</td>
<td>Introduction to Quantum Mechanics 1</td>
<td>X</td>
<td></td>
<td>X</td>
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<tr>
<td>PHYS 315</td>
<td>Introduction to Solid State Physics</td>
<td>X</td>
<td></td>
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<tr>
<td>STAT 312</td>
<td>Statistics for Engineering and Science</td>
<td>X</td>
<td></td>
<td>X</td>
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<tr>
<td>or STAT 313</td>
<td>Statistics for Experimenters</td>
<td>X</td>
<td></td>
<td>X</td>
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</tr>
</tbody>
</table>

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multaneously satisfy undergraduate and graduate requirements. Typically, students in this program start their research leading to the M.S. 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 B.S. degree is awarded at the completion of the senior year.

Application for admission to the five year B.S./M.S. program is made after completion of five semesters of course work. Minimum requirements are a 3.2 grade point average and the recommendation of the department. Interested students should contact Professor Lagerlof.

**GRADUATE PROGRAMS**

The department offers programs leading to the Master of Science and Doctor of Philosophy degrees with research specialties in metallurgy, ceramics, electronic materials, and materials science. A broad range of studies of the theory, properties, and engineering behavior of materials is encompassed in the academic courses and research within the department, with primary areas of specialization in materials processing, mechanical properties, surface and microstructural characterization, environmental effects, and electronic materials.

**M.S. DEGREE REQUIREMENTS**

The M.S. 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 often followed by part-time graduate students.

Plan A requires successful completion of 6 courses (18 credit hours) and at least 9 credit hours of M.S. research project (EMSE 651). Plan B requires the successful completion of eight courses (24 credit hours) as well as 3 credit hours of a Special Projects course (EMSE 649). 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 3xx level can be included; all other courses must be at a higher level. Transfer of credit from another university is limited to six credit hours of graduate level courses (with grade B or better) taken in excess of degree requirements at the other university. A 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 G.P.A. 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 3 faculty members of the department.

**PH.D. DEGREE REQUIREMENTS**

Immediately upon entering the Materials Science and Engineering Department, the Ph.D. candidate must fill out and submit the first part of the “Ph.D. Student Permanent Record” form; register for 2 classes during the first semester, and register for EMSE 701 Dissertation Research (usually 1 to 3 credit hours) during the first semester. Note that registration for EMSE 701 is not permitted before the form is turned in.

Candidates for a Ph.D. 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 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 M.S. degree (12 months for students with an M.S. 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 Ph.D. Student Permanent Record” form.

Upon successful completion of all requirements and research, the Ph.D. candidate must submit a written dissertation as evidence for his/her ability to conduct independent research at an advanced level. The Ph.D. candidate must pass a final oral exam in defense of the dissertation. The Dissertation Committee must consist of 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.

(1) Ph.D. Program of Study (Course Requirements)

A Ph.D. 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 Ph.D. program is 5 years, starting with the first semester of EMSE 701 registration.

The minimum course requirement for a Ph.D. degree is 12 courses (36 credit hours) beyond the B.S. 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 2 courses must satisfy the Basic Science Requirement for the department as outlined below. In the case of a student entering with an M.S. degree from another discipline, additional courses may be required as decided by the department. A G.P.A. of 3.0 is required.
Breadth Requirement.
A broad knowledge of the field of materials science and engineering includes a minimum level of understanding of the following six areas
a. Mechanical Behavior
b. Structure
c. Physical Properties
d. Processing
e. Thermodynamics and Kinetics
f. Phase Transformations
The Breadth Requirement for the Ph.D. can be fulfilled by taking a total of 6 courses (18 credit hours); these 6 courses must include at least one course from areas 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 Ph.D. 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 Program of Study, a list of the courses the student will take to fulfill the Ph.D. 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 Advisory Committee (excluding the non-departmental member) and the chairman of the department and submitted to the dean of graduate studies within one semester of passing the General Exam.

(2) Ph.D. General Exam
The written General Exam is offered twice a year, typically in January and in June, provided at least three students are registered to take the exam. The Exam is comprehensive and consists of two parts
1. Thermodynamics, Kinetics and 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 and Kinetics
Section 2 Processing

Part 2 (afternoon)
Section 3 Structure
Section 4 Properties, Performance, and 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 revised grading criteria is as follows—6 out of 10 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 try that exam a second time.

(3) Thesis Proposal Exam
The Thesis Proposal Exam tests the more specific knowledge of the Ph.D. 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, an 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 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.

Materials Processing
Ceramic and metal powder synthesis and processing, computer-aided manufacturing of laminated materials, metals casting, crystal growth, thin film deposition, deformation processing of metals.

Environmental Effects

Surfaces and Interfaces
Free surfaces, grain boundaries, metal/ceramic, polymer/metal composite interfaces. Major facilities for transmission electron microscopy, scanning electron microscopy, and surface spectrosopies.

Electronic, Magnetic and Optical Materials
Electronic materials—silicon, germanium, gallium arsenide, silicon carbide; gallium nitride; thin film dielectric, optical,
and magnetic ceramics; synthesis and characterization of multi-component ceramics, including barium titanate and materials for sensors, catalysts, and fuel cells.

**FACILITIES**

**Materials Processing**

The department’s processing laboratories include facilities which permit materials processing from the liquid state (casting) as well as in the solid state (powder processing). The department has its own foundry that houses mold making capabilities (green and bonded sand, permanent mold, and investment casting), induction melting furnaces of various capabilities for air melting of up to 1500 pounds of steel, a dual chamber vacuum induction melting unit with a capacity of up to 30 pounds of refractory metals, a 350 ton squeeze casting press, and state-of-the-art testing and characterization equipment. The Crystal Growth Laboratory has facilities for production of high purity electronic single crystals using a variety of furnaces with the additional capability of solidifying under large magnetic fields. In addition, a CVD and MOCVD reactor has been set up to do research on the growth of SiC and GaN on Si, sapphire, and other substrates. Secondary processing and working can be accomplished using a high-speed hot and cold rolling mill, swaging units, and a state-of-the-art hydrostatic extrusion press. The department has heat treatment capabilities including numerous box, tube, and vacuum furnaces. For the processing of powder metals or ceramics the department possesses a 300,000 pound press, a vacuum hot press (with capabilities of up to 7 ksi and 2300 C), a hot isostatic press (2000 C and 30 ksi), a 60 ksi wet base isostatic press, and glove boxes. Sintering can be performed in a variety of controlled atmospheres while a microcomputer-controlled precision dilometer is available for sintering studies. Several ball mills, shaker mills, and a laboratory model attritor are also available for powder processing. In addition, facilities are available for sol-gel processing, glass melting, diamond machining; a spray dryer is available for powder granulation.

**Mechanical Testing Facility**

The 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 guidance of a full-time engineer. The facility contains one of the few laboratories in the United States 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:** This unit enables tension or compression testing to be conducted under conditions of high hydrostatic pressure. The 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.

- **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.

- **High Pressure/High Temperature Deformation Apparatus:** In addition to the units described above, testing at temperatures up to 1200 C and 1.0 GPa are possible on a recently designed and constructed apparatus which permits conventional hot isostatic pressing (i.e. HIP) as well as triaxial compaction. Experiments can be conducted under load, strain, or stroke control on this servo-hydraulically controlled machine.

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.

- **Universal Testing Machines:** Four 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:** Five 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 Testing:** A Nikon Model QM High-Temperature Microhardness Tester has been instrumented to provide load vs. indentation time information on specimens tested at temperatures ranging from -196 C to 1600 C under vacuum and inert gas conditions.
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 electrobalances for thermogravimetric studies and polymer/metal adhesion test fixtures.

Transmission Electron Microscope Laboratory
Three microscopes are available that provide virtually all transmission electron optical techniques needed for materials research and involve an installed capacity worth $2,000,000. The microscopes available are i) a JEOL 4000 EX 400 keV high resolution machine (point-to-point resolution of 0.19 nm) equipped with a GATAN TV camera (and requisite software for rigorous image interpretation); ii) a Philips CM20 200 keV analytical electron microscope equipped with a Tracor Northern high purity Ge energy dispersive spectroscopy (EDS) detector, a GATAN parallel electron energy loss spectrometer (PEELS) (the combination permitting microanalysis with -10 nm spatial resolution for all elements between boron and uranium), and a GATAN image intensifier TV system; and iii) a JEOL 200CX 200 keV microscope, with point-to-point resolution of 0.35 nm, for general purpose microstructural analysis and for teaching. Conventional TEM techniques, such as electron diffraction, bright- and dark-field imaging, and weak-beam dark-field (WBDF), are used routinely to analyze line defects (dislocations) and planar defects (for example, stacking faults) in materials. Specialized techniques, such as convergent beam electron diffraction (CBED) can be used to obtain crystallographic information and determine orientation relationships between different grains in polycrystalline materials, or between different phases in composite materials. The chemistry of microscopic regions (regions between dissimilar phases, or interfacial phases formed by reactions between the matrix and reinforcements) can be investigated using analytical TEM. Specimen preparation facilities for transmission electron microscopy consist of dimples, two ion-thinners with four ports, and two electropolishing units for TEM specimen thinning.

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 660 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 5400 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 interfacial regions, 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 turbomolecular 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.

Electronic Properties Laboratory

The Electronic Characterization Laboratory is equipped for research studies and characterization of electrical properties of semiconductors and other electronic materials. The facility includes a deep level transient Spectroscopy System (DLTS) for the characterization of deep level impurities in semi-conductors, conductance and capacitance measurement techniques, a Hall effect system, and a scanning-tunneling microscope.

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 thermoelectrically 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.

A Deformation Processing Laboratory has recently been commissioned that contains two dual hydraulic MTS presses. The first press is designed to evaluate the stretching and drawing properties of materials in sheet form. Its maximum punch and hold down forces are 150,000 each. Its maximum punch velocity is 11.8 inch/sec. The second press is designed to evaluate the plastic flow behavior of materials in an environment that 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.

A Computational Materials Processing Laboratory has recently been established. The core of the facilities is a Silicon Graphics Origin 2000 which has high speed networking with an array of Octane workstations. A host of software packages are available as tools for the simulation and design of materials processing activities that range from crystal growth to powder consolidation to plastic deformation and also maintains a computer lab expressly for student use, including IBM-compatible and Macintosh computers, laser printers, DEC-net terminals, and a VAX-station 2000 with a large screen high resolution display.

Materials Science and Engineering (EMSE)

UNDERGRADUATE COURSES

EMSE C100. Co-Op Seminar I for Materials Science and Engineering (1)
Professional development activities for students returning from cooperative education assignments. Prerequisite: COOP 001.

EMSE C200. Co-Op Seminar II for Materials Science and Engineering (2)
Professional development activities for students returning from cooperative education assignments. Prerequisites: COOP 002 and EMSE C100.

EMSE 102. Materials Seminar (1)
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. Prerequisite or corequisite: EMSE 201.

EMSE 103. Materials in Sports (3)
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 201. Introduction to Materials Science and Engineering (3)
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 samples and problems in materials selection and of design of materials for particular performance requirements. Prerequisites: ENGR 145 and PHYS 121 and MATH 121.

EMSE 202. Phase Diagrams and Transformations (3)

EMSE 203. Applied Thermodynamics (3)
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. Prerequisite: CHEM 301.

EMSE 270. Materials Laboratory I (2)
Introduction to processing, microstructure and property relationships of metal alloys, ceramics and glass. Solidification of a binary alloy and metallurgy 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)
Synthesis and processing. Experiments designed to demonstrate and evaluate different ways to process different types of materials. Solidification of melts. Crystallization kinetics, processing using electrochemistry, oxidation and oxidized microstructures. Laboratory teams are selected for all experiments.
EMSE 290. Materials Laboratory III (2)
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. Prerequisite: EMSE 201.

EMSE 301. Fundamentals of Materials Processing (3)
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. Prerequisites: EMSE 201 and EMSE 202 and EMSE 203.

EMSE 302. Fundamentals of Materials Processing Laboratory (1)
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)

EMSE 307. Foundry Metallurgy (3)
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. Prerequisites: EMSE 202 and EMSE 203 and ENGR 225.

EMSE 310. Applications of Diffraction Principles (1)
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. Prerequisite: EMSE 312 or consent of instructor.

EMSE 312. Diffraction Principles (3)

EMSE 313. Engineering Applications of Materials (3)
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. Prerequisites: EMSE 202 and ENGR 200.

EMSE 314. Electrical, Magnetic, and Optical Properties of Materials (3)

EMSE 316. Applications of Ceramic Materials (3)
Engineering applications of ceramics. Survey of processing techniques. Thermal and mechanical properties; strength, thermal conductivity, thermal expansion, stress corrosion. Electrical properties: electrical conductivity, dielectric properties, piezo- and ferro-electricity. Glass manufacture and structure-property relationships. Prerequisite: EMSE 201.

EMSE 360. Transport Phenomena in Materials Science (3)
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. Prerequisites: ENGR 225 and MATH 224 or equivalent.

EMSE 396. Special Project or Thesis (1-18)
Special research projects or undergraduate thesis in selected material areas.

EMSE 397. Special Project or Thesis (1-18)
Special research projects or undergraduate thesis in selected material areas.

EMSE 398. Senior Project in Materials I (1)
Independent research project. Projects selected from those suggested by faculty; usually entail original research.

EMSE 399. Senior Project in Materials II (2)
Independent research project. Projects selected from those suggested by faculty; usually entail original research.

GRADUATE COURSES

EMSE 400T. Graduate Teaching I (0)
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. Prerequisite: Ph.D. student in materials science and engineering.

EMSE 401. Transformations in Materials (3)
Review of solution thermodynamics, surfaces and interfaces, recrystallization, austenite decomposition, the martensite transformation and heat treatment of metals. Prerequisite: EMSE 202.
EMSE 403. Modern Ceramic Processing (3)
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. Prerequisite: EMSE 316 (or concur).

EMSE 404. Diffusion Processes in Solids and Liquids (3)

EMSE 405. Dielectric, Optical and Magnetic Properties of Materials (3)
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. Prerequisite: Consent of instructor.

EMSE 407. Solidification of Materials (3)
Fundamental science of solid-liquid phase transformations and the application of these basics to the solidification processing of materials. Includes nucleation and growth, heat and solute transport, rapid solidification, and an overview of solidification processing techniques. Emphasis is on the effect of solidification and solidification processing on resulting microstructure. Prerequisite: EMSE 301.

EMSE 409. Deformation Processing of Metals (3)
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. Prerequisite: EMSE 303.

EMSE 410. Numerical Modeling of Materials Forming Processes (3)
Numerical modeling of large plastic deformation during materials processing from primary shapes, i.e., bars, sheets, etc., into engineering components. Emphasis on fundamental concepts and on the use of finite element software to simulate metal forming processes including sheet forming, forging, extrusion, and rolling. Prerequisites: EMSE 301 and EMSE 303 or consent of instructor.

EMSE 411. Environmental Effects on Materials Behavior (3)
Aqueous corrosion; principles and fundamental concepts; recognition of modes; monitoring and testing; methods to control and prediction. Applications of engineering problems: design, and economics. Mixed potential theory; principles of protection, hydrogen effects, and behavior in metal systems.

EMSE 412. Materials Science and Engineering Seminar (0)
Prerequisite: Consent of instructor.

EMSE 413. Fundamentals of Materials Engineering and Science (3)
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 414. Properties of Materials at High Temperatures (3)

EMSE 415. Dislocations in Solids (3)
Experimental techniques; thermodynamics of oxidation reactions; defects and diffusion in oxides; oxidation rate laws. Effects of alloying, surface treatment and stress on oxidation. High-temperature corrosion.

EMSE 416. Phase Equilibria and Microstructures of Materials (3)
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 420. Powder Processing (3)
Fundamental science and technology of modern metal powder processing and fabrication techniques. Includes powder synthesis, characterization, consolidation mechanisms and practices, effects of atmosphere, diffusional homogenization processing, and applications of powder metallurgy.

EMSE 421. Fracture of Materials (3)
Micromechanisms of deformation and fracture of engineering materials. Brittle fracture and ductile fracture mechanisms in relation to microstructure. Strength, toughness, and test techniques. Review of predictive models. Prerequisites: ENGR 200 and EMSE 303 or EMSE 427; or consent.

EMSE 426. Semiconductor Thin Film Science and Technology (3)

EMSE 427. Dislocations in Solids (3)
Elasticity and dislocation theory; dislocation slip systems; links and dislocation motion; jogs and dislocation interactions, dislocation dissociation and stacking faults; dislocation multiplication, applications to yield phenomena, work hardening and other mechanical properties. Prerequisite: Consent of instructor.

EMSE 429. Crystallography and Crystal Chemistry (3)
Crystal symmetries, point groups, translocation symmetries, space lattices, crystal classes, space groups, crystal chemistry, crystal structures and physical properties. Prerequisite: Consent of instructor.

EMSE 500T. Graduate Teaching II (0)
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 student 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 concur-
rently. Prerequisite: Ph.D. student in materials science and engineering.

**EMSE 502. Mechanical Properties of Metals and Composites (3)**
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. Prerequisites: ENGR 200 and EMSE 503 or EMSE 421; or consent.

**EMSE 504. Thermodynamics of Solids (3)**

**EMSE 511. Failure Analysis (3)**
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. Prerequisites: EMSE 201 and EMSE 303 and ENGR 200; or consent.

**EMSE 512. Advanced Electron Microscopy Techniques (3)**
Theory and laboratory experiments to learn advanced techniques in electron microscopy: high resolution electron microscopy (HREM), convergent beam electron microscopy (CBED), and chemical analysis using energy dispersive x-ray spectroscopy (EDXS) and electron energy loss spectroscopy (EELS). Prerequisites: EMSE 515 and EMSE 516.

**EMSE 514. Defects in Semiconductors (3)**
Presentation of the main crystallographic defects in semiconductors; point defects (e.g., vacancies, interstitials, substitutional and interstitial impurities, line 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 methods including TEM, EBIC, CL, DLTS, etc. Prerequisite: EMSE 426.

**EMSE 515. Analytical Methods in Materials Science: Lecture (3)**
The common advanced analytical methods used in materials science are TEM, SEM, SAM, SIMS, and ESCA. These acronyms will be defined and the theory and application of each will be explained.

**EMSE 516. Analytical Methods in Materials Science (3)**
A laboratory course designed to achieve proficiency in TEM, SEM, SIMS, SAM, and ESCA.

**EMSE 600T. Graduate Teaching III (0)**
To provide teaching experience for all Ph.D.-bound graduate students. This will include preparing exam/quiz/home-work, 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. Prerequisite: Ph.D. student in materials science and engineering.

**EMSE 601. Independent Study (1-18)**

**EMSE 633. Special Topics (1-18)**

**EMSE 649. Special Projects (1-18)**

**EMSE 651. Thesis M.S. (1-18)**
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)**
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.

**EMSE 702. Appointed Dissertation Fellowship (9)**

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**Department of Mechanical and Aerospace Engineering**

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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, Bachelor of Science in Engineering with a major in fluid and thermal engineering sciences and Bachelor of Science in Engineering with a major in mechanical engineering. All three curricula are based on four-year programs of preparation for productive engineering careers or further academic training. All three are accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology (ABET).

The mission of the Department of Mechanical and Aerospace Engineering is to challenge students to reach towards positions of leadership in the professions of aerospace engineering, fluid and thermal engineering science, and mechanical engineering. The undergraduate program emphasizes fundamental engineering science, analysis and design 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 lead by concerned educators and researchers.
The department’s research applies the principles of mechanics, thermodynamics, heat and mass transfer, and engineering design to problems in aeronautics, astronautics, biomechanics and orthopaedic engineering, biomimetics and biological inspired robotics, energy, environment, machinery dynamics, mechanics of materials, and tribology. Many of these activities involve strong collaborations with the departments of biology, electrical engineering and computer science, and orthopaedics of the School of Medicine. The department programs provide

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.

FACULTY

Joseph M. Prahl, Ph.D. (Harvard University), P.E.
Professor, Chair
Fluid dynamics; heat transfer; tribology.
Maurice L. Adams, Ph.D. (University of Pittsburgh)
Professor
Dynamics of rotating machinery; nonlinear dynamics; vibration; tribology; turbomachinery.
J. Iwan D. Alexander, Ph.D. (Washington State University)
Associate Professor
Fluid dynamics; heat and mass transfer; crystal growth & solidification, capillary phenomena, microgravity convection, vibrational convection.
Rafat R. Ansari, Ph.D. (University of Waterloo, Canada)
Research Associate Professor
Light Scattering, biomedical applications, and microgravity fluids
Dwight T. Davy, Ph.D. (University of Iowa), P.E.
Professor
Musculo-skeletal biomechanics; applied mechanics.

Alexander Dybbs, Ph.D. (University of Pennsylvania)
Professor
Experimental fluid mechanics; heat transfer; bio-fluid mechanics; computer data acquisition.

Isaac Greber, Ph.D. (Massachusetts Institute of Technology)
Professor
Fluid dynamics; molecular dynamics and kinetic theory; biological fluid mechanics; acoustics.
Jaikrishnan R. Kadambi, Ph.D. (University of Pittsburgh)
Professor
Experimental fluid mechanics; multiphase flows; laser diagnostics; biological fluid mechanics; turbomachinery; heat transfer.

Yasuhiro Kamotani, Ph.D. (Case Western Reserve University)
Professor
Experimental fluid dynamics; heat transfer; microgravity fluid mechanics.

Thomas P. Kicher, Ph.D. (Case Institute of Technology)
Arthur P. Armington Professor of Engineering
Elastic stability; plates and shells; composite materials; design; failure analysis.

Joseph M. Mansour, Ph.D. (Rensselaer Polytechnic Institute)
Professor
Biomechanics; applied mechanics.

Simon Ostrich, Ph.D. (Brown University)
Wilbert J. Austin Distinguished Professor of Engineering and Director of the National Center for Microgravity Research on Fluids and Combustion
Fluid mechanics; heat transfer; micro-gravity phenomena; materials processing; physicochemical hydrodynamics.

Vedha Nayagam, Ph.D. (University of Kentucky)
Research Associate Professor
Low gravity combustion and fluid physics.

Vikas Prakash, Ph.D. (Brown University)
Associate Professor
Experimental and computational solid mechanics; dynamic deformation and failure; time resolved high-speed friction; ultra-high speed manufacturing processes; ballistic penetration of superalloys; engine fan-blade containment.

Roger D. Quinn, Ph.D. (Virginia Polytechnic Institute & State University)
Professor
Biologically inspired robotics; agile manufacturing systems; structural dynamics, vibration and control.

Clare M. Rimmac, Ph.D. (Lehigh University)
Associate Professor
Biomechanics; fatigue and fracture mechanics.

Chih-Jen Sung, Ph.D. (Princeton University)
Assistant Professor
Combustion; propulsion; laser diagnostics.
BACHELOR OF SCIENCE IN ENGINEERING DEGREE
MAJOR IN AEROSPACE ENGINEERING

<table>
<thead>
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<th>Spring Semester</th>
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a Engineering Core Course
b Selected students may be invited to take PHYS 123-124, General Physics I, II-Honors
In place of PHYS 121-122, General Physics I, II (4).
May be taken fall or spring semester.
### Bachelor of Science in Engineering Degree

#### Major in Fluid and Thermal Engineering Sciences

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<td>ENGR 398N Professional Communication&lt;sup&gt;c&lt;/sup&gt;</td>
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Hours required for graduation: 129
### BACHELOR OF SCIENCE IN ENGINEERING DEGREE

#### MAJOR IN MECHANICAL ENGINEERING

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| **SOPHOMORE**                                     |                        |
| Humanities or Social Science Sequence I           | (3-0-3)                |
| ENGR 200 Introduction to Mechanics a, c           | (3-0-3)                |
| EMAE 172 Mechanical Manufacturing or Sci Elective c | (3-3-4)                |
| MATH 223 Calculus for Science & Engineering III  | (3-0-3)                |
| EMAE 250 Computers in Mechanical Engineering c    | (2-2-3)                |
| Total                                             | (14-5-16)              |

| **JUNIOR**                                        |                        |
| Humanities or Social Science Sequence III         | (3-0-3)                |
| EMAE 325 Fluid and Thermal Engineering II         | (4-0-4)                |
| EMAE 282 Mechanical Engineering Lab I             | (1-3-2)                |
| ECIV 310 Strength of Materials c                   | (3-0-3)                |
| EMAE 350 Mechanical Engineering Analysis          | (3-0-3)                |
| Total                                             | (14-3-15)              |

| **SENIOR**                                        |                        |
| Humanities or Social Science Elective             | (3-0-3)                |
| ESCI 212 Systems and Control a                    | (3-0-3)                |
| ESCI 214 Systems and Control Lab                  | (0-2-1)                |
| EMAE 355 Design of Fluid and Thermal Elements c   | (3-0-3)                |
| EMAE 360 Engineering Design                       | (3-0-3)                |
| ESCI 352 Engr Econ and Dec Making                 | (3-0-3)                |
| Total                                             | (15-2-16)              |

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| **SOPHOMORE**                                     |                        |
| Humanities or Social Science Sequence II          | (3-0-3)                |
| EMAE 181 Dynamics c                               | (3-0-3)                |
| MATH 224 Elementary Differential Equations        | (3-0-3)                |
| ENGR 225 Introduction to Fluid & Thermal Engr a   | (4-0-4)                |
| Science Elective or EMAE 172 c                    | (3-0-3)                |
| Total                                             | (16-0-16)              |

| **JUNIOR**                                        |                        |
| Humanities or Social Science Elective             | (3-0-3)                |
| ENGR 210 Electronic Circuits a                    | (3-2-4)                |
| EMAE 271 Kinematic Analysis and Synthesis         | (2-2-3)                |
| EMAE 283 Mechanical Engineering Laboratory II     | (1-3-2)                |
| EMAE 370 Design of Mechanical Elements            | (3-0-3)                |
| Technical Elective c                              | (3-0-3)                |
| Total                                             | (15-7-18)              |

| **SENIOR**                                        |                        |
| Humanities or Social Science Elective             | (3-0-3)                |
| Technical Elective                                | (3-0-3)                |
| EMAE 398 Senior Project a,c                       | (1-6-3)                |
| ENGL 398N Professional Communication c            | (3-0-3)                |
| Technical Elective c                              | (3-0-3)                |
| Total                                             | (13-6-15)              |

Hours required for graduation: 129

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a Engineering Core Course

b Selected students may be invited to take PHYS 123-124, General Physics I, II-Honors (3) in place of PHYS 121-122, General Physics I, II (4).

c May be taken fall or spring semester.
APPROVED TECHNICAL ELECTIVES

EMAE The following list of technical electives has been established for both the Fluid and Thermal Engineering Sciences Program and the Mechanical Engineering Program. The courses must be selected to provide a minimum of two additional design credits for each program. Once the design credit minimum is met, the technical electives can be selected from the list of Approved Technical Electives for students of the Department and must be approved by the student’s adviser to insure a coherent program of courses to meet the student’s professional objectives.

DESIGN ELECTIVES

Fluid and Thermal Engineering Science Program
EMAE 172 Mechanical Manufacturing
EMAE 271 Kinematic Analysis & Synthesis
EMAE 370 Design of Mechanical Elements

Mechanical Engineering Program
EMAE 152 Thermodynamics II
EMAE 356 Aerospace Design
EMAE 359 Aero/Gas Dynamics

All Programs
EMAE 372 Relation of Materials to Design
EMAE 376 Aerostructures
EMAE 378 Mechanics of Machinery I
EMAE 387/487 Vibration Problems in Engr.
EMAE 381 Flight and Orbital Mechanics
EMAE 382 Propulsion

TECHNICAL ELECTIVES

Aerospace
EMAE 356 Aerospace Design
EMAE 359 Aero/Gas Dynamics
EMAE 376 Aerostructures
EMAE 381 Flight and Orbital Mechanics
EMAE 382 Propulsion

Biomechanics
EBME 201 Physiology-Biophysics I
EBME 202 Physiology-Biophysics II
EBME 306 Introduction to Biomedical Materials
EBME 309 Modeling of Biomedical Systems
EBME 310 Principles of Biomedical Instrumentation
EMAE 402 Muscles, Biomechanics and Control of Movement
EMAE 415 Introduction to Musculo-skeletal Biomechanics

Digital Electronics and Control
EEAP 245 Electronic Circuits
EEAP 246 Circuits, Signals & Systems II
ESCI 304 Control Engr with Lab
ECES 281 Logic Design and Computer Organization
EEAP 382 Microprocessor-based Design

Dynamics and Vibration
EMAE 378/478 Mechanics of Machinery I
EMAE 387/487 Vibration Problems in Engineering
EMAE 479 Mechanics of Machinery II
EMAE 481 Advanced Dynamics I
EMAE 484 Mechanisms and Motion Synthesis

Fluid and Thermal Engineering
EMAE 152 Thermodynamics II
EMAE 359 Aero/Gas Dynamics
EMAE 453 Advanced Fluid Dynamics I
EMAE 460 Theory & Design of Fluid Power Machinery

Fluid and Thermal Sciences
EMAE 453 Advanced Fluid Dynamics I
EMAE 454 Advanced Fluid Dynamics II
EMAE 455 Advanced Thermodynamics
EMAE 457 Combustion

Mathematics and Statistics
MATH 323 Advanced Calculus
MATH 324 Introduction to Complex Analysis
MATH 331 Computational Linear Algebra
STAT 312 Statistics for Engr & Sci.
STAT 333 Uncertainty in Engr & Sci

Materials
EMSE 301 Fundamentals of Materials Processing
EMSE 303 Mechanical Behavior of Materials
EMSE 307 Foundry Metallurgy
EMSE 313 Engineering Applications of Materials
EMAE 473 Mechanical Behavior of Composite Materials
EMAE 480 Fatigue of Materials

Mechanical Design
EMAE 372 Relations of Materials to Design
EMAE 471 Design Methods
EMAE 472 Computers, Optimization and Design

Mechanical Manufacturing
EMAE 290 Computer Aided Manufacturing
EMAE 390 Advanced Manufacturing
ESCI 350 Production and Operational Systems
ESCI 360 Manufacturing and Integrated Systems
OPMT 350 Operations Management
OPMT 352 Design of Production Systems
OPRE 201 Introduction to Operations Research I

Solid Mechanics
ECIV 220 Structural Analysis I
ECIV 221 Structural Design I
EMAE 372 Relation of Materials to Design
EMAE 376 Aerostructures
ECIV 410 Advanced Strength of Materials
EMAE 473 Mechanical Behavior of Composite Material
EMAE 480 Fatigue of Materials
able 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.

**FLUID AND THERMAL ENGINEERING SCIENCES**

The fluid and thermal engineering sciences are significant not only for modern technology but also for many phenomena related to the association of man with his environment. The importance of this field to aeronautics and astronautics is readily apparent, but it is also of critical importance to many industrial manufacturing processes, power generation and lubrication.

Physicochemical transport phenomena is a subject that has developed at the interface between physics and chemistry, and is concerned with problems raised by the effects of fluid motions on chemical and physicochemical transformations and by the effect of physicochemical factors on the motion of fluids. This subject has considerable significance to microgravity fluids and combustion processes that will be critical to sustaining life for manned space exploration and to many important industrial processes on earth such as materials processing; electrochemical processes; energy storage; pollution; oil recovery; and biological, physiological, and geological phenomena.

The educational program in fluid and thermal engineering sciences takes cognizance of a broad scope of applications and is fundamental and comprehensive. The interdisciplinary nature of the field is continually stressed, and the subject matter is made relevant to current research and development.

**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.

**5-YEAR PROGRAMS OF STUDY**

The department curriculum offers a five-year cooperative (co-op) education program and five-year combined bachelors-masters programs. 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 to participate in the middle of the sophomore year and nominally 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.

Alternative to the co-op 5 year program, is the 5 year combined bachelors/masters program in which a student can, by double counting 9 credit hours, complete a bachelor of science degree in any one of the department’s three degree programs as well as a master of science degree in mechanical and aerospace engineering with a thesis by the end of the fifth year. 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.

**GRADUATE PROGRAMS**

**Master of Science Program.**

Each M.S. candidate must complete a minimum of 27 hours of graduate-level credits. These credits can be distributed in one of two ways.

**Plan A**

Students electing Plan A take 18 hours of graduate-level courses and complete at least 9 credit hours of M.S. thesis research.

**Plan B**

Plan B is directed primarily to part-time students whose technical work in industry or government laboratories is suitable for project courses. Plan B requires completion of 27 credit hours distributed in either of two ways 21 or 24 credit hours (seven or eight courses) of approved graduate course work and 6 or 3 credit hours of project replacing the M.S. thesis.

**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 chose to take it at the beginning of 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 closely related engineering disciplines. 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 thesis adviser to meet the objectives of the thesis research topic.

**Breadth and Basic Science Courses**

A minimum of six courses outside the department must be taken. These can be chosen from other engineering departments and the departments of mathematics and natural science. A minimum of two elective courses must be in mathematics.

**Thesis research**

All doctoral programs must include a minimum of 18 credit hours of thesis research, EMAE 701.

**Residence and teaching requirements**

All doctoral programs require a minimum of one year of full-time residence in the program of study, three semesters of teaching experience, and must meet the rules of the School of Graduate Studies and 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 Reinberger Product and Process Development Laboratory, the Alden Laboratory for Numerically Controlled Machine Instruction and the General Motors 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://biorobots.case.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 three biologically based hexapod robots including the stick insect inspired Robot II, and the latest cockroach-like robot, Robot III. Robot III, based on the Blaberus cockroach, has 24 actuated revolute joints. It is a 117 scale model of the insect and is 30 inches long and weighs 30 pounds. A compressed air facility has been installed to operate the robot. 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 10 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.

**FLUID, THERMAL AND COMBUSTION EXPERIMENTAL FACILITIES**

Among the major facilities in fluid and thermal engineering sciences are a low-turbulence subsonic wind tunnel, an internal combustion engines laboratory, and a laser combustion diagnostics laboratory. The laboratories are well equipped with high precision flow, temperature and species measuring equipment such as hot wire and hot-film anemometers, laser Doppler velocimeters, laser vibrometers, spontaneous Raman Spectroscopy, coherent anti-stokes Raman spectroscopy and particle dynamics analyzers. Under a variety of special joint programs, many students perform their experiments in laboratories at the NASA Glenn Research Center.

**LASER FLOW DIAGNOSTICS LABORATORY**

A laser diagnostics laboratory is directed toward investigation of complex two-phase flow fields involved in energy-related areas, fluid mechanics of the heart, and slurry flow in pumps and spray characterization. The laboratory is equipped with state of the art Particle Image Velocimetry (PIV) equipment, phase Doppler and laser Doppler anemometers and modern data acquisition and analysis equipment including PCs. The laboratory houses a pulsatile flow loop simulating flow through the heart, a clear centrifugal slurry flow pump loop, and a particle laden jet facility simulating flow in fossil fuel flue gas flow conditions. Current research projects include investigation of flow through heart valves, development of simultaneous particle/droplet size and velocity measurement technique using PIV, development of innovative nozzles for sorbent laden flows for removal of toxins from flue gas, solid slurry flow through centrifugal pump impellers.
The National Center for Microgravity Research on Fluids and Combustion

The mission of the National Center for Microgravity Research on Fluids and Combustion is to lead a national effort to increase both the number and quality of microgravity researchers. The Center will perform the critical-path research in microgravity fluids and combustion sciences necessary to support the long-term human presence, development and exploration of space as well as to enhance life on Earth by applying the resultant advances in human knowledge and technology acquired through experimentation in the space environment. The Center is dedicated to research in fluid mechanics, heat transfer and combustion in microgravity, such as that found on Shuttle flights, the International Space Station, and long-duration space flight. This activity is directed toward a fundamental understanding of thermocapillary flow, double-diffusive convection, convection in the float-zone crystal growth process, various types of combustion phenomena and spacecraft fire safety.

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 multipoint 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.

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.
- The Structural Dynamics Laboratory was developed with a grant from NSF and includes facilities for performing vibration and modal testing. This equipment includes laser vibrometers, accelerometers, electrodynamic shakers, computers and data acquisition systems.
- In association with the Department of Electrical Engineering and Computer Science we have agile manufacturing facilities including flexible parts feeders of our design.
- The Biomechanical Testing Laboratory with two Instron Mechanical Test machines, and several specialized test apparatus. A soft tissue testing lab with several standard and special test machines, and an Instrumentation Laboratory devoted to the task of measuring these behavior parameters. A Biomechanical Computations and Design lab utilizing computer workstations has recently been added. In addition, it shares many research facilities with University Circle area hospitals.
- Well-equipped, manned central shops and instrument rooms are available, as well as a controlled-environment room for experiments requiring extreme precision.

Graphical and Computational Facilities

The Computer-Aided Engineering Laboratory (CAEL) includes 18 Dell 500MHz Pentium III computers attached to a Dell dual 500 MHz Pentium III server, running Windows NT 4.0, via local area network running at 100 Mb/s. The CAEL provides access to a number of software packages. Some of these include Pro/Engineer, Release 2000i; Visual Fortran, Release 6.0; AutoCAD, Release 13; Matlab, Release 5.3; and Microsoft Office 2000 Professional. 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 7 days a week from 600 a.m. through midnight via card access.
The General Motors Design Studio includes 13 Dell 400MHz Pentium II workstations and 6 NetPower 233MHz Pentium II workstations. These machines are connected via local network to a Dell Dual 333MHz Pentium II server running Windows NT 4.0. The GM Lab is tied directly to the campus network allowing information to be shared with the CAEL. The GM Design Studio is used for instructor on Pro/Engineer CAD/CAM software, and offers a Rapid Prototyping Machine for creating wax models from Pro/Engineer models.

**Supercomputing**

The department has a direct access to all NSF supercomputing centers, primarily to the Pittsburgh Supercomputing Center and the Ohio 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 have access to NASA computing facilities. Sophisticated, extensive, and updated general and graphics software are available for applications in research and classroom assignments.

**RESEARCH**

The research in the department encompasses many areas of modern technology. Among them are:

**Aerospace Technology and Transportation**

Aerospace mechanics, aircraft aerodynamics (subsonic, supersonic and hyper- sonic), inlet aerodynamics for supersonic air-breathing aircraft, stability and transition of boundary layers and free shear layers, icing research, micro-electro-mechanical sensors applied to boundary layer control, flow in turbomachinery, molecular dynamics simulation of rarified gas flow, two phase flow, supersonic combustion and control of internal combustion engines.

**Combustion**

Flame spread, microgravity combustion, fire research, chemical kinetic models and pollutant formation.

**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.

**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.

**Microgravity Research**

Transport phenomena in crystal growth, thermocapillary flows in the containerless processing of materials, and industrial processes influenced by gravity; g-jitter effects on microgravity flows. Combustion phenomena in microgravity, spacecraft fire safety.

**Multiphase Flow Research**


**Orthopaedic Engineering**

Kinematics and mechanical joint dynamics of the knee, hip, ankle, and spine; dynamic stability of the human spine; neuromuscular control; mechanics of injuries; gait analysis; design and failure analysis of medical prostheses and material selection; biomechanical measurements, tools and instrumentation; mechanical properties of bone and soft tissue.

**Robotics**

Biologically inspired and biologically based design and control of legged robots. Dynamics, control and simulation of animals and robots.

**Tribology**

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 and magnetic bearing systems with application to oil-free turbomachinery. Retainerless bearings for space applications such as long duration instrument and guidance systems and momentum wheels.

**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.

### Mechanical and Aerospace Engineering (EMAE)

**UNDERGRADUATE COURSES**

**EMAE C100. Co-Op Seminar I for Mechanical Engineering (1)**
Professional development activities for students returning from cooperative education assignments. Prerequisite: COOP 001.

**EMAE C200. Co-Op Seminar II for Mechanical Engineering (2)**
Professional development activities for
EMAE 152. Thermodynamics II (3)
Thermodynamic properties of liquids, vapors and real gases, non-reactive mixtures, psychrometrics and reactive systems; combustion: thermodynamic cycles. Prerequisite: ENGR 225.

EMAE 170. Introduction to Mechanical Engineering (3)
Introduces beginning engineering student to how things work through an insightful overview of mechanical and aerospace engineering. Focus is on automobiles, airplanes and flight mechanics, turbomachinery and electric power generation, manufacturing methods, heating and air conditioning, rockets and space flight mechanics. Relevance of math, science and engineering fundamentals to well-founded B.S. engineering programs.

EMAE 172. Mechanical Manufacturing (4)
The course is taught in two sections (Graphics and Manufacturing Processes) through a series of lectures, laboratory sessions and weekly engineering workshop classes. The course aim is to provide a solid manufacturing engineering foundation. The course includes: manual and computer-aided drafting and design (CAD), primary and secondary engineering processes, engineering materials and a field trip to a local company. Laboratory sessions will provide hands-on experience using Pro/ENGINEER CAD software.

EMAE 181. Dynamics (3)
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 center of mass, momentum, mass moment of inertia, dynamic equilibrium. Elementary vibrations. Prerequisites: MATH 122 and PHYS 121. ENGR 200 recommended.

EMAE 250. Computers in Mechanical Engineering (3)
Numerical methods including analysis and control of error and its propagation, solutions of systems of linear algebraic equations, solutions of nonlinear algebraic equations, curve fitting, interpolation, and numerical integration and differentiation. Prerequisites: ENGR 131 and MATH 122.

EMAE 271. Kinematic Analysis and Synthesis (3)
Graphical, analytical, and computer techniques for analyzing displacements, velocities, and accelerations in mechanisms. Analysis and synthesis of linkages, cams, and gears. Laboratory projects include analysis, design, construction, and evaluation of students’ mechanisms. Prerequisite: EMAE 181.

EMAE 282. Mechanical Engineering Laboratory I (2)
Techniques and devices used for experimental work in mechanical engineering and fluid and thermal science. Lectures on topics in the theory of experimentation. Laboratory includes typical experiments, measurements, analysis, and report writing. Prerequisites: EMAE 181 and ENGR 225.

EMAE 283. Mechanical Engineering Laboratory II (2)
Application of techniques developed in EMAE 282 to solution of individual semester-long experimental projects, including complete report on results. Prerequisite: EMAE 282.

EMAE 290. Computer-Aided Manufacturing (3)
A manufacturing engineering course covering a wide range of topics associated with the application of computers to the product design and manufacturing process. Topics include: Computer-aided design (CAD) using Pro/ENGINEER software, design methodology, the design/manufacturing interface, introduction to computer numerical control (CNC), manual part-programming for CNC milling and CNC turning machine tools. Significant time will be spent in both CAD and CNC laboratories. Prerequisite: EMAE 282.

EMAE 325. Fluid and Thermal Engineering II (4)
The continuation of the development of the fundamental fluid and thermal engineering principles introduced in ENGR 225. 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. Prerequisite: ENGR 225.

EMAE 350. Mechanical Engineering Analysis (3)
Methods of problem formulation and application of frequently used mathematical methods in mechanical engineering. Modeling of discrete and continuous systems, solutions of single and multi-degree of freedom problems, boundary value problems, transform techniques, approximation techniques. Prerequisite: MATH 224.

EMAE 355. Design of Fluid and Thermal Elements (3)
Synthesis of fluid mechanics, thermodynamics, and heat transfer. Practical design problems originating from industrial experience. Prerequisites: ENGR 225 and EMAE 325.

EMAE 356. Aerospace Design (3)
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)

EMAE 360. Engineering Design (3)
The various elements of design: formulation, conceptualization, selection, and evaluation for the initiation of new designs and the modification of existing designs. Various design methodologies including optimization methods, search techniques, constrained gradient methods, penalty functions, statistical design methods, risk analysis, probabilities of failure, and computer applications. Prerequisite: ECIV 310.

EMAE 370. Design of Mechanical Elements (3)
Application of mechanics and mechanics of solids in machine design situations. Design of production machinery and consumer products considering fatigue and mechanical behavior. Selection and sizing of basic mechanical components: fasteners, springs, bearings, gears, fluid power.
elements. Prerequisites: ECIV 310 and EMAE 271.

**EMAE 372. Relation of Materials to Design (4)**
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. Prerequisite: ECIV 310.

**EMAE 376. Aerostructures (3)**
Mechanics of thin-walled aerospace structures. Load analysis. Shear flow due to shear and twisting loads in open and closed cross-sections. Thin-walled pressure vessels. Virtual work and energy principles. Introduction to structural vibrations and finite element methods. Prerequisite: EMAE 310.

**EMAE 378. Mechanics of Machinery I (3)**
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. Prerequisite: EMAE 370.

**EMAE 381. Flight and Orbital Mechanics (3)**
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. Prerequisite: ENGR 225. EMAE 359 suggested.

**EMAE 382. Propulsion (3)**

**EMAE 387. Vibration Problems in Engineering (4)**

**EMAE 390. Computer-Integrated Manufacturing (3)**
The course is taught through a series of lectures, class discussions, group projects, and laboratory sessions. The course aim is to provide a solid understanding of the many aspects of the engineering processes and systems associated with the integration of product design through to manufacture. Laboratory sessions will provide hands-on experience using a number of Pro/ENGINEER modules to become aware of the integration of manufacturing issues. Prerequisite: EMAE 290.

**EMAE 396. Special Topics in Mechanical and Aerospace Engineering I (1-18)**
(Credit as arranged.) Prerequisite: Consent of instructor.

**EMAE 397. Special Topics in Mechanical and Aerospace Engineering II (1-18)**
(Credit as arranged.) Prerequisite: Consent of instructor.

**EMAE 398. Senior Project I (3)**
Individual or team design or experimental project under faculty supervisor. Prerequisites: Senior standing, EMAE 360 and consent of instructor.

**EMAE 399. Senior Project II (3)**
Continuation of EMAE 398.

**GRADUATE COURSES**

**EMAE 400T. Graduate Teaching I (0)**
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. Prerequisite: Ph.D. student in mechanical engineering.

**EMAE 401. Mechanics of Continuous Media (3)**
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)**
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, receptors and reflexes 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. Prerequisite: EMAE 181 or equivalent. Cross-listed as EBME 402.

**EMAE 403. Aerophysics (3)**
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)**

**EMAE 453. Advanced Fluid Dynamics I (3)**
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)

EMAE 455. Advanced Thermodynamics (3)
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)
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 458. Propulsion (3)
Energy sources of propulsion. Momentum theorems and performance criteria. Air breathing systems and their components; chemical rockets—liquid and solid propellant; nuclear rockets—solid core, liquid core and gaseous core; rocket heat transfer and heat protection; electric propulsion—electrothermal, electrostatic and plasma thrusters; thermonuclear propulsion. Prerequisite: Consent of instructor.

EMAE 459. Advanced Heat Transfer (3)
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. Prerequisite: EMAE 453.

EMAE 460. Theory and Design of Fluid Power Machinery (3)
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. Prerequisite: Consent of instructor.

EMAE 471. Design Methods (3)
An advanced course on design methodologies. Conceptualization, preliminary design, detail design, and manufacturing. Failure analysis, materials selection, methods of design optimization, and current approaches in computer-aided design. Prerequisite: EMAE 360.

EMAE 472. Computers, Optimization, and Design (3)
Application of computer methods to engineering design. Optimization and automated design methods. The use of linear and non-linear programming methods for engineering design and related problems. Unconstrained minimization, penalty functions, feasible directions. Prerequisite: Consent of instructor.

EMAE 473. Mechanical Behavior of Composite Materials (3)
Mechanical properties, static and dynamic characteristics, stress analysis methods, design properties, manufacturing methods, mechanical testing and design considerations. Prerequisite: EMAE 360.

EMAE 474. Advanced Thermodynamics (3)
Prerequisite: EMAE 453.

EMAE 475. Design Methods (3)
An advanced course on design methodologies. Conceptualization, preliminary design, detail design, and manufacturing. Failure analysis, materials selection, methods of design optimization, and current approaches in computer-aided design. Prerequisite: EMAE 360.

EMAE 476. Computers, Optimization, and Design (3)
Application of computer methods to engineering design. Optimization and automated design methods. The use of linear and non-linear programming methods for engineering design and related problems. Unconstrained minimization, penalty functions, feasible directions. Prerequisite: Consent of instructor.

EMAE 477. Mechanical Behavior of Composite Materials (3)
Mechanical properties, static and dynamic characteristics, stress analysis methods, design properties, manufacturing methods, mechanical testing and design considerations. Prerequisite: EMAE 360.

EMAE 478. Mechanics of Machinery I (3)
(See EMAE 378.)

EMAE 479. Mechanics of Machinery II (3)
A comprehensive treatment of design analysis methods and computational tools for machine components. Emphasis is on vibration and machinery dynamics.

EMAE 480. Fatigue of Materials (3)

EMAE 481. Advanced Dynamics I (3)

EMAE 482. Advanced Dynamics II (3)

EMAE 483. Advanced Thermodynamics (3)
Prerequisite: EMAE 453.

EMAE 484. Mechanism and Motion Synthesis (3)

EMAE 486. Stress Waves in Solids (3)

EMAE 487. Vibration Problems in Engineering (3)

EMAE 488. Robotics I (3)

EMAE 489. Robotics II (3)
The course is taught through a series of lectures, class discussions, and group projects. The course aim is to provide a solid understanding of the changing technologies and management strategies for companies to maintain competitive advantage in an increasingly global market. Issues such as ‘Order Winning Criteria,’ ‘Lean Manufacturing,’ and ‘Cellular Manufacturing’ will be reviewed and guest speakers will be invited to give an industrial perspective on specific topics of the course. Prerequisite: EMAE 290, EMAE 390 or permission of instructor.
EMAE 500T. Graduate Teaching II (0)
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 as 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. Prerequisite: Ph.D. student in mechanical engineering.

EMAE 540. Advanced Dynamics II (3)

EMAE 541. Dynamics of Nonlinear Systems (3)
Nonlinear oscillations; including equations of Duffing, van der Pol, Hill, and Mathieu; and perturbation solution approaches. Bifurcation theory and jump phenomena. Strange attractors, chaos, Poincare maps, and related engineering applications.

EMAE 552. Viscous Flow Theory (3)
Compressible boundary layer theory. Blowing and suction effects. Three-dimensional flows; unsteady flows. Introduction to real gas effects. Prerequisite: EMAE 454.

EMAE 554. Turbulent Fluid Motion (3)

EMAE 556. Variational Methods in Applied Mechanics (3)
Variational and energy principles in dynamics, structures and mechanics of continua. Calculus of variations, principle of virtual work, energy principles and generalization, statics of deformable bodies, dynamics, development of variational principles in fluid mechanics, direct solution methods. Prerequisite: Consent of instructor.

EMAE 557. Convection Heat Transfer (3)
Energy equation of viscous fluids. Dimensional analysis. Forced convection; heat transfer from non-isothermal and unsteady boundaries; free convection and combined free and forced convection; stability of free convection flow; thermal instabilities. Rea gas effects, combined heat and mass transfer; ablation, condensation, boiling. Prerequisites: EMAE 453 and EMAE 454.

EMAE 558. Conduction and Radiation (3)
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. Prerequisite: Consent of instructor.

EMAE 559. Molecular Gasdynamics (3)
Development of the basic kinetic theory model of a gas, including essential physical ideas and some important fundamental results (equilibrium state, entropy, transport coefficients). Numerical methods of analysis, with special emphasis on computer simulation techniques, especially molecular dynamics and Monte Carlo methods. Applications to basic fluid flows and low earth orbit flight. Prerequisite: Consent of instructor.

EMAE 570. Computational Fluid Dynamics (3)

EMAE 587. Experimental Stress Analysis (3)
Length, displacement and strain measurements. Electric strain gage, moire, photoelasticity and caustic techniques and their applications to stress analysis. Time and spatially resolved measurements using laser interferometry. Loading devices for studying the mechanical response of engineering materials under static, quasistatic and dynamic loading conditions. Prerequisite: EMAE 401 or ECIV 411.

EMAE 600T. Graduate Teaching III (0)
This course will engage the Ph.D. candidate in a variety of teaching experiences that will include direct (for example, teaching recitations and laboratories, guest lectures, office hours) as well as 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. Prerequisite: Ph.D. student in mechanical engineering.

EMAE 601. Independent Study (1-18)
EMAE 651. Thesis M.S. (1-18)
EMAE 655. Theories of Hydrodynamic Stability (3)
Stability of parallel flows: general development with application to channel flows and boundary layer flows; magnetohydrodynamic parallel flows; rotating Couette flow; superposed fluids; thermal instability of fluids heated from below; non-linear considerations. Prerequisite: EMAE 454.

EMAE 657. Experimental Techniques in Fluid and Thermal Engineering Sciences (3)
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)
EMAE 701. Dissertation Ph.D. (1-18)
College of Arts and Sciences
College of Arts and Sciences

Crawford Hall, Seventh Floor
Phone 216-368-4413
Fax 216-368-3842

The College of Arts and Sciences houses departments and interdisciplinary programs in the areas of the humanities, fine and performing arts, social sciences, natural sciences, and mathematics. The college traces its origins to several predecessor units including Adelbert College, Flora Stone Mather College, Cleveland College, Western Reserve College, and several programs of Case Institute of Technology.

The college offers both undergraduate and graduate programs. The undergraduate programs provide each student with a liberal education, the cornerstones of which are general education courses and advanced study in one or more major and minor fields.

General education courses, while broadening students’ knowledge of their cultural past, social world, and natural environment, offer instruction in critical reading and thinking, in writing and oral presentation, and in quantitative reasoning. They also ground the student in experimental and theoretical approaches to the understanding of human culture and behavior, scientific knowledge, and methods of research.

Major and minor programs are offered within 21 academic departments of the college in a broad range of disciplines. Cooperation among departments has produced many interdisciplinary programs including women’s studies, Asian studies, environmental studies, and childhood studies. The college’s honors program is the College Scholars Program, an interdisciplinary experience open to all students in any major (see alphabetical listing). Major and minor programs are also offered by the college in four areas housed in other units of the university: biochemistry, computer science, economics, and nutrition. Collaborative opportunities with departments in the Case School of Engineering allow the development of applied perspectives on problems in the sciences. Undergraduates as well as graduate students are encouraged to engage in independent research in their chosen fields of study.

The college provides graduate programs in a select number of fields in the arts, the humanities, and the physical, biological, and social sciences in which CWRU’s size and special expertise allow it to make a distinctive contribution to advanced education and research.

In addition to formal curricula, the college offers many arts presentations, lecture series, and symposia through its Office of Interdisciplinary Programs and Centers. Academic programs of the College of Arts and Sciences extend into the community in the form of human services, educational collaborations, and summer internships in research, business, and government.

THE PRACTICUM PROGRAM

The Practicum Program provides undergraduates in the College of Arts and Sciences the opportunity to engage in active learning through experience in a workplace environment. Students develop new skills and gain insights into the connections between their academic studies and possible career choices. The practicum is a planned, structured, supervised, full-time, semester-long experience during the academic year. Successful completion of a practicum is noted on the student’s transcript.

Program Requirements

The Practicum Program is administered by the Career Center in collaboration with the College of Arts and Sciences. To be eligible, a student must have completed 60 credit-hours prior to the start of the work assignment, must be enrolled as a full-time student, and must be in good academic standing. To participate in the program, the student must register with the Career Center no later than the last day of the third week of class 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.

Interdisciplinary Centers

BAKER-NORD CENTER FOR THE HUMANITIES
Tom Bishop, Director
Catherine Scallon, Associate Director
www.cwru.edu/artsci/bakernord/

The Baker-Nord Center for the Humanities was founded in 1996 by an endowment gift from Eric and Jane Nord. The Center facilitates and encourages collaborative work among faculty and students in the humanities and performing arts disciplines. It sponsors, often with other University Circle institutions, conferences, seminars, lectures, research and special events that enhance the presence and visibility of the humanities at CWRU.

CENTER FOR POLICY STUDIES
Kenneth Grundy, Director
www.cwru.edu/artsci/cps/CFPS.html

The Center for Policy Studies was established in 1998 by a leadership gift from Charles P. Bolton. Although based in the College of Arts and Sciences, the center endeavors to encourage the many policy scholars across the University to interact with each other and with the larger public beyond the campus, and to increase the local and national visibility of policy studies at CWRU. The center brings together CWRU faculty and staff experts, leaders from the community, and distinguished visitors in forums, seminars, and workshops to address current regional, national, and international policy issues.

CENTER FOR SCIENCE AND MATHEMATICS EDUCATION
James Bader, Director
www.cwru.edu/artsci/csm/

The Center for Science and Mathematics Education was established in 1998. It coordinates the college’s commitment to outreach programs for middle and high schools by providing in-service education for teachers and by bringing pre-college
students to campus for enrichment opportunities. The center also provides a local base for the national JASON project, an annual research expedition that uses interactive satellite communications systems to engage middle school students and their teachers in interdisciplinary learning.

COLLEGE SCHOLARS PROGRAM
Peter McCall, Director
www.cwru.edu/artsci/scholars/

The College Scholars Program, instituted in 1997, is a three-year academic enhancement program open to CWRU undergraduates interested in forming a community of learners dedicated both to excellence in individual intellectual pursuits and applying classroom learning to larger world concerns. The program, funded by the Mandel Brothers Foundation, emphasizes broad interdisciplinary learning beyond the requirements of professional or disciplinary competence, connection of academic learning to the larger society, and development of a sense of the relationship between service and leadership. The scholars collaborate with faculty in the design, operation, and evaluation of the curriculum. The program takes up the equivalent of one course for each of six semesters.

SAMUEL ROSENTHAL CENTER FOR JUDAIC STUDIES
Peter Haas, Director
www.cwru.edu/artsci/rosenthal/

The Samuel Rosenthal Center for Judaic Studies, funded through the Samuel Rosenthal Foundation, was established in 1996 to broaden the scope of CWRU’s Jewish Studies curriculum and to strengthen interest in Judaic Studies on campus and throughout the local, national, and international communities. To this end, the center supports a variety of initiatives, including visiting professorships, guest lectures, student scholarships and prizes, Hebrew language instruction, and the acquisition of library materials.

SCHUBERT CENTER FOR CHILD DEVELOPMENT
Jill Korbin, Director
www.cwru.edu/artsci/schubert/

The Schubert Center for Child Development, established in 1997, supports research in child development as well as certain areas of mental illness and mental retardation, and sponsors conferences, lectures, and symposia to disseminate new findings in the field. The center works to enhance links between basic and applied research and to foster the application of new information to community problems. The center is funded by a gift from Leland and Helen Schubert, as well as other endowments.

American Studies
Clark Hall 311
Phone 216-368-2220
Christa Carvajal, Director

American studies is an interdisciplinary program governed by an interdepartmental steering committee and taught by an associated faculty from throughout the university. It offers students an interdisciplinary approach to the study of social change and cultural diversity in the United States. This approach combines American studies courses – which emphasize connections among the economic, intellectual, social, and political facets of culture – with offerings from various traditional academic departments. The goal of the program is to connect contemporary social issues to their historical origins and relate them to local, national, and international conditions.

In addition to preparation for a variety of career options in both the public and the private sector, American studies offers undergraduate and graduate interdepartmental concentrations to students with interests in such areas as women’s studies and urban studies. The interdisciplinary goal of the undergraduate program is achieved by a combination of required courses and an individualized program of study worked out by each student under the supervision of the program director.

Graduates in American studies have pursued careers in law, social work, journalism, teaching, historic preservation, business, public health, and government. Graduate study in American studies at CWRU is designed primarily for students already holding a master’s degree or presenting other evidence of academic strength and experience in multi-disciplinary programs. The opportunity to combine the theoretical perspective of American studies with advanced work in theater arts is a special feature of the graduate program. *

AMERICAN STUDIES STEERING COMMITTEE
Christa Carvajal, Ph.D. (University of Texas, Austin)
Professor of Theater Arts; Director of American Studies Program
History of theater; dramaturgy; semiotics
Henry Adams, Ph.D. (Yale University)
Professor of American Art; Curator of American Art, Cleveland Museum of Art
American Art of the 19th century
Thomas Csordas, Ph.D. (Duke University)
Professor
Psychological anthropology; medical anthropology; comparative religion; anthropological theory; language and culture; American Indian culture; University States
Thomas Sayers Ellis, M.F.A. (Brown University)
Assistant Professor
Creative writing (poetry); African-American literature
Frances E. Lee, Ph.D. (Vanderbilt University)
Assistant Professor
American government, Congress, legislative policy-making
William Marling, Ph.D. (University of California, Santa Barbara)
Professor of English
American literature; modernism
Colin McLarty, Ph.D. (Case Western Reserve University)
Associate Professor and Chair of Department of Philosophy
Logic; philosophy of logic; philosophy of mathematics; philosophy of science; contemporary French philosophy
Carroll W. Purcell, Ph.D. (University of California, Berkeley)
Adeline Barry Davee Distinguished Professor
History of technology; U.S. science and technology policy

UNDERGRADUATE PROGRAMS

Major (36 hours)
American studies comprises the study of American cultures and the study of interdisciplinary methods and models. On
American Studies (AMST)

UNDERGRADUATE COURSES

AMST 117. Introduction to American Studies (3)
This lecture and discussion course surveys the methods, theory, and questions that have shaped American Studies as it has developed over the past fifty years. It aims to introduce students to the various disciplines that constitute American Studies while paying special attention to the ways in which these disciplines can work together to illuminate the study of American cultures, past and present. The first unit explores the changing concerns and approaches of American Studies scholars by considering a classic American Studies text, Henry Nash Smith’s The Virgin Land, and then exploring the ways in which scholars have challenged Smith’s methods, assumptions, and conclusions. The second unit explores both the diversity of American society and the diversity of scholarly approaches to questions of individual and collective identity. Finally, the third unit samples several forms of contemporary cultural production. Cross-listed as HSTY 117.

AMST 217. Visual Culture and Cultural Criticism in Modern America (3)
This course introduces the often diverging strategies and views expressed as visual art and performance on the one hand, and as critical thought, often in reaction to art, on the other. The historical framework spans the second half of the nineteenth and all of the twentieth century and is constituted by issues raised in American transcendentalism, pragmatism, and modernism/post-modernism. Students will study examples of artistic expression side by side with critical thought. Prerequisite: AMST 117. Cross-listed as THTR 227.

AMST 270. American Art and Culture (3)
Survey of the development of American art from colonial times to the present 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. Cross-listed as ARTH 270.

AMST 327. American Theater and Playwrights (3)
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. Cross-listed as THTR 327.

AMST 342. Seminar: American Playwrights (3)
Cross-listed as THTR 342.

AMST 390. Independent Study (1-3)

GRADUATE COURSES

AMST 427. American Theater and Playwrights (3)
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. Cross-listed as THTR 427.

AMST 550. American Studies Research Seminar (3)

AMST 601. Independent Study (1-18)
(Credit as arranged.)

AMST 651. Thesis M.A. (1-18)
(Credit as arranged.)

AMST 701. Dissertation Ph.D. (1-18)
(Credit as arranged.)

Department of Anthropology

238 Mather Memorial
Phone 216-368-2264, Fax: 216-368-5334

Melvyn Goldstein, Chair

Anthropology, with its broad comparative approach, is in a strategic position to contribute to the identification and resolution of many of the problems 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, and combined Doctor of Medicine-Doctor of Philosophy and Master of Science in Nursing-Master of Arts) degrees. Students graduating with a B.A. in anthropology normally must continue for the M.A. or Ph.D. degree if they are interested in working as anthropologists.
FACULTY

Melvyn C. Goldstein, Ph.D. (University of Washington)
John Reynolds Harkness Professor and Chair
Director, Center for Research on Tibet
Social cultural anthropology; population anthropology; cross-cultural aging; cultural ecology development; ethnicity and nationalism; Tibet, China, Mongolia, Himalayas

Charlotte Ikels, Ph.D. (University of Hawaii)

Lawrence P. Greksa, Ph.D. (Pennsylvania State University)
Sarah Idell Pyle Professor
Physical anthropology; human growth, development and aging; human ecology; hominids; Andes, Tibet, Himalayas, Mongolia

Rachel Chapman, Ph.D. (University of California, Los Angeles)
Assistant Professor
Social cultural anthropology, reproductive health, pregnancy and pre-natal care, gender systems, women’s health in Africa; political economy, applied international health, medical pluralism, medical anthropology; Africa, Mozambique

Thomas Csordas, Ph.D. (Duke University)
Professor
Editor, Ethos, Journal of Psychological Anthropology
Psychological anthropology; medical anthropology; comparative religion; anthropological theory; language and culture; American Indian cultures; United States

Atwood D. Gaines, Ph.D. (University of California, Berkeley), M.P.H. (University of California, Berkeley, School of Public Health)
Professor
Professor of Biomedical Ethics, Psychiatry, and Nursing, School of Medicine, Francis Payne Bolton School of Nursing
Medical and psychiatric anthropology; religion; aging; cultural studies of science; bioethics; social identity; United States, the Mediterranean

Lawrence P. Greksa, Ph.D. (Pennsylvania State University)
Professor
Physical anthropology; human biology; modernization; Polynesia, South America; Old Order Amish

Charlotte Ikels, Ph.D. (University of Hawaii)
Professor
Gerontology; health care; urban life; comparative bioethics; Hong Kong, China, United States

Janis Hunter Jenkins, Ph.D. (University of California, Los Angeles)
Professor; Associate Professor of Psychiatry, School of Medicine; Editor, Ethos, Journal of Psychological Anthropology; Director of Women’s Studies
Psychological and medical anthropology; mental disorder; emotion; gender; Central America, North America

Jill E. Korbin, Ph.D. (University of California, Los Angeles)
Professor
Cultural and medical anthropology; psychological anthropology; cross-cultural child rearing and family studies; child abuse and neglect; family violence; neighborhood; United States, Polynesia, Old Order Amish

Janet McGrath, Ph.D. (Northwestern University)
Associate Professor; Associate Professor of International Health, School of Medicine
Biological and biomedical anthropology; anthropology of disease; international health; AIDS; United States, Africa

James Pfeiffer, Ph.D., M.P.H. (University of California, Los Angeles)
Assistant Professor
Medical anthropology; international health; political economy; nutritional anthropology; development studies; applied anthropology; Southern Africa; Central America; History

Jim G. Shaffer, Ph.D. (University of Wisconsin, Madison)
Associate Professor
Archaeology; Middle East; Central Asia; Indus Valley

Secondary Faculty

Associate and Adjunct Faculty
Gary Brittenham, M.D. (Columbia University Medical School)
Professor of Medicine
Disease and society; hematology; genetics of small populations; United States, India, Costa Rica, Guatemala, Thailand, Sri Lanka

N’omi Greber, Ph.D. (Case Western Reserve University)
Professor
Archaeology, computer and remote sensing applications, early/middle Woodland eastern U.S., prehistory of eastern North America, prehistoric social organization, Shwae ethnohistory

Bruce Latimer, Ph.D. (Kent State University)
Assistant Professor
Curator of Physical Anthropology, Cleveland Museum of Natural History
Archaeology, computer applications, and remote sensing eastern U.S., prehistoric social organization, Shwae ethnohistory

Isabel Parraga, Ph.D. (Case Western Reserve University)
Assistant Professor
Archaeology, computer and remote sensing applications, early/middle Woodland eastern U.S., prehistory of eastern North America, prehistoric social organization, Shwae ethnohistory

Janet McGrath, Ph.D. (Northwestern University)

The health science-oriented anthropology concentration begins with the department’s expertise in medical anthropology. Students learn about the three

UNDERGRADUATE PROGRAM

Major
The undergraduate major requires a minimum of 36 semester hours in anthropology. The undergraduate program provides a cross-cultural perspective on human behavior, culture, and biology. Students study other cultures as well as their own. Students may choose from four major concentrations, or may consult with the department to tailor the major to their individual interests and goals.

The general anthropology concentration includes 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 and biological 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.

The health science-oriented anthropology concentration builds upon the department’s expertise in medical anthropology. Students learn about the three
subdisciplines discussed above, but with a focus on their relationship to physical and mental health, illness, disease, and medicine.

Archaeology anthropology concentration reconstructs the customs and daily life of people who lived in the past by excavating and analyzing the material remains of the sites of human occupation. At the same time, archaeology seeks to understand the evolution of culture and society by determining how and why changes in human society occurred over the past 5 million years that our species has inhabited the earth.

Physical anthropology concentration deals with the biological nature of humans past and present. The physical anthropologist looks beyond purely biological phenomena to understand how biology, behavior and environment interact.

Paleoanthropology documents the biological history of humans and, in conjunction with archaeology, analyzes those relationships for past humans. Human biology studies physiology, genetics, nutrition and epidemiology in modern human populations throughout the world in order to understand those relationships.

The anthropology scholars' concentration permits highly qualified and motivated Anthropology majors, with well-defined interests and goals that could be met by an alternative course sequence, to tailor an individual program of study.

General Anthropology Concentration
ANTH 102 and 103
ANTH 319
One course dealing with a geographic area (e.g., ANTH 300, 331, 341, 352, 353, 356, or 357)
Approved anthropology electives: 24 semester hours

Health Science-oriented Anthropology Concentration
ANTH 102, 103, and 215
ANTH 319
One course dealing with a geographic area (e.g., ANTH 330, 331, 341, 352, 353, 356, or 357)
At least three courses dealing with health/illness-related topics (e.g., ANTH 301, 304, 306, 309, 318, 351, 359, 365, 369, 371, 376, 393, or 397)
Approved anthropology electives: 12 semester hours

Archaeology Anthropology Concentration
ANTH 102, 103, and 107
ANTH 319
One course dealing with a geographic area (e.g., ANTH 202, 330, 331, 341, 352, 353, 356, or 357)
Three approved archaeology courses: ANTH 202, 321, 324, 330, 331, 333, 399, summer fieldwork
Four approved electives: 12 semester hours

Physical Anthropology Concentration
ANTH 102 and 103
ANTH 319
One course dealing with a geographic area (e.g., ANTH 330, 331, 341, 352, 353, 356, or 357)
At least three courses dealing with physical anthropology (e.g., ANTH 295, 301, 302, 369, 393, 397, ANAT 375, 377, 383)
Approved anthropology electives: 15 semester hours

Minor
The department offers four minor emphases in anthropology: a general anthropology emphasis, a health science-oriented anthropology emphasis, an archaeological anthropology emphasis, and a physical anthropology emphasis. All require a minimum of 15 semester hours in anthropology.

General Anthropology Minor
ANTH 102 and 103
One course dealing with a geographic area (e.g., ANTH 330, 331, 341, 352, 353, 356, or 357)
Two approved electives: 6 semester hours

Health Science-Oriented Anthropology Minor
ANTH 102, 103, and 215
One course dealing with a geographic area (e.g., ANTH 330, 331, 341, 352, 353, 356, or 357)
One course dealing with health-related topics (e.g., ANTH 301, 304, 306, 309, 318, 351, 359, 365, 369, 371, 376, 393, or 397)

Archaeology Anthropology Minor
ANTH 102, 103, and 107
One course dealing with a geographical area (e.g., ANTH 330, 331, 341, 352, 353, 356, or 357)
One approved archaeology elective: ANTH 202, 321, 324, 330, 331, 333, 399, summer fieldwork

Physical Anthropology Minor
ANTH 102 and 103
One course dealing with a geographical area (e.g., ANTH 330, 331, 341, 352, 353, 356, or 357)
Two approved physical anthropology electives: ANTH 295, 301, 302, 369, 393, 397, ANAT 375, 377, 383

Engineering Core
A social science sequence for the B.S. based on the Engineering Core requires ANTH 102 or 103 and two other courses of which at least one must be a 300-level course.

General Education Requirements
Natural and Mathematical Sciences
A. Mathematical Reasoning and Analysis
   ANTH 319 may be used (as part of a sequence)
B. Natural Sciences
   ANTH 105
C. Science and Society
   ANTH 215 or 317 or 337 or 363

Social Sciences
A. Social Institutions
   ANTH 102 and 103 (sequence is required)
B. Human Behavior and Development
   ANTH 304, 306, 309, 318, 340, 345, 371

Global and Cultural Diversity
   ANTH 314, 352, 353, 356, 357

Departmental Honors
This program is open to qualified majors in anthropology who have completed 15 hours of anthropology with a 3.25 grade point average and who have a 3.0 grade point overall average. Students should apply for the program in the fall semester of their senior year and, if approved, register for ANTH 391 and 392, Honors Tutorial, in the spring of their junior year and 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 the department’s undergraduate advisor.
Integrated Graduate Studies
The Department of Anthropology participates in the Integrated Graduate Studies program. Interested students should note the general requirements and the admission procedures for the Integrated Graduate Studies program in this bulletin and may consult the department for further information.

GRADUATE PROGRAM
The Department of Anthropology offers graduate programs leading to the Master of Arts and Doctor of Philosophy degrees with specializations in medical anthropology, cross-cultural aging, physical anthropology/human biology, international health, psychological anthropology and other areas.

The department also offers a combined Master of Science in Nursing/Master of Arts in Anthropology with the School of Nursing, and a combined Doctor of Medicine/Doctor of Philosophy degree program with the School of Medicine. An M.P.H. program is also available through the School of Medicine.

Requirements for the Master of Arts Degree
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 coursework in anthropology, while helpful, is not a prerequisite for admission. However, students with no previous training in anthropology are expected to remedy deficiencies prior to taking the M.A. examination.

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 graduate credit, including an approved statistics course (3 hours) in which the student has earned a grade of C or better. Not more than 6 semester hours 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 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 also have 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 re-taken once.

Requirements for Doctor of Philosophy Degree
The Doctor of Philosophy degree program in anthropology includes subspecializations in medical anthropology, international health, psychological anthropology, cross-cultural aging, human biology/physical anthropology, and sociocultural anthropology. It requires a minimum of 36 credit hours:
1. 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 M.A. level.
2. Students must complete two seminars (500 level).
3. Students must take 9 credit hours in electives, as approved by their advisory committee. For those students completing the statistics requirement at the M.A. level, 12 hours of electives are required. Students may not take more than six total credit hours of either ANTH 599 or ANTH 601.
4. Students must take 18 credit hours in dissertation (ANTH 701).

After completing course requirements, a student must take the written Doctor of Philosophy candidacy examination. Within one semester of successfully completing the written Doctor of Philosophy candidacy 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.

DESCRIPTION OF PROGRAMS

Medical Anthropology Program
The objective of the Medical Anthropology 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; and (2) to analyze and evaluate how health services are organized and delivered. A student who chooses this specialty concentrates on the methods and perspectives of either social-cultural or physical anthropology in his or her studies and research.

Within the Medical Anthropology Program, students may choose to specialize in medical anthropology, cross-cultural aging, international health, or psychological anthropology.

M.A. Requirements
The curriculum covers the range of medical anthropology interests: ethnomedicine, human adaptation and disease, nutrition, international health, psychiatric anthropology, social demography, and so on. All Master of Arts degree students in medical anthropology must complete 27 hours, including the following core courses: ANTH 462, 480, 481, and 504 as well as an approved statistics course. The remaining 12 credit hours are taken as electives in anthropology or in other departments with the advisor’s approval.

Ph.D. Requirements
All Ph.D. students in medical anthro-
pology are required to complete the Ph.D. requirements. A specific plan of study is developed in consultation with their advisor. It requires a minimum of 36 credit hours:

1. 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 M.A. level.

2. Students must complete two seminars (500 level).

3. Students must take 9 credit hours in electives, as approved by their advisory committee. For those students completing the statistics requirement at the M.A. level, 12 hours of electives are required. Students may not take more than six total credit hours of either ANTH 599 or ANTH 601.

4. Students must take 18 credit hours in dissertation (ANTH 701).

After completing course requirements, a student must take the written Doctor of Philosophy candidacy examination. Within one semester of successfully completing the written Doctor of Philosophy candidacy 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.

Specializations in Medical Anthropology Program

Cross-Cultural Aging

The cross-cultural aging specialization within the graduate program in Medical Anthropology focuses on the processes of aging and the problems of the elderly throughout the world in both theoretical and applied perspectives. Particular emphasis is given to understanding the relationship between non-Western and Western experiences in terms of social, cultural, economic, political, and demographic concomitants. All Master of Arts students in cross-cultural aging must complete 27 credit hours including the Medical Anthropology Program core courses, an approved statistics course, and 12 credit hours of electives approved by the advisor. At the Ph.D. level, students specializing in cross-cultural aging must develop a program with their advisor to meet all Ph.D. requirements.

International Health

The international health specialization within the graduate program in Medical Anthropology offers students training in international health research as well as evaluation of international health projects. The curriculum includes coursework in medical anthropology, epidemiology, and special topics in international health, including child survival, fertility and family planning, and nutritional intervention. Students are qualified to work in international health research, academic, or administrative positions in governmental or private agencies. All Master of Arts students in international health must complete 27 credit hours including the following core courses: ANTH 459, 462, 480, 481, and 504, as well as an approved statistics course. The remaining 9 credit hours are taken as electives in anthropology or other departments with the advisor’s approval. At the Ph.D. level, students specializing international health must develop a program with their advisor to meet all Ph.D. requirements.

Psychological Anthropology

The psychological anthropology specialization within the graduate program in Medical Anthropology 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. All Master of Arts students in the psychological anthropology specialization must complete ANTH 462, 471, 480, 481, and 504 as well as an approved statistics course. The remaining 9 credit hours are taken as electives in anthropology or other departments with the advisor’s approval. At the Ph.D. level, students specializing in psychological anthropology must develop a program with their advisor to meet all Ph.D. requirements.

The 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.

M.A. Requirements

Graduates of this program are qualified to work in research or administrative positions in governmental and private agencies, as well as teach at the college and university levels. All Master of Arts students in cross-cultural gerontology must complete 27 credit hours including the following core courses: ANTH 401, 404, 462, and 504. In addition to the four core courses, students must take an approved statistics course. Nine credit hours are taken as electives in anthropology or in other departments with advisor’s approval.

Ph.D. Requirements

All Ph.D. students in cross-cultural aging are required to develop a specific plan of study in consultation with their advisor. It requires a minimum of 36 credit hours:

1. Students must take 18 credit hours in electives as approved by their advisory committee. (For those students who have not completed the M.A. statistics requirement, an approved 3-credit course in statistics is required.)

2. Students must take 18 credit hours in dissertation (ANTH 701).

After completing course requirements, a student must take the written Doctor of Philosophy candidacy examination. Within one semester of successfully completing the written Doctor of Philosophy candidacy 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.

**Joint M.S. Nursing/M.A. Anthropology Program**

The joint M.S.N./M.A. 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 multi-cultural society. There are 18 hours of required nursing courses: Clinical Major (9 hours), Professional Development N421-N422 (6 hours), Inquiry I N405 (Nursing Theory – 3 hours); and 18 hours of required anthropology courses (ANTH 480, 481, plus four electives). There are also 6 hours of required research courses and 3 hours of electives taken in either anthropology or nursing. The total M.S.N./M.A. degree requirement is 45 hours.

**Joint Doctor of Medicine/Doctor of Philosophy Program**

The objectives of the joint M.D./Ph.D. programs are to train unusually qualified students

1. to conduct research on a broad range of bio-cultural problems, with emphasis on the relationship between traditional and lay medical beliefs and practices, ecological and subsistence variables, population dynamics, and disease epidemiology; and
2. to identify and analyze sociocultural impediments to the successful introduction of effective functioning, and evaluation of programs of health care in less developed countries as well as developed ones.

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 must include MCAT scores, in addition to other information indicated on the graduate school forms.

Application to the School of Medicine is initiated through the American Medical College Application Service in Washington, D.C., but applicants may write to the Admission Office of the School of Medicine for further information about the application procedure. The names of students whose applications have been reviewed favorably by the Department of Anthropology will be forwarded to the Admissions Committee of the School of Medicine with a recommendation that, if accepted by the School of Medicine, these applicants be admitted to the joint-degree program. The Department of Anthropology’s recommendation does not imply automatic admission to that school. The credentials presented by applicants to the program will be considered competitively among all other applicants to the School of Medicine.

**Other Specializations**

Students interested in graduate degrees in social-cultural or physical anthropology should contact the department about requirements.

**Anthropology (ANTH)**

**UNDERGRADUATE COURSES**

**ANTH 102. Being Human: An Introduction to Social and Cultural Anthropology (3)**

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)**

Physical, cultural, and technological evolution of humans. The systematic interrelationships between humans, culture, and environment.

**ANTH 105. Worldwide Variation in Human Biology (3)**

The genetic, ontogenetic, and physiological bases for biological variation within human populations. These variations are put in the context of adaptation to the natural environment, human-made environment, and continuing environmental change.

**ANTH 107. Archaeology: An Introduction (3)**

Basic archaeological concepts are discussed followed by a review of human cultural and biological evolution from the earliest times through development of state state-organized societies. Geographical scope is worldwide with special attentions given to ecological and cultural relationships affecting human societies through time.

**ANTH 202. Archaeology of Eastern North America (3)**

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 212. Popular Culture in the United States (3)**

This course considers the history, character and constituents of popular culture in the U.S. and the various methods by which it is defined and studied. Key elements of popular culture in the United States are considered in their social (ethnic, gender, age) and historical contexts. The course provides an introduction to other more specialized courses in the anthropology of gender, popular music and science and medicine. We will consider both themes and images (icons) of Usonian popular culture, their origins and transformations.

**ANTH 215. Health, Culture, and Disease: An Introduction to Medical Anthropology (3)**

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 295. Comparative Primate Behavior (3)**

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. Prerequisite: ANTH 102 or ANTH 103 or consent of department.
ANTH 301. Biological Aging in Humans (3)
Biological aging phenomena, evidence that various socio-cultural and environmental influences may slow or accelerate the aging process, and theories explaining the evolution of the aging process. Pre-requisite: ANTH 103 or consent of department.

ANTH 302. Darwinian Medicine (3)
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. Prerequisite: ANTH 105 or ANTH 103.

ANTH 304. Introduction to the Anthropology of Aging (3)
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. Prerequisite: ANTH 102 or consent of department.

ANTH 306. Anthropology of Childhood and the Family (3)
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. Prerequisite: ANTH 102 or consent of department.

ANTH 309. Family Violence and Child Abuse (3)
The prevalence and causes of intrafamilial violence. Spouse abuse, child abuse, adolescent abuse, sexual abuse, parent abuse, and sibling violence. Major theoretical positions on the occurrence of these behaviors in light of information from both Western and non-Western cultures. Prerequisite: ANTH 102 or consent of department.

ANTH 313A. Medical Anthropology - Scholars Seminar (3)
This course will combine seminar and hands-on experience in medical settings. Seminar topics will include culture and ethnicity; health care utilization; medical anthropology; and cross-cultural parenting and child development. Concurrent research will be carried out with families being cared for at University Hospital's Pediatric Clinics. Prerequisites: ANTH 102 or ANTH 215 and application to the department of Anthropology.

ANTH 313B. Medical Anthropology - Scholars Seminar (3)
Spring semester continuation of ANTH 313A. Prerequisites: ANTH 102 and ANTH 215.

ANTH 314. Cultures of the United States (3)
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 and discrimination and their consequences. Groups of interest include various Latino and Native peoples, African-American groups, and specific ethnic groups of Pacific, Mediterranean, European, Asian and Caribbean origin.

ANTH 317. Asian Medical Systems (3)
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. Prerequisite: ANTH 102 or consent of department.

ANTH 318. Death and Dying (3)
Examines cultural context of death and dying. Topics include the 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. Prerequisite: ANTH 102 or consent of department.

ANTH 319. Introduction to Statistical Analysis in Social Sciences (3)
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 Engineering Core humanities and social sciences requirement.

ANTH 321. Methods in Archaeology (3)
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, ethno-archaeology, and cultural interpretation. Prerequisite: ANTH 107 or consent of department.

ANTH 322. Living Africa (3)
This course is an introduction to the peoples and cultures of Africa. Rather than a traditional, survey approach, this course takes a thematic approach to issues regarding core aspects of African societies such as history, political organization, family and kinship, art and literature, religion, gender, international relations, and economy. Taking a multidisciplinary perspective, the course will draw on diverse sources, from classical ethnographic writings to popular cultural criticism, literature, films, poetry, and news media.

ANTH 323. AIDS: Epidemiology, Biology, and Culture (3)
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 prevalence of AIDS, and cultural responses to the epidemic. Special emphasis will be placed on the long-term biological and social consequences of the epidemic. Prerequisite: ANTH 102 or ANTH 103 or ANTH 105 or consent of department.

ANTH 324. Field Methods in Archaeology (3)
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
ANTH 327. Great Lakes Archaeology (3)  
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. Prerequisite: ANTH 107 or permission of the department.

ANTH 328. Ethics in Science (3)  
This course is a survey of key ethical and value issues in science. Topics to be covered may include: research with human subjects; research with animals; scientific misconduct, including fraud; the role of science in society; opposition to science based on alternative value systems; the historical context of contemporary science relationships between science and industry, including potential conflicts of interest; the social responsibilities of scientists; science and government; the use of science in public policy, including controversies over smoking and lung cancer, asbestos, and global warming; and the scientist as a “hired gun.” Extensive student participation is expected. Cross-listed as BIOL 328.

ANTH 330. Special Topics in Prehistory (3)  
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). Prerequisite: ANTH 102 or ANTH 107 or consent of department.

ANTH 331. Ancient Civilizations of the Near East (3)  
The social, economic, and ecological factors involved in the formation of the earliest Asian civilizations. The developmental role of cities, warfare, trade, and irrigation considered with respect to “state” formation in Mesopotamia, Iran, and the Indus valley. Prerequisite: ANTH 102 or ANTH 107 or consent of department.

ANTH 333. Roots of Ancient India: Archaeology of South Asia (3)  
Examination of the archaeological record of cultural development from earliest times through the Iron Age in India, Pakistan, Sri Lanka, and Bangladesh. Particular attention devoted to how these ancient cultural developments laid the foundations for the early historic civilization of this region. Prerequisite: ANTH 102 or ANTH 107 or consent of department.

ANTH 334. Urban Anthropology (3)  
This urban anthropology course will focus on contemporary understandings of the institutions of urban, national and transnational life. We will explore the complex ways that urban worlds and social problems are shaped by globalizing capitalism, national, and transnational processes. As well, we will examine how and why various identities, nations, and transnational institutions are expressed in and by people living in current global urban hierarchies. In particular, we will look at how the urban, national, and transnational dynamically produce and are produced by the everyday cultural practices of people living and struggling in North American urban spaces. Prerequisite: ANTH 102 or consent of department.

ANTH 337. Comparative Medical Systems (3)  
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, and 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. Prerequisite: ANTH 215.

ANTH 340. Culture and Emotion (3)  
The cross cultural consideration of the relationship of culture and emotion. The cultural construction of the experience and expression of emotion. Key substantive issues include: ethno-psychological variations in indigenous conceptualizations and displays of emotion; the socialization of affect; the self and emotion; contextual variations in emotional expression with respect to gender, power relations, patterns of subsistence, and the individual; and the relationship between emotion and illness processes. Prerequisite: ANTH 102 or consent of department.

ANTH 341. Cultural Area Studies in Anthropology (3)  
Prerequisite: ANTH 102.

ANTH 343. Psychoanalytic Anthropology (3)  
Psychoanalytic theory and its application to cross cultural materials. Cultural context of analytic theory’s development and its application in social/cultural and medical anthropology. Application of cultural criticism to psychoanalytic conceptions and its constructions of the following: social evolution; religious ideology, praxis, patterns and dynamics; altered states of consciousness; individual personality and psychopathology; individual and cultural defense mechanisms; socialization; cognition and affect; symbolism; and gender. Also considers basis of a culturally relative analytic theory.

ANTH 345. Ethnicity, Gender, and Mental Health (3)  
An overview of mental health status and ethnicity. Analysis of ethnicity in relation to culture, social class, gender, sociopolitical conflict and the world refugee crisis. Consideration of populations at special risk for development of specific mental disorders (e.g., schizophrenia, affective disorders, adjustment and stress disorders). Contemporary ethnographic survey of ethnic groups at risk both at home and abroad. Prerequisite: ANTH 102.

ANTH 351. Topics in International Health (3)  
Prerequisite: ANTH 102 or ANTH 215.

ANTH 351D. International Health Policy (3)  
Prerequisite: ANTH 102 or ANTH 215.

ANTH 352. Japanese Culture and Society (3)  
Focuses on contemporary Japanese cultural and social institutions. Topics include child-rearing, personality, values, education, gender roles, the dual economy, and popular culture. Prerequisite: ANTH 102 or consent of department.
ANTH 353. Chinese Culture and Society (3)
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. Prerequisite: ANTH 102 or consent of department.

ANTH 356. Mediterranean Culture and Society (3)
Ethnography of the Mediterranean culture area. Topics include geography, toponomy, climate, rural and urban life styles, economy, social identity (encompassing gender, ethnic, national, provincial, tribal and religious identity), religion, ritual relations, concepts of self, health and healing, politics, world view and values, family and kinship, aging, death and dying. Past and present methods and problems of anthropological research in the region and the theoretical frameworks that have guided researchers. Prerequisite: ANTH 102 or consent of department.

ANTH 357. Native American Cultures (3)
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. Prerequisite: ANTH 102.

ANTH 358. Women's Mental Health (3)
This anthropological course is an examination of the cultural psychology of women in the following domains: (1) women's social status cross-culturally; (2) specific psychiatric syndromes, such as psychoses and, mood and personality disorders as they affect women; and (3) power and resilience. Issues of the cultural validity of psychological theories for women across diverse settings is the subject of critique throughout the seminar. Prerequisite: ANTH 102 or ANTH 215.

ANTH 359. Introduction to International Health (3)
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. Prerequisite: ANTH 102.

ANTH 362. Contemporary Theory in Anthropology (3)
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. Prerequisite: ANTH 102 or consent of department.

ANTH 363. Anthropology and Bioethics (3)
The course will review theoretical work on anthropology and values, the discipline of bioethics, its philosophical roots, the body of anthropological work in bioethics, and critically examine a number of current bioethical issues in the United States and internationally.

ANTH 365. Gender and Sex Differences: Cross-cultural Perspective (3)
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. Prerequisite: ANTH 102 or consent of department.

ANTH 366. The Anthropology of Nutrition (3)
Human nutrition and physical performance within the framework of human adaptability theory. 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. Prerequisite: ANTH 103 or consent of department.

ANTH 369. The Anthropology of Religion (3)
This course provides an introduction to the basic methods and techniques of anthropological research in religion. 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 of evolutionary biology. Prerequisites: ANTH 103 and BIOL 110. Cross-listed as RLGN 372.

ANTH 376. Topics in the Anthropology of Health and Medicine (3)
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; paleo-epidemiology; and population anthropology. Prerequisite: ANTH 102 or ANTH 103.

ANTH 377. Human Osteology (4)
This course for upper division undergraduates and graduate students will review the following topics: human skeletal development and identification; forensic identification (skeletal aging, sex identification and population affiliation). Cross-listed as ANAT 377.

ANTH 380. Independent Study in Laboratory Archaeology I (1-3)
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. Prerequisites: ANTH 107 and permission of department.

ANTH 381. Independent Study in Laboratory Archaeology II (1-3)
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 mate-
ual 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. Prerequisites: ANTH 107 and permission of department.

ANTH 383. Evolutionary Anatomy (4)
This course will introduce graduate and advanced undergraduate students to primate comparative anatomy and will examine methods of reconstructing physiology and behavior from fossil remains. Prerequisites: ANTH 103 and BIOL 110. Cross-listed as ANAT 383.

ANTH 385. Applied Anthropology (3)
Analysis of the use of anthropological theory and data for social development planning and programs. A cross-cultural analysis of the implications of planned change and their ramifications. Prerequisites: ANTH 102 or ANTH 103 and ANTH 105.

ANTH 389. Crossroads: Transformation of Rural Blues into Urban Rock (3)
A multimedia approach to the development and transformation of an American musical form, the blues. Foci include the social and cultural history of rural and urban blues, rhythm and blues, rock and roll, and the later forms of rock, the social context and life histories of modern music’s creators and innovators, the development of vocal and instrumental styles, blues and rock, visual and performance iconography, milestones in the development of musical genres and the major roles of racism and discrimination in the development of these forms of popular music. Prerequisite: ANTH 102.

ANTH 391. Honors Tutorial (3)

ANTH 392. Honors Tutorial (3)

ANTH 393. Human Ecology: Biology of Human Adaptability (3)
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 man-made stresses on man’s adaptation to the environment. Prerequisite: ANTH 103 or consent of department.

ANTH 394. Seminar in Evolutionary Biology (3)
Cross-listed as PHIL 394.

ANTH 397. Epidemiology and Evolution of Human Diseases (3)
Basic concepts of infectious and degenerative diseases. Description and analysis of the changing distribution and determinants of disease in prehistoric, historic, and contemporary human populations. Prerequisites: ANTH 103 and consent of department.

ANTH 399. Independent Study (1-6)
Students may propose topics for independent reading and research. Prerequisite: Consent of department.

GRADUATE COURSES

ANTH 401. Biological Aging in Humans (3)
(See ANTH 301.) Prerequisite: ANTH 103 or consent of department.

ANTH 402. Darwinian Medicine (3)
(See ANTH 302.) Prerequisite: ANTH 103 or ANTH 105 or consent of department.

ANTH 404. Introduction to the Anthropology of Aging (3)
(See ANTH 304.) Prerequisite: ANTH 102 or consent of department.

ANTH 406. Anthropology of Childhood and the Family (3)
(See ANTH 306.) Prerequisite: ANTH 102 or consent of department.

ANTH 409. Family Violence and Child Abuse (3)
(See ANTH 309.) Prerequisite: ANTH 102 or consent of department.

ANTH 414. Cultures of the United States (3)
(See ANTH 314.) Prerequisite: ANTH 102 or consent of department.

ANTH 417. Asian Medical Systems (3)
(See ANTH 317.) Prerequisite: ANTH 102 or consent of department.

ANTH 418. Death and Dying (3)
(See ANTH 318.) Prerequisite: ANTH 102 or consent of department.

ANTH 422. Living Africa (3)
(See ANTH 322.)

ANTH 423. AIDS: Epidemiology, Biology, and Culture (3)
(See ANTH 323.) Prerequisite: ANTH 102 or ANTH 103 or ANTH 105 or consent of department.

ANTH 424. Field Methods in Archaeology (3)
(See ANTH 324.)

ANTH 427. Great Lakes Archaeology (3)
(See ANTH 327.) Prerequisite: ANTH 107 or consent of department.

ANTH 428. Ethics in Science (3)
(See ANTH 328.)

ANTH 430. Origins of Civilization (3)

ANTH 430A. North American Prehistory (3)

ANTH 431. Ancient Civilizations of the Near East (3)
(See ANTH 331.) Prerequisite: ANTH 102 or ANTH 107 or consent of department.

ANTH 433. Roots of Ancient India: Archaeology of South Asia (3)
(See ANTH 333.) Prerequisite: ANTH 102 or ANTH 107 or consent of department.

ANTH 434. Urban Anthropology (3)
(See ANTH 334.) Prerequisite: ANTH 102 or consent of department.

ANTH 437. Comparative Medical Systems (3)
(See ANTH 337.) Prerequisite: ANTH 215.

ANTH 440. Culture and Emotion (3)
(See ANTH 340.) Prerequisite: ANTH 102 or consent of department.

ANTH 441. Cultural Area Studies in Anthropology (3)
(See ANTH 341.) Prerequisite: ANTH 102.

ANTH 443. Psychoanalytic Anthropology (3)
(See ANTH 343.) Prerequisite: ANTH 102 or consent of department.

ANTH 445. Ethnicity, Gender, and Mental Health (3)
(See ANTH 345.) Prerequisite: ANTH 102 or consent of department.

ANTH 451. Topics in International Health (3)
(See ANTH 351.) Prerequisite: ANTH 102 or ANTH 105.

ANTH 451D. International Health Policy (3)
Prerequisite: ANTH 102 or ANTH 215.

ANTH 452. Japanese Culture and Society (3)
(See ANTH 352.) Prerequisite: ANTH 102 or consent of department.

ANTH 453. Chinese Culture and Society (3)
(See ANTH 353.) Prerequisite: ANTH 102 or consent of department.

ANTH 456. Mediterranean Culture and Society (3)
(See ANTH 356.) Prerequisite: ANTH 102 or consent of department.
ANTH 457. Native American Cultures (3)
(See ANTH 357.) Prerequisite: ANTH 102.
ANTH 458. Women’s Mental Health (3)
(See ANTH 358.) Prerequisite: ANTH 102 or ANTH 215.
ANTH 459. Introduction to International Health (3)
(See ANTH 359.) Prerequisite: ANTH 102 or consent of department.
ANTH 462. Contemporary Theory in Anthropology (3)
(See ANTH 362.) Prerequisite: ANTH 102 or consent of department.
ANTH 463. Anthropology and Bioethics (3)
(See ANTH 363.) Prerequisite: ANTH 102 or consent of department. Cross-listed as BETH 463.
ANTH 465. Gender and Sex Differences: Cross-cultural Perspective (3)
(See ANTH 365.) Prerequisite: ANTH 102 or consent of department.
ANTH 469. The Anthropology of Nutrition (3)
(See ANTH 369.) Prerequisite: ANTH 103 or consent of department.
ANTH 470. Tutorial in Physical Anthropology (3)
Guided readings in social anthropology. Prerequisites: Graduate standing and consent of graduate advisor.
ANTH 471. Culture, Behavior, and Person: Psychological Anthropology (3)
(See ANTH 371.) Prerequisite: ANTH 102 or consent of department.
ANTH 472. Anthropological Approaches to Religion (3)
(See ANTH 372.) Prerequisite: ANTH 102 or consent of department.
ANTH 475. Human Evolution: The Fossil Evidence (3)
(See ANTH 375.) Cross-listed as ANAT 475.
ANTH 476. Topics in the Anthropology of Health and Medicine (3)
(See ANTH 376.)
ANTH 477. Human Osteology (4)
(See ANTH 377.) Cross-listed as ANAT 477.
ANTH 479. Social-Cultural Anthropology (3)
ANTH 480. The Anthropology of Health and Illness I (3)
Part one of the graduate core course in medical anthropology. Includes sections giving an overview of topics such as the history and conceptual development of medical anthropology, anthropological epidemiology, psychiatric anthropology, social networks/support systems, and health care systems.
ANTH 481. The Anthropology of Health and Illness II (3)
Part two of the graduate core course in medical anthropology. Includes sections giving an overview of topics such as human adaptability theory, nutritional anthropology, demography, the anthropology of biomedicine, cross cultural aging, clinical anthropology and international health. Prerequisite: ANTH 480.
ANTH 483. Evolutionary Anatomy (4)
(See ANTH 383.) Prerequisites: ANTH 103 and BIOL 110. Cross-listed as ANAT 483.
ANTH 485. Applied Anthropology (3)
(See ANTH 385.) Prerequisite: Graduate standing.
ANTH 489. Crossroads: Transformation of Rural Blues into Urban Rock (3)
(See ANTH 389.) Prerequisite: ANTH 102.
ANTH 491. Tutorial in Physical Anthropology (3)
Guided readings in physical anthropology. Prerequisites: Graduate standing and consent of graduate advisor.
ANTH 493. Human Ecology: Biology of Human Adaptability (3)
(See ANTH 393.) Prerequisite: ANTH 103 or consent of department.
ANTH 494. Seminar in Evolutionary Biology (3)
Cross-listed as PHIL 494.
ANTH 497. Epidemiology and Evolution of Human Diseases (3)
(See ANTH 397.)
ANTH 498. Public Policy and Aging (3)
Cross-listed as EPBI 408.
ANTH 502. Research Practicum in Medical Anthropology and Cross-cultural Gerontology (3)
Provides M.A. students with firsthand experience in applying anthropology to health and aging problems. Prerequisite: Graduate standing.
ANTH 503. Seminar in Social Cultural Anthropology (3)
ANTH 504. Advanced Methods in Medical and Gerontological Anthropology (3)
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. Prerequisite: Graduate standing.
ANTH 505. Women’s Mental Health (3)
This anthropological course is a feminist examination of the cultural psychology of women in the following domains: 1) contextualized modes of attention, perception, and orientations for being-in-the-world; 2) power, resistance and resilience; and 3) specific psychiatric syndromes of schizophrenia and depression as they affect women. Issues of the cultural validity of theories premised upon an Euro-American ethno-psychology will be the subject of critique throughout the seminar.
ANTH 506. Seminar in Comparative Health Systems (3)
Prerequisite: ANTH 480.
ANTH 508. Seminar in Policy and Program Planning and Evaluation (3)
Prerequisite: ANTH 504.
ANTH 509. Seminar in Ethnopsychology of Emotion (3)
In this seminar we will be concerned with the relationship of culture and emotion. The study of emotion, traditionally the domain of philosophy, psychology, and physiology, has increasingly attracted the attention of psychological and medical anthropologists. Contemporary anthropological approaches to the problem have documented the substantial role that culture plays in mediating both the experience and the expression of emotion. These issues will be examined through review of cross-cultural, ethnographic materials. Prerequisite: ANTH 480.
ANTH 510. Seminar in International Health (3)
This seminar will survey the major areas of research in the field of international health, including anthropology and public health research in international health. Emphasis will be on critical evaluation of current international health theory and methods and review of relevant literature, in regard to the health of the world’s population. Prerequisites: ANTH 480 and ANTH 481.
ANTH 511. Seminar in Medical Ecology (3)
ANTH 513. Seminar in Ethnopsychiatry (3)
Theory and practice of psychotherapeutic
forms. Diagnostic and therapeutic forms from Europe, the United States, Japan, India, and other major cultural traditions and those of local areas such as West Africa, Native America, and Latin America. The cultural theories of mental disorders, related conceptions of self and person, and the relationships of local psychological theory to clinical praxis and outcome. Prerequisites: ANTH 215 and ANTH 371.

ANTH 519. Seminar in Human Ecology and Adaptability (3)

ANTH 530. Seminar in Medical Anthropology: Topics (3)
Selected topics will be offered for graduate students in medical Anthropology. Topics may include “Contemporary Perspectives in Medical Anthropology” and “New Directions in Population Policy.” Prerequisite: ANTH 480.

ANTH 542. Human Body: Discourse and Experience (3)
Interdisciplinary approach to embodiment as a starting point for rethinking the concepts of culture and existence. Methodological distinction between phenomenological and semiotic approaches. Topics include cultural uses of the body, the body as representation and expression, the body as an object of domination, the body of health and illness, sexuality and gendered body, religion and the sacred body, and technology and the body. Prerequisite: Graduate standing or consent of department.

ANTH 591. Seminar in Physical Anthropology (3)

ANTH 599. Tutorial: Advanced Studies in Anthropology (1-18)
(Credit as arranged.)

ANTH 601. Independent Research (1-18)
(Credit as arranged.)

ANTH 651. Thesis M.A. (1-18)

ANTH 700. Dissertation Fieldwork (0)
Students conducting dissertation fieldwork off-campus may choose to register for this course with the permission of their dissertation advisor. Students may register for a maximum of two academic years. Prerequisite: Must be Ph.D. candidate and have permission of department.

ANTH 701. Dissertation Ph.D. (1-18)
(Credit as arranged.)

ANTH 702. Appointed Dissertation Fellow (9)

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**Department of Art History and Art**

**ART HISTORY**

Mather House
Phone 216-368-4118; Fax 216-368-4681
Ellen G. Landau, Chair

**ART EDUCATION/ART STUDIO**

First Floor, Wickenden Building
216-368-2714; Fax 216-368-2715
Tim Shuckerow, Director

**Art History and Art**

The Department of Art History and Art offers opportunities to study art history, both Western and Asian, 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. In addition, the department offers graduate programs leading to the degrees of Master of Arts in art history, in art history and museum studies, and in art education; and the Doctor of Philosophy in art history, and in art history and museum studies. All art programs are considerably enhanced by close cooperation with and access to the facilities of cultural institutions located in University Circle, in particular the Cleveland Museum of Art and the Cleveland Institute of Art.

The undergraduate and 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. All classes are taught at the museum, and courses are occasionally offered by the 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. Students majoring in art history have a wide variety of career opportunities. Graduates with a strong background in art are employed as teachers, as museum professionals (both curatorial and administrative); as art librarians and archivists; as journalists or as sales representatives in commercial art galleries, auction houses, and bookstores; as art conservators and restorers; as art specialists in the diplomatic service and at all levels of government; and in industry, film, and television. Some of these specialties require additional study and professional preparation beyond the bachelor’s degree.

**Art Education**

The undergraduate and graduate degree programs in art education are given jointly 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 which educates artists and designers. Students participate in educational field experiences conducted in many of greater Cleveland’s urban, suburban and rural school systems, its hospitals, museums and cultural institutions. Graduates of CWRU’s art education programs 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 art therapists in hospitals and community centers; as designers of educational programs for industry; and as practicing artists.

A second major and a minor sequence in pre-architecture are offered for those CWRU students expecting to continue architectural studies at the graduate level (or who simply wish to pursue an area of interest).

The university offers introductory and intermediate studio courses taught by experienced artists/teachers in its own studios for non-art education majors. Qualified undergraduates majoring in art history or art education may also participate in the Integrated Graduate Studies Program.

**FACULTY**

Art History and Art
Ellen G. Landau, Ph.D. (University of Delaware)
Professor and Chair
20th century American and European art;
Critical Theory and Gender Studies
Henry Adams, Ph.D. (Yale University)
Professor & Curator of American Painting, Cleveland Museum of Art
American art
Stanislaw Czuma, Ph.D. (University of Michigan)
Maxine J. Stone Visiting Professor of Asian Art
George P. Bickford Curator of Indian and Southeast Asian Art, Cleveland Museum of Art
Asian art; Indian art
Dario L. Gamboni, Ph.D (University of Lausanne)
Andrew W. Mellon Professor of Humanities
19th century European art and theory
Jenifer Neils, Ph.D. (Princeton University)
Ruth Coulter Heede Professor
Ancient art and classical archaeology
Edward J. Oliszewski, Ph.D. (University of Minnesota)
Ancient art and classical archaeology
Diane De Grazia, Ph.D (University of Michigan)
Northern Renaissance and Baroque art
Catherine B. Scallen, Ph.D. (Princeton University)
Assistant Professor and Undergraduate Advisor
Asian art; Indian art

ADJUNCT FACULTY

Curators of the Cleveland Museum of Art
Michael Bennett, Ph.D. (Harvard University)
Ancient Art
Michael Cunningham, Ph.D. (University of Chicago)
Japanese art
Diane De Grazia, Ph.D. (Princeton University)
Clara T. Rankin Chief Curator, Cleveland Museum of Art
Italian Baroque art
Stephen Fliegel, M.A. (University of Sheffield)
Medieval art
Nancy C. McAfee, M.A. (Case Western Reserve University)
Contemporary art; museum studies
William Robinson, Ph.D. (Case Western Reserve University)
Modern art
Katherine Solender, M.A. (Johns Hopkins University)
Modern art; museum studies
Marjorie Williams, M.A. (University of Michigan)
Asian art

ART EDUCATION
Tim Shuckerow, M.A. (Case Western Reserve University)
Director of Art Education and Art Studio Supervisor of Art Education
Norm Schnepf, M.E. (Kent State University)
Supervisor of Art Education Secondary Student Teaching
Sandra Noble, M.A. (Cleveland State University)
Supervisor of Art Education Elementary

Student Teaching and Clinical/Field-Based Experience

UNDERGRADUATE PROGRAMS

MAJORS

Art History
The curriculum in art history 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 also develop a technical and critical vocabulary as well as sound writing skills to analyze works of art.

The major in art history, which leads to the Bachelor of Arts degree, requires 36 hours of coursework in art history, including:

- ARTH 101, Art History I (3)
- ARTH 102, Art History II (3)
- ARTH 396, Majors Seminar (3)

At least 6 credit hours must be taken at the 200 level. At least 15 credit hours must be taken at the 300 level. One approved art studio course is also required. Foreign language study (French, German, or Italian) is highly recommended.

Pre-Architecture
The pre-architecture major leads to the Bachelor of Arts degree. However, it 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. The pre-architecture program introduces the student to the forms, history, and functions of architecture as well as 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.

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:

- ARTS 302, 303, Architecture and City
- ARTH 101, Art History I (3)
- ARTH 102, Art History II (3)
- ARTS 106, Creative Drawing I (3)

Fifteen hours of electives must be selected from the following groups:

A. 6 hours from selected art history courses.

B. 6 hours from:
- ARTS 101, 201, Design and Color I, II (3, 3)
- ARTS 206, Creative Drawing II (3)
- ARTS 220, Photography Studio I (3)
- THTR 223, 224, Stagecraft I, II (3, 3)

C. For students whose interests lie in aesthetics and the history of architecture, 3 hours in sociology, American studies, anthropology, history of science and technology, civil engineering, or geology. Students are encouraged to include as many of the courses listed below as possible in their schedules:

- MATH 125, 126, Mathematics I, II (4, 4)
- PHYS 115, 116, Introduction to Physics (4, 4) and Laboratory (4, 4)
- PHYS 121, General Physics-Mechanics (4)
- PHYS 122, General Physics II-Electricity and Magnetism (4) and Laboratory

Art Education
The program in art education, which leads to the Bachelor of Science degree, requires a total of 123 credits and is designed to educate professional teachers of art for the public and private schools who are also competent, creative artists. It meets all requirements of the State Board of Education of Ohio for the Provisional PreK-12 Special Licensure in Art, qualifying its university-recommended holders to teach art in the public schools of Ohio and over 40 reciprocating states, pre-K - 12th grade. This program is conducted
Admission requires application to Case Western Reserve and submission of a portfolio to the Cleveland Institute of Art. Credentials must be acceptable to both institutions. Academic work is taken at Case Western Reserve University and studio courses at the Cleveland Institute of Art, as follows:

**Academic Courses at Case Western Reserve University**

*ENGL 150 ........................................ 3
*ENGL electives (300 level) .................. 3
*GER: Mathematics ............................. 3
*GER: Natural Sciences ........................ 3
*GER: Natural Science or Science and Society ........................................ 3
*Art History 101, 102 ............................ 6
*GER: History, Philosophy, Religion .............................. 6
*PSCL 101, EDUC 304 .......................... 6
ARTS 295, 300, 385, 386, 393, 366A, 366B, 465 ................................. 24
*EDUC 301 ........................................ 3
ARTH electives (one must be at 300 level) ........................................ 6
ENGL elective (300 level) ...................... 3
*GER: Global and Cultural Diversity .............................. 3
One open elective (300 level) ................ 3
* indicates courses fulfilling Arts and Sciences General Education

**Requirements**

**Art Studio at Cleveland Institute of Art**

- Computer Basics 101, 201 .................. 3
- Design 107, 108, 209 ........................ 9
- Drawing 117, 118, 217 ..................... 9
- Painting 121, 122, 210 ..................... 9
- Sculpture 227 ................................. 3
- 5 studio electives at 3 hours each ...... 15
- CIA open elective .......................... 3

**Retention and Advanced Standing**

*(Undergraduate Level)*

Students in art education who expect to meet state licensure requirements must apply for advanced standing by the end of their first semester junior year. To apply, students must submit to the art education faculty information about grade point average, written personal goals, and self-analysis of program progress up to the point of evaluation. Art education faculty may (1) accept a student for advanced standing; (2) accept a student with reservation, with a remedial plan; or (3) reject a student and recommend a career change.

A 2.5 cumulative grade point average is required to enter student teaching as well as a total of 300 contact hours of clinical field-based experience as required by the State of Ohio.

A 3.0 grade point average must be maintained in all professional education courses and an overall G.P.A. of 3.0 is required to be recommended by the university’s director of teacher licensure for State Teacher Licensure. Completion of the Bachelor of Arts degree exists separately from the assurance that State of Ohio Visual Art Teacher Licensure will be awarded.

The State of Ohio requires passing scores on the National Teacher Examination and fingerprinting with a criminal background check by the Ohio Bureau of Criminal Identification, in addition to the requirements stated above. Additional information on this program is available in the office of the director of art education.

**Minors**

Four minors are available in art: one in art history, and three through the art studio program:

**Art History**

Requires 18 hours of art history including:
- ARTH 101, Art History I (3)
- ARTH 102, Art History II (3)
At least three credit hours must be taken at the 200 level.

**Art Studio**

Requires 18 hours in art studio including:
- ARTS 101, Design and Color (3)
- ARTS 106, Creative Drawing (3)
Four additional studio courses, two of which must be in the same area (i.e., drawing, painting, design, photography, or ceramics).

**Photography**

Requires 18 hours including:
- ARTS 220, Photography Studio I (3)
- ARTS 320, Photography Studio II (3)
- ARTS 322, Photography: Color Studio (3)
- ARTS 325, Creative Photography (3) or ARTS 365D, Black and White Photography Studio

ARTS 365E, Color Studio (3) or ARTS 365K, Creative Photography

An elective, either ARTS 399, Independent Study in Art Studio (3) or ARTH 102, Art History II (3)

**Pre-Architecture**

Requires 18 hours including:
- ARTS 302, 303, Architecture and City Design I, II (3, 3)
- ARTH 101, Art History I (3)
- ARTH 102, Art History II (3)
- ARTS 106, Creative Drawing (3)
One approved elective.

**Sequences**

Sequences for students in the Engineering Core are available in art history and in art studio, in photography, and in pre-architecture. Sequences must include three art history courses, two of which should be at the 100 or 200 level, and selected in consultation with the departmental advisor. Art history sequences may include one three-hour course in art studio. A pre-architecture sequence is offered by art studio, drawn from ARTS 106, 302, 303; ARTH 101, 102.

**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 honors thesis (ARTH 399) that receives a grade of A.

**Integrated Graduate Studies**

Qualified undergraduates majoring in art history or art education also may participate in the Integrated Graduate Studies Program. Interested students should note the general requirements and the admission procedure. Additional information is available in the bulletin and can be consulted for further information.

**GRADUATE PROGRAMS**

**Master of Arts in Art History**

The master’s program in art history is designed to provide the student with a broad knowledge of the major art histori-
cal 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 term papers which they consider to represent their best work. Applicants for the M.A. should have a BA major or minor concentration in art history or a related humanities field and a minimum G.P.A. of 3.0.

The master’s degree in art history is conducted exclusively under Plan B as described under the School of Graduate Studies in this bulletin. All other requirements of the M.A. program must be fulfilled:

**ARTH 495, Methodologies of Art History (3)**

Eight graduate courses, including one each from four of the following five areas, three of which must be seminars at the 500-level (24):

1. Asian
2. Ancient
3. Medieval
4. Renaissance/Baroque
5. Modern and American

A reading knowledge of one foreign language (French, German, or Italian). Successful performance on the M.A. comprehensive examination.

3 credit hours of Qualifying Paper (ARTH 489)

Total: 30 hours.

**Master of Arts in Art History and Museum Studies**

The master’s program in art history and museum studies includes the same broad requirements and objectives of the master’s program in art history, with additional study of art museum procedures and two supervised museum internships. The requirements include:

**ARTH 495, Methodology of Art History (3)**

**ARTH 490, Visual Arts and Museums (3)**

**ARTH 491A&B, Visual Arts and Museums: Internship (1/3)**

Seven graduate courses, including one each from four of the following five areas, three of which must be graduate seminars at the 500 level (21):

1. Asian
2. Ancient
3. Medieval
4. Renaissance/Baroque
5. Modern and American

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 are already teacher licensed and who desire advanced studio- and art-related studies; Plan II for those holding the Bachelor of Fine Arts or equivalent degree who desire teaching licensure as visual art specialists. Both programs are offered jointly by Case Western Reserve University and the Cleveland Institute of Art.

The admission procedure includes a formal application, three letters of recommendation, and a college transcript, which are to be submitted to the Art Education office. The Cleveland Institute of Art admission procedure requires a portfolio of art work. Approval by both CWRU and the Cleveland Institute of Art is required for admission. Information and application forms are available through the office of Graduate Admissions at Case Western Reserve University and through the department.

Students in this program may follow either of two plans.

**Plan I: 36 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 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 based on individual research not less than 6 semester hours of registration.

**Plan II: 36 semester hours of course credit**

(Teacher Licensure Track for holders of the Bachelor of Fine Arts degree or equivalent studio background)

**EDUC 401, Introduction to Education (3)**

**EDUC 404, Educational Psychology (3)**

**ARTS 385, Clinical Field-Based Experience I (1)**

**ARTS 386, Clinical Field-Based Experience II (1)**

**ARTS 387, Clinical Field-Based Experience III (1)**

**ARTS 400, Current Issues in Art Education (3)**

**ARTS 493, Art Content, Pedagogy, Methodology, and Assessment (3)**

**ARTS 466 A&B, Student Teaching in Art for Pre-K – 6th Grade and 7th – 12th Grade (4 each)**

**ARTS 465, Seminar for Art Teachers (4)**

**ARTS 462, Studio Electives at the Cleveland Institute of Art at the 300-level or above (6)**

**RETENTION AND ADVANCED STANDING**

(Graduate Level)

Students in art education who expect to meet state teacher licensure requirements must apply for advanced standing prior to the semester in which they register for student teaching. To apply, students must submit to the art education faculty information about grade point average, personal goals, self-analysis of performance in the program up to the point of evaluation. Art education faculty may (1) accept a student for advanced standing; (2) accept a student with reservation, with a remedial plan; or (3) reject a student and recommend a career change.

A 3.0 cumulative grade point average is required to enter student teaching as well as a total of 300 contact hours of clinical field-based experience as required by the State of Ohio.

A 3.0 grade point average must be maintained in all professional education courses and an overall G.P.A. of 3.0 is required to be recommended by the university’s Director of Teacher Licensure for State Teacher Licensure.

Completion of the Master of Arts degree exists separately from the assurance that State of Ohio Visual Art Teacher Certification will be awarded. The State of Ohio requires a passing score on the National
Doctor of Philosophy in Art History and Museum Studies

The Ph.D. program in art history and museum studies is offered to a limited number of candidates. The program combines the academic requirements of a Ph.D. with practical museum training and is designed to provide experience in connoisseurship, conservation, and art education, as well as a planned program of academic coursework and independent research. Admission to the program is made on the basis of academic record, experience, recommendations, and personal interviews. A master’s degree in art history or its equivalent is required for admission as well as GRE scores and a reading knowledge of one foreign language. A Ph.D. qualifying examination or the equivalent is also required for admission.

Students in the Museum Studies Program are required to take a minimum of 38 hours of graduate study as follows: ARTH 610, Cleveland Museum of Art Internship (2); two graduate seminars at the 500 level or above (6); four elective courses at the 400 level or above (12); and a minimum of 18 hours of ARTH 701, Ph.D. Dissertation.

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 Joint Faculty in Art History. The dissertation subject may 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. Any student who has not taken ARTH 495, Methodologies of Art History or the equivalent, will be required to do so as part of the 12 hours of elective courses. Students also must satisfy all other requirements for the Ph.D. degree in art history.

Art History (ARTH)

UNDERGRADUATE COURSES

ARTH 101. Art History I: Pyramids to Pagodas (3)

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 Mapplethorpe (3)

The second half of a two-semester survey of world art highlighting the major monuments of Renaissance and Baroque Europe, America, and Asia. Special emphasis on visual analysis, historical and socio-cultural contexts, and objects in the Cleveland Museum of Art. (ARTH 101 and 102 may be combined, or either can be taken in conjunction with any other 100 or 200 level Art History class to complete a sequence in the Arts portion of the Humanities section of the General Education Requirements in the College of Arts and Sciences or can be used as part of a three course Humanities sequence in the Engineering Core curriculum.)

ARTH 103. Works of Art, Images, and Artifacts (3)

This course is designed to introduce students to the history of art and to the cultural resources of University Circle. It is comprised of slide lectures, videos, presentations by invited curators, and visits to the museums surrounding the University. By examining a variety of objects from many times and places and raising issues that cut across categories, it encourages discussion and helps to develop a critical understanding of visual and material culture.

ARTH 203. The Arts of Asia (3)

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 226. Introduction to Greek and Roman Art (3)

Classical art from the 8th century B.C. to the fourth century A.D.; the major developments in the architecture, sculpture, and painting of ancient Greece, Etruria, and Rome. Cross-listed as CLSC 226.

ARTH 227. Ancient Cities and Sanctuaries (3)

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. Cross-listed as CLSC 227.
ARTH 240. Introduction to Medieval Art (3)
Architecture, sculpture, painting, manuscript illumination, mosaics, and metal work from Early Christian period through later Middle Ages.

ARTH 250. Art in the Age of Discovery (3)
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 the Age of Grandeur (3)
A survey of European art in the seventeenth and eighteenth centuries, an era of rising nationalism, political aggrandizement, religious expansion and extravagant art patronage.

ARTH 270. American Art and Culture (3)
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. Cross-listed as AMST 270.

ARTH 280. Modern Art and Modern Science (3)
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)
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 302. Buddhist Art in Asia (3)
The development of Buddhist art from its origins in India along the silk route to China and along the maritime routes to Japan and southeast Asia.

ARTH 303. History of Far Eastern Art (3)
A survey of traditional arts of Asia east of the Indus river, designed to emphasize the creative contributions of the artist with particular attention to the international relations of: the Bronze Age, Buddhist art, Hindu art and the later arts of China, Korea, and Japan. National and regional contributions to the developed styles of South Asia and the Far East will be stressed.

ARTH 305. The Art of India (3)
A survey of Indian art from the Indus valley civilization to the Islamic conquest of India. Stylistic developments of the three-dimensional arts examined through cave sites and other extant materials.

ARTH 367. 17th and 18th Century Art (3)
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. Cross-listed as CLSC 332.

ARTH 332. Art and Archaeology of Ancient Italy (3)
The arts of ancient Italy from 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. Cross-listed as CLSC 332.

ARTH 333. Greek and Roman Painting (3)
Greek vase painting, Etruscan tomb painting and Roman wall painting. The development of monumental painting in antiquity. Cross-listed as CLSC 333.

ARTH 334. Art and Classical Archaeology of Greece (3)
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. Cross-listed as CLSC 334.

ARTH 351. Late Gothic Art in Italy (3)
Sculture 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.

ARTH 352. Italian Art of the 15th Century (3)
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.

ARTH 353. Sixteenth Century Italian Art (3)
The development of the High Renaissance and Mannerist styles in Italy and late 16th century trends: painting and sculpture.

ARTH 356. Italian Renaissance and Baroque Sculpture (3)
Italian sculpture from the early 12th century to the later 18th century. The Pisani, Ghiberti, Donatello, Michelangelo, the Mannerists and Bernini.

ARTH 361. Dutch and Flemish 17th Century Painting (3)
The golden age of Dutch and Flemish art with study of major masters (Rubens, Hals, Rembrandt, and Vermeer) and developments in subject matter: landscape, still-life, and genre themes.

ARTH 362. Issues in Renaissance Art (3)
Various topics in Renaissance art. Lectures, discussions and reports.

ARTH 365. Issues in Baroque Art (3)
Various topics in baroque art. Lectures, discussions and reports.

ARTH 367. 17th and 18th Century French Art (3)
A survey of the arts of painting, sculpture and architecture in France from 1600 to 1780. Attention will be given to stylistic developments and to social and political contexts, patronage and art theory.

ARTH 370. Visions of Landscape (3)
Major aspects of the representation of nature from the eighteenth 18th to the twentieth 20th century. Includes questions of art theory, social function, techniques of observation and depiction, and critical reception.

ARTH 374. Impressionism to Symbolism (3)
Major developments in European painting and sculpture during the latter half of the nineteenth century. Post-impressionism, symbolism, and the arts and crafts movement considered in their socio-cultural contexts. Works of Degas, Manet, Monet, Klimt, Bocklin, Gauguin, etc.

ARTH 378. 19th Century American Painting (3)
A survey of American painting covering the period from the beginning of the 19th
century up to the Armory Show of 1913. Much of the class will focus on American paintings in the Cleveland Museum of Art or will relate to American art exhibitions being planned at the museum.

ARTH 379. Issues in 19th Century Art (3)
Various topics in 19th century art, with class lectures, discussions, and reports. Consult department for current topic.

ARTH 380. Abstract Expressionism and Its Aftermath (3)
An examination of the development and influences of Abstract Expressionism, including the impact on the Beat Generation and Pop Art.

ARTH 381. Neoclassicism to Realism (3)
The main developments of European art, chiefly painting and sculpture from post-impressionism to the present; the nature of abstract art and the interrelationships between the visual arts and new developments in literature, philosophy, and science.

ARTH 382. Visions of Utopia: 20th Century European Art (3)
Major movements in early 20th century European painting and sculpture with utopian goals. Focus on the interrelationships between the visual arts and new developments in literature, philosophy, and sciences.

ARTH 383. Gender Issues in Feminist Art (3)
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.

ARTH 385. American Avant-Garde: 1900 - 1925 (3)
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.

ARTH 392. Issues in 20th Century Art (3)
Various topics in 20th century art, with class lectures, discussions and reports.

ARTH 393. Contemporary Art: Critical Directions (3)
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.

ARTH 396. Majors Seminar (3)
A group discussion course designed to focus on methodology and the relationship between art and contemporary society. Required of majors. Offered in alternate years.

ARTH 397. History of Prints and Printmaking (3)
Development of techniques and style and the social function of prints. The great masters: Durer, Rembrandt, Goya, and others. Based on the extensive collections of the Cleveland Museum of Art.

ARTH 398. Independent Study in Art History (1-3)
Individual research and reports on special topics.

ARTH 399. Honors Thesis (3)
Intensive study of a topic or problem leading to the preparation of an honors thesis.

GRADUATE COURSES

ARTH 402. Buddhist Art in Asia (3)
(See ARTH 302.)

ARTH 403. History of Far Eastern Art (3)
(See ARTH 303.)

ARTH 405. The Art of India (3)
(See ARTH 305.)

ARTH 406. History of Indian Sculpture (3)
(See ARTH 306.)

ARTH 428. Greek Sculpture (3)
(See ARTH 328.)

ARTH 432. Art and Archaeology of Ancient Italy (3)
(See ARTH 332.)

ARTH 433. Greek and Roman Painting (3)
(See ARTH 333.)

ARTH 434. Art and Classical Archaeology of Greece (3)
(See ARTH 334.)

ARTH 450. Problems in Medieval Art (3)
Various topics in Medieval art. Lectures, discussions, and reports.

ARTH 451. Late Gothic Art in Italy (3)
(See ARTH 351.)

ARTH 452. Italian Art of the 15th Century (3)
(See ARTH 352.)

ARTH 453. Sixteenth Century Italian Art (3)
(See ARTH 353.)

ARTH 456. Italian Renaissance and Baroque Sculpture (3)
(See ARTH 356.)

ARTH 461. Dutch and Flemish 17th Century Painting (3)
(See ARTH 361.)

ARTH 462. Issues in Renaissance Art (3)
(See ARTH 362.)

ARTH 465. Issues in Baroque Art (3)
(See ARTH 365.)

ARTH 467. 17th and 18th Century French Art (3)
(See ARTH 367.)

ARTH 470. Visions of Landscape (3)
(See ARTH 370.)

ARTH 474. Impressionism to Symbolism (3)
(See ARTH 374.)

ARTH 478. 19th Century American Painting (3)
(See ARTH 378.)

ARTH 479. Issues in 19th Century Art (3)
(See ARTH 379.)

ARTH 480. Abstract Expressionism and Its Aftermath (3)
(See ARTH 380.)

ARTH 481. Neoclassicism to Realism (3)
(See ARTH 381.)

ARTH 482. Visions of Utopia: 20th Century European Art (3)
(See ARTH 382.)

ARTH 483. Gender Issues in Feminist Art (3)
(See ARTH 383.)

ARTH 485. American Avant-Garde: 1900 - 1925 (3)
(See ARTH 385.)

ARTH 489. M.A. Qualifying Paper (3)
Individual research and intensive study of a specific topic in art history which culminates in a written M.A. Qualifying Paper. Prerequisite: 27 credit hours of Art History.

ARTH 490. Visual Arts and Museums (3)
Students who successfully complete this course 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)
Prerequisite: ARTH 490.

ARTH 491B. Visual Arts and Museums: Internship (3)
Second semester of internship; includes...
ARTH 492. Issues in 20th Century Art (3)
(See ARTH 392.)
ARTH 493. Contemporary Art: Critical Directions (3)
(See ARTH 393.)
ARTH 494B. Ancient Art (1-3)
ARTH 494C. Medieval Art (1-3)
ARTH 494D. Renaissance and Baroque Art (1-3)
ARTH 494E. American Art (1-3)
ARTH 494F. Modern Art (1-3)
ARTH 495. Methodologies of Art History (3)
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 497. History of Prints and Printmaking (3)
(See ARTH 397.)
ARTH 512. Seminar in Ancient Art (3)
ARTH 518B. Seminar in Asian Art (3)
ARTH 545B. Seminar in Medieval Art (3)
ARTH 550. Seminar: Issues in Western European Art (3)
ARTH 551. Seminar in Renaissance Art (3)
ARTH 552. Seminar in Baroque Art (3)
ARTH 565. Seminar in American Art (3)
ARTH 570. Seminar: 19th Century Art (3)
ARTH 575. Critical Theory Seminar (3)
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. Prerequisite: ARTH 495.

ARTH 576. Seminar in Modern Art (3)

ARTH 601. Research in Art History (1-18)
(Credit as arranged.)

ARTH 610. Cleveland Museum of Art Internship (1)
Prerequisite: ARTH 490.

ARTH 701. Dissertation Ph.D. (1-18)
(Credit as arranged.)

ARTH 702. Appointed Dissertation Fellow (9)

**Art Education/Art Studio (ARTS)**

**ARTS 101. Design and Color I (3)**
Organizational and structural problems as a basis for the development of style. Studies in line, texture, shape, space, value, color, and two dimensional composition through studio problems.

**ARTS 102. Design and Color II (3)**

**ARTS 206. Creative Drawing II (3)**
Continuation of ARTS 106. Advanced work in graphic representation. Development of visual acuity and a personal drawing style while working in color. Work from the model. Prerequisite: ARTS 106.

**ARTS 210. Enameling and Jewelry I (3)**
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)**
Basic techniques of weaving, macrame, and textile printing. Use of natural and synthetic fibers. Introduction to batik, quilting, and block printing on fabric.

**ARTS 214. Ceramics I (3)**
The techniques of hand building. Development of sensitivity to design and form. Basic work in stoneware, earthenware, and glazing.

**ARTS 216. Painting I (3)**
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)**
Camera, film, and darkroom techniques. Development of basic perceptual and photographic skills. Darkroom and photographic field and lab work. 35mm camera required.

**ARTS 295. Introduction to Art Education (3)**
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.

**ARTS 300. Current Issues in Art Education (3)**
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, and special populations. Prerequisite: ARTS 295.

**ARTS 302. Architecture and City Design I (3)**
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. Problems related to small, intimate scale and residential structures. Lectures, field trips, studio experiences. Recommended ARTS 101 or ARTS 106 courses prior to enrollment.

**ARTS 303. Architecture and City Design II (3)**
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. Problems 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.

**ARTS 310. Enameling and Jewelry II (3)**
Continuation of ARTS 210. Advanced enameling and jewelry techniques applied to copper or silver, cloisonne, champleve, basse taille, plaque-jour. Creative use of design principles and jewelry techniques. Prerequisite: ARTS 210.
ARTS 312. Weaving, Fibers, and Textile II (3)
Continuation of ARTS 212. Development of a selected area of weaving or textiles: loom weaving tapestry, three dimensional work, batik, or fabric printing. Exploration of an area through design and execution of a series of projects. Prerequisite: ARTS 212.

ARTS 314. Ceramics II (3)
Continuation of ARTS 214. Problematic approach to technical aspects of ceramics; extensive experience in wheel throwing, experimentation with glaze and clay body formulation. Prerequisite: ARTS 214.

ARTS 316. Painting II (3)
Continuation of ARTS 216. Expansion of basic concepts treated in ARTS 216. Work in acrylic and mixed media. Development of personal style. Prerequisite: ARTS 216.

ARTS 320. Photography Studio II (3)
Continuation of ARTS 220. Advanced theory and black and white techniques, historic processes and theory. Development of personal aesthetic encouraged. Field work. 35mm camera required. Prerequisite: ARTS 220.

ARTS 322. Photography: Color Studio (3)
Personal expression through use of color photography. Introduction to color printing and processing techniques. History of the medium. Field and lab work. 35mm camera required. Prerequisite: ARTS 220.

ARTS 365A. Painting (3)
Advanced painting problems determined in consultation with instructor. Prerequisites: ARTS 216 and ARTS 316.

ARTS 365B. Design and Color (3)
Advanced design problem determined in consultation with instructor. Prerequisites: ARTS 101 and ARTS 201.

ARTS 365C. Enameling and Jewelry (3)
Advanced enameling and jewelry problems determined in consultation with instructor. Prerequisites: ARTS 210 and ARTS 310.

ARTS 365D. B&W Photography Studio (3)
Advanced black and white problems determined in consultation with instructor. Prerequisites: ARTS 220 and ARTS 320.

ARTS 365E. Color Studio (3)
Advanced color studio problems determined in consultation with instructor. Prerequisites: ARTS 220 and ARTS 320.

ARTS 365F. Creative Drawing (3)
Advanced multimedia drawing. Prerequisites: ARTS 106 and ARTS 206.

ARTS 365G. Ceramics (3)
Advanced ceramics problems determined in consultation with instructor. Prerequisites: ARTS 214 and ARTS 314.

ARTS 365H. Weaving, Fibers, and Textiles (3)
Advance textile problems determined in consultation with instructor. Prerequisites: ARTS 212 and ARTS 312.

ARTS 365K. Creative Photography (3)
Incorporates computer technologies and multimedia processes with photography. Prerequisites: ARTS 220 and ARTS 320 and ARTS 322.

ARTS 366A. Student Teaching in Art: Pre-K - 6th Grade (4)
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. Prerequisites: ARTS 295, ARTS 300, ARTS 385, ARTS 386, ARTS 387, and ARTS 393. Corequisites: ARTS 366B and ARTS 465.

ARTS 366B. Student Teaching in Art: 7th - 12th Grade (4)
Teaching adolescents and young adults art in a school setting. Includes art curriculum development, implementation, and assessment. Professional standards and practices. Prerequisites: ARTS 295, ARTS 300, ARTS 385, ARTS 386, ARTS 387, and ARTS 393. Corequisites: ARTS 366A and ARTS 465.

ARTS 385. Clinical/Field Based Experience I (1)
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, and Cleveland Children’s Museum. 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. Prerequisite: ARTS 295 or consent of Art Education director.

ARTS 386. Clinical/Field Based Experience II (1)
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. Prerequisite: ARTS 295 or consent of Art Education director.

ARTS 387. Clinical/Field Based Experience III (1)
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. Prerequisite: ARTS 295.

ARTS 393. Art Content, Pedagogy, Methodology, and Assessment (3)
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. Prerequisite: ARTS 295.

ARTS 399. Independent Study in Art Studio (1-3)
Prerequisite: Permit required from Director of Art Studio.

GRADUATE COURSES

ARTS 400. Current Issues in Art Education (3)
(See ARTS 300.) Research paper required for graduate students.

ARTS 402. Architecture and City Design I (3)
(See ARTS 302.)

ARTS 403. Architecture and City Design II (3)
(See ARTS 303.)

ARTS 465. Seminar for Art Teachers (4)
For art education majors. Principles and practice in art instruction in grades pre-K through 12th grade. Organization and management of the art program that incorporates production, art history, appreciation, and criticism into an integrated sequential curriculum. Planning, development, and evaluation of teaching materials, lessons, and units. Prerequisites: ARTS 295 or ARTS 602, and ARTS 393 or ARTS 493. Corequisites: ARTS 366A and ARTS 366B or ARTS 466A and ARTS 466B.

ARTS 466A. Student Teaching in Art: Pre-K - 6th Grade (4)
(See ARTS 366A.) Prerequisites: ARTS 385, ARTS 386, ARTS 387, ARTS 400,
Program in artificial intelligence offers an undergraduate minor. The core of the minor introduces students to the techniques of artificial intelligence programming and the basic theoretical concepts of artificial intelligence, knowledge representation, and automated reasoning. Within the minor, a student may choose a track pertaining to science and engineering or a track pertaining to artificial intelligence and cognition. Students who take the science and engineering track will have the opportunity to build significant intelligent systems. They will acquire a solid understanding of methods for knowledge representation and automated reasoning. The science and engineering track provides an opportunity for a student to acquire knowledge that is useful in areas such as management and engineering.

The artificial intelligence and cognition track will give students the opportunity to explore the relationships between computational processes and the study of mind and language. Studies of the relationships between these areas have led to developments in robotics, mathematical neuroscience, visual processing systems, parallel processing systems, mathematical and experimental psychology, and linguistics.

A minor consists of five courses. Every student who takes the minor in artificial intelligence must take the two courses, ENGR 131 (Elementary Computer Programming) and ECES 391 (Introduction to Artificial Intelligence). Students who take the artificial intelligence minor must also take one of two minor tracks:

**The Technology Track** requires 3 of the following courses:
- BIOL 373 Introduction to Neurobiology
- BIOL 374 Neurobiology of Behavior
- BIOL 478 Computational Neuroscience (cross listed as ECES 478)
- BIOL 479 Seminar in Computational Neuroscience (cross listed as ECES 479)
- ECES 411 Logic Programming
- ECES 375 Autonomous Robotics (cross listed as BIOL 375)
- ECES 475 Autonomous Robotics (cross listed as BIOL 475)
- ECES 491 Intelligent Systems I (cross listed as EEAP 491)
- ECES 591 Intelligent Systems II (cross listed as EEAP 591)
- EEAP 484 Computational Intelligence I: Basic Principles (cross listed as ECES 484)
- EEAP 485 Computational Intelligence II: Applications
- EEAP 489 Robotics I
- EEAP 531 Computer Vision for Industrial Applications
- EEAP 589 Robotics II
- ESCI 352 Engineering Economics and Decision Analysis
- ESCI 350 Manufacturing Systems Engineering
- PHIL 201 Introduction to Logic
- PHIL 306 Mathematical Logic

**The Cognitive Science Track** requires 3 of the following courses:
- BIOL 373 Introduction to Neurobiology
- BIOL 374 Neurobiology of Behavior
- BIOL 478 Computational Neuroscience (cross listed as ECES 478)
- BIOL 479 Seminar in Computational Neuroscience (cross listed as ECES 479)
- ENGL 301 Linguistic Analysis of Modern English
- PHIL 201 Introduction to Logic
- PHIL 306 Mathematical Logic
- PSCL 101 General Psychology I
- PSCL 352 Physiological Psychology
- PSCL 353 Psychology of Learning
- PSCL 355 Sensation and Perception

**Artificial Intelligence**

508 Olin
Phone 216-368-2839
George W. Ernst, Director
Email: ernst@eecs.cwru.edu

**Program Faculty**

George W. Ernst, Ph.D. (Carnegie Institute of Technology)
Associate Professor of Computer Science

Randall D. Beer, Ph. D. (Case Western Reserve University)
Professor of Computer Science

Michael S. Branicky, Ph.D. (Massachusetts Institute of Technology)
Assistant Professor of Electrical Engineering

Hillel J. Chiel, Ph.D. (Massachusetts Institute of Technology)
Professor of Biology

Grover C. Gilmore, Ph.D. (Johns Hopkins University)
Professor of Psychology

Robert L. Greene, Ph.D. (Yale University)
Professor of Psychology

Miles H. Kennedy, Ph.D. (University of London, England)
Professor of Management Information and Decision Systems

Gilles Klopman, Ph.D. (University of Brussels, Belgium)
Professor of Chemistry

Behnam Malakooti, Ph.D. (Purdue University)
Professor of Systems and Control Engineering

Francis L. Merat, Ph.D. (Case Western Reserve University)
Associate Professor of Electrical Engineering

Wyatt S. Newman, Ph.D. (Massachusetts Institute of Technology)
Professor of Electrical Engineering
PSCL 357 Cognitive Psychology
PSCL 370 Human Intelligence
PSCL 402 Cognition and Information Processing
400- and 500-level courses require the approval of the minor advisor.

Asian Studies

112 Mather House
Phone 216-368-2205
William E. Deal, Director

ADVISORY COMMITTEE
William E. Deal, Ph.D. (Harvard University)
Severance Associate Professor of the History of Religion and Chair
Director, Asian Studies Program
Buddhism, Japanese and Chinese religions, comparative ethics, methodology of religion
Eileen Doherty, Ph.D. (University of California, Berkeley)
Assistant Professor, Political Science
International relations; U.S. foreign policy; international political economy; Asian political-economic development
Melvyn C. Goldstein, Ph.D. (University of Hawaii/ East-West Center)
Associate Professor, Japanese and Comparative Literature
Cinema and art, emphasis on Asian (Japanese) cinema; traditional Asian theater; set design, landscape architecture and film; Japanese poetry; literature and film; cinema of Spain
Linda C. Ehrlich, Ph.D. (University of Hawaii/ East-West Center)
Assistant Professor, Japanese and Comparative Literature
Religious traditions, religious ethics; China, Hong Kong, U.S.
William E. Deal, Ph.D. (Harvard University)
Professor, Management and Policy
Japanese technology policy and management of technology in Japan

UNDERGRADUATE PROGRAMS
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 CWRU 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 these nations.

The CWRU Asian Studies Program brings together faculty with research and teaching interests in the histories and cultures of Asia, and provides students with a curriculum that offers several different approaches to the study of Asia. The Asian Studies Program is interdisciplinary, drawing faculty and courses from such departments as anthropology, art history and art, economics, modern languages and literatures, history, philosophy, political science, and religion.

A current list of approved courses is available from a program advisor. Several Asian studies courses contribute to the completion of the Arts and Sciences General Education Requirements.

The undergraduate program in Asian studies offers a major, minor, and sequence. 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. Asian studies 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 for exploring and understanding the importance of Asia in the global community. Extracurricular activities include sponsorship of lectures, films, and the administration of a Web site devoted to Asia. The program also encourages students to study abroad in an Asian country and to utilize local Asian resources at the Cleveland Museum of Art and other area institutions.

Major (for B.A.)
The major in Asian Studies consists of two tracks. Students choose one of the two tracks. Track 1 requires a minimum of 37 credit hours and includes an Asian language requirement. Track 2, which does not require study of an Asian language, can only be taken as a second major. Both tracks require ASIA 133 and ASIA 134, and additional hours chosen from a list of approved courses available from a program advisor. Students prepare a program of study, indicating specific course selections to meet the requirements for the chosen track. A program advisor must approve a student’s program of study.

Track 1 (first major) - 37 semester hours total
• ASIA 133 and ASIA 134 (cross-listed as: HSTY 133 and HSTY 134)
• at least 16 hours in an Asian language
• 3 hours in anthropology (Asia-related)
• 3 hours in political science or economics (Asia-related)
• 3 hours in religion (Asia-related)
• 6 additional hours (Asia-related) selected in consultation with a Program advisor

Track 2 (can only be taken as a second major) - 36 semester hours total
• ASIA 133 and ASIA 134 (cross-listed as: HSTY 133 and HSTY 134)
• 6 hours in anthropology (Asia-related - suggested: ANTH 352 and ANTH 353)
• 6 hours in religion (Asia-related - suggested: RLGN 204 and RLGN 217)
• 3 hours in comparative literature (Asia-related)
• 3 hours in political science or economics (Asia-related)
• 12 additional hours (Asia-related) selected in consultation with a Program advisor

Minor
The minor in Asian Studies consists of 18 semester hours of courses, including ASIA 133 or ASIA 134. The remaining 15 credit hours are selected in consultation with a Program advisor. Only one year (8 credits) of language study (Japanese or Chinese) counts toward the minor.
Asian Studies (ASIA)

ASIA 110. Introduction to East Asian Culture and Society (3)
This course is an introduction to Chinese and Japanese culture and society from both contemporary and historical perspectives. Students will examine political, social, religious, artistic, literary, and other phenomena which have shaped these two East Asian nations. This course is both an introduction to China and Japan for non-majors, and a foundation for Asian Studies majors and minors pursuing further course work on East Asia.

ASIA 133. Introduction to Chinese History and Civilization (3)
Cross-listed as HSTY 133.

ASIA 134. Introduction to Japanese History and Civilization (3)
Cross-listed as HSTY 134.

ASIA 230. Asian Cinema and Drama (3)
Cross-listed as CMPL 230.

ASIA 398. Honors Thesis (1-4)
Intensive study of a topic or problem under the direction of a faculty member, resulting in the preparation of an honors thesis. Prerequisite: Permission of program director.

ASIA 399. Independent Study (1-3)
Tutorial in Asian studies.

Department of Astronomy

422 A.W. Smith Building
Phone 216-368-3728; Fax 216-368-5406
R. Earle Luck, Chairman
wsobs@grendel.astr.cwru.edu

FACILITIES
The Department of Astronomy operates the Kitt Peak Station near Tucson, Arizona, home of the Burrell Schmidt telescope. This is telescope is used for deep surveys and imaging with large format CCDs. The 0.9m reflector located at the Nassau Station near Chardon, Ohio is robotically controlled and equipped for both direct imaging and spectroscopy. A 9.5-inch refractor is permanently mounted on the roof of the campus offices of the Department of Astronomy and is available for use by students. The department also maintains a research and instruction computer laboratory.

FACULTY
R. Earle Luck, Ph.D. (University of Texas, Austin)
Worcester R. and Cornelia B. Warner Professor and Chair
Director of the Warner and Swasey Observatory
J. Christopher Mihos, Ph.D. (University of Michigan)
Assistant Professor
Heather L. Morrison, Ph. D. (Australian National University)
Assistant Professor

SECONDARY FACULTY
Lawrence M. Krauss, Ph.D. (Massachusetts Institute of Technology)
Ambrose Swasey Professor and Chair, Department of Physics
Glenn Starkman, Ph.D. (Stanford University)
Associate Professor, Department of Physics

UNDERGRADUATE PROGRAMS
Two degrees in astronomy are offered, the Bachelor of Science degree and the Bachelor of Arts degree. The primary difference between the two degrees is that the B.A. degree allows somewhat more flexibility in choice of courses. Both the B.A. and B.S. degrees provide excellent preparation for graduate studies. There are also two minor programs in astronomy.

A broad and substantial background in physics and mathematics with introductory exposure to astronomy is emphasized in the astronomy curriculum. A faculty actively engaged in research provides first-rate instruction and opportunity for undergraduate involvement in research.

A bachelor's degree in astronomy is designed to prepare for graduate study in astronomy, but the holder of this undergraduate degree who seeks employment can fill the same jobs as physics and computer science majors.

GRADUATE PROGRAMS
The department offers graduate programs leading to the degrees of Master of Science and Doctor of Philosophy in astronomy. Current research provides opportunities in optical observational astronomy and theoretical studies of galaxy interaction and formation. Prospective graduate students must submit scores on
BACHELOR OF ARTS DEGREE

MAJOR IN ASTRONOMY

Fall Semester  

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
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<tr>
<td>FRESHMAN</td>
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<tr>
<td>MATH 121</td>
<td>Calculus for Science &amp; Engineering I</td>
<td>4</td>
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<td>or</td>
<td>MATH 123 Calculus I</td>
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<tr>
<td>PHYS 121</td>
<td>General Physics I: Mechanics</td>
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<tr>
<td>ENGL 150</td>
<td>Expository Writing</td>
<td>3</td>
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<tr>
<td>PHED 101</td>
<td>Physical Education Activities</td>
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<tr>
<td>Social Science I</td>
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<td>3</td>
</tr>
<tr>
<td>Arts &amp; Humanities I</td>
<td></td>
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</tbody>
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SOPHOMORE

ASTR 221 Stars and Planets                                   | 3            |
| MATH 223 Calculus for Science & Engineering III             | 3            |
| or          | MATH 227 Calculus III                                 | 3            |
| PHYS 221    | General Physics III: Modern Physics                  | 3            |
| ENGR 131    | Elementary Computer Programming                      | 3            |
| Arts & Humanities III |                                             | 3            |

JUNIOR

ASTR 311 Stellar Physics                                     | 3            |
| PHYS 313    | Thermodynamics & Statistical Mechanics              | 3            |
| STAT 312    | Statistics for Science and Engineering              | 3            |
| Technical Elective |                                             | 3            |

SENIOR

ASTR 306 Astronomical Techniques                             | 3            |
| ASTR 309    | Seminar I                                          | 1            |
| PHYS 331    | Quantum Mechanics I                               | 3            |
| Social Science III |                                            | 3            |

Spring Semester  

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tr>
<td>FRESHMAN</td>
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<tr>
<td>MATH 122</td>
<td>Calculus for Science &amp; Engineering II</td>
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<tr>
<td>or</td>
<td>MATH 124 Calculus II</td>
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<tr>
<td>PHYS 122</td>
<td>General Physics II: Electricity and Magnetism</td>
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<tr>
<td>PHED 102</td>
<td>Physical Education Activities</td>
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<td>Social Science II</td>
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<tr>
<td>Arts &amp; Humanities II</td>
<td></td>
<td>3</td>
</tr>
</tbody>
</table>

SOPHOMORE

ASTR 222 Galaxies and Cosmology                              | 3            |
| MATH 224    | Elementary Differential Equations                 | 3            |
| or          | MATH 228 Differential Equations                   | 3            |
| PHYS 250    | Mathematical Physics & Computing                  | 3            |
| PHYS 310    | Classical Mechanics                               | 3            |
| Arts & Humanities IV |                                             | 3            |

JUNIOR

ASTR 328 Cosmology and the Structure of the Universe          | 3            |
| PHYS 324    | Electricity & Magnetism I                         | 3            |
| PHYS 326    | Contemporary Physical Optics                      | 3            |
| Technical Elective |                                             | 3            |

SENIOR

ASTR 310 Senior Seminar II                                    | 1            |
| Science & Society |                                             | 3            |
| Cultural Diversity |                                             | 3            |

Total Hours In Core and Departmental Requirements: 104

Open Electives to be added as appropriate to bring the total number of hours to the minimum of 120 needed for graduation with a B.A.

Nine hours of Mathematics and Natural Science (Physics) double-counted toward General Education Requirement.

Astronomy Hours: 17
Physics Hours: 29
Math/Stat Hours 17
Technical Electives Hours 09

Technical electives are additional courses in astronomy, chemistry, mathematics, statistics, physics, or geology which satisfy interests of the student but also fall within the science/mathematics objectives of the major. For a list of approved technical electives see advisor.

Minors in Astronomy

For non-physical science majors: ASTR 221, 222; PHYS 115, 116, and 1 of the following: (ASTR 306, 311, 323, 328).

For physical science majors: ASTR 221, 222, and 3 of the following: (ASTR 306, 311, 323, 328).

Approved Technical Electives - B.A. in Astronomy

(This is not an exhaustive list)

CHEM 107 Properties and Structure of Matter I
CHEM 108 Properties and Structure of Matter II
PHYS 204 Advanced Instrumentation Lab
PHYS 316 Introduction to Nuclear and Particle Physics
PHYS 325 E&M II
PHYS 332 QM II

Astronomy Hours: 17
Physics Hours: 29
Math/Stat Hours 17
Technical Electives Hours 09

Technical electives are additional courses in astronomy, chemistry, mathematics, statistics, physics, or geology which satisfy interests of the student but also fall within the science/mathematics objectives of the major. For a list of approved technical electives see advisor.

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For non-physical science majors: ASTR 221, 222; PHYS 115, 116, and 1 of the following: (ASTR 306, 311, 323, 328).

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Approved Technical Electives - B.A. in Astronomy

(This is not an exhaustive list)

CHEM 107 Properties and Structure of Matter I
CHEM 108 Properties and Structure of Matter II
PHYS 204 Advanced Instrumentation Lab
PHYS 316 Introduction to Nuclear and Particle Physics
PHYS 325 E&M II
PHYS 332 QM II
## Bachelor of Science in Astronomy Degree

### Fall Semester (Class/Lab/Credit Hours)

**FRESHMAN**
- MATH 121 Calculus for Science & Engineering I ........................................... (4-0-4) or (4-0-4)
- MATH 123 Calculus I ................................................................................. (4-0-4)
- PHYS 121 General Physics I - Mechanics ............................................... (4-0-4)\(^a\)
- ENGL 150 Expository Writing .................................................................. (3-0-3)
- PHED 101 Physical Education Activities .................................................. (0-3-0)
- Arts & Humanities I ................................................................................ (3-0-3)
- Social Science I ...................................................................................... (3-0-3)

**TOTAL:** ........................................................................................................... 16-0-16

**SOPHOMORE**
- ASTR 221 Stars and Planets .................................................................... (3-0-3)
- MATH 223 Calculus for Science & Engineering III ................................. (3-0-3) or (3-0-3)
- MATH 227 Calculus III .............................................................................. (3-0-3)
- PHYS 203 Laboratory Physics ................................................................ (2-4-4)
- PHYS 221 General Physics III: Modern Physics ................................. (3-0-3)\(^a\)
- ENGR 131 Elementary Computer Programming .................................. (3-0-3)

**TOTAL:** ........................................................................................................... 14-4-16

**JUNIOR**
- ASTR 311 Stellar Physics ........................................................................ (3-0-3)\(^b\)
- PHYS 313 Thermodynamics & Statistical Mechanics ......................... (3-0-3)
- STAT 312 Statistics for Science and Engineering ............................... (3-0-3)
- Technical Elective .................................................................................... (3-0-3)
- Arts & Humanities III .............................................................................. (3-0-3)

**TOTAL:** ........................................................................................................... 15-0-15

**SENIOR**
- ASTR 306 Astronomical Techniques ....................................................... (3-0-3)\(^b\)
- ASTR 309 Senior Seminar I .................................................................... (1-0-1)
- PHYS 325 Electricity & Magnetism II ....................................................... (3-0-3)
- PHYS 331 Quantum Mechanics I ............................................................ (3-0-3)
- Social Science III .................................................................................... (3-0-3)
- Cultural Diversity ................................................................................... (3-0-3)

**Total Hours Required for Graduation: 125**

Nine hours of Mathematics and Natural Science (Physics) double counted toward General Education Requirement.

Astronomy Hours: 20

Physics Hours: 38

Math/Stat Hours 17

Technical Electives Hours 12

Technical Electives are additional courses in astronomy, chemistry, mathematics, statistics, physics, or geology which satisfy interests of the student but also fall within the science/mathematics objectives of the major. For a list of approved technical electives see advisor.

\(^a\) selected students may be invited to take PHYS 123, 124, 223 in place of 121, 122, 221.

\(^b\) Courses taught every other year only.

### Spring Semester (Class/Lab/Credit Hours)

**FRESHMAN**
- MATH 122 Calculus for Science & Engineering II .................................. (4-0-4) or (4-0-4)
- MATH 124 Calculus II .............................................................................. (4-0-4)
- PHYS 222 General Physics II: Electricity & Magnetism ...................... (4-0-4)\(^b\)
- PHED 102 Physical Education Activities .................................................. (0-3-0)
- Arts & Humanities II .............................................................................. (3-0-3)
- Social Science II .................................................................................... (3-0-3)

**TOTAL:** ........................................................................................................... 14-3-14

**SOPHOMORE**
- ASTR 222 Galaxies and Cosmology ......................................................... (3-0-3)
- MATH 224 Elementary Differential Equations ....................................... (3-0-3) or (3-0-3)
- PHYS 204 Advanced Instrumentation Lab .............................................. (1-4-3)
- PHYS 250 Mathematical Physics & Computing .................................... (3-0-3)
- PHYS 310 Classical Mechanics ................................................................. (3-0-3)

**TOTAL:** ........................................................................................................... 13-4-15

**JUNIOR**
- ASTR 328 Cosmology and the Structure of the Universe ...................... (3-0-3)\(^b\)
- PHYS 324 Electricity & Magnetism I ......................................................... (3-0-3)
- PHYS 326 Physical Optics ....................................................................... (3-0-3)
- Technical Elective .................................................................................... (3-0-3)
- Science & Society ................................................................................... (3-0-3)

**TOTAL:** ........................................................................................................... 15-0-15

**SENIOR**
- ASTR 310 Senior Seminar II ................................................................. (1-0-1)
- ASTR 323 The Local Universe ................................................................. (3-0-3)\(^b\)
- PHYS 332 Quantum Mechanics II .......................................................... (3-0-3)
- Technical Elective .................................................................................... (3-0-3)
- Arts & Humanities IV ............................................................................. (3-0-3)
- Open Elective .......................................................................................... (3-0-3)

**TOTAL:** ........................................................................................................... 16-0-16

### Approved Technical Electives - B. S. in Astronomy

(This is not an exhaustive list)

- GEOL 345 Planetary Materials
- MATH 201 Introduction to Linear Algebra
- MATH 345 Introduction to Applied Mathematics
- PHYS 316 Introduction to Nuclear and Particle Physics
- PHYS 349 Methods of Mathematical Physics I
- PHYS 350 Methods of Mathematical Physics II

### Minors in Astronomy

For non-physical science majors: ASTR 221, 222; PHYS 115, 116; and 1 of the following: (ASTR 306, 311, 323, 328).

For physical science majors: ASTR 221, 222, and 3 of the (ASTR 306, 311, 323, 328).
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)**

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 to astronomy majors.

**ASTR 203. Archeoastronomy: Calendars, Barrows, and Megaliths (3)**

To acquaint the student with the regular cycles of the sun, moon, planets, and stars. To show how ancient civilizations (and some not so ancient) have used those cycles to formulate calendars which are evidenced primarily by artifacts and ruins scattered over the entire earth.

**ASTR 204. Einstein’s Universe (3)**

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 205. The Scale of the Universe (3)**

The solar system, stars, and galaxies. Our place in the universe. Cosmology and the evolution of the Universe. The use of physical laws to study the Universe. The scientific method—predictions and tests of scientific theory.

**ASTR 221. Stars and Planets (3)**

Stellar structure and energy production. Formation and evolution of stars. Supernovae, neutron stars, and black holes. Star clusters. Planetary systems and the detection of extrasolar planets. The application of physical laws to the study of the universe. Prerequisite: MATH 122 or MATH 126.

**ASTR 222. Galaxies and Cosmology (3)**


**ASTR 306. Astronomical Techniques (3)**

Emphasis will be on acquisition of direct imaging and/or spectroscopic data at the 0.9 meter telescope and its subsequent reduction. Principles of optics applied to astronomical telescopes and instrumentation. Modern detector technology. Computational techniques will also be explored through projects emphasizing modeling of data, dynamical simulations of star clusters emphasizing modeling of data, dynamical simulations of star clusters and galaxies, or astronomical database mining. Prerequisites: ASTR 221 and ASTR 222.

**ASTR 309. Senior Seminar I (1)**

Selected topics in astronomy not covered ordinarily in courses. Presentation of talks by the students.

**ASTR 310. Senior Seminar II (1)**

Selected topics in astronomy not covered ordinarily in courses. Presentation of talks by students.

**ASTR 311. Stellar Physics (3)**

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. Prerequisite: ASTR 222.

**ASTR 323. The Local Universe (3)**


**ASTR 328. Cosmology and the Structure of the Universe (3)**


**ASTR 396. Special Topics in Astronomy (1-3)**

Open to astronomy majors only.

**ASTR 409. Nucleosynthesis and Chemical Evolution (3)**

Formation of the elements by stellar nucleosynthesis, especially within supernovae. The subsequent dispersal of this material into the interstellar medium and its incorporation into stars. The observable elemental content of stars and the relation of that content to the history and dynamics of the galaxy. Prerequisite: Consent of department.

**GRADUATE COURSES**

**ASTR 411. Stellar Physics (3)**

(See ASTR 311.)
University that provide other possible avenues of study for those interested in pursuing a career in biochemistry. Research interests within the department include a broad spectrum of modern biochemical topics. Departmental facilities include major special equipment and well-equipped laboratories needed for research in modern biochemistry. Additional information about either the undergraduate or graduate programs can be obtained by contacting the departmental office.

**FACULTY**
(See School of Medicine.)

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**UNDERGRADUATE PROGRAMS**

The two undergraduate major programs are based on the Arts & Sciences General Education Requirements, but they differ in their requirements of fundamental mathematical and physical sciences. Either degree is excellent for students planning to undertake graduate work in biochemistry or in related areas of the biomedical sciences. Both the B.A. and the B.S. programs, shown on the following pages, 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 employment in the chemical or pharmaceutical industry, or as research assistants in academic research laboratories. The B.A., has a reduced emphasis on the quantitative aspects of science and the availability of a considerable amount of elective time permits a student to concentrate on biochemistry even more intensively than the curriculum requires, or to pursue other subjects in science or the liberal arts. The B.S. degree is for the student who has a particularly strong interest in the quantitative physical sciences. A small number of additional courses will qualify biochemistry

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**BACHELOR OF ARTS DEGREE**
**MAJOR IN BIOCHEMISTRY**

<table>
<thead>
<tr>
<th>Fall Semester</th>
<th>Credit hours</th>
<th>Spring Semester</th>
<th>Credit hours</th>
</tr>
</thead>
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<tr>
<td><strong>FRESHMAN</strong></td>
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<td><strong>FRESHMAN</strong></td>
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<tr>
<td>MATH 125 Mathematics I .................................. (4)</td>
<td>MATH 126 Mathematics II ................................. (4)</td>
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<tr>
<td>CHEM 105 Principles of Chemistry I ...................... (3)</td>
<td>CHEM 106 Principles of Chemistry II ...................... (3)</td>
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<tr>
<td>CHEM 107 Properties and Structure of Matter I .......... (3)</td>
<td>CHEM 108 Properties and Structure of Matter II .......... (3)</td>
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<tr>
<td>BIOL 110 Principles of Biology ............................ (3)</td>
<td>CHEM 113 Principles of Chemistry Laboratory ........... (2)</td>
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<td>or</td>
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<tr>
<td>PHED 100 Physical Education Activities ................... (0)</td>
<td>ENGL 150 Expository Writing ................................ (3)</td>
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<tr>
<td>GER Course ......................................................... (3)</td>
<td>PHED 100 Physical Education Activities ................... (0)</td>
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<td>GER Course ......................................................... (3)</td>
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<td><strong>SOPHOMORE</strong></td>
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<tr>
<td>CHEM 223 Introductory Organic Chemistry I ............ (3)</td>
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<td><strong>JUNIOR</strong></td>
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<td><strong>JUNIOR</strong></td>
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<tr>
<td>CHEM 301 Physical Chemistry I ................................ (3)</td>
<td>BIOC 308 Molecular Biology: Genes &amp; Genetic Engineering (4)</td>
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<td>BIOC 307 General Biochemistry ................................ (4)</td>
<td>BIOL 326 Genetics .............................................. (3)</td>
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<td>BIOL 210 Cell Biology: Structure, Function, Genetics (3)</td>
<td>GER Course ......................................................... (3)</td>
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<td>BIOL 211 Cell Biology Laboratory .......................... (2)</td>
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<td>Electives ............................................................ (6)</td>
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**SENIOR**

| BIOC 371 Undergraduate Seminar .......................... (1) | BIOC 372 Undergraduate Seminar .......................... (1) |
| BIOC Elective ..................................................... (3) | Approved Biochemistry Elective .......................... (3) |
| Approved Biochemistry Elective ........................... (3) | Electives ............................................................ (3) |
| Electives ............................................................ (6) | Electives ............................................................ (11) |

**NOTE:** Up to nine credit hours of undergraduate research, BIOC 391, may be counted as electives toward graduation. Students should consult their academic advisers about the elective parts of the curriculum.

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*Selected students may be invited to take CHEM 323, 324.

*Students who have completed or received advanced placement credit for BIOL 110 may elect to take BIOL 210 in the sophomore year.
students for a double major in chemistry and for associate or full membership in the American Chemical Society.

Undergraduate research is strongly encouraged for all biochemistry majors. As many as nine hours of Research in Biochemistry (BIOC 391) may be credited toward the requirements for graduation.

**Major**

(leading to the Bachelor of Arts degree)

Students enroll in the curriculum for the Bachelor of Arts degree in biochemistry, and are required to complete the following courses: BIOC 307, 308, 371, 372 BIOC elective (312, 334, or approved equivalent)

Approved Technical Electives in Biochemistry, 2 courses (6 cr)BIOL 110, 210, 211, 326; CHEM 105, 106 (or 107, 108), 113, 223, 224 (or 323,324), 233, 234, 301;

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### BACHELOR OF SCIENCE DEGREE

#### MAJOR IN BIOCHEMISTRY

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<th>(Class/Lab/Credit Hours)</th>
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<td>CHEM 105 Principles of Chemistry I ..................</td>
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<td>ECES 131 Elementary Computer Programming ..........</td>
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<tr>
<td>BIOC 110 Principles of Biology .......................</td>
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<td>CHEM 223 Introductory Organic Chemistry I ..........</td>
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<td>CHEM 321 Laboratory Methods and Techniques I .......</td>
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<td>MATH 223 Calculus for Science and Engineering III ..</td>
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<td>PHYS 122 General Physics II, Electricity and Magnetism</td>
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<td><strong>JUNIOR</strong></td>
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<tr>
<td>BIOC 307 General Biochemistry ..........................</td>
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<td>BIOL 210 Cell Biology: Structure, Function, Genetics</td>
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<td>BIOC 334 Structural Biology of Proteins, Enzymes, and Nucleic Acids (formerly Proteins and Enzymes) ..</td>
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**Spring Semester**

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<td>CHEM 106 Principles of Chemistry II ..................</td>
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<td>CHEM 108 Properties and Structure of Matter II .....</td>
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<td>PHYS 121 General Physics I, Mechanics ................</td>
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<tr>
<td><strong>SOPHOMORE</strong></td>
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<tr>
<td>CHEM 224 Introductory Organic Chemistry II ..........</td>
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<tr>
<td>CHEM 322 Laboratory Methods and Techniques II .....</td>
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<td>MATH 224 Elementary Differential Equations ..........</td>
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<td>PHYS 221 General Physics III, Modern Physics .......</td>
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<td>BIOC 308 Molecular Biology: Genes and Genetic Engineering</td>
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<td>BIOL 326 Genetics .............................................</td>
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<td>CHEM 302 Physical Chemistry II ..........................</td>
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<td>(16-0-16)</td>
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<tr>
<td><strong>SENIOR</strong></td>
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<tr>
<td>BIOC 312 Macromolecular Structure and Function (formerly Intro. to Physical Biochemistry) ..................</td>
<td>(3-0-3)</td>
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<tr>
<td>BIOC 372 Undergraduate Seminar .........................</td>
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<tr>
<td>Statistics/Data Analysis Elective (PHYS 250, ECES 251, STAT 312, 313, or equivalent) ..................</td>
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<td>GER Course ....................................................</td>
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<tr>
<td>Electives ................................................................</td>
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<tr>
<td>Total .....................................................................</td>
<td>(17-0-16)</td>
</tr>
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</table>

**TOTAL HOURS REQUIRED FOR GRADUATION:**

129

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a Selected students may be invited to take PHYS 123, 124, Physics and Frontiers, I, II (Honors), in place of PHYS 121, 122.

b Students who have either completed or received advanced placement credit for BIOL 110 may elect to take BIOL 210 in the sophomore year.

c Selected students may be invited to take CHEM 323, 324, Organic Chemistry, in place of CHEM 223, 224.
MATH 125, 126 (or 121, 122); PHYS 115, 116 (or 121,122), including laboratory.

**Major**

(leading to the Bachelor of Science degree)

Students enroll in the curriculum for the Bachelor of Science degree in Biochemistry, and are required to complete the following courses: BIOC 307, 308, 312, 334, 371, 372

Approved Technical Elective in Biochemistry, 1 course (3 cr) BIOL 110, 210, 211, 326; CHEM 105, 106 (or 107, 108), 113, 223, 224 (or 323,324), 301, 302 (or 335, 336), 321, 322 (or 233, 234, and 304); ECES 131; MATH 121, 122, 223, 224 (or 123, 124, 227, 228); PHYS 121, 122 (or 123,124), including laboratory, 221 (or 223); Statistics/Data Analysis

Elective (PHYS 250, ECES 251, STAT 312, 313, or equivalent)

**Honors Program**

Biochemistry majors who have excellent academic records will 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 3.300 in biochemistry, biology, and chemistry, and an overall grade point average of 3.000
2. A minimum of 6 credit hours of undergraduate research (BIOC 391) in one laboratory
3. A research 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.

The research adviser is asked to write a letter recommending the student for honors.

**Minor**

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. A recommended sequence of courses would include:

CHEM 105, 106 (or 107, 108)
CHEM 113 laboratory
CHEM 223, 224 (or 323, 324), 233, 234
BIOC 310, 210
BIOC 307, 308, and either 312 or 334.

The sequences may be followed after consultation with the Department of Biochemistry and with the other departments involved.

**GRADUATE PROGRAMS**

(See School of Medicine.)

**Biochemistry (BIOC)**

**UNDERGRADUATE COURSES**

**BIOC 307. General Biochemistry (4)**
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. Prerequisite: CHEM 223 or CHEM 224.

**BIOC 308. Molecular Biology: Genes and Genetic Engineering (4)**
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 development. Current literature is discussed briefly as an introduction to techniques of genetic engineering. Prerequisite: BIOL 205 or BIOC 307. Cross-listed as BIOL 308.

**BIOC 312. Macromolecular Structure and Function (3)**
Interactions between biomolecules are discussed in a system-based approach that stresses quantitative and structural characterization. Topics discussed include site-directed mutagenesis of enzymes, RNA-protein and protein-protein interactions. Prerequisites: BIOC 307 and CHEM 301 and CHEM 302.

**BIOC 334. Structural Biology of Proteins, Enzymes, and Nucleic Acids (3)**
A detailed consideration of the structure and function of proteins and enzymes. Topics include: enzyme structure, kinetics, and mechanisms; structural biology of proteins and protein-DNA complexes; and techniques for structural analysis. Prerequisite: BIOL 205 or BIOC 307. Cross-listed as BIOL 334.

**BIOC 371. Undergraduate Biochemistry Seminar (1)**
Discussion of current topics in biochemical research using readings from the scientific literature. Prerequisites: BIOC 307 and BIOC 308.

**BIOC 372. Undergraduate Biochemistry Seminar (1)**
Discussion of current topics in biochemical research using readings from the scientific literature. Prerequisites: BIOC 307 and BIOC 308.

**BIOC 391. Research Project (1-9)**
(Credit as arranged.) Offered on a pass/fail basis only. Maximum 9 hours total credit.

**GRADUATE COURSES**

(See School of Medicine.)

**Department of Biology**

Biochemistry Building
Phone 216-368-3558; Fax 216-368-4672

Joseph F. Koonce, Chair

The Department of Biology offers courses leading to the degrees of Bachelor of Science in 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 Metroparks Zoo, the Cleveland Clinic, and other departments in Case Western Reserve University and other institutions are available. Cooperative programs are designed to provide students with an opportunity to combine classroom study with practical experience in biological fields.
Reserve University significantly extend the range of resources available to biology students. Undergraduate students are encouraged to conduct individual supervised research projects with faculty in the Biology Department and with faculty in cooperating departments. A supervised research project is required of all students in the B.S. program.

**Career Opportunities**

The undergraduate programs in biology provide excellent preparation for graduate or professional school programs and for careers in industry and governmental agencies. Students are well prepared for medical, dental, or veterinary schools, or to enter the many specialized graduate programs in the biological sciences. Increasingly, career opportunities are opening up in the developing fields of biotechnology both in industry and government. Elective sequences of courses in areas of biotechnology within the B.A. and B.S. degrees in biology are an excellent preparation for such careers.

**FACULTY**

Joseph F. Koonce, Ph.D. (University of Wisconsin, Madison)  
Professor, Professor of Systems Engineering  
Aquatic ecology; systems ecology

Morris Burke, Ph.D. (University of New South Wales, Australia)  
Professor, Professor of Physiology and Biophysics  
Muscle physiology, protein chemistry

Arnold I. Caplan, Ph.D. (Johns Hopkins University)  
Professor, Professor of Physiology and Biophysics, Professor of General Medical Sciences (Oncology), Director - Skeletal Research Center  
Developmental biology and biochemistry; molecular and cellular aspects of muscle, cartilage, and bone development

Hillel J. Chiel, Ph.D. (Massachusetts Institute of Technology)  
Associate Professor, Associate Professor of Neurosciences  
Neurobiology and animal behavior; cellular dynamics of neuronal computation

Christopher A. Cullis, Ph.D. (University of East Anglia, United Kingdom)  
Professor, Francis Hobart Herrick Professor of Biology  
Plant molecular biology and genetics; modifications of the information content of plant cells

Stephen E. Haynesworth, Ph.D. (Case Western Reserve University)  
Associate Professor, Assistant Professor of Orthopaedics, Assistant Professor of General Medical Sciences (Oncology)

**SECONDARY FACULTY**

Randall D. Beer, Ph.D. (Case Western Reserve University)  
Associate Professor, Associate Professor of Computer Engineering and Science  
Computational neurosciences

Peter L. McCall, Ph.D. (Yale University)  
Professor, Professor of Geological Sciences  
Paleoecology

**ADJUNCT FACULTY**

Amiya K. Banerjee, Ph.D. (Calcutta University, India)  
Adjunct Professor  
Department of Molecular Biology  
The Cleveland Clinic Foundation  
Molecular biology

James Bissell, M.S. (University of Oregon)  
Adjunct Instructor  
Curator of Botany, Cleveland Museum of Natural History  
Plant ecology

Martha K. Cathcart, Ph.D. (Case Western Reserve University)  
Adjunct Associate Professor  
Department of Cell Biology  
The Cleveland Clinic Foundation  
Immunology

Paul E. DiCorleto, Ph.D. (Cornell University)  
Adjunct Professor  
Department of Cell Biology  
The Cleveland Clinic Foundation  
Vascular cell biology

Richard F. Drushel, Ph.D. (Case Western Reserve University)  
Adjunct Instructor  
Kinematic Modeling and Neural Control

Thomas A. Hamilton, Ph.D. (University of Oregon Health Sciences Center)  
Adjunct Professor  
General Medical Sciences Department  
The Cleveland Clinic Foundation  
Cell and molecular biology of macrophage activation

Marian L. Harter, Ph.D. (Texas Tech University)  
Adjunct Associate Professor  
Department of Molecular Biology, The Cleveland Clinic Foundation  
Molecular urology

Ana B. Locci-Hernandez, Ph.D. (Case Western Reserve University)  
Adjunct Instructor  
Aquatic ecology and population biology

Ronald J. Midura, Ph.D. (Case Western Reserve University)  
Adjunct Assistant Professor  
Department of Biomedical Engineering  
The Cleveland Clinic Foundation  
Bone matrix and proteoglycan structure

**UNDERGRADUATE PROGRAMS**

Students interested in life sciences can take a major or minor in biology.

**Major Programs**

Major programs share a core of 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, plant sciences, population biology, ecology, and environmental science. Individual research projects form a significant part of the curriculum for many undergraduates and are required for students in the B.S. program. Advanced biology majors may register, with permission, for graduate-level courses in the Biology Department and within the School of Medicine.

The department offers programs leading to the B.S. and the B.A. Thirty hours of biology are required for the B.A. and 39 hours for the B.S. Students for both the B.A. and B.S. degrees must complete the General Education Requirements (GER) of the College of Arts and Sciences. They may begin their biology program in either the freshman or sophomore years.
BACHELOR OF ARTS DEGREE
MAJOR IN BIOLOGY

Fall Semester
Credit hours
FRESHMAN
ENGL 150 Expository Writing ...........................................(3)
BIOL 110 Principles of Biology .........................................(3)
BIOL 111 Introduction to Experimental Biology Laboratory ...........................................(2)\textsuperscript{a}
MATH 125 Mathematics I ......................................................(4)
CHEM 105 Principles of Chemistry I ....................................(3)
CHEM 113 Principles of Chemistry Laboratory ........................(2)
PHED 101 Physical Education Activities ................................(0)

SOPHOMORE
BIOL 210 Molecular Cell Biology ......................................(3)
BIOL 211 Cell Biology Laboratory ......................................(2)\textsuperscript{b}
CHEM 223 Introductory Organic Chemistry I ......................(3)
CHEM 224 Introductory Organic Chemistry II .....................(3)
GER Course .........................................................................(3)
GER Course .........................................................................(3)

JUNIOR
BIOL 310 Population Biology ............................................(3)
Approved BIOL elective .....................................................(3)
PHYS 115 Introductory Physics I .........................................(4)
GER Course .........................................................................(3)
Course in selected minor field ............................................(3)
Elective ...............................................................................(3)

SENIOR
Approved BIOL elective .....................................................(3)
Approved BIOL elective (3) or BIOL lab ..............................(2)
Course in selected minor field ............................................(3)
Electives .............................................................................(6)

Minor in Biology
Biology (16 semester hours)
BIOL 110, 111
Eleven additional hours of BIOL, six of which must be at the 200 level or above

Spring Semester
Credit hours
FRESHMAN
BIOL 220 Organismal Biology ............................................(3)
BIOL 221 Physiology Lab ....................................................(2)\textsuperscript{c}
CHEM 106 Principles of Chemistry II ................................(3)
MATH 126 Mathematics II ..................................................(4)
GER Course .........................................................................(3)
PHED 102 Physical Education Activities .............................(0)

SOPHOMORE
Approved BIOL elective (3) or BIOL lab ..............................(2)
Approved BIOL elective (3) or BIOL lab ..............................(2)
CHEM 224 Introductory Organic Chemistry II .....................(3)
GER Course .........................................................................(3)
GER Course .........................................................................(3)
Course in selected minor field ............................................(3)

JUNIOR
BIOL 205 Chemical Biology ..............................................(3)
Approved BIOL elective (3) or BIOL lab ..............................(2)
PHYS 116 Introductory Physics II .........................................(4)
Course in selected minor field ............................................(3)
Elective ...............................................................................(3)

SENIOR
Approved BIOL elective .....................................................(3)
Approved BIOL elective (3) or BIOL lab ..............................(2)
Course in selected minor field ............................................(3)
Electives .............................................................................(6)

\textsuperscript{a} This requirement may be fulfilled by taking BIOL 211 and 221 at a later time.
\textsuperscript{b} May be taken in a later semester. Recommended but not required if BIOL 111 and 221 are taken.
\textsuperscript{c} May be taken in a later semester. Recommended but not required if BIOL 111 and 221 are taken.
ogy; BIOL 221, Physiology Laboratory; BIOL 301, Biotechnology Laboratory; Genes and Genetic Engineering or BIOL 326, Genetics; BIOL 315, Quantitative Biology Laboratory; two 300-level laboratory courses (except BIOL 346, 388, 390) and one upper-level advanced lecture course (300- or 400-level). B.S. students must undertake an undergraduate research project, completing BIOL 388, Undergraduate Research; BIOL 390, Advanced Undergraduate Research (same project as BIOL 388); and BIOL 395, Undergraduate Research Discussion. Additional requirements for the B.S. degree consist of: Mathematics: one year of calculus - MATH 125 & 126 (or 121 & 122, but former preferred); MATH 201, Linear Algebra or MATH 225, Discrete & Continuous Models or an approved statistics course; Computer Science: ECES131, Computer Science (or other approved computer programming course); Chemistry: Principles of Chemistry I & II and laboratory (CHEM 105, 106, & 113); Organic Chemistry I & II and laboratory (CHEM 223, 224, & 233 or 323, 324, & 233); Physical Chemistry I (CHEM 301); and Physics: Introductory Physics I & II (PHYS 115 & 116).

All biology majors are required to meet with their departmental advisor at least once each semester to discuss their academic program, and must have their schedule cards and drop-add cards signed by their advisers. In addition to formal courses, departmental seminars in recent advances in biology are held every Thursday afternoon at 4:15 p.m.

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 in the biological sciences. These concentrations have been developed between the Biology Department, the Biological Sciences Departments of the School of Medicine, and other departments. Currently, concentrations have been developed in the following areas: biotechnology and genetic engineering, computational biology, chemical biology, developmental biology, genetics, immunology, molecular & cell biology, neurobiology and animal behavior, physiology and biophysics, plant science, population biology, ecology and environmental science.

BACHELOR OF SCIENCE IN BIOLOGY DEGREE

Fall Semester

**FRESHMAN**
ENGL 150 Expository Writing (3)
BIOL 110 Principles of Biology (3)
MATH 125 Mathematics I (4)
CHEM 105 Principles of Chemistry I (3)
CHEM 113 Principles of Chemistry Laboratory (2)
PHED 101 Physical Education Activities (0)

**SOPHOMORE**
BIOL 210 Molecular Cell Biology (4)
BIOL 211 Cell Biology Laboratory (2)
CHEM 223 (or 323) Introductory Organic Chem I (3)
CHEM 233 Organic Chemistry Laboratory (2)
PHYS 115 Introductory Physics I (4)
GER Course (3)

**JUNIOR**
BIOL 310 Population Biology (3)
CHEM 301 Introductory Physical Chemistry I (3)
BIOL 301 Biotechnology Laboratory (3)*
MATH 225 Discrete & Continuous Models (3) or MATH 201 Linear Algebra (3) or an approved statistics course (3)

**SENIOR**
BIOL 388 Undergraduate Research (3)
BIOL 300-level laboratory (2)
GER Course (3)
Elective (3)
Elective (3)

Spring Semester

**FRESHMAN**
BIOL 220 Organismal Biology (3)
BIOL 221 Physiology Lab (2)
MATH 126 Mathematics II (4)
CHEM 106 Principles of Chemistry II (3)
GER Course (3)
PHED 102 Physical Education Activities (0)

**SOPHOMORE**
GER Course (3)
GER Course (3)
CHEM 224 (or 324) Introductory Organic Chem II (3)
PHYS 116 Introductory Physics II (4)
ECES 131 Elementary Computer Programming (3)

**JUNIOR**
BIOL 315 Quantitative Biology Lab (3)
BIOL 326 Genetics (3)*
BIOL 205 Chemical Biology (3)
GER Course (3)
GER Course (3)

**SENIOR**
BIOL 390 Undergraduate Research (3)
BIOL 395 Undergraduate Research Discussions (1)
BIOL 300-level laboratory (2)
Elective (3)
Elective (3)
Elective (3)

*If BIOL 301 is selected during this fall semester, a BIOL 300-level elective may be substituted for BIOL 326 during the following spring semester. If BIOL 326 is selected during the spring semester, a BIOL 300-level elective may be substituted for BIOL 301 during the fall semester.
Integrated Graduate Studies Program in Biology
The Biology Department participates in the Integrated Graduate Studies Programs for both B.A./M.S. and B.S./M.S. degrees. These programs are intended for gifted and highly-motivated students for the B.A. or the B.S. degrees whose objective is a degree at the master’s or doctoral level. By more closely integrating undergraduate and graduate studies, qualified students begin a program of graduate study in their senior year leading to the simultaneous completion of requirements for both the master’s and bachelor’s degrees, each within its specified framework. Students desiring to pursue this dual degree program will normally apply during the sophomore year by contacting the department office.

Minor in Biology
A minor in biology is available to students. The minor requires a minimum of 16 credit hours in biology consisting of BIOL 110, 111 (Principles of Biology, Introductory Laboratory), plus at least 11 more credit hours in biology. Six of these 11 hours must be at the 200 level or above. Suitable minor sequences are available for students majoring in the humanities and arts, social and behavioral sciences, health sciences, mathematics, chemistry, physics, astronomy, and geological sciences.

Biology Courses Satisfying the Arts and Sciences General Education
Requirements
Students who are non-science majors may fulfill the science core requirement by taking two semesters of biology or one semester of biology and one semester of another science. Students electing two semesters of biology may choose either of the following sequences: BIOL 110 and 101 or BIOL 110 and 220. Students electing one semester of biology may choose either BIOL 110 or BIOL 101.

Honors Program in Biology
To receive a bachelor’s degree with honors in biology, the student must meet the following criteria:
1. Maintain a 3.2 grade-point average, with a 3.5 in the major
2. Write a senior honors thesis with the approval of the faculty supervisor
3. Submit the thesis for review by an ad hoc Honors Committee
4. Successfully defend the thesis at an oral examination

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 department office.

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 is required for the non-thesis degree. The remaining credits may be research credits (BIOL 601 and 651). Further information is available in the Biology Department Office.

Doctor of Philosophy
Students who are planning to enter the doctoral program in biology should obtain information from the department office. 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.

RESEARCH
The research activities of faculty members within the Department of Biology cover a broad spectrum of interests. Collaborative research projects with faculty members in other departments provide for multi-disciplinary approaches to important biological problems. Some areas of research are:

Biochemistry
Active research programs in biochemistry include studies of the solution conformations of peptides by spectroscopic and chemical methods; studies of the mechanism of regulation of proteolytic enzymes; isolation and characterization of hormone receptors; studies of the interaction of subunits in contractile proteins; studies of the mechanism of regulation of ATP hydrolysis by myosin; the biochemistry of glycoproteins; and the biochemistry of muscle, cartilage, bone, and connective tissues.

Biotechnology and Genetic Engineering
Research includes: plant molecular biology, novel plant development, plant cell and tissue culture, developmental genetics, molecular mechanisms of RNA splicing, regulation of gene expression in plant systems, gene structure and function.

Cell and Molecular Biology and Cell Physiology
Research in these areas includes the chemistry and role of extracellular matrix components in cell development, physiology, and aging; muscle contraction and cell motility; the cellular activities of hormones; cell-cell recognition in plant systems; and regulation of proteolysis.

Developmental Biology
Research areas currently being investigated include molecular control of development of muscle, bone, and cartilage; control of flower development and plant reproduction; protein synthesis and chromatin structure and function; inductive factors in cell differentiation; factors that control morphogenesis; and bone marrow mesenchymal stem cells and their role in skeletal tissue development, maintenance, and repair.
Ecology, Population Biology, and Environmental Science

Current research on campus and at the Biological Field Station includes spatial dynamics, seasonal succession, and life-history strategies of phytoplankton; spatial dynamics and community ecology of zooplankton; migration, community dynamics, and biogeography of old-field leaf hoppers; adaptive management of fisheries ecosystems, particularly in relation to Lake Erie; internalized management of resource ecosystems; modeling of aquatic ecosystems; and epidemiological studies of large human populations.

Genetics

Current areas of research are developmental genetics: regulation of gene expression during development and dissection of developmental processes by the isolation, characterization, and mapping of developmental mutants; characterization of the DNA changes observed during environmental induction of heritable changes in plants.

Neurobiology and Animal Behavior

Research activities focus upon behavioral and electrophysiological studies of invertebrate animals. Studies include the neural control of movement, pattern generation, integration of sensory information, and cellular dynamics of neuronal computation. Observations relating specific movements to underlying neural activity are used in collaborative efforts with mechanical, computer, and biomedical engineers. This collaboration has led to novel designs of robots and to a deeper understanding of the control of several adaptive behaviors such as escape, locomotion, and feeding.

Physiology

Problems under consideration are the relationships of pituitary and steroid hormones to enzyme activity in the gonads and accessory organs; vertebrate breeding cycles; transduction of chemical energy into mechanical energy in muscle; and the mechanism of action of peptide hormones.

Plant Science

Research interests in this area include: plant molecular and developmental biology; regulation of gene expression in plant systems; the evolution of plant genomes; genetics of disease resistance in plants; DNA changes associated with environmental induction of heritable changes in plants; synthesis of plant hormones; role of hormones in growth and development.

Biology (BIOL)

UNDERGRADUATE COURSES

BIOL 101. Introduction to Biotechnology (3)
Principles of genetic engineering and other aspects of biotechnology and their applications in science and society. Biological molecules and how they are derived from the genetic information in DNA. Theory and practice of recombinant DNA techniques; function and use of antibodies and vaccines. Applications will include biopharmaceuticals, the construction and uses of transgenic animals and plants, diagnosis and therapy of human diseases, the Human Genome Project, forensic science, and bioremediation. Patents and ethical aspects will be discussed. Assumes some high school biology but has no prerequisites. Fulfills a science requirement of the Arts and Sciences General Education Requirements but does not count toward biology major.

BIOL 103. Biological Issues (3)
This course will focus on controversial biological issues. The goal is to present basic biological and scientific knowledge about specific areas of controversy which students must confront in society. We also seek to develop an appreciation for the requirements and limits of scientific investigation, so that students can evaluate claims which may appear in the popular press or media. Biological topics will be selected by the class each term, but some obvious possibilities are: fetal tissue research, human cloning, brain and behavior. No science background is assumed.

BIOL 110. Principles of Biology (3)
The diversity of life at the cellular level. The diversity of life at the organismal level. Interactions of living things at the ecosystem level. Evolution and genetics are central themes.

BIOL 111. Introduction to Experimental Biology Laboratory (2)
Some concepts of classical and modern biology. Students carry out experiments of their own design and function including cell structure, metabolism, enzyme kinetics, membrane physiology, and genetics. One laboratory and one lecture/discussion per week. Prerequisite or corequisite: BIOL 110. (or concur).

BIOL 119. Concepts for a Molecular View of Biology I (3)
Introduction to the principles of inorganic and organic chemistry essential to the study of biochemistry, molecular biology, and pharmacology. 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.

BIOL 121. Concepts for a Molecular View of Biology II (3)
The second semester of a two-course sequence in elementary inorganic, organic, and biochemistry. Topics include: carbohydrates, lipids, proteins, enzyme kinetics, metabolic pathways and bioenergetics, DNA and RNA, methods of molecular biology, and nutrition. Applications to human physiology and medicine emphasized. Prerequisite: BIOL 119.

BIOL 150. Human Anatomy and Physiology for Health Science Students (5)
A study of the organ systems of the human body at an introductory level. Survey of all the major systems, their structure, anatomical relationships, and how they are integrated to maintain a homeostatic state. Four lectures and one laboratory demonstration per week. This course does not count towards the biology major. Prerequisites: BIOL 110 and BIOL 119 and BIOL 121.

BIOL 205. Chemical Biology (3)
Introduction to the chemistry of biological processes. The relationship of biological function to biological structure which ultimately depends on the chemical structure of biological macromolecules. Methods of purification of proteins and nucleic acids. Chemical mechanisms for simple and complex reversible binding, and for enzyme kinetics and derivation of functions and their graphical representations from these mechanisms and their use for...
analyzing binding and kinetic data. The relationship of function to biological and chemical structures. Thermodynamics of biological reactions and the bioenergetics associated with the glycolytic pathway and the tricarboxylic acid cycle. Oxidative phosphorylation. Prerequisite: CHEM 223 or CHEM 323.

**BIOL 210. Molecular Cell Biology, General (4)**

**BIOL 211. Laboratory in Biochemistry, Molecular, and Cell Biology (2)**
Section 1: Students will practice the use of methods for measuring cell proliferation and identifying cell adhesion. They will then use these methods to experimentally test a hypothesis which they generate in response to a problem proposed by the instructor. Data collection, analysis and scientific writing will be emphasized. Section 2: protein synthesis and the structure of a gene, using radioisotope labeling and counting, restriction enzyme analysis of DNA structure, and autoradiography. Section 3: equilibrium binding and enzyme kinetics measured by spectrophotometry. Prerequisite or corequisite: BIOL 210 (or concur).

**BIOL 220. Organismal Biology (3)**
The principles by which organism systems function and develop in a wide variety of animals. The functional aspects of systems, including nervous system, muscle, cardiovascular, respiratory, renal, and digestive systems. The role and requirements for each system are described, as well as general solutions to problems which the systems encounter in specific animal examples. The last third of the course describes embryological principles and mechanisms that are used to develop these organism systems. Prerequisite: BIOL 110.

**BIOL 221. Physiology Laboratory (2)**
Animal physiology. Experiments in osmoregulation, excretion, temperature regulation, circulation, neuro- and muscle physiology and development, using a variety of vertebrate and invertebrate species. Students demonstrate basic principles, analyze data, and become familiar with techniques routinely employed in physiological research. One lab per week. Prerequisite or corequisite: BIOL 220 (or concur) or EBME 201 (or concur).

**BIOL 223. Vertebrate Biology (3)**
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 organism 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. Prerequisite: BIOL 110.

**BIOL 225. Evolution (3)**
Cross-listed as PHIL 225.

**BIOL 301. Biotechnology Laboratory: Genes and Genetic Engineering (3)**
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. Prerequisite: BIOL 210.

**BIOL 304. Laboratory in Quantitative Methods for Chemical Biology (2)**
Laboratory course designed to provide the skills and the background to analyze data from biochemical, biomedical, and pharmacological processes with the goal of determining their underlying chemical mechanisms. Focus on simple and complex equilibrium binding behavior, simple and complex enzyme kinetics, and some elementary bioenergetics. Use of these functions and graphs to analyze data from the biochemical literature. Preparation for students going on to graduate studies in chemical and molecular biology or to medical school.

**BIOL 305. Herpetology (4)**
Structure, function, and identification of amphibians and reptiles; emphasis on North American herpetofauna. Evolution, anatomy, zoogeography, and systemsatics of the major families of amphibians and reptiles. Physiological ecology, behavior, reproductive and population biology, field survey techniques, and behavioral observations of live animals. Three lectures and one session on special topics per week. Several weekend field trips. Prerequisite: BIOL 110.

**BIOL 307. Evolutionary Biology of the Invertebrates (3)**
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)**
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 development. Current literature is discussed briefly as an introduction to techniques of genetic engineering. Prerequisite: BIOL 205 or BIOL 307. Cross-listed as BIOC 308.

An introduction to the ecology and genetics of populations. The course takes an evolutionary approach to understanding the effects of ecological and biological constraints on adaptive characteristics of populations of plants and animals, including life-history strategy, social organization, and population substructure. Emphasis will be on understanding the regulation of abundance, distribution, and diversity of natural populations and on contrasts between humans and other species. Prerequisite: BIOL 210 (or concur) and one year of math.

**BIOL 311. Field Biology Laboratory (2)**
Two projects involving taxonomy, abundance, density, and distribution of plants at Squire Valleevue Farm, with particular emphasis on tree species. Students will collect plant samples and make their own herbarium. Following this there will be four weeks of field work and three weeks of workshop sessions to analyze and interpret data. Use of personal computers for analysis of field data. A final report and a presentation required for the final project. Prerequisite or corequisite: BIOL 110 (or concur).
BIOL 313. Genetics Laboratory (2)
This laboratory exposes students to the methods used to study the genetics of a wide range of organisms. Some of the topics covered are: gene mapping in diploids, tetrad analysis, mutagenesis, complementation, and mitotic recombination. Emphasis is placed on the relationship between the genotype and the biochemical reactions which determine the phenotype. One laboratory per week. Prerequisite or corequisite: BIOL 326 (or concur).

BIOL 315. Quantitative Biology Laboratory (3)
Application of personal computers to biological research. Emphasis on the use of structured programming and flowcharting. Use of statistical techniques, analysis of experimental design, modeling strategies. The use of diverse software packages such as spreadsheets, word processing, statistical packages. Continuous interaction with the WWW/Internet. Weekly lectures and problem sets posted in the WWW web page. One lecture and one lab per week. Prerequisite: BIOL 310.

BIOL 316. Fundamental Immunology (3)
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, antigen processing and presentation, cell-cell interactions, cell-mediated immunity, cytokines, and basic molecular biology of B and T lymphocytes. Lectures emphasize experimental findings leading to the concepts of modern immunology. Prerequisite: BIOL 210.

BIOL 326. Genetics (3)
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, quantitative genetics. Prerequisite: BIOL 210.

BIOL 328. Ethics in Science (3)
This course is a survey of key ethical and value issues in science. Topics to be covered may include: research with human subjects; research with animals; scientific misconduct, including fraud; the role of science in society; opposition to science based on alternative value systems; the historical context of contemporary science relationships between science and industry, including potential conflicts of interest; the social responsibilities of scientists; science and government; the use of science in public policy, including controversies over smoking and lung cancer, asbestos, and global warming; and the scientist as a “hired gun.” Extensive student participation is expected. Cross-listed as ANTH 328.

BIOL 330. Plant Physiology (3)
The principles of plant physiology, development, biochemistry, and reproduction. Among the topics examined are plant anatomy and cell architecture, photosynthesis, flowering and reproduction, the synthesis and translocation of nutrients, plant pathology, the prospects for improving plants through genetic and molecular methods, stress physiology, defense mechanisms, hormone and light responses, and the control of growth and development. Prerequisite: BIOL 110.

BIOL 334. Structural Biology of Proteins, Enzymes, and Nucleic Acids (3)
A detailed consideration of the structure and function of proteins and enzymes. Topics include: enzyme structure, kinetics, and mechanisms; structural biology of proteins and protein-DNA complexes; and techniques for structural analysis. Prerequisite: BIOL 205 or BIOC 307. Cross-listed as BIOC 334.

BIOL 335. Field Trip in Marine Ecology (1)
A week-long, intensive, field-oriented class in the ecology of marine life. Students will study diversity of marine organisms, their ecological adaptations, habitats, and behavior. Daily lectures, field trips, snorkeling (scuba diving available for certified divers), and observation and experiments in classroom aquarium. Students will be expected to pay costs of transportation, meals, lodging, and staff support. The course is conducted at a marine station. Prerequisite: BIOL 337 or GEOL 115.

BIOL 336. Aquatic Biology (3)
Physical, chemical, and biological dynamics of lake ecosystems. Factors governing the distribution, abundance, and diversity of freshwater organisms. Prerequisite: BIOL 110.

BIOL 337. Marine Ecology (3)
Survey of ecological and biological aspects of major marine habitats. Distribution, community structure, and adaptive strategies of marine organisms. Local and global cycles of materials through marine ecosystems. Prerequisite: BIOL 110 or GEOL 307.

BIOL 339. Aquatic Biology Laboratory (2)
The physical, chemical, and biological limnology of freshwater ecosystems will be investigated. Emphasis will be 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. Prerequisite: BIOL 336.

BIOL 340. Human Physiology (3)
Physiology of organs and organ systems of humans and other mammals. Knowledge of organic chemistry required. Prerequisites: BIOL 110 and BIOL 205.

BIOL 343. Microbiology (3)
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. Prerequisite: BIOL 110.

BIOL 344. Laboratory for Microbiology (2)
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. Prerequisite or corequisite: BIOL 343 (or concur).

BIOL 346. Human Anatomy (3)
Gross anatomy of the human body. Two lectures and one laboratory demonstration per week. Prerequisite: BIOL 110.

BIOL 348. Human Anatomy and Physiology (4-5)
The anatomy and physiology of the human body. Enrollment is restricted to students majoring in nutrition. Four lectures and one laboratory per week.
BIOL 350. Introduction to Ecosystem Analysis and Environmental Science (3)
Reviews major ecological theories and principles through analysis of contemporary environmental problems. Exploration of difficulties in applying scientific information to public policy formation and the role of computer models in linking theory and practice in managing the environment. Two lectures and one laboratory per week. Prerequisite: BIOL 220.

BIOL 358. Animal Behavior (3)
An evolutionary approach to animal behavior, with emphasis on experimental behavioral studies. Evolution of behavior, communication, learning and sensory approaches. Field excursions to Cleveland Zoo/Rain Forest, Mentor Marsh, Squire Valleeue Farm and Sea World. Each student will design and conduct an original, independent behavioral experiment outside of class. Prerequisite: BIOL 110.

BIOL 359. Cell Physiology (3)
Introduction to fundamental topics and mechanisms of cellular physiology. Basic concepts in signal transduction, including roles of cell surface receptor, GTP and kinase signaling pathways, calcium-mediated signaling, tyrosine kinase-mediated signaling pathways, and regulation of cell contractility. Other fundamental concepts in cell physiology include an introduction to energy metabolism in cells, membrane structure and principles of membrane transport, membrane potential, and introduction to enzyme kinetics. Prerequisite: BIOL 205.

BIOL 362. Principles of Developmental Biology (3)
The descriptive and experimental aspects of animal development. Gametogenesis, fertilization, cleavage, morphogenesis, induction, differentiation, organogenesis, growth, and regeneration. Prerequisite: BIOL 220.

BIOL 364. Endocrinology (3)
Hormonal regulation of physiological processes of development, growth, metabolism, excretion, digestion, and reproduction and the neural control of hormone secretion in vertebrates. Effects of hormones at the cellular and organismic levels. Prerequisites: BIOL 220 and CHEM 224.

BIOL 370. Ecology (3)
The course is a review of basic principles governing abundance and distribution of organisms. Topics will include both theoretical and empirical analysis of community structure and ecosystem processes. The course will also emphasize the practical implication these principles to contemporary environmental concerns with the sustainable use of natural resources. Prerequisite: BIOL 220 (or concur).

BIOL 373. Introduction to Neurobiology (3)
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. Prerequisite: BIOL 220 or consent of department.

BIOL 374. Neurobiology of Behavior (3)
In this course students will be shown how a neurobiologist interested in animal behavior studies the linkage between neural circuitry and complex behavior. Several exercises will be used in this endeavor. In addition to traditional lectures providing background on neural systems selected for the insight that they provide to behavioral principles, we will spend approximately half of the formal class periods in reading contemporary papers and discussing their methods and conclusions. Various vertebrate and invertebrate systems will be considered. In addition, several class periods will be spent observing animal behavior in order to get an appreciation of the fantastic things animals do. Finally, students will be required to complete a term project that will be designed to give them a first hand feel for the processes followed in studying neurobiology of behavior. The exact form of the project will vary from year to year. Prerequisite: BIOL 220.

BIOL 375. Autonomous Robotics (3)
Introduction to the design, construction and control of autonomous mobile robots. The first half of the course consists of focused exercises on mechanical construction with LEGO, characteristics of sensors, motors and batteries, and control strategies for autonomous robots. In the second half of the course, students design, build and program their own complete robots that participate in a public competition. All work is performed in groups. Biologically-inspired approaches to the design and control of autonomous robots are emphasized throughout. Prerequisite: Consent of department. Cross-listed as ECES 375.

BIOL 376. Neurobiology Laboratory (3)
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. Prerequisites: BIOL 220 and consent of department.

BIOL 378. Computational Neuroscience (3)
Computer simulation 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 circuits, as well as to cable theory, passive and active compartmental modeling, numerical integration methods, models of plasticity and learning, models of brain systems, and their relationship to artificial neural networks. Term project required. Two lectures per week.

BIOL 380. Introduction to Neuropharmacology (3)
This course focuses on the principles of drug absorption, distribution, and elimination. Current theories on the mechanisms through which therapeutic agents and drugs of abuse affect brain chemistry and behavior are presented. Among the topics to be covered are receptor-ligand interaction/tolerance; neuroanatomy, electrophysiology, and neurotransmitters; receptors/second messengers; dopamine and Parkinson’s Disease; antischizophrenic agents; and amphetamine, cocaine, alcohol, psychedelics, and other agents. Prerequisite: BIOL 110.

BIOL 383. Seminar in Plant Science (1-3)
Prerequisite: BIOL 210.

BIOL 386. Seminar in Behavior: The Epidemiology of Violence (1-3)
BIOL 387. Seminar in Population Biology (1-3)
Discussion of major themes in population biology, evolution, and ecology, based on critiquing scientific papers. One discussion per week.
BIOL 388. Undergraduate Research (1-3)
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 389. Selected Topics (1-3)
Individual library research projects under the guidance of a biology sponsor. A major paper must be submitted and approved before credit is awarded.

BIOL 390. Advanced Undergraduate Research (1-3)
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)
Co-listed as PHIL 394.

BIOL 395. Research Discussions (1)
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. Prerequisites: BIOL 388 and BIOL 390.

GRADUATE COURSES

BIOL 401. Biotechnology Laboratory: Genes and Genetic Engineering (3)
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.

BIOL 404. Laboratory in Quantitative Methods for Chemical Biology (2)
Laboratory course designed to provide skills and the background to analyze data from biochemical, biomedical, and pharmacological processes with the goal of determining their underlying chemical mechanisms. Focus on simple and complex equilibrium binding behavior, simple and complex enzyme kinetics, and some elementary bioenergetics. Use of these functions and graphs to analyze data from the biochemical literature. Preparation for students going on to graduate studies in chemical and molecular biology or to medical school.

BIOL 407. General Biochemistry (4)
Cross-listed as BIOC 407.

BIOL 408. Molecular Biology: Genes and Genetic Engineering (4)
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 development. Current literature is discussed briefly as an introduction to techniques of genetic engineering. Prerequisite: BIOL 205 or BIOC 307. Cross-listed as BIOC 408.

BIOL 415. Quantitative Biology Laboratory (3)
Application of personal computers to biological research. Emphasis on the use of structured programming and flow charting. Use of statistical techniques, analysis of experimental design, modeling strategies. The use of diverse software packages such as spreadsheets, word processing, statistical packages. Continuous interaction with the WWW/Internet. Weekly lectures and problem sets posted in the WWW web home page. During the last 6 six weeks of the course, the student will have a final project that consists of data analysis and interpretation. Report required for the final project. One lecture and one lab per week.

BIOL 416. Fundamental Immunology (3)
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, antigen processing and presentation, cell-cell interactions, cell-mediated immunity, cytokines, and basic molecular biology of B and T lymphocytes. Lectures emphasize experimental findings leading to the concepts of modern immunology. A term paper is required. Prerequisite: BIOL 210 or equivalent. Cross-listed as PATH 416.

BIOL 417. Cytokines: Function, Structure, and Signaling (3)
Cross-listed as PATH 417 and CLBY 417.

BIOL 426. Genetics (3)
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, quantitative genetics.

BIOL 427. Principles of Neural Development (3)
Cross-listed as NEUR 427.

BIOL 429. Neural Development and Plasticity (3)
Cross-listed as NEUR 429.

BIOL 431. Statistical Methods I (3)
Cross-listed as EPBI 431.

BIOL 432. Statistical Methods II (3)
Cross-listed as EPBI 432 and MPH 432.

BIOL 434. Structural Biology of Proteins, Enzymes, and Nucleic Acids (3)
A detailed consideration of the structure and function of proteins and enzymes. Topics include: enzyme structure, kinetics, and mechanisms; structural biology of proteins and protein-DNA complexes; and techniques for structural analysis. Prerequisites: BIOL 205 or BIOC 307. Cross-listed as BIOC 434.

BIOL 435. Field Trip in Marine Ecology (1)
A week-long, intensive, field-oriented class in the ecology of marine life. Students will study diversity of marine organisms, their ecological adaptations, habitats, and behavior. Daily lectures, field trips, snorkeling (scuba diving available for certified divers), and observation and experiments in classroom aquaria. Student will be expected to pay costs of transportation, meals, lodging, and staff support. The course is conducted at a marine station. A research project paper will be required. Prerequisites: BIOL 337 or
BIOL 436. Advanced Aquatic Biology (3)
Physical, chemical, and biological dynamics of lake ecosystems. Factors governing the distribution, abundance, and diversity of freshwater organisms.

BIOL 437. Marine Ecology (3)
Survey of physical, chemical, and biological aspects of major marine habitats. Distribution, community structure, and adaptive strategies of marine organisms. Local and global cycles of materials through marine ecosystems. Students will carry out a library research project based on an extensive review of the original literature, write a rigorous paper on their topic, and present their work to the class. Prerequisite: BIOL 110 or GEOL 307.

BIOL 443. Advanced Microbiology (3)
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. Prerequisite: BIOL 110.

BIOL 448. Human Anatomy and Physiology (4-5)
(See BIOL 348.)

BIOL 457. Proteins: Structure and Function (3)
Cross-listed as PHOL 456.

BIOL 458. Animal Behavior (3)
An evolutionary approach to animal behavior, with emphasis on experimental studies. Concentration includes communication, learning and sensory processes, sociobiology, experimental design, and statistical approaches. Graduate students will lead an additional oral presentation discussion on a research paper, will conduct an extensive research project, and will write a more extensive research paper than that required of undergraduate students. Prerequisites: BIOL 110 or GEOL 307 and graduate standing.

BIOL 460. Introductory Molecular Biology (3)
Cross-listed as PHOL 460.

BIOL 462. Advanced Principles of Developmental Biology (3)
Same as BIOL 362 except the required term paper is an NIH-format research proposal. Prerequisite: BIOL 220. Cross-listed as ANAT 462.

BIOL 465. Endocrinology (3)
Hormonal regulation of physiological processes of development, growth, metabolism, excretion, digestion, and reproduction and the neural control of hormone secretion in vertebrates. Effects of hormones at the cellular and organismic levels.

BIOL 473. Introduction to Neurobiology (3)
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. Two lectures per week. Prerequisite: Consent of department. Cross-listed as NEUR 473.

BIOL 474. Neurobiology of Behavior (3)
(See BIOL 374.) Cross-listed as NEUR 474.

BIOL 475. Autonomous Robotics (3)
Introduction to the design, construction and control of autonomous mobile robots. The first half of the course consists of focused exercises on mechanical construction with LEGO, characteristics of sensors, motors and batteries, and control strategies for autonomous robots. In the second half of the course, students design, build and program their own complete robots that participate in a public competition. All work is performed in groups. Biologically-inspired approaches to the design and control of autonomous robots are emphasized throughout. Lab reports and a term paper required. Prerequisite: Consent of department. Cross-listed as ECES 478.

BIOL 476. Neurobiology Laboratory (3)
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 per week. Prerequisite: Consent of department. Cross-listed as NEUR 476.

BIOL 479. Seminar in Computational Neuroscience (3)
Readings and discussion in the recent literature on computational neuroscience, adaptive behavior, and other current topics. Cross-listed as EBME 479, ECES 479, and NEUR 479.

BIOL 480. Physiology of Organ Systems (3)
This course presents an advanced introduction to the fundamental physiological principles governing the major organ systems in mammals. The function of the nervous, endocrine, digestive, muscle, circulatory, respiratory, and urinary systems are discussed. At the conclusion of the semester, integrative aspects of the major organ systems will be illustrated through consideration of exercise and high altitude physiology. Cross-listed as PHOL 480.

BIOL 485A. Seminar in Organismal Biology (1-3)

BIOL 494. Seminar in Evolutionary Biology (3)
Cross-listed as PHIL 494.

BIOL 536. Seminar in Great Lakes Issues (1-3)
Selected topics related to Great Lakes basin studies: research problems, scientific processes, classic research papers, current events, policy issues, and legislative initiatives. Course content may vary depending on interests of students and faculty. Cross-listed as GEOL 536.

BIOL 540B. Seminar in Molecular Biology (1-3)

BIOL 541. Seminar in Genetics (1)
A 2-week summer ecology course to take ecology for high school teachers (2)

BIOL 803. Autonomous Robotics for High School Science Teachers (2)
A 2-week, 10-day summer course in designing, building, and programming computer-controlled robots which are able to function autonomously in complex, real-world environments. LEGO Technics components are used for structures and gear trains. Various mechanical and photodetection sensors provide sensory feedback. A microcontroller board programmed in C is used for sensory integration and behavioral control. Participants work in groups of 2 per workstation. Detailed written documentation and laboratory exercises will be provided. Topics include: mechanical design with LEGO, sensors and feedback control, C programming, multi-tasking control strategies, and an end-of-course robot competition. Eligibility: high school (grades 9-12) science teachers; those in the biological sciences preferred. Limit 10. Prerequisite: Consent of department.

BIOL 804. School Yard Ecology (2)
This 13-day program (including 10 days of summer instruction) will introduce teachers of middle grades (4-9) to both ecological concepts and scientific inquiries. Participants will conduct daily observations and use hands-on studies to build understanding of the abiotic environment, diversity and adaptation, biogeochemical cycles and energy flow, interspecies interactions, population characteristics, and change in ecological time. After practicing using simple field instruments and basic methods, participants will be challenged to design instruments and methods to answer their own research questions using their schoolyards.

Three follow-up sessions for this course will be held during the school year. These will permit teachers to investigate seasonal phenomena and share the results of personal and student investigations with other participants.
Chemistry is often referred to as the central science because of the key role it plays in a number of areas of interdisciplinary studies. Correspondingly, an important aspect of a degree in chemistry is the broad range of employment opportunities it affords. Chemists can direct their talents to specialized problems of applied research, or they can choose to delve into fundamental investigations. They cover the spectrum of chemical specialties from microbiochemistry to the study of lunar materials. A chemical degree also provides a valuable preparation for various other related professions, such as medicine, dentistry, and law.

The American Chemical Society, with its more than 100,000 members, is the major professional society in the United States for practicing chemists. Both undergraduate and graduate students may become affiliated with the society.

### FACULTY

**Anthony J. Pearson, Ph.D. (University of Aston, Birmingham, England)**  
Rudolph and Susan Rense Professor and Chairman of the Department of Chemistry  
Natural products, organometallics; organic synthesis

**Alfred B. Anderson, Ph.D. (Johns Hopkins University)**  
Professor  
Pure and applied theoretical chemistry: surface science, inorganic chemistry and properties of materials

**Mary D. Barkley, Ph.D. (University of California, San Diego)**  
Professor  
Laser fluorescence spectroscopy; biophysical chemistry

**Robert C. Dunbar, Ph.D. (Stanford University)**  
Professor  
Gas phase ions and ion-neutral interactions: ion-molecular reaction kinetics

**Philip P. Garner, Ph.D. (University of Pittsburgh)**  
Professor  
Synthetic organic chemistry

**Zhong-Wu Guo, Ph.D. (Polish Academy of Sciences)**  
Assistant Professor  
Carbohydrate chemistry, oligosaccharide and glycopeptide synthesis

**Malcolm E. Kenney, Ph.D. (Cornell University)**  
Hurlbut Professor of Chemistry  
Photodynamic therapy; porphyrin-like compounds; organosilicon compounds; flue gas desulfurization

**Stephen J. Klippenstein, Ph.D. (California Institute of Technology)**  
Professor  
Theoretical chemistry; chemical reaction dynamics

**Gilles Klopman, Ph.D. (University of Brussels, Belgium)**  
Theoretical chemistry; artificial intelligence programming; drug design; environmental impact of chemicals

**Irene Lee, Ph.D. (Penn State University)**  
Assistant Professor  
Biochemistry; enzymology

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### BACHELOR OF SCIENCE IN CHEMISTRY DEGREE

(Recommended sequence for the required science and math courses)

#### Fall Semester

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<tr>
<th>Class/Lab/Credit Hours</th>
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<tbody>
<tr>
<td>Freshman</td>
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<tr>
<td>CHEM 105, Principles of Chemistry I .................. (3-0-3)</td>
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<tr>
<td>CHEM 113, Principles of Chemistry Laboratory ........ (1-3-2)</td>
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<tr>
<td>MATH 121, Calculus for Science and Engineering I .... (4-0-4)</td>
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<tr>
<td>Sophomore</td>
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<tr>
<td>CHEM 323, Organic Chemistry I .......................... (3-0-3)</td>
</tr>
<tr>
<td>CHEM 321, Laboratory Methods &amp; Techniques I .......... (1-6-3)</td>
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<tr>
<td>MATH 223, Calculus for Science &amp; Engineering III ... (3-0-3)</td>
</tr>
<tr>
<td>PHYS 122, General Physics II. Electricity &amp; Magnetism. (4-0-4)</td>
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<tr>
<td>Junior</td>
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<tr>
<td>CHEM 335, Physical Chemistry I .......................... (3-0-3)</td>
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<tr>
<td>CHEM 331, Laboratory Methods &amp; Techniques III ..... (1-6-3)</td>
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<tr>
<td>CHEM 311, Inorganic Chemistry I .......................... (3-0-3)</td>
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<td>Senior</td>
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<tr>
<td>CHEM 330, Computer Techniques in Chemistry .......... (1-3-2)</td>
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<td>Chemistry or approved elective .......................... (3-0-3)</td>
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<tr>
<td>Technical elective ........................................ (3-0-3)</td>
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<td>Technical elective ........................................ (3-0-3)</td>
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#### Spring Semester

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<tr>
<td>Freshman</td>
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<tr>
<td>CHEM 106, Principles of Chemistry II .................. (3-0-3)</td>
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<tr>
<td>ECES 131, Elementary Computer Programming ............ (2-2-3)</td>
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<tr>
<td>MATH 122, Calculus for Science and Engineering II .. (4-0-4)</td>
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<td>PHYS 121, General Physics I. Mechanics ................ (4-0-4)</td>
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<td>CHEM 324, Organic Chemistry II .......................... (3-0-3)</td>
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<td>CHEM 322, Laboratory Methods &amp; Techniques II ..... (1-6-3)</td>
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<tr>
<td>MATH 224, Elementary Differential Equations .......... (3-0-3)</td>
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<td>STAT 312, Statistical Methods ........................... (3-0-3)</td>
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<td>PHYS 221, General Physics III. Modern ................ (3-0-3)</td>
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<td>CHEM 336, Physical Chemistry II .......................... (3-0-3)</td>
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<tr>
<td>CHEM 332, Laboratory Methods &amp; Techniques IV ..... (1-6-3)</td>
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<td>Senior</td>
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<td>Chemistry or approved elective .......................... (3-0-3)</td>
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<td>Biochemistry Requirement ................................ (3-0-3)</td>
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<td>Technical elective ........................................ (3-0-3)</td>
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*Selected students may be invited to take PHYS 123, 124, 223 (Honors).*
Gheorghe D. Mateescu, Ph.D. (Case Western Reserve University)  
Professor  
In vivo cell bioenergetics (concerted 17O/31P nmr spectroscopy and imaging); instrumental analytical chemistry (NMR, FTIR, Raman, ESCA, ISS, SIMS)  
Barry Miller, Ph.D. (Massachusetts Institute of Technology)  
Hovorka Professor Emeritus of Chemistry  
Analytical chemistry; electrochemistry  
Ignacio Ocasio, Ph.D. (University of Puerto Rico)  
Assistant Professor  
Physical chemistry  
John D. Protasiewicz, Ph.D. (Cornell University)  
Associate Professor  
Inorganic chemistry; organometallic reaction mechanisms; catalyzed oxidations  
Robert G. Salomon, Ph.D. (University of Wisconsin, Madison)  
Professor  
Organic chemistry; synthesis; biosynthesis; homogeneous catalysis  
Lawrence M. Sayre, Ph.D. (University of California, Berkeley)  
Professor  
Bioorganic and bioinorganic chemistry; redox coenzyme mechanisms; protein oxidation/modification; neurotoxicology  
Daniel A. Scherson, Ph.D. (University of California, Davis)  
Professor  
Electrochemistry; electrode kinetics; electrocatalysis; in-situ spectroscopic methods in electrochemistry  
M. Cather Simpson, Ph.D. (University of New Mexico)  
Assistant Professor  
Biophysical chemistry; spectroscopic studies of biologically significant processes  
John E. Stuehr, Ph.D. (Case Western Reserve University)  
Professor of Chemistry and Biochemistry; Associate Chairman, Chemistry Department  
Rapid reactions in solution; metal complexing kinetics; proton transfer kinetics; protein and enzymatic dynamics  
Fred L. Urbach, Ph.D. (Michigan State University)  
Professor  
Inorganic chemistry; multidentate transition metal chelates; models for copper protein active sites; redox behavior of metal complexes and oxometalate species  
Michael G. Zagorski, Ph.D. (Case Western Reserve University)  
Associate Professor  
Organic chemistry; nuclear magnetic resonance; structure of peptides  
ASSOCIATED FACULTY  
Marc S. Berridge, Ph.D. (Washington University)  
Associate Professor of Radiology and Chemistry  
Nuclear and radiochemistry  
Vernon E. Anderson, Ph.D. (University of Wisconsin-Madison)  
Associate Professor of Biochemistry and Chemistry  
Enzyme reactions and mechanisms  
Paul Carey, Ph.D (University of Sussex, UK)  
Professor of Biochemistry and Chemistry  
Raman spectroscopy; proteins and protein-ligand interactions  
John J. Mieyal, Ph.D. (Case Western Reserve University)  
Professor of Pharmacology and Chemistry  
Hemoprotein chemistry, oxygen transport and activation; drug metabolism and related activity of cytochrome P 450  
Charles R. Sanders, Ph.D. (The Ohio State University)  
Associate Professor of Physiology and Biophysics, and Chemistry  
Structural and chemical biology of membrane proteins; NMR spectroscopy

UNDERGRADUATE PROGRAMS

The Department of Chemistry offers two basic curricula for undergraduate chemistry majors, leading to either a Bachelor of Science degree or a Bachelor of Arts degree.

Bachelor of Science Program

The Bachelor of Science degree program is designed for students who plan professional careers in chemistry and leads to certification by the American Chemical Society. The required science, math and computing courses for the B.S. curriculum are shown on the following page. The B.S. curriculum provides a rigorous background in chemistry yet has considerable flexibility in the senior year in the choice of electives. During the senior year, the B.S. major is expected to

BACHELOR OF ARTS DEGREE IN CHEMISTRY

(Recommended sequence for the required science and math courses)

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<th>Fall Semester</th>
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<td>Freshman</td>
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<tr>
<td>CHEM 105, Principles of Chemistry I .................. (3)</td>
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<td>or CHEM 323, Organic Chemistry I ........................ (3)</td>
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<td>CHEM 233, Organic Chemistry Laboratory I .......... (2)</td>
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<td>CHEM 301, Introductory Physical Chemistry I .......... (3)</td>
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<td>CHEM 304, Chemical Measurements Lab ................ (3)</td>
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<td>Electives</td>
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<td>or CHEM 324, Organic Chemistry II .................... (3)</td>
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<td>CHEM 234, Organic Chemistry Laboratory II .......... (2)</td>
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<td>CHEM 302, Introductory Physical Chemistry II ........ (3)</td>
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<tr>
<td>CHEM 305, Introductory Physical Chemistry Laboratory (3)</td>
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<td>Electives</td>
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go a step beyond basic preparation in an area of chemistry of particular interest to him or her. Research is strongly encouraged. As many as nine hours of research (CHEM 397) may be credited toward the degree. B.S. majors who plan to go on to graduate study may elect to take advanced courses in inorganic chemistry (CHEM 412, 413); organic chemistry (CHEM 421, 422, 433); chemical thermodynamics (CHEM 407); quantum mechanics (CHEM 446); instrumental analytical chemistry (CHEM 410), or other graduate offerings. Interdisciplinary strengths can be achieved by selecting technical electives to follow designed “tracks” in biological chemistry, chemical physics, environmental chemistry, materials science or polymer science.

Bachelor of Arts Program

The B.A. program is intended for students who plan careers in medicine or other health or science-related fields for which a baccalaureate degree in chemistry provides appropriate pre-professional training. B.A. majors may supplement their chemical training by electing additional chemistry courses or may utilize the curriculum flexibility in the Department of Chemistry to develop an interdisciplinary program of their choice. Many B.A. majors participate in undergraduate research within the Department of Chemistry (CHEM 397) or in other science departments including those in the medical school.

Honors Program

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 3.30 in chemistry, physics, and mathematics and an overall grade point average of 3.00.
2. A minimum of six semester hours of CHEM 397, or, with departmental approval, chemical research done under another course number.
3. A thesis approved by the Undergraduate Committee of the Department on the basis of the level of research, the quality of the manuscript, and the chemical content.

Minor

Students may complete a minor in chemistry, defined as one year of freshman chemistry (including laboratory); two additional three hour lecture courses; and two additional laboratory or approved courses. A recommended sequence would include: CHEM 105, 106, Principles of Chemistry I, II (3,3), and CHEM 113, Principles of Chemistry Laboratory (2); CHEM 223, 224, Introductory Organic Chemistry I, II (3,3), or CHEM 323, 324, Organic Chemistry I, II (3,3), and CHEM 233, 234, Introductory Organic Chemistry Laboratory I, II (2,2). Other sequences may be followed after consultation with the Department of Chemistry.

GRADUATE PROGRAMS

Master of Science Program

The Master of Science degree in chemistry may be obtained by completing a program including the preparation of a master’s thesis or a program involving only course work. Both programs require a minimum of 27 semester credit hours, of which up to 6 semester credit hours may be for the master’s thesis. Course work for the master’s degree may be taken on a part-time basis. Thesis research can be undertaken only by full-time graduate students. Only the master’s degree without thesis can be earned entirely on a part-time basis.

Doctor of Philosophy Program

The Doctor of Philosophy 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, most importantly, original research. At least twelve months must be spent in residence on campus while fulfilling the Ph.D. thesis research requirement.

Full-time graduate students who maintain satisfactory academic performance while pursuing the Ph.D. 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.

FACILITIES

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. The instruments facility centers on a Varian Gemini 200 Fourier transform nuclear magnetic resonance spectrometers, Varian Gemini 200 and 300 MHz NMR, a Varian Inova 600 MHz FT NMR (to be installed Spring, 2000), a Varian IEE x-ray photoelectron spectroscopy unit, 3M ion scattering and secondary ion mass spectrometers, a Kratos MS-25 RFA GC mass spectrometer, and an electron-spin resonance spectrometer.

Other departmental instrumentation includes equipment for ion cyclotron resonance spectrometry, laser Raman spectroscopy, x-ray diffraction, extremely rapid kinetics measurements, spectropolarimetry and circular dichroism, protein structure elucidation, ellipsometry, electrochemical measurements, and low-energy diffraction and Auger studies of surfaces. Access to very high field NMR instrumentation is available on campus at the Cleveland Center for Structural Biology (CCSB). Many faculty in the chemistry department are actively involved with the CCSB, which is equipped with a modern 300 and 500 MHz, plus two 600 MHz, spectrometers. The Frank Hovorka Information Center stands as the core of the Chemistry Department’s computer facility. This center and associated laboratories represent an array of advanced computational and graphics capabilities, including several Silicon Graphics Indigo computers and two SUN workstations. Many of the department’s analytical instruments are networked with these workstations together with computers in individual faculty research areas. The Chemistry Department’s computers are part of the campus-wide communications network, CWRU net. In addition to the full complement of software, Internet, and library database services offered by the University through CWRU net, connections to off-site databases, such as STN.
and Ohio Supercomputer Center, are available to departmental users. A large number of laboratory microcomputers are in operation throughout the department.

RESEARCH

The Department of Chemistry is noted for the diversity of its research efforts. These range from synthetic studies of important bioactive substances, including antibiotics and DNA-binding substances, to a detailed understanding 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 which deposit in neurodegenerative disease. Multidisciplinary approaches are being applied to understanding energy transfer in proteins. Efforts are being made to understand the basic chemical properties leading to reactive modifiers generated from physiological lipids. Other research is aimed at developing new drugs for photodynamic therapy and at understanding biological activity through artificial intelligence approaches. 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 synthesis and catalysis. Experimental and theoretical studies of gas phase molecules are providing a fundamental understanding of unimolecular reaction dynamics and ionization processes important in atmospheric chemistry. Chemical surfaces are being studied. Of particular importance are studies designed to characterize the electrode-electrolyte interfaces important in electrocatalysis and the electrochemical properties of new semiconductors. These efforts are complemented by theoretical studies on the interfacial structure and bonding in composite materials.

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.

THE GRADUATE PROGRAM

The Chemistry of Life Processes offers the student the opportunity of pursuing a course of study that cuts across traditional disciplines. The three traditional areas of chemistry—inorganic, organic, and physical—are all represented in their biological aspects. Through strong ties with the biomedical community within the University surroundings, faculty who carry out research in biochemical areas have coordinated a program of integrated coursework, seminar offerings, and research experience. Although the student receives a Ph.D. degree in chemistry, participants in this program gain a broader, interdisciplinary background which provides distinct advantages when embarking upon a career in teaching/research, industry, or at government laboratories.

Case Western Reserve University ranks among the leading universities internationally in its strengths in electrochemistry and has brought these strengths together under one coordinated structure, the Yeager Center for Electrochemical Studies (YCES). 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 membrane 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 the area of electrochemistry with 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 the general audience of faculty, students, and other chemical scientists in the University and the Cleveland area, and are a vital means to a broad, 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.

Chemistry (CHEM)

UNDERGRADUATE COURSES

CHEM 105. Principles of Chemistry I (3)
Atomic structure; thermochemistry; periodicity, bonding and molecular structure; intermolecular forces; properties of solids; liquids, gases and solutions. Prerequisite: One year of high school chemistry.

CHEM 106. Principles of Chemistry II (3)
Thermodynamics, chemical equilibrium; acid/base chemistry; oxidation and reduction; kinetics; spectroscopy; introduction to nuclear, organic, and polymers. Prerequisite: CHEM 105 or equivalent.

CHEM 111. Principles of Chemistry for Engineers (4)
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. Prerequisite: One year high school chemistry or permission of department.

CHEM 113. Principles of Chemistry Laboratory (2)
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. Corequisite: CHEM 105, CHEM 106, CHEM 111, or ENGR 145.

CHEM 223. Introductory Organic Chemistry I (3)
Introductory course for engineering students and science majors. Develops themes of structure and bonding along with elementary reaction mechanism. Includes extensive treatment of hydrocarbons, alkyl halides, alcohols and ethers. Prerequisite: CHEM 106 or CHEM 111.
CHEM 224. Introductory Organic Chemistry II (3)
Continues and extends themes of structure and bonding from CHEM 223 and introduces spectroscopy and more complex reaction mechanisms. Includes extensive treatment of aromatic rings, carbonyl compounds, amines and selected special topics. Prerequisite: CHEM 223 or CHEM 323.

CHEM 233. Introductory Organic Chemistry Laboratory I (2)
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. Prerequisites: CHEM 113 and CHEM 106 or equivalent. Corequisite: CHEM 223 or CHEM 323.

CHEM 234. Introductory Organic Chemistry Laboratory II (2)
A continuation of CHEM 233, involving multi-step organic synthesis, peptide synthesis, product purification and analysis using sophisticated analytical techniques such as chromatography and magnetic resonance spectroscopy. Prerequisite: CHEM 233.

CHEM 290. Chemical Laboratory Methods for Engineers (3)
Techniques of chemical synthesis, analysis, and characterization. Uses students’ backgrounds in general and organic chemistry, but requires no background in chemical laboratory operations. Corequisite: CHEM 223 or CHEM 323.

CHEM 301. Introductory Physical Chemistry I (3)
First of a two-semester sequence covering principles and applications of physical chemistry, intended for chemistry and chemical engineering majors and other students having primary interests in biochemical, biological or life-science areas. States and properties of matter. Thermochemistry and its application to chemical and biochemical systems. Chemical equilibrium. Chemical kinetics and catalysis. Prerequisites: CHEM 106 or equivalent and one year each of physics and calculus, preferably including partial derivatives.

CHEM 302. Introductory Physical Chemistry II (3)
Continuation of CHEM 301. Introductory quantum chemistry. Spectroscopy. Electrochemistry. Statistical thermodynamics. Prerequisite: CHEM 301 or CHEM 335.

CHEM 304. Chemical Measurements Laboratory (3)
A one-semester laboratory course involving quantitative chemical measurements, error analysis and advanced concepts in ionic equilibria. Electrogravimetric and volumetric analysis; separation techniques; metal complexation. Basic chemical instrumentation. Prerequisites: CHEM 233 and CHEM 234, or CHEM 321 and CHEM 322. Corequisite: CHEM 301.

CHEM 305. Introductory Physical Chemistry Laboratory (3)
A one-semester laboratory course in the principles and quantitative characterization of chemical and biomedical systems. Experiments such as phase equilibria, calorimetry, chemical equilibrium, kinetics, electrochemistry, spectroscopy and the use of computers to analyze data. Prerequisites: CHEM 304 and CHEM 301 or CHEM 335. Corequisite: CHEM 302 or CHEM 336.

CHEM 310. Inorganic Chemistry I (3)
Fundamentals of inorganic chemistry. Topics include molecular structure, molecular shape and symmetry, structure of solids, d-metal complexes and oxidation and reduction. Prerequisite: CHEM 301 or CHEM 335 (may be taken concurrently).

CHEM 311. Inorganic Chemistry II (3)
Continuation of CHEM 310. Fundamentals of inorganic chemistry. Topics include acids and bases, electronic spectra of complexes, structures and properties of solids, and descriptive chemistry of representative elements. Prerequisite: CHEM 311.

CHEM 317. Radiochemistry: Radioactivity and its Applications (3)
Application of radiotracers in chemistry, biology, engineering, and medical diagnosis and therapy. Covers radiation safety and basic theory, techniques, and uses of radiochemistry. Prerequisite: CHEM 106 or equivalent.

CHEM 321. Laboratory Methods and Techniques I (3)
CHEM 321 and 322 are the first two semesters of an integrated laboratory course. Experimental approach to chemical problems. Chemical measurements, synthesis, and characterization. Prerequisite: CHEM 113. Corequisite: CHEM 223 or CHEM 323.

CHEM 322. Laboratory Methods and Techniques II (3)
Continuation of CHEM 321. Prerequisite: CHEM 321. Corequisite: CHEM 224 or CHEM 324.

CHEM 323. Organic Chemistry I (3)
An enriched course for the sufficiently able and interested student who wishes a deeper and broader appreciation of theory and practice of organic chemistry. Focuses on relationships between molecular structure and chemical reactivity, and stresses the 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, topic in stereochemistry and spectroscopy. Recommended for chemistry, biochemistry, and related majors. Prerequisites: CHEM 106 or equivalent and consent of department.

CHEM 324. Organic Chemistry II (3)
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. Prerequisites: CHEM 223 or CHEM 323 and consent of department.

CHEM 325. Physical Methods for Determining Organic Structure (3)
Determination of structure of organic compounds, separation techniques. Application of infrared, ultraviolet, and visible spectroscopy, nuclear magnetic resonance spectroscopy, mass spectrometry, and modern instrumental techniques. Prerequisite: Two semesters of organic chemistry required.

CHEM 328. Introductory Biochemistry (3)

CHEM 329. Chemical Aspects of Living Systems (3)
A series of special topics in the chemistry of biological processes at the level of mo-

**CHEM 330. Computer Techniques in Chemistry Laboratory (2)**

Computer techniques for chemical research; searching chemical databases; data collection and analysis with computers; computational methods and molecular modeling. Introduction to software packages for computer applications in chemistry. Prerequisites: CHEM 322; and CHEM 302 or CHEM 336; and permission of department.

**CHEM 331. Laboratory Methods and Techniques III (3)**

Synthesis, separation techniques, physical properties, and analysis. Advanced techniques of chemical synthesis, leading the student to the preparation of interesting inorganic and organometallic compounds. Prerequisite: CHEM 322.

**CHEM 332. Laboratory Methods and Techniques IV (3)**

Modern techniques of physical measurement, including nuclear magnetic resonance, electronic spin resonance, and electrochemistry. Prerequisite: CHEM 331. Corequisite: CHEM 336.

**CHEM 335. Physical Chemistry I (3)**

First of a two-semester sequence of physical chemistry for chemistry majors and others with career goals in the physical sciences or engineering. States of matter. Kinetic theory of gases. Transport phenomena. Chemical thermodynamics and its application to chemical systems. Equilibrium. Ionic solutions and chemical quantum mechanics electrochemistry. Statistical mechanics and thermodynamics. Prerequisites: CHEM 106 or equivalent, plus a year each of physics and calculus, including partial derivatives.

**CHEM 336. Physical Chemistry II (3)**

Continuation of CHEM 335. Chemical quantum mechanics. Spectroscopy (including optical spectroscopies, magnetic resonance, mass spectrometry). Reaction kinetics and catalysis. Further consideration of statistical thermodynamics and chemical equilibrium. Reaction dynamics. Prerequisite: CHEM 335.

**CHEM 337. Quantum Mechanics I (3)**

Introduction to quantization, measurement and the Schrödinger equation; angular momentum and states of molecules. Perturbation theory, spectroscopy and chemical bonding. Variational theory and calculations of molecular properties. Prerequisite: CHEM 336.

**CHEM 395. Chemistry Colloquium Series (1)**

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)**

Independent research project within a research group in the chemistry 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. Prerequisite: Consent of department.

**GRADUATE COURSES**

**CHEM 406. Chemical Kinetics (3)**

Theory and characterization of chemical rate processes. Prerequisite: Two semesters of undergraduate physical chemistry.

**CHEM 407. Chemical Thermodynamics (3)**

Thermodynamics and statistical thermodynamics and their application to chemical problems. Prerequisite: Two semesters of undergraduate physical chemistry.

**CHEM 410. Instrumental Analytical Chemistry (3)**

Principles and applications of analytical instrumentation including optical spectroscopy, photoelectron and ion bombardment spectrometry, mass spectrometry, NMR and magnetic resonance imaging. Prerequisite: Two semesters of undergraduate physical chemistry.

**CHEM 412. Advanced Inorganic Chemistry I (3)**

Chemistry of inorganic systems. Spectroscopy, magnetism, and stereochemistry of transition metal compounds. Prerequisites: One semester of undergraduate inorganic chemistry and two semesters of physical chemistry.

**CHEM 413. Advanced Inorganic Chemistry II (3)**

Chemistry of inorganic compounds; mechanisms of reactions. Prerequisite: CHEM 412 or equivalent.

**CHEM 414. Organometallic Reactions and Structures (3)**

Bonding and structure in organometallic chemistry and the relevance of organometallic species to chemical catalysis. Prerequisite: One semester of undergraduate inorganic chemistry.

**CHEM 415. Chemical Applications of Group Theory (3)**

Treatment of structure, bonding, and spectroscopy in chemical systems based on a presentation of relationships and the theory of point and space groups. Prerequisite: CHEM 412 or equivalent.

**CHEM 417. Radiochemistry: Radioactivity and its Applications (3)**

Application of radiotracers in chemistry, biology, engineering, and medical diagnosis and therapy. Covers radiation safety and basic theory, techniques, and uses of radiochemistry. Prerequisite: CHEM 106 or equivalent.

**CHEM 421. Advanced Organic Chemistry I (3)**


**CHEM 422. Advanced Organic Chemistry II (3)**


Determination of the structure of organic compounds; and separation techniques. Application of infrared, ultraviolet, and visible spectroscopy, nuclear magnetic resonance spectroscopy, mass spectrometry, and modern instrumental techniques. Prerequisite: Two semesters of undergraduate organic chemistry.

**CHEM 429. Chemical Aspects of Living Systems (3)**

A series of special topics in the chemistry of biological processes at the level of molecular mechanisms. Chemico-biological interactions. Homogeneous catalysis in biochemical and biomimetic systems. Biochemical dynamics. Mitochondrial respiration and photosynthesis. Biological activity and carcinogenesis. Prerequisites: Two semesters of undergraduate or-
ganic and one semester of undergraduate physical chemistry.

CHEM 430. Advanced Methods in Structural Biology I (3)
Cross-listed as BIOL 430.

CHEM 435. Synthetic Methods in Organic Chemistry (3)
Systematic consideration of reactions which allow carbon-carbon bond formation or cleavage, as well as the introduction, removal, interconversion, or transposition of functional groups. Prerequisite: Two semesters of undergraduate organic chemistry.

CHEM 436. Complex Molecular Synthesis (3)
An advanced organic chemistry course providing students with an in-depth examination of the art of total synthesis using notable examples drawn from the chemical literature. Topics include: Problem Analysis and Strategy, Classical Total Synthesis, and recent Synthetic Milestones. Prerequisite: CHEM 421 or consent of department.

CHEM 445. Electrochemistry I (3)
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. Prerequisites: One undergraduate course in physical chemistry and a working knowledge of thermodynamics.

CHEM 446. Quantum Mechanics I (3)
Introduction of 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. Prerequisite: Two semesters of undergraduate physical chemistry.

CHEM 447. Quantum Mechanics II (3)
Continuation of CHEM 446. Ab initio and semi-empirical methods, configuration interaction, time dependent phenomena, and principles of group theory. Prerequisite: CHEM 446.

CHEM 448. Statistical Mechanics (3)
A systematic development of equilibrium statistical mechanics; the properties of the gaseous, liquid, and solid states of matter. Introduction to nonequilibrium statistical mechanics. Prerequisites: CHEM 407 and CHEM 446 or consent of department.

CHEM 450. Molecular Spectroscopy (3)
Rotation, vibration, and electronic spectra of simple and complex molecules. Prerequisite: CHEM 446.

CHEM 470. Macromolecular Synthesis (4)
Organic chemistry of macromolecules; mechanism of polymer reactions; preparation of addition, condensation, and biopolymers, and the chemical reactions of polymers. Prerequisites: CHEM 224 or CHEM 324 and EMAC 270. Cross-listed as EMAC 470.

CHEM 479. X-ray Crystallography (3)
Scattering of x-rays by crystalline and amorphous solids including polymers. Technique of structure analysis.

CHEM 501. Special Topics in Inorganic Chemistry (1-6)
(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)
(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 503. Special Topics in Organic Chemistry (1-6)
(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. Prerequisites: Two semesters each of undergraduate organic and physical chemistry.

CHEM 504. Special Topics in Organic Chemistry (1-6)
(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. Prerequisite: CHEM 445 or permission of department.

CHEM 505. Special Topics in Physical Chemistry (1-6)
(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 506. Special Topics in Physical Chemistry (1-6)

Childhood Studies
210 Mather Memorial, 7125
Phone: 216-368-2278, Fax:216-368-5334
Jill E. Korbin, Director

The undergraduate childhood studies minor, initiated in 1999, provides an educational opportunity for undergraduate students interested in a wide array of issues concerning children and the experience of childhood. The interdisciplinary minor focuses on the life stages of infancy through adolescence, but also includes issues of parenting, gender, the life course, and the place of children in society and culture.
department providing that the supervising faculty member in that department and the Childhood Studies Minor Director agree that the independent study is relevant to the minor. If an independent study course is an individually arranged practicum, the credit hour limits for practicum courses above will apply. Examples of such courses would include, but are not limited to the following:
PSCL 390. Seminars in Psychology (3)
ANTH 399: Independent Study (1-3)
PSCL 397: Independent Study (1-3)
SOCI 375: Independent Study (1-3)

ASSOCIATE FACULTY
Michael Altschul, Ph.D. (Johns Hopkins University)
Professor, History
Roman history and civilization

Jennifer Neils, Ph.D. (Princeton University)
Ruth Coulter Heede Professor
Art History and Art
Greek and Roman art and archaeology

ADJUNCT FACULTY
John J. Phillips, Ph.D. (Yale University), J.D. (Northwestern University)
Adjunct Assistant Professor; Assistant University Attorney
Classical languages and literature

UNDERGRADUATE PROGRAMS

Major
The classics major leading to the Bachelor of Arts degree requires 36 hours of departmental offerings. In addition, each student completing the classics major will be strongly advised to choose a related minor selected in consultation with and approved by the departmental advisor. Courses from the Department of Classics (36 hours): Eight courses (24 hours) in either Greek or Latin or a combination of both, provided that at least three courses are included from the most advanced level in one of the languages. Four classics courses, of which at least two must be numbered above 300. Recommended additional courses outside the Department of Classics (12 to 18 hours): We strongly advocate the addition of four to six courses in a closely related field to be selected by the student in consultation with the departmental advisor. Examples of closely related fields are anthropology, art history, philosophy, comparative literature, history, theater, and English. A second major or a minor in one of these fields will normally satisfy this recommendation.
Minor

The minor programs in the Department of Classics are designed to acquaint the student with aspects of the ancient civilization of Greece and Rome by means of a coherent sequence of 15 to 18 hours of coursework. In order that the knowledge acquired may have the potential for depth and provide access to primary materials, some study of one or both of the classical languages is required in every minor program. The student may choose one of three basic patterns:

Latin concentration
Nine hours from courses in Latin above the 102 level, plus six hours from: CLSC 112 Classical Civilization: Rome (3) CLSC 201 The Ancient World (3) CLSC 304 Ancient Rome: Republic and Empire (3) CLSC 395 Directed Readings (1-3)

Greek concentration
Twelve hours in the Greek language, plus three hours from: CLSC 111 Classical Civilization: Greece (3) CLSC 201 The Ancient World (3) CLSC 301 Ancient Philosophy (3) CLSC 302 Ancient Greece: Archaic, Classical, and Hellenistic Periods (3)

Classics concentration
(Requires consultation with departmental advisor)
Any two Latin or any two Greek courses, CLSC 111 or CLSC 112, or CLSC 201. Three courses from: CLSC 226 Introduction to Greek and Roman Art (3) CLSC 228 Theater History I (3) CLSC 301 Ancient Philosophy (3) CLSC 302 Ancient Greece: Archaic, Classical, and Hellenistic Periods (3) CLSC 304 Ancient Rome: Republic and Empire (3) CLSC 305 Selected Topics in Philosophy (3) CLSC 312 Women in the Ancient World CLSC 314 Love Poetry from Sappho to Shakespeare Courses in Greek and Roman art at the 300 level

Any of these minor programs may be varied to suit the needs of the individual student, subject to the availability of other courses, after consultation with the chairman and with the approval of the student’s major advisor. A student may, with the consent of his or her major advisor, design and propose a more radically different minor in classics suited to his or her particular needs, with the approval of the department and such other curricular authorities as may be required.

Sequences (Engineering Core curriculum)
All sequences should include CLSC 111, 112, and any other CLSC course above the 100 level in either Greek or Roman culture. Students should consult with the advisor (Professor Helzle) on the development of an acceptable sequence. The following are sample programs:

Emphasis on Greece
CLSC 111 Classical Civilization: Greece (3) CLSC 112 Classical Civilization: Rome (3) CLSC 203 Heroes, Myth and Performance in Greek Literature (3) or CLSC 302 Ancient Greece: Archaic, Classical, and Hellenistic periods (3)

Emphasis on Rome
CLSC 111 Classical Civilization: Greece (3) CLSC 112 Classical Civilization: Rome (3) CLSC 204 Classical Literature II (3) or CLSC 304 Ancient Rome: Republic and Empire (3)

Departmental Honors
A student desiring to earn the Bachelor of Arts degree with departmental honors in classics must make written application to the department chairman no later than May 1 of the junior year. Permission to enter the Honors Program will be granted to majors who have earned an overall grade point average of 3.0 and an average of 3.25 in departmental offerings. Each candidate for honors must enroll in CLSC 381 in each semester of the senior year for a total of six hours credit and must pass a departmental examination on the work completed. A wide range of projects is available, and every attempt is made to suit the project to the interests and individual strengths of the candidate. Some projects require the completion of a thesis as the culmination of study; others employ different demonstrations of competence.

Classics (CLSC)

UNDERGRADUATE COURSES

CLSC 111. Classical Civilization: Greek (3) The enduring significance of the Greeks studied through their history, literature, art, and philosophy. Lectures and discussion.

CLSC 112. Classical Civilization: Rome (3) The enduring significance of the Romans studied through their history, literature, art, and philosophy. Lectures and discussion.

CLSC 201. The Ancient World (3) Ancient history from the origins of civilization in Mesopotamia to the dissolution of the Roman Empire in the West. Cross-listed as HSTY 200.


CLSC 203. Heroes, Myth, and Performance in Greek Literature (3) This course constitutes the first half of a sequence on Classical literature. As such, it examines the major works of Greek literature and seeks to place them within their immediate historical, literary, and cultural context. It traces the evolution of heroes to citizens and analyzes oral and live performances while interpreting myth from a literary and socio-political standpoint. Constant themes are war and community, wandering, tyranny and democracy, and the literary manifestations of men’s and women’s roles within the household and the city.

CLSC 204. Heroes and Hustlers in Latin Literature (3) 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.
CLSC 210. Byzantine World 300-1453 (3)
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. Cross-listed as HSTY 210.

CLSC 226. Introduction to Greek and Roman Art (3)
Cross-listed as ARTH 226.

CLSC 227. Ancient Cities and Sanctuaries (3)
Cross-listed as ARTH 227.

CLSC 295A. Greek and Latin Elements in English: The Basic Course (1.5)
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. Available on CWRUnet.

CLSC 295B. Greek and Latin Elements in English: Biomedical Terminology (1.5)
(See CLSC 295A.) Advanced section that is oriented especially toward scientific and medical terminology. Prerequisite: Previous or concurrent registration in CLSC 295A.

CLSC 301. Ancient Philosophy (3)
Western philosophy from the early Greeks to the Skeptics. Emphasis on the pre-Socrates, Plato and Aristotle. Prerequisites: PHIL 101 and consent of department. Cross-listed as PHIL 301.

CLSC 302. Ancient Greece: Archaic, Classical, and Hellenistic Periods (3)
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. Cross-listed as HSTY 302.

CLSC 304. Ancient Rome: Republic and Empire (3)
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. Cross-listed as HSTY 304.

CLSC 312. Women in the Ancient World (3)
The course offers a chronological survey of women's lives in Greece, Hellenistic Egypt, and Rome. It focuses on reading 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 Graeco-Roman model. Additionally, the course aims to demonstrate how the various methodological approaches applied to the source material regarding women's lives have yielded significant insights into our own perception of the categories of sex and gender. Specific topics include matriarchy and patriarchy; the antagonism between male and female in myth; the legal, social, economical, and political status of women; the ancient family; women's role in religion and cult; ancient theories of medicine regarding women; paederasty and homosexuality. Cross-listed as WSTD 312.

CLSC 314. Love Poetry from Sappho to Shakespeare (3)
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. Cross-listed as CMPL 314.

CLSC 328. Greek Sculpture (3)
Cross-listed as ARTH 328.

CLSC 332. Art and Architecture of Ancient Italy (3)
Cross-listed as ARTH 332.

CLSC 333. Greek and Roman Painting (3)
Cross-listed as ARTH 333.

CLSC 334. Art and Archaeology of Greece (3)
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. Cross-listed as ARTH 334.

CLSC 381. Special Studies (1-6)
Subject matter varies according to need. Prerequisites: Required is 18 hours in the department of Classics and permission of the department.

CLSC 395. Directed Readings (1-3)
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. Prerequisite: Consent of department.

GRADUATE COURSES

CLSC 481. Special Studies (1-6)
Subject matter varies according to need. Prerequisite: Consent of department.

CLSC 603. Tutorial: Aristotle's Rhetoric (2)

Greek (GRK)

UNDERGRADUATE COURSES

GREK 101. Elementary Greek I (3)
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. (Both GREK 101 and 102 must be completed to obtain credit.)

GREK 102. Elementary Greek II (3)
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. (Both GREK 101 and 102 must be completed to obtain credit.) Prerequisite: GREK 101 or equivalent.

GREK 201. Greek Prose Authors (3)
Readings from authors such as Plato, Lysias, Xenophon and Herodotus. Prerequisite: GREK 102 or equivalent.

GREK 202. Introduction to Greek Poetry (3)
Primarily readings from Homer, Hesiod, and Theocritus. Selections from Greek lyric may be introduced at the instructor's discretion. Prerequisite: GREK 201 or equivalent.

GREK 305. Readings in Ancient Philosophy: Plato (3)
Reading and interpretation of selected dialogues by Plato or other philosophical works. Prerequisite: GREK 202.

GREK 306. Tragedy (3)
Reading and interpretation of selected plays of Aeschylus, Euripides, and Sophocles. Prerequisite: GREK 202.
LATN 101. Elementary Latin I (3)
An introduction to the elements of Latin; pronunciation, forms, syntax, vocabulary, and reading. (Both LATN 101 and 102 must be completed to obtain credit.)

LATN 102. Elementary Latin II (3)
An introduction to the elements of Latin; pronunciation, forms, syntax, vocabulary, and reading. (Both LATN 101 and 102 must be completed to obtain credit.)

LATN 201. Latin Prose Authors (3)
Reading and discussion of such prose authors as Cicero, Caesar, Livy or Pliny. Prerequisite: LATN 102 or equivalent.

LATN 202. Virgil (3)
Primarily readings from The Aeneid; selections from Virgil’s other work may be introduced at instructor’s discretion. Prerequisite: LATN 201 or equivalent.

LATN 305. Literature of the Republic (3)
Prerequisite: LATN 202.

LATN 306. Survey of Latin Literature (3)
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. Prerequisite: LATN 202 or equivalent.

LATN 307. Livy (3)
Readings in Books I and XXI, with other selections from this major Augustan historian. Prerequisite: LATN 202.

LATN 308. Horace: Odes and Epodes (3)
Readings and discussion of extensive selections from the poetry of Horace; consideration of Horace as exemplifying the spirit of the Augustan Age. Prerequisite: LATN 202.

LATN 309. Medieval Latin Translation (3)
Reading and interpretation of Latin texts from the Middle Ages. Material selected according to the needs and interests of the students. Prerequisite: LATN 202.

LATN 350. History (3)
Works of the Roman historian Cornelius Tacitus; his Annals I-VI dealing with his portrait of Emperor Tiberius and the Empire after the death of Augustus. Prerequisite: LATN 202.

LATN 351. Latin Didactic Literature (3)
Readings from didactic poetry such as Lucretius and Virgil’s Georgics. Parodies like Ovid’s Ars Amatoria or prose treatises may also be introduced. Prerequisite: LATN 202.

LATN 352. Drama (3)
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. Prerequisite: LATN 202.

LATN 355. Epic (3)
Extensive readings in Latin epic poetry, including Catullus, Virgil’s Aeneid, Lucan, Statius or other “silver” epics. Particular attention to the artistic and literary qualities of the works and to the development of Latin epic tradition. Prerequisite: LATN 202.

LATN 356. Elegiac Poetry (3)
Translation and interpretation of selected elegies by Catullus, Tibullus, Propertius, and Ovid. Prerequisite: LATN 202.

LATN 395. Directed Readings (1-3)
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. Prerequisite: Consent of department.

College Scholars Program

Peter McCall, Director
www.cwru.edu/artsci/scholars/

FACULTY COMMITTEE
Peter L. McCall, Ph.D. (Yale University)
Professor; Director, Environmental Studies Program; Benthic ecology, paleoecology

Alice Bach, Ph.D. (Union/Columbia University)
Hallinan Chair of Catholic Studies and Associate Professor, Religion

Gladyss Haddad, Ph.D. (Case Western Reserve University)
Adjunct Professor, American Studies

Shanna Beth McGee, M.F.A. (University of Georgia)
Associate Professor, Theater Arts
Voice; acting; Shakespearean text

Patricia Princehouse, M.A. (Yale University)
Lecturer, Philosophy

Jonathan Sadowsky, Ph.D. (The Johns Hopkins University)
Associate Professor, History

African history; comparative history; cultural anthropology; medical history

The College Scholars Program, instituted in 1997, is a three-year academic enhancement program open to CWRU undergraduates interested in forming a community of learners dedicated both to excellence in individual intellectual pursuits and applying classroom learning to larger world concerns. The program, funded by the Mandel Brothers Foundation, emphasizes broad interdisciplinary learning beyond the requirements of professional or disciplinary competence, connection of academic learning to the larger society, and development of a sense of the relationship between service and leadership. College scholars collaborate with faculty in the design, operation, and evaluation of the program. The program takes up the equivalent of one course for each of six semesters.
College Scholars (ARSC)

UNDERGRADUATE COURSES

ARSC201. Introduction to College Scholars I (3)
First course for students already admitted to the College Scholars Program. Principles and practice of leadership, learning styles, ethical decision making, group dynamics, and communication skills.

ARSC202. Introduction to College Scholars II (3)
Continuation of ARSC 201. Emphasis on leadership, learning styles, ethical decision making, group dynamics, and communication skills. Prerequisite: ARSC 201.

ARSC301. College Scholars Colloquia I (3)
Students in the second year of the College Scholars Program, in conjunction with CSP faculty, select topics for interdisciplinary study, construct curricula, and invite visiting speakers. Prerequisites: ARSC 201 and ARSC 202.

ARSC302. College Scholars Colloquia II (3)
Continuation of ARSC 301. Multidisciplinary study of selected topics. Prerequisite: ARSC 202.

ARSC397. CSP Senior Project I (3)
Year-long independent study project under the guidance of CSP faculty. In the first semester, pre-proposals are approved and funded and work commences. In the second semester, work is completed and at year end a public presentation of results is made. Prerequisites: ARSC 201 and ARSC 202.

ARSC398. CSP Senior Project II (3)
Year-long independent study project under the guidance of CSP faculty. In the first semester, pre-proposals are approved and funded and work commences. In the second semester, work is completed and at year end, a public presentation of results is made. Prerequisite: ARSC 397.

Department of Communication Sciences

Cleveland Hearing and Speech Center
Room 410, 11206 Euclid Avenue
Phone 216 368-2470; Fax 216 368-6078

Communication is an essential component of our culture. Today more than ever, competence in the classroom, workplace, and community is based on the ability to communicate. Mastery of the technical and theoretical aspects of communication can enhance success in professional and personal endeavors. At the same time, impairments of communication can deprive an individual of the success and satisfaction associated with human accomplishment. The Department of Communication Sciences offers programs leading both to undergraduate (BA) and graduate (MA and PhD) degrees. Two undergraduate major tracks are offered. The communication disorders track prepares students for graduate study in communication disorders (e.g., speech-language pathology, audiology) and provides useful background for students preparing for many other careers, especially in the health care professions. The communication studies track provides a theoretical and practical grounding in the gamut of human communication (e.g., media, public speaking, writing, persuasion). At the graduate level the Department offers widely recognized programs in speech-language pathology. The Department enjoys a particularly close relationship with Cleveland Hearing and Speech Center, an outstanding independent, non-profit provider of care in speech-language pathology and audiol-

Undergraduate Communication Sciences Major - Communication Studies Track:

Sequence Of Courses (33 Credits)

<table>
<thead>
<tr>
<th>Fall Credit hours</th>
<th>Spring Credit hours</th>
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<tbody>
<tr>
<td>FRESHMAN</td>
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<tr>
<td>COSI 100, Introduction to Human Communication ..... (3)</td>
<td>COSI 109, Introduction to Communication Disorders . (3)*</td>
</tr>
<tr>
<td>SOPHOMORE</td>
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<tr>
<td>COSI 211, Phonetics and Phonology .................. (3)</td>
<td>COSI 220, Introduction to American Sign Language ... (3)*</td>
</tr>
<tr>
<td>COSI 228, Mass Media and Communication ............. (3)</td>
<td>COSI 236, Public Speaking ................................. (3)</td>
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<tr>
<td>COSI 260, Multicultural Aspects of Communication ... (3)</td>
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<tr>
<td>JUNIOR</td>
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<tr>
<td>COSI 313, Language Development ...................... (3)*</td>
<td>COSI 332, Persuasion ........................................ (3)</td>
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<tr>
<td>COSI 300, Theories of Human Communication .......... (3)</td>
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<td>SENIOR</td>
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<tr>
<td>COSI 336, Communication in Professional Contexts ... (3)</td>
<td>COSI 3/445, Communication and Aging ..................... (3)*</td>
</tr>
</tbody>
</table>

*Students must take 4 of these courses.
An interdisciplinary program tailored to the student’s goals is also available. See COSI advisors for further information.
ogy. The center is located on the CWRU campus and the department is housed within the center.

**FACULTY**

Steven H. Long, Ph.D. (Northwestern University)  
Assistant Professor  
Language development and language disorders in children; language sampling and microcomputer applications in speech-language pathology.

F. Joseph Routman, M.A. (Case Western Reserve University)  
Senior Instructor  
Speech communication.

C. Melanie Schuele Ph.D. (University of Kansas)  
Instructor  
Language acquisition and disorders; grammatical development in children with specific language impairment; phonological awareness and emergent literacy interventions.

Lyn S. Turkstra, Ph.D. (University of Arizona)  
Assistant Professor  
Neuroscience of communication and communication disorders in adolescents and adults, with a primary focus on traumatic brain injury.

Peter J. Watson, Ph.D. (University of Arizona)  
Assistant Professor  
Acoustics and aeromechanics, with primary focus on respiratory control and respiratory-laryngeal interaction in normal and disordered populations; respiratory control in professional voice users.

**LECTURERS**

Patricia Roberts, Ph.D. (Kent State University)  
American Sign Language.

Mary M. Step, Ph.D. (Kent State University)  
Emotion and affect in human communication processes.

**ASSOCIATE FACULTY**

Barbara Lewis, Ph.D. (Case Western Reserve University)  
Assistant Professor, Pediatrics, Case Western Reserve University School of Medicine  
Familiality and genetic bases of speech/language disorders.

Gail S. Murray, Ph.D. (Case Western Reserve University)  
Assistant Professor, Dept. of Otolaryngology, Case Western Reserve University School of Medicine  
Pediatric audiology; audologic assessment of special populations; cochlear implants.

**ADJUNCT FACULTY**

Pamela R. Altman, M.A., CCC-SLP (Kent State University)  
Adjunct Instructor, primary appointment Cleveland Hearing & Speech Center  
Speech-language pathology.

Laura Brady, M.A., CCC-A (Kent State University)  
Adjunct Instructor, primary appointment Cleveland Hearing & Speech Center  
Audiology.

Laurie E. Burman, M.A., CCC-A (The University of Connecticut)  
Adjunct Instructor, primary appointment Cleveland Hearing & Speech Center  
Audiology.

Heather Calanni, M.A., CCC-SLP (Kent State University)  
Adjunct Instructor, primary appointment Cleveland Hearing & Speech Center.

**UNDERGRADUATE COMMUNICATION SCIENCES MAJOR - COMMUNICATION DISORDERS TRACK**

**SEQUENCE OF COURSES (36 credits)**

<table>
<thead>
<tr>
<th>Fall Credit hours</th>
<th>Spring Credit hours</th>
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<tbody>
<tr>
<td><strong>FRESHMAN</strong></td>
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</tr>
<tr>
<td>PSCL 101, General Psychology (3)</td>
<td>COSI 109, Introduction to Communication Disorders (3)</td>
</tr>
<tr>
<td><strong>SOPHOMORE</strong></td>
<td></td>
</tr>
<tr>
<td>COSI 211, Phonetics and Phonology (3)</td>
<td>COSI 220, Introduction to American Sign Language (3)</td>
</tr>
<tr>
<td>COSI 260, Multicultural Aspects of Communication (3)</td>
<td>PSCL 230, Child Psychology (3)</td>
</tr>
<tr>
<td><strong>JUNIOR</strong></td>
<td></td>
</tr>
<tr>
<td>COSI 3/413, Language Development (3)</td>
<td>COSI 321/421, Speech and Hearing Science (3)</td>
</tr>
<tr>
<td>COSI 325, Anatomy and Phys. of Speech and Hearing Mechanism (3)</td>
<td>PSCL 282, Quantitative Methods in Psychology (3)*</td>
</tr>
<tr>
<td>PSCL 375, Research Design and Analysis (3)*</td>
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<tr>
<td><strong>SENIOR</strong></td>
<td></td>
</tr>
<tr>
<td>COSI 352, Introduction to Clinical Practice in Speech-Language Pathology (3)</td>
<td>COSI 3/445, Communication and Aging (3)</td>
</tr>
<tr>
<td>COSI 3/470, Introduction to Audiology (3)</td>
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</tbody>
</table>

Students seeking clinical certification by the American Speech-Language-Hearing Association upon completion of a Master’s Degree, are required to take the following:

1. At least one, three semester credit hour course in the biological/physical sciences.
2. At least one, three semester credit hour course in college-level math (a math statistics course is acceptable, e.g., PSCL 282).

3. At least six semester credit hours in the behavioral and/or social sciences.

N.B. Undergraduate students in the Communication Disorders track may take 6 credit hours of graduate coursework beyond the 120 hours required for the B.A. degree. These 6 credit can be applied to course requirements for a graduate degree in communication disorders at CWRU.
Speech-language pathology
Bernard P. Henri, Ph.D. (Northwestern University)
Adjunct Assistant Professor
Fluency disorders; professional issues in speech-language pathology; health care management
Karen Kantzes, M.A., CCC-A (Ohio State University)
Adjunct Instructor, primary appointment
Communication Disorders, Speech Center
Audiology
Dell-Ann Lewis, M.A., CCC-SLP (Cleveland State University)
Adjunct Instructor, primary appointment
Communication Disorders, Speech Center
Speech-language pathology
Kay McNeal, M.S., CCC-SLP (Purdue University)
Adjunct Instructor and Coordinator of Clinical Education, CWRU
Speech-Language Pathology, Cleveland Hearing & Speech Center
Darlene Moenter, Ph.D. (Ohio State University)
Adjunct Assistant Professor
Auditory potentials
Richard H. Nodar, Ph.D., F.A.S.H.A. (Purdue University)
Adjunct Professor
Auditory evoked potentials; tinnitus; cochlear implants; hearing aids and hearing problems in the aging population
Bonnie L. Podrava, Ph.D. (University of Minnesota - Minneapolis)
Adjunct Assistant Professor
Dysphagia
Erika Snelson, M.A., CCC-SLP. (Kent State University)
Adjunct Instructor, primary appointment
Communication Disorders, Speech Center
Speech-Language Pathology, Cleveland Hearing & Speech Center
Brigid Whitford, M.A., CCC-A (Kent State University)
Adjunct Instructor, primary appointment
Communication Disorders, Speech Center
Audiology

UNDERGRADUATE PROGRAMS

Major
The communication sciences major leads to the Bachelor of Arts degree. Undergraduate students majoring in communication sciences choose a concentration in one of two tracks: communication disorders communication studies.

The Communication Disorders Track
The Department offers a track in communication disorders for undergraduate students intending to pursue graduate degrees in speech-language pathology, audiology, behavioral science, or a variety of other health professions. A master’s degree is the entry level degree for clinical practice in speech-language pathology. This track requires 36 hours of coursework in normal processes of speech, language and hearing; sign language; psychology; and communication disorders. Throughout the course of study, students have opportunities to observe clinical treatment of persons with communication disorders at the Cleveland Hearing and Speech Center as well as other clinical and medical facilities in the surrounding community. Specific course requirements are presented in the accompanying chart. Undergraduate students in communication disorders may take 6 credit hours of graduate coursework beyond the 120 hours required for the B.A. degree. These 6 credits can be applied to course requirements for a graduate degree in communication disorders at CWRU. In addition, students can combine undergraduate and graduate study through the Integrated Graduate Studies Program (see below).

The Communication Studies Track
Communication is a fundamental activity that defines and differentiates the human experience. It is a formative process, shaping individuals, relationships, social and political institutions, and cultures. Courses in this track reflect the various contexts, skills, and theories necessary to understand and practice communicative processes in social and professional life. The focus is on the construction, dissemination and outcomes of messages from a variety of perspectives. Coursework provides students with a theoretical foundation in the communication discipline. Students increase problem-solving ability through the practice of critical skills. There is also a focus on various symbol systems and how they enable social connections and relationships. The major offers development in the following competencies: conflict management, public speaking, sign language, multicultural perspectives, persuasion, rhetoric, argumentation, critical analysis, and relational and perceptual processes. The major also entails an interdisciplinary approach tailored by additional electives in the humanities and behavioral sciences. Communication studies is excellent preparation for a variety of professional careers.

Minors
Undergraduate students in other majors may choose a minor in one of two tracks: communication disorders or communication studies. Each minor requires a minimum of 15 credit hours.

Communication Disorders Track
The communication disorders minor track focuses on normal processes of speech, language, and hearing, as well as the speech, language and hearing disorders that result from breakdowns in these processes. Required courses: COSI 109, 313, 325 and two of the following: COSI 211, 220, 321, 345.

Communication Studies Track
Advanced skills and knowledge in communication are consistently ranked among the top qualifications in a wide range of careers such as business, law, political science, and medicine. The communication studies minor track focuses on skill enhancement and understanding of communication processes in a variety of contexts. Required courses: COSI 100, 300, 336 and two of the following: COSI 109, 220, 226, 228, 332 or 345.

Arts and Sciences General Education Requirement
The department offers several options for fulfilling portions of the Arts and Sciences General Education Requirements:

Global and Cultural Diversity:
COSI 260

Human Behavior and Development:
COSI 100 and one of the following: 220, 236, 300, 332, or 336
COSI 109 and one of the following: 211, 220, 313, or 345

Sequences for Case School of Engineering students
Two sequences, emphasizing either communication studies or communication disorders coursework, are offered to fulfill the social science requirements in the Engineering Core. Each includes three courses:

Communication Studies Sequence
COSI 100 and any two of the following: 220, 228, 236, 260, 300, 332, 336, 345
Communication Disorders Sequence

COSI 109 and any two of the following: 211, 321, 325

Departmental Honors

Juniors with a 3.0 overall grade point average and a 3.25 average in the communication sciences are encouraged to apply to the Honors Program. The Honors Program consists of one three-credit course, COSI 395, in which the student carries out an independent project in an area of interest, under the direction of a COSI faculty member. Satisfactory completion of the project qualifies the student to receive the Bachelor of Arts degree with Departmental Honors noted on the transcript. Admission to the Honors Program is by faculty approval. STAT 201 or PSCL 282 and PSCL 375 are prerequisites to COSI 395. Additional information is available from the academic advisor.

Integrated Graduate Studies Program

Students in the communication disorders track may be eligible for the Integrated Graduate Studies (IGS) Program. This program 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 coursework. Interested students should consult this bulletin and their academic advisor for additional information concerning the IGS program requirements.

GRADUATE PROGRAMS

Graduate programs leading to the Master of Arts and Doctor of Philosophy degrees in communication disorders (speech-language pathology) are offered.

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 American Speech-Language-Hearing Association. Upon successful completion of the Masters of Arts degree, students will also meet the academic and clinical practicum requirements for certification by the American Speech-Language-Hearing Association and licensure in the State of Ohio. Students may also elect to obtain Ohio Teacher Licensure in speech-language pathology. Degree requirements include completion of 36 credit hours of coursework and clinical practicum in communication disorders. In addition, students must satisfactorily complete written and oral comprehensive exams or may elect to write a master’s thesis. Specific course requirements are determined by the student’s undergraduate background and academic and career goals. The following courses are required for all students: COSI 497, Methods of Research (3); and four semesters of COSI 452, Graduate Clinical Practicum (1).

Clinical Opportunities in Speech, Language, and Hearing Disorders

The Department is affiliated with, and located in, the Cleveland Hearing and Speech Center (CHSC), a non-profit agency that serves children and adults with communication disorders. The CHSC is accredited by the Professional Services Board of the American Speech-Language-Hearing Association and serves as the primary training site for graduate students enrolled in clinical practicum. The personnel and facilities of the CHSC provide exceptional clinical experiences for students seeking clinical certification in speech-language pathology. The Department also draws upon clinical resources in University Circle and the greater Cleveland area. In addition to clinical practicum experiences at the CHSC, graduate students complete at least two externship site placements in the greater Cleveland area. Some of these include the Achievement Center for Children, Cleveland area HeadStart Programs, Cleveland Heights/University Heights Public Schools, Cleveland Public Schools, Cuyahoga Board of MR/DD, Easter Seals of Wayne County, Cleveland Clinic Foundation Children’s Hospital, Lakewood Public Schools, Maternal and Infant Clinics, Millridge School for Hearing Impaired, Parma Community Hospital, Positive Education Program, Rainbow Babies & Children’s Hospital, RoseMary Center, Shaker Heights Public Schools, Southwest General Hospital, Heather Hill Rehabilitation Hospital, MetroHealth Medical Center, Mt. Sinai Hospital, St. Augustine Manor, University Hospitals, and the Veterans Administration Medical Center.

Teacher Licensure

Students enrolled in the master’s program in communication disorders may also complete the requirements for Ohio Teacher Licensure in speech-language pathology. The Department’s Teacher Licensure Program meets the requirements of the Ohio Department of Education and prepares students for employment in a public school setting. (See the departmental advisor for additional details.)

Doctor of Philosophy

The Doctor of Philosophy is awarded to students in recognition of both the mastery, at an advanced level, of a body of knowledge that encompasses the disciplines of communication sciences and speech-language pathology, and the demonstration of the 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 develop expertise in a content area that is the primary focus of their course of study (e.g., communication and aging, medically based speech disorders, child language development and disorders). Each student is encouraged to enhance his or her scholarly preparation by completing coursework outside of the primary content area. In addition to coursework within the Department, doctoral students may choose coursework from graduate programs in other departments of the College of Arts and Sciences, as well as from several professional schools at CWRU, including the School of Medicine (e.g., neuroscience, genetics), the Case School of Engineering (e.g., biomedical engineering), the School of Dentistry, the Weatherhead School of Management, and the Mandel School of Applied Social Sciences.

Requirements for the doctoral program include coursework, research rotations, a supervised classroom teaching experience, written and oral comprehensive ex-
aminations, and a dissertation.

- A minimum of 36 hours of coursework is required. Twelve credit hours in the area of research are required (nine credit hours of statistics and research design; three 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 (COSI 690) is completed under the guidance of a faculty member in the Department.

- Written and oral examinations are undertaken after all coursework 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.

**Communication Sciences (COSI)**

**UNDERGRADUATE COURSES**

**COSI 100. Introduction to Human Communication (3)**
Communication theories account for the functions of human life which make possible the transfer of an idea or feeling from one individual to another through a shared symbol system. The history and development of communication; the understanding and application of communication theories via readings, discussion and interactive experiences.

**COSI 103. Voice and Articulation (3)**
Characteristics and skills of voice and articulation necessary for effective oral communication. Modification of voice and speech habits.

**COSI 109. Introduction to Communication Disorders (3)**
The normal prerequisites for speech, language and hearing. The disorders of hearing, language, articulation, fluency and voice. Observations within the Cleveland Hearing and Speech Center.

**COSI 130. Workshop in Radio Broadcasting (1)**
Training in radio broadcasting by participating in the operation of WRUW-FM.

**COSI 211. Phonetics and Phonology (3)**
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 (3)**
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. Intermediate American Sign Language (3)**
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, adverbal non-manual behaviors, temporal aspects, sequencing, and includes a brief introduction to ASL English diglossia and bilingual aspects. There will be opportunities for discussion of deaf culture. Prerequisite: COSI 220

**COSI 228. Mass Media and Communication (3)**
The media of mass communication, particularly in this time of exploding channel availability and information overload, are central factors in the function, maybe even the evolution, of modern society. While most of us are intimately familiar with the products of mass communicators, few understand how media developed, how they function independently and interactively, or what their true effects are.

**COSI 236. Public Speaking (3)**
Process and lecture course. Develops ability to speak effectively in various contexts. Weekly preparation and delivery of speeches.

**COSI 260. Multicultural Aspects of Human Communication (3)**
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 309. Introduction to Communication Disorders (3)**
Limited to graduate and professional students in the Department of Communication Sciences. The normal prerequisites for speech, language and hearing. The disorders of hearing, language, articulation, fluency, and voice. Observations within the Cleveland Hearing and Speech Center.

**COSI 313. Language Development (3)**
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 prerequisites: Child Psychology

**COSI 321. Speech and Hearing Science (3)**
Acoustics and the processes of speech/motor control. Human perception of speech sounds, motor control, methodological procedures, instrumentation and research findings. Prerequisite: COSI 325

**COSI 325. Anatomy and Physiology of Speech and Hearing Mechanisms (3)**
The anatomy and physiology of normal speech production and of the hearing mechanism.

**COSI 326. Anatomy and Physiology of Singing Voice (1)**
For music students with interest in the use of the vocal mechanism in singing. The systems and processes that contribute to a normal voice for speaking and singing. Focus on normal respiration and phonation, with consideration of disorders resulting from vocal abuse.
COSI 330. Seminar in Radio Broadcasting (3)  
One hour of class per week and participation in operation of WRUW-FM. The history of radio, government control and the FCC, public responsibility, program policy, station management with practical broadcast application. Prerequisite: COSI 130

COSI 331. Seminar In Radio Broadcasting (3)  
Prerequisite: COSI 130

COSI 332. Persuasion (3)  
This course is an introduction to persuasion and attitude change, including examples of the influence tactics used by actual persuaders, and is aimed at developing an understanding of principles of persuasion and the practical application of those principles in life and/or career situations. The course combines the practice of public speakers, advertisers, attorneys, politicians, managers, salespeople, editorial/essay writers, therapists and consultants, with a general discussion of the more relevant persuasion and attitude change theories and research.

COSI 336. Communication in Professional Contexts (3)  
Communication interactions used by professionals, includes interviews, conferences, group interactions, counseling, and others where problem solving and decision making form the primary goal of the communication exchange. Provides an opportunity to gain skills in these activities.

COSI 345. Communication and Aging (3)  
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.

COSI 352. Practicum in Communication Disorders (3)  
Students are introduced to the clinical processes of speech-language pathology. Clinical procedures, guidelines, and strategies are discussed. Students will complete 25 hours of clinical observation and will learn to evaluate clinical effectiveness. Prerequisite: COSI 309 and COSI 313, or consent of instructor

COSI 370. Introduction to Audiology (3)  
Disorders of hearing, assessment of hearing; including behavioral and objective measures; intervention strategies; and identification programs. Prerequisite: COSI 325 and COSI 321 or COSI 421

COSI 390. Independent Study and Research (1-6)  
Either COSI 390 or 391 required for students intending to graduate with departmental honors.

COSI 391. Independent Study and Research (1-6)  
(See COSI 313)

GRADUATE COURSES

COSI 421. Speech and Hearing Science (3)  
(See COSI 321)

COSI 445. Communication and Aging (3)  
(See COSI 345) Graduate students are given an opportunity to incorporate information from their own disciplines in a special project, where appropriate.

COSI 452A. Graduate Clinical Practicum I: Case Management (1)  
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.) Prerequisite: COSI 352, COSI 413.

COSI 452B. Graduate Clinical Practicum II: Professional Issues (1)  
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.) Prerequisite: COSI 352, COSI 413, COSI 452A, COSI 453

COSI 452C. Graduate Clinical Practicum III: Special Populations (1)  
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.) Prerequisite: COSI 352, COSI 452A, COSI 452B, COSI 453, COSI 456.

COSI 452D. Graduate Clinical Practicum IV: Student Teaching (1)  
Four hundred hours of student teaching practicum in urban/suburban public school districts. Prerequisite: COSI 352, COSI 452A, COSI 452B, COSI 452C, COSI 463, COSI 464, COSI 470, COSI 580.

COSI 452E. Graduate Clinical Practicum V: Medical Speech Pathology (1)  
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.) Prerequisite: COSI 352, COSI 452A, COSI 452B, COSI 452C, COSI 453, COSI 456.

COSI 453. Articulation and Phonology Disorders (3)  
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)  
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)  
Nature and characteristics of language disorders in children. Theoretical and clinical issues related to effective intervention with children and their families. Assessment and treatment of disorders of syntax, semantics and pragmatics. Strategies for intervention with children from special populations and multicultural populations. Prerequisite: COSI 413

COSI 463. Speech and Language Therapy in Educational Setting (3)  
Organization and administration of speech, language and hearing programs within public and private educational settings. Focus on federal legislation on education of handicapped children, alternative service delivery models, emergent literacy, reading, writing, and classroom discourse as they relate to speech, language, and hearing disorders. Overview of special populations. Team-based service delivery and (para) professional supervision discussed. Requires supervised practicum experience in public schools that is completed in the following semester.
COSI 464. Diagnosis of Speech and Language Disorders (3)
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. Prerequisite: COSI 453 and COSI 456

COSI 470. Introduction to Audiology (3)
Disorders of hearing; assessment of hearing, including behavioral and objective measures; intervention strategies; identification programs. Prerequisite: COSI 325

COSI 497. Methods of Research (3)
Pure and applied research design for speech language pathologists. Focus on evaluation of research methodology and the formulation of testable research questions.

COSI 505. Neuroscience of Communication and Comunication Disorders (3)
Neuroanatomy and neurophysiology related to cognition and language. Includes principles of neurophysiology and neurochemistry; functional neuroanatomy of the central and peripheral nervous systems; neurological and neuropsychological assessment of communication; neurodiagnostic methods. Normal aspects of human neuroscience will be discussed in the context of neurological disorders affecting communication, as an introduction to COSI 557.

COSI 557. Acquired Adult Language and Cognitive Disorders (3)
A review of current theories of human information processing will serve as the foundation for 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 discussions on assessment and intervention for these disorders. Prerequisite: COSI 557

COSI 560. Medical Aspects of Speech Pathology I: Voice Disorders (3)
Aspects of normal and abnormal voice production, evaluation and management of various voice and resonance disorders.

COSI 561. Medical Aspects of Speech Pathology II: Neuromotor and Craniofacial Anomalies (3)
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.

COSI 562. Medical Aspects of Speech Pathology III: Dysphagia & Laryngectomy Rehabilitation (3)
Survey of clinical problems involving dysphagia, alaryngeal speech, tracheostomy and ventilator dependency in medical speech pathology. Normal development of pre-feeding skills, pediatric dysphagia, adult dysphagia, the clinical swallowing assessment, the modified barium swallow study, and therapeutic intervention for dysphagia for both children and adults. Issues, methods, and philosophies related to teaching esophageal speech, TEP voice, and use of mechanical instruments as means of providing voice to laryngectomized individuals. Issues related to use of tracheostomy tubes and tracheostomy speaking devices for patients who may be ventilator-dependent.

COSI 580. Aural Rehabilitation (3)
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.

COSI 600. Special Problems and Topics (1-3)
Topics and instructors by arrangement of the department chair.

COSI 601. Directed Study and Research (1-6)
Individual study and research under the direction of a faculty member.

COSI 651. Thesis M.A. (1-6)
COSI 690. Supervised Classroom Teaching (3)
Required of all doctoral students. Teaching of an undergraduate course planned in conjunction with a supervising faculty member. Follows the doctoral student’s earlier experience of observing and assisting a faculty member in classroom teaching.

COSI 691. Clinical Supervision (3)
Brings the student first-hand knowledge and experience in principles of supervision and the supervisory process. Provides knowledge of supervision research, administration, and evaluation, as well as practical experience, either in the Cleveland Hearing and Speech Center or in the student’s own clinical work setting. Application dependent on the student’s certification status.

COSI 701. Dissertation Ph.D. (1-36)
COSI 702. Appointed Dissertation Fellowship (9)

Department of Economics

400 Wickenden Building
William T. Bogart, Chairman
Phone: 216-368-2970
Fax: 216-368-5039

FACULTY
William T. Bogart, Ph.D. (Princeton University)
Associate Professor of Economics; Chairman, Economics Department
Urban economics, public finance, real estate

E. Mandell deWindt Professor of Industrial Economics; Associate Dean for Research and Graduate Programs
Industrial economics, industrial economics

David J. Cooper, Ph.D. (Princeton University)
Assistant Professor of Economics
Industrial Organization, Microeconomic Theory

Eric Bettinger, Ph.D. (Massachusetts Institute of Technology)
Assistant Professor of Economics
Regional economics

John R. Mannix Blue Cross & Blue Shield Associate Professor of Health Care Economics
Health care economics, industrial economics

John R. Mannix Blue Cross & Blue Shield Associate Professor of Health Care Economics
Health care economics, industrial economics

Robin A. Dubin, Ph.D. (The Johns Hopkins University)
Associate Professor of Economics
Spatial econometrics, urban economics, regional economics

Asim Erdilek, Ph.D. (Harvard University)
Professor of Economics
International economics, international finance
Michael S. Fogarty, Ph.D. (University of Pittsburgh)
Professor of Economics
Regional growth and development, science and technology infrastructure, economics of cities

Susan Helper, Ph.D. (Harvard University)
Associate Professor of Economics
Economic history, technical change, economics of supplier relations

William S. Peirce, Ph.D. (Princeton University)
Professor of Economics
Public finance, public choice, economics of energy and industrial economics

James B. Rebitzer, Ph.D. (University of Toronto)
Frank Tracy Carlton Professor of Economics
Economics of organizations, employment relationships and labor markets, human resource management and industrial relations, behavioral economics

Richard A. Shatten, M.B.A. (Harvard University)
Professor for the Practice of Public Policy and Management; Director, Center for Regional Economic Issues
Public policy, nonprofit leadership and corporate involvement in society

Robert L. Sionim, Ph.D. (Duke University)
Assistant Professor of Economics
Game theory, learning, behavioral economics, reference theory, price theory, auctions, decision theory and experimental economics

Marcus Stanley, M.A. (Syracuse University)
Instructor of Economics

SECONDARY APPOINTMENTS
Paul D. Gottlieb, Ph.D. (Princeton University)
Associate Director, Center for Regional Economic Issues; Senior Lecturer of Economics
Economics of cities and regions, public policy, labor markets and commuting, amenities and economic development

David C. Hammersch, Ph.D. (Columbia University)
Elbert Jay Benton Professor of History, College of Arts and Sciences; Professor of Economics
Nonprofit organizations, urban and social policy history

Andrew P. Morriss, J.D., M.Pub.Aff. (University of Texas at Austin), Ph.D. (Massachusetts Institute Technology)
Professor, School of Law; Associate Professor of Economics
Labor economics, industrial organization, law and economics

Dennis R. Young, Ph.D. (Stanford University)
Professor of Nonprofit Management, Mandel School of Applied Social Sciences; Professor of Economics
Economics of nonprofit organizations, economics of public services, entrepreneurship

ADJUNCT FACULTY
Martine Lussier, Ph.D. (University of Toronto)
Instructor of Economics

Ayhan Talu, Ph.D. (Arizona State University)
Lecturer

BACHELOR OF ARTS
(College of Arts and Sciences)
Economics is concerned with the problems of allocating scarce resources to meet human needs. Students who study economics gain an understanding of how consumers (households), producers (firms) and governments make decisions affecting the allocation of resources and, therefore, the society’s economic performance. Economics also involves an examination of how the interaction of these decisions in markets and in the political process produces certain outcomes, and how legal and institutional arrangements can influence these outcomes. Finally, the study of economics leads to a better appreciation of the ways in which trade, investment and the movement of people and information across national boundaries tie the global economy together.

An undergraduate major in economics provides an excellent preparation for a variety of professional careers, such as management, law and government service. A major is essential for those wanting to pursue graduate work in economics.

Major
(for B.A. degree)
A major in economics consists of 30 hours, with a minimum of 24 hours of economics courses. It leads to the Bachelor of Arts degree.

Required courses (15 hours)
ECON 102, 103, 307, and either 308 or 309 (12 hours)
STAT 201 or 207 or equivalent (3 hours)

Electives (15 hours)
Minimum of four economics electives (12 or more hours)
One elective may be in a related field (such as ACCT, HSTY, MATH, PHIL) approved by the departmental adviser (3 hours max)

Minor
(for B.A. or B.S. degree)
A minor in economics consists of 15 hours, as follows
ECON 102, ECON 103, and three additional economics courses (9 hours) selected in consultation with the minor adviser.

Social Science Sequence
(for B.S. based upon Engineering Core Curriculum)
The sequence requirement is satisfied by taking ECON 102, ECON 103, and one other 200- or 300-level ECON course.

Social Sciences/Social Institutions Requirement
(for B.A. or B.S. based upon Arts and Sciences General Education Requirements)
The three-credit minimum may be satisfied by taking any one of the courses listed below. The six-credit sequence may be satisfied by taking any two of the courses listed below ECON 102, ECON 103, ECON 205

Economics (ECON)

UNDERGRADUATE COURSES
ECON 102. Principles of Microeconomics (3)
This course covers how productive resources are allocated in a market economy, the determination of individual prices and costs of production, consumer behavior, the consequences of governmental controls over prices and wages, and problems related to allocating resources between the private and public sectors.

ECON 103. Principles of Macroeconomics (3)
This course covers how incomes, employment, inflation, and the national output of goods and services are determined, as well as the monetary system and its management. Government revenue and expenditure policies and their influence on economic stability and growth are also studied.

ECON 205. Economic Perspectives (3)
This course examines important contemporary and historical issues from an economic perspective. It enables students to
This course covers the techniques used by economists to estimate the parameters of economic relationships such as demand curves and consumption functions. Prerequisites: ECON 102 and ECON 103 and one semester of statistics.

ECON 328. Experimental Economics (3)
This course covers the methods of experiments to study economic behavior. This course will examine the role of market institutions, game theory, and individual choice. Specific topics will depend on both the instructor and student interest, but will include market organization, game theory and rational choice and recent modifications to economic thinking on this topics. Prerequisite: ECON 102.

ECON 329. Game Theory: The Economics of Thinking Strategically (3)
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. Prerequisite: ECON 102.

ECON 330. Economic Analysis of Labor Markets (3)
This course examines the determinants of the demand for and supply of labor, the operation of labor markets under differing degrees of competition, and the relationship between the operation of the labor market and the level of inflation. Prerequisite: ECON 102.

ECON 335. Comparative Economic Systems (3)
This course examines the way that different institutions affect economic performance. An alternative course title might be “Comparative Institutional Analysis.” In particular, we look at the economic institutions of three capitalist economies (the U.S., Japan and Sweden), one socialist economy (the former Soviet Union), and two economies in transition (Poland and Hungary), together with the unique institutional arrangements in Iran (the “Islamic Model”) and the former Yugoslavia (“worker self-management”). We combine insights from traditional economic theory, recent developments in “information economics,” and the use of case studies. Prerequisites: ECON 102 and ECON 103.

ECON 338. Law and Economics (3)
This course examines legal institutions and rules from an economic perspective. Students will learn when and how legal rules can be efficient. Topics will depend on both the instructor and student interest, but will include commercial law, accident law, property rights, contracts, and polycentric legal systems. Prerequisite: ECON 102.

ECON 341. Money and Banking (3)
Prerequisite: ECON 103. Cross-listed as BAFI 341.

ECON 342. Public Finance (3)
This course covers economic aspects of government spending and taxing, allocation of scarce resources among competing claims in the public and private sectors, application of equity and efficiency criteria to tax and expenditure systems, and theories of bureaucratic performance. Prerequisites: ECON 102 and ECON 103. Cross-listed as BAFI 342.

ECON 343. Economics of State and Local Governments (3)
This course examines economic analysis of the roles of federal, state, and local government; economic effects of state and local property, sales, and other taxes; effects of intergovernmental grants; public school finance; the urban fiscal crisis. Prerequisite: ECON 102.

ECON 345. Public Choice (3)
This course covers economic theory and empirical analysis of the behavior of politicians, bureaucrats, and voters based on the assumption of rational pursuit of self-interest, comparison with other approaches to the study of political behavior, and implications of alternative collective decision procedure. Prerequisites: ECON 102 and ECON 103.

ECON 361. Managerial Economics (3)
This course explores the economic principles that underlie strategic decisions in firms. Topics include the determination of vertical and horizontal boundaries of firms, strategic positioning and the sources of competitive advantage. Prerequisite: ECON 102.

ECON 364. Competition and Public Policy (3)
This course covers alternative market structures and their performance in terms of profit, prices, and productivity, as well as antitrust laws and regulations and their importance to industrial organization. Prerequisite: ECON 102.
ECON 367. Economics of Energy (3)
The economic aspects of energy are studied. Long term trends in consumption, sources of supply, the theory of non-renewable resources, interactions with environmental problems, and current questions of energy policy are included. Prerequisite: ECON 102.

ECON 368. Environmental Economics (3)
This course examines the economics of both the causes of pollution and the remedies for it. Among the topics covered will be: citing of environmentally undesirable facilities (such as nuclear waste repositories), tradable air pollution emissions permits, pesticide use in agriculture, and international cooperation in cleaning up the Great Lakes. Prerequisite: ECON 102.

ECON 369. Economics of Technological Innovation (3)
This course looks at the process of technological change. We will explore topics such as: the computer/internet revolution, Japanese manufacturing techniques, the mechanization of housework, the impact of new technology on workers and consumers, and how managers and government policy-makers can affect the nature of technological change. Prerequisite: ECON 102.

ECON 372. International Finance (3)
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. Prerequisites: ECON 102 and ECON 103. Cross-listed as BAFI 372.

ECON 373. International Trade (3)
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. Prerequisites: ECON 102 and ECON 103.

ECON 375. Economics of Developing Countries (3)
This course examines the problems of less developed countries, including theories of economic growth, policies for capital accumulation, criteria for resource allocation, foreign trade problems, inflation, population trends, and development planning. Prerequisites: ECON 102 and ECON 103.

ECON 377. Economics of Nonprofit Organizations (3)
The purpose of this course is to familiarize students with the private nonprofit sector of the U.S. economy, with economic theory contributing to our understanding of this sector, and with economic analysis of policy and management issues affecting nonprofit organizations. Topics include understanding the different types of nonprofit organizations; the size, scope and economic impact of the nonprofit sector; economic theories of why nonprofit organizations exist and how they behave; economic analysis of tax and regulatory policy issues affecting nonprofits. Prerequisite: ECON 102.

ECON 378. Health Care Economics (3)
This course deals with the health care system, the fastest growing sector of the U.S. economy. Because of its complexity and sheer size, the health care system affects virtually every facet of the economy, including labor productivity, income distribution and international competitiveness. The course will foster an understanding of economic analysis of health care markets and related public policy issues by developing a general understanding of the health care system, and then focusing on (1) the behavior of consumers; (2) the supply side (physicians, hospitals and their markets); (3) insurance and regulation with special emphasis on current events. Prerequisite: ECON 102; ECON 103 recommended.

ECON 386. Urban Economics (3)
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 this course, we examine the implications of spatial location for economic analysis. One of the most important implications is that households and firms can find it advantageous to cluster together in cities in order to reduce transportation costs. The course will emphasize applying the theoretical analysis to real world issues, with a special emphasis on important problems facing the Cleveland metropolitan area. Prerequisite: ECON 102.

ECON 397. Honors Research I (3)
ECON 398. Honors Research II (1-3)
Prerequisite: ECON 397.

ECON 399. Individual Readings and Research (1-6)
Intensive examination of a topic selected by the student.

GRADUATE COURSES

ECON 403. Economics for Management (3)
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 421. Health Care Economics (3)
The health care industry is one of the largest sectors of the economy, yet the usual supply and demand relationships are often violated because of the presence of large third-party-payers (insurers) and the heavy involvement of central governments. We will develop an understanding of the roles of health care consumers, providers, and large purchasers in health care markets, financial incentives contained in various reimbursement schemes, and of principles insurance. The policy intricacies of this sector have sparked a fruitful area of consulting with government agencies, health care systems, pharmaceutical firms, and even hospitals among the typical clients. The course will be taught from the perspective of a policy or economic consultant in health care and is appropriate not only for those with an interest in consulting, but also for prospective business leaders and decision makers who will have to evaluate policies for their organizations, and for corporate officers who need a better understanding of benefits management. Many topics and applications covered in this course may be of interest to decision makers in other sectors of the economy. These include cost-benefit analysis, or principles of insurance, to name but two. Prerequisite: ECON 403 or MBAC 426. Cross-listed as HSMC 421.

ECON 431. Economics of Negotiation and Conflict Resolution (3)
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
structuring incentives and investing in re-
relationships. In the incentives section, we
analyze how organizations: allocate deci-
sion rights; evaluate performance; and
implement motivation strategies. In the
relationships section, we analyze how or-
ganizations sustain functional, long-term
relationships in competitive or conflictual
environments. A small number of surpris-
ingly simple economic models, it turns
out, offer important insights into incen-
tive design and investments in long-term
relationships.

ECON 436B. Economics of Organiza-
tions-M.B.A. (3)
Dramatic changes in technology, work
force demographics and economic com-
petition are forcing firms to rethink their
internal organization. Implementing new
internal strategies is remarkably hard for
organizations and managers to do. This
class is designed to provide the economic
tools that managers need to understand
why their organizations are the way they
are and why change can be as difficult as
it is important. This course focuses on
two elements of a firm’s internal strategy:
structuring incentives and investing in re-
relationships. In the incentives section, we
analyze how organizations: allocate deci-
sion rights; evaluate performance; and
implement motivation strategies. In the
relationships section, we analyze how or-
ganizations sustain functional, long-term
relationships in competitive or conflictual
environments. A small number of surpris-
ingly simple economic models, it turns
out, offer important insights into incen-
tive design and investments in long-term
relationships.

ECON 434. Business and Nonprofit
Entrepreneurship (3)
This course examines the power of en-
trepreneurship in the nonprofit sector. It
will cover large scale policy initiatives,
new services and for-profit activities.
Course elements include vision, staffing,
leadership, and funding. Cross-listed as
MAND 434 and ENTP 434.

ECON 435. Industrial Economics and
Technical Innovations-E.M.B.A. (2)
This course, which is limited to students
in the Executive M.B.A. program, pre-
sents the basic elements in the analysis of
production and technological change. It
explores the uses and limitations of
theory in analyzing innovative activity in
industry and examines the role of techno-
logical progress in the growth of firms
and industries.

ECON 436A. Economics of Organiza-
tions-E.M.B.A. (2)
Dramatic changes in technology, work
force demographics and economic com-
petition are forcing firms to rethink their
internal organization. Implementing new
internal strategies is remarkably hard for
organizations and managers to do. This
class is designed to provide the economic
tools that managers need to understand
why their organizations are the way they
are and why change can be as difficult as
it is important. This course focuses on
two elements of a firm’s internal strategy:
structuring incentives and investing in re-
relationships. In the incentives section, we
analyze how organizations: allocate deci-
sion rights; evaluate performance; and
implement motivation strategies. In the
relationships section, we analyze how or-
ganizations sustain functional, long-term
relationships in competitive or conflictual
environments. A small number of surpris-
ingly simple economic models, it turns
out, offer important insights into incen-
tive design and investments in long-term
relationships.

ECON 441. Advanced Money and
Banking (3)
Prerequisites: ACCT 401 or MBAC 415
and BAFI 402 or MBAC 416 and ECON
403 or MBAC 426 and QUMM 414 or
MBAC 414. Cross-listed as BAFI 441.

ECON 461. Managerial Economics (3)
This course explores the economic prin-
ciples that underlie strategic decisions in
firms. What determines their boundaries
-i.e., Which activities do they expand, ac-
quire and divest? What are the sources of
competitive advantage, and how do firms
position themselves strategically? Prereq-
quisite: ECON 403 or MBAC 426.

ECON 462. Industrial Economics (3)
This course deals with the dynamics of
the industrial growth process. Topics in-
clude industrial production and produc-
tivity, the evolution of industrial struc-
ture, technological innovation and choice of
technology, the response of firms to
competition in an international environ-
ment, the characteristics of industrial re-
structuring processes, and the role of in-
dustrial policy. Prerequisite: ECON 403.

ECON 472. The World’s Regions and
Strategic Advantage (3)
This course will focus on business deci-
sions in an increasingly complex regional
and global economic environment and
the significance of place in business suc-
cess. Every company decision involves lo-
cation—recruiting, locating headquarters
or an R&D lab, choosing where to invest,
evaluating a merger, evaluating the in-
vestment portfolio of a bank, locating a
new facility, and marketing your product.
Topics include: high technology develop-
ment, interpreting business climate in-
dexes, the business location decision,
sources of regional advantage, case stud-
ies of the world’s important cities, geo-
graphic clustering of industries, and busi-
ness partnerships for improving regional
economics. Prerequisite: ECON 403.

ECON 474. International Trade (3)
This course deals with the causes and ef-
effects of international trade and invest-
ment. 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 Orga-
nization are treated extensively. Prereq-
usite: ECON 403.

ECON 475. International Finance (3)
This course covers the global financial
markets that multinational corporations,
government agencies, and banks use in
conducting business. These financial mar-
rkets include the market for foreign ex-
change, the Eurocurrency and related
money markets, the Eurobond and global
equity markets, the commodity markets,
the markets for forward contracts, op-
tions, swaps, and other derivatives. Pre-
quisite: ECON 403.

ECON 476. Fundamentals of Interna-
tional Business-E.M.B.A. (3)
This course deals with the fundamentals
of business activities that cross national
boundaries. It focuses on not only ex-
ports and imports, but all other issues,
such as foreign direct investment, inter-
national technology transfer, organiza-
tional structure, and financial manage-
ment, that required a corporate strategy in
establishing and maintaining global
competitiveness. It covers the basic inter-
national business activities within an in-
terdisciplinary framework, drawing from economics, finance, accounting, marketing, organizational behavior, political science, and history. Its aim is not only to enable an understanding of such technical issues as how the effects of tariffs and quotas differ or how foreign exchange rates are determined, but also to provide a systemic view of how government policies and corporate strategies interact in changing the environment of international business. The basic premise of the course is that to formulate successful global corporate strategies, we must comprehend and cope with the political, cultural, and economic environment of international business.

**ECON 482. High-Tech Regions and Business Strategy (3)**

Many regions of the world seek to emulate Silicon Valley’s success as a high-tech center. These include Taiwan, Israel, India, Britain, Cote d’Azur (“Europe’s California”), Pyramid Technology Park of Egypt, and Malaysia. A region’s innovation system serves as both a source of strategic advantage for high-tech companies and as a critical infrastructure for supporting the development and use of new technology by a region’s companies and industries. In this course we look at what makes Silicon Valley so successful as a high-tech region, and whether it can be used as a model for high-tech development in other countries and regions. We examine alternative systems of innovation in other regions of the world and the U.S., including older industrial regions. Countries and regions will be selected depending on class composition. The class will focus on the critical ingredients that form a regional innovation system and their effect on the performance of companies and industries. Prerequisites: ECON 403 or MBAC 426 or equivalent.

**ECON 501. Special Problems and Topics (1-18)**

This course is offered, with permission, to students undertaking reading in a field of special interest.

**ECON 501H. Special Problems and Topics (1-36)**

This course is offered, with permission, to Ph.D. candidates undertaking reading in a field of special interest.

**ECON 601. Special Problems and Readings (1-18)**

This course is offered, with permission, to students undertaking reading in a field of special interest.

**ECON 701. Dissertation Ph.D. (1-18)**

**ECON 702. Appointed Dissertation Fellow (9)**

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**Education**

114 Wickenden Building Phone 216-368-2714; Fax 216-368-2715

Tim Shuckerow, Director

**Ohio Teacher Licensure**

Ohio teacher licensure can 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. Adolescence/young adult teacher licensure 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. The program requires 35 credit hours in professional education, 12 taken at Case Western Reserve University and 23 credit hours at John Carroll University.

Teacher licensure programs are also offered in art education and music education at the undergraduate Bachelor of Science and graduate Master of Arts levels, and the school speech-language pathology personnel licensure can be attained at the graduate level. For further information, turn to the departmental listings for art history and art, music, and communication sciences.

A 3.0 grade point average must be maintained in all professional education courses, and a cumulative GPA of 2.5 in all coursework is required to be recommended for Ohio teacher licensure. Completion of the University’s program in education does not ensure that Ohio teacher licensure will be awarded. The Ohio Department of Education also requires that licensure applicants receive passing scores on the PLT (Principles of Learning and Teaching) and Content Area subtests of the National Teachers’ Examination and fingerprinting with a criminal background check by the Ohio Bureau of Criminal Identification. Once licensed, teachers can transfer their Ohio licensure to over 40 states. Students should contact individual state departments of education for teacher reciprocity details.

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**PROGRAM FACULTY**

Tim Shuckerow, M.A. (Case Western Reserve University)

Director of Teacher Licensure

Rita Saslaw, Ph.D. (Case Western Reserve University)

Associate Director of Teacher Licensure

Phil Safford, Ph.D. (University of Michigan)

Instructor

David Bellini, M.A. (Cleveland State University)

Instructor

**Education (EDUC & EDJC)**

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**UNDERGRADUATE COURSES**

**EDUC 301. Introduction to Education (3)**

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.

**EDUC 304. Educational Psychology (3)**

Application of psychological principles as they relate to various educational learning theories. Principles and practices of measurement and evaluation. Learning developmental differences between child, adolescent, and young adult growth. Continuation of professional development. Application of research to instructional methodologies. Clinical/Field experiences required. Prerequisite: PSCL 101.

**EDUC 338. Seminar and Practicum in Adolescents (3)**

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. Prerequisites: PSCL 101, EDUC 301, EDUC 304 and permission of program director. Cross-listed as PSCL 338 and SOCI 338.

**EDUC 401. Introduction to Education (3)**

(See EDUC 301.) Research project required for graduate students.

**EDUC 404. Educational Psychology (3)**

(See EDUC 304.) Research project required for graduate students. Prerequisite: PSCL 101.
Taken at John Carroll University

EDJC 186. Instructional Technology (2)
Principles and techniques of instructional design and use of technology in educational settings. Includes examination of emerging technologies and production of instructional materials. Prerequisites: EDUC 301, EDUC 388 and EDUC 304.

EDJC 255. Literacy Across the Curriculum (3)
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 clinical experience. Prerequisites: EDUC 301, EDUC 338 and EDUC 304.

EDJC 337. Adolescent Education Special Methods (3)
Taken by adolescent licensure program candidates. Methods for planning, implementing and integrating language arts/social studies/science/math curricula and assessing student achievement consistent with NCATE standards, the Ohio Department of Education’s Competency Based models and Praxis III frameworks. Attention given to examining pedagogic believes and practices consistent with the developmental level of adolescents and the nature of the teaching field. Emphasis placed on nurturing a risk-taking classroom community responsive to students with diverse backgrounds, abilities, and learning styles. Practical application of methods and issues to candidate’s field placement in a secondary language arts/social studies/science/math classroom. Prerequisites: EDUC 301, EDUC 338 and EDUC 304.

EDJC 405A. Adolescent Education Seminar (3)

EDJC 405S. Multi-Age Education Seminar (3)
Continued study of student development, learner achievement, and assessment. Seeks to integrate program learning with student teaching experience. Development of the Professional Portfolio and preparation for job interviewing. Corequisite: EDJC 444S.

EDJC 427. Adolescent Education Special Topics (3)
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. Practical application of issues to pre-student teaching field setting. Prerequisite: Acceptance into pre-student teaching.

EDJC 444A. Adolescent Student Teaching (9)
A full day, full semester of teaching in an accredited secondary school under the direction of a classroom teacher and a university supervisor, including a scheduled seminar. Supervision includes personnel with advanced training in the relevant content area. Lab fee required. Prerequisites: All professional education courses. Corequisite: EDJC 405A.

EDJC 444S. Multi-Age Student Teaching (6)
A full day, full semester of teaching in an accredited secondary school under the direction of a classroom teacher and a university supervisor, including a scheduled seminar. Supervision includes personnel with advanced training in the relevant content areas. Lab fee required. Prerequisite: All professional education courses. Corequisite: EDJC 405S.

Department of English

106 Guilford House
Phone 216-368-2340; Fax 216-368-2216
Gary L. Stonum, Chair

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 the major periods of English and American literature, film, creative writing, and composition. The department aims in its programs to integrate program learning with student teaching experience. Development of the Professional Portfolio and preparation for job interviewing. Corequisite: EDJC 444S.

The Department of 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 B.A. in English traditionally has been an important stepping stone to success in professional school, and many CWRU 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.

The department is home to The Emily Dickinson Journal and The Society for Critical Exchange, an international community of scholars in literary and cultural theory.

FACULTY
Gary L. Stonum, Ph.D. (Johns Hopkins University)
Oviatt Professor and Chair
Editor, The Emily Dickinson Journal
American literature, literary theory

Thomas G. Bishop, Ph.D. (Yale University)
Associate Professor
Shakespeare; Renaissance literature
Thomas Sayers Ellis, M.F.A. (Brown University)
Assistant Professor
Creative Writing (poetry); African-American Literature

Christopher Flint, Ph.D. (University of Pennsylvania)
Associate Professor
18th Century English literature; history of the book

Louis D. Giannetti, Ph.D. (University of Iowa)
Professor
Film

Mary Grimm, M.A. (Cleveland State University)
Associate Professor
Creative writing (fiction), contemporary literature

Ted Gup, J.D. (Case Western Reserve University)
Shirley Wormser Professor of Journalism
Journalism, non-fiction writing

William H. Marling, Ph.D. (University of California, Santa Barbara)
Professor
American literature; modernism

Todd V. Oakley, Ph.D. (University of Maryland)
Assistant Professor and Director of Composition
Rhetoric; linguistics

Judith Oster, Ph.D. (Case Western Reserve University)
Associate Professor
The teaching of English; American literature; poetry

James Porter, Ph.D. (University of Detroit)
Professional writing, rhetorical theory

William R. Siebensuch, Ph.D. (University of California, Berkeley)
Professor
18th- and 19th-century literature

Athena Vrettos, Ph.D. (University of Pennsylvania)
Associate professor
19th-century English literature, women’s studies

Martha Woodmansec, Ph.D. (Stanford University)
Professor, Executive Director, The Society for Critical Exchange
Literary theory; 18th- and 19th-century literature; comparative literature

UNDERGRADUATE PROGRAMS

Major
The major in English consists of 30 semester hours in English above the 100 level, including ENGL 200 (Literature in English), ENGL 380 (Senior Seminar), and a minimum of 15 additional hours at the 300 level or above. 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, and foreign language literature courses. Students planning to go to graduate school are reminded of the importance of foreign language study. Completion of the University composition requirement (ENGL 150) is a prerequisite for most English courses at the 200 level and above.

Secondary Teacher Certification in Integrated Language Arts
A special program is available that leads to the B.A. in English and certification by the State of Ohio to teach Integrated Language Arts in grades 7-12. The teaching credential is valid in Ohio, and it is 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. 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 Professor Judith Oster, the English advisor for this program.

Minor
The minor in English consists of at least 15 hours above the 100 level. Students who wish to minor in English must arrange their sequence of courses in consultation with the department’s minor advisor. Minors are strongly advised to take ENGL 200 (Literature in English) early in the sequence. They also should keep it in mind that the flexibility of the department’s requirements often makes it possible to take English as a second major.

Arts and Sciences General Education Requirements
ENGL 200 (Literature in English), ENGL 255 (Major British Writers), or ENGL 256 (Major American Writers) satisfies the Language and Literature requirement in the Arts and Sciences GER. Students may complete the two-course sequence with any two of the three courses.

Sequences for Case School of Engineering students
Sequences in English provide students with an examination of major literary texts, close study of a cultural period or genre (including film), increased facility in writing, and a better understanding of the nature and functioning of language. Any sequence of three courses above the 200 level (9 hours) that meets at least two of these goals normally will be acceptable. Students should consult the department’s sequence advisor in planning their programs. ENGL 398 and 398N cannot be counted toward a sequence or a minor.

Departmental Honors
The Departmental Honors Program is for specially talented and dedicated majors. Requirements for Honors in English are available from all advisors and from the main office. Interested students with a grade point average of at least 3.5 in English courses should consult with their major advisor. Those who complete the program’s requirements receive the notation “with Departmental Honors in English” on their academic transcript at graduation. A registration form for students electing to pursue honors in English is available from the departmental office, incorporating the new requirements. Highly achieving students should also consider the I.G.S. program, described below.

Integrated Graduate Studies
The Department of English participates in the Integrated Graduate Studies Program, which makes it possible to complete both a B.A. and an M.A. in English within 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 Ph.D. programs. Interested students should note the general requirements and the admission procedures in this publication.
GRADUATE PROGRAM

The Department of English offers programs in American and English literature and language leading to the Master of Arts and Doctor of Philosophy degrees. 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 aptitude sections of the Graduate Record Examination. Candidates are also required to submit a writing sample 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 it was earned in graduate-level courses and has 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 welcomes part-time students.

Although not formally a requirement for graduate degrees, teaching is viewed as part of the education of every graduate student. The department provides opportunities for graduate assistants to gain teaching experience in a variety of courses offered by the department. Other teaching opportunities exist elsewhere in the university and in the Greater Cleveland area.

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 500, Seminar in Rhetoric and the Teaching of Writing, before or during the first semester in which they teach.

Special Master of Arts Programs

Master of Arts in comparative literature (English and French, German or Spanish). A more detailed description of all graduate programs in English is available from the departmental office or the Office of Graduate Admissions.

FACILITIES

Faculty and graduate student offices are in Guilford House, as is a faculty/student lounge and reading room (Guilford 223). In cooperation with the undergraduate Film Society and the Department of Modern Languages and Literatures, the English Department maintains a library of classic movies on videotape. Camera, recorders, and monitors are available in Guilford for making and viewing video tapes. The Film Society maintains a state-of-the-art film projection facility in Strosacker Auditorium. Kelvin Smith Library, a part of the University Libraries, houses the collections of printed material. In addition to manuscript and rare-book holdings in the Special Collections Division, the library has strengths in Renaissance literature, 18th- and 19th-century English literature, and American literature. The Library has recently acquired an outstanding collection of approximately 6500 art films on videotape, supported in part by English department endowment funds.

CURRENT AREAS OF RESEARCH

Current topics of faculty research include 16th and 17th century women’s writing; Shakespeare’s theater; biography and autobiography; film; authorship and cultural studies; American “Roman noir” and the “export” of American popular culture in Europe and Asia; American multicultural literature and post-colonial literatures; history of the book; interarts comparisons; medical and psychological contexts of Victorian literature; professional writing; gender studies in literature; cognitive rhetoric; Dickinson, Faulkner, Frost.

English (ENGL)

UNDERGRADUATE COURSES

ENGL 148. Introduction to Composition (3)
Practice and training in various modes of writing. Includes regular individual conferences as well as classes. Texts and readings vary from section to section. May be repeated in special instances, but a maximum of three semester hours will count toward a Bachelor’s degree. Students placing 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)
Practice and training in expository writing. Although a common quantity of writing is assigned, methods and texts may vary from section to section. A grade of C or better in ENGL 150 fulfills the University composition requirement.

ENGL 180. Writing Tutorial (1-2)
Students who pass ENGL 150 with a grade of D and transfer students who are placed in ENGL 180 on the basis of the ENGL placement test must pass ENGL 180 with a grade of C or higher to meet the ENGL composition requirement of the colleges. Others desiring substantial scheduled tutorial work in composition may report to the Writing Center during the first week of classes to arrange a tutorial appointment. May be repeated in special instances, but no more than three semester hours of ENGL 180 credit will count toward the degree.

ENGL 181. Reading Tutorial (1)
Scheduled tutorial in reading for those who need work beyond ENGL 148 or who come to the Writing Center seeking substantial help. May be repeated in special instances, but only one semester hour will count toward the degree.

ENGL 200. Literature in English (3)
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 imaginative literature has taken, together with some of the changes that have taken place in what and how readers read. Prerequisite: ENGL 150.

ENGL 202. Expository Writing (3)
A workshop-style course for students who wish to refine the skills acquired in ENGL 150. Special attention to style and presentation.
ENGL 203. Introduction to Creative Writing (3)
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. Prerequisite: ENGL 150.

ENGL 204. Introduction to Journalism (3)
Print news and feature stories, broadcast writing, advertising copy, and public relations. Considerable writing. Guest speakers from the profession. Prerequisite: ENGL 150.

ENGL 213. Introduction to Fiction Writing (3)
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. Prerequisite: ENGL 150.

ENGL 214. Introduction to Poetry Writing (3)
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. Prerequisite: ENGL 150.

ENGL 255. Major British Writers (3)
Introduction to literary studies and survey of selected English authors from the Medieval period to the present. Prerequisite: ENGL 150.

ENGL 256. Major American Writers (3)
Introduction to literary studies and survey of literature of United States from colonial times to the present. Prerequisite: ENGL 150.

ENGL 257A. The Novel (3)
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)
Introductory readings in poetry. May be organized chronologically or thematically. Attention to the formal qualities of poetry in relation to meaning, expressivity, etc.

ENGL 268. Understanding Movies (3)
An introductory course designed to familiarize students with the language systems and aesthetic components of the movies and provide the means to analyze how movies work as complex aesthetic entities. Films are shown in 35mm. Prerequisite: ENGL 150.

ENGL 270. Introduction to Gender Studies (3)
This course introduces women and men 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, and art history. It is the required introductory course for students taking the women’s studies major. Prerequisite: ENGL 150. Cross-listed as WSTD 201.

ENGL 273. Literature and the Environment (3)
American writers—primarily of the 19th and 20th centuries—whose works deal with themes of the environment. Approved for the Environmental Studies program. Prerequisite: ENGL 150.

ENGL 274. A Course in Shakespeare History, Literature, Genre, and Practice (3)
Close reading of a selection of Shakespeare’s tragedies and history plays through examples from established poets. Maximum 6 credits. Prerequisite: ENGL 203 or ENGL 214.

ENGL 305. Playwriting (3)
Theory and practice of dramatic writing, in the context of examples, classic and contemporary. Prerequisite: Any one of the following: ENGL 203 or ENGL 213 or ENGL 214, ENGL 303, ENGL 304. Cross-listed as THTR 312.

ENGL 307. Intermediate Writing Workshop: Journalism (3)
Continues developing the concepts and practices of the introductory course, with emphasis on feature writing for magazines, story structure, and repertorial techniques. Prerequisites: ENGL 150 and ENGL 204, or permission of department.

ENGL 310. History of the English Language (3)
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. Prerequisite: ENGL 150.

ENGL 312. Chaucer (3)
An introduction to the work of Geoffrey Chaucer, with emphasis on “The Canterbury Tales.” Prerequisite: ENGL 150.

ENGL 317. Business and Technical Writing (3)
Professional communication in theory and practice, including audience analysis, logic and strategy applied to the writing of technical reports, proposals, manuals, progress and feasibility studies, memos, and letters. Prerequisite: ENGL 150.

ENGL 320. Renaissance Literature (3)
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. Prerequisite: ENGL 150.

ENGL 323. Milton (3)
Poetry and selected prose, including the careful study of “Paradise Lost.” Prerequisite: ENGL 150.

ENGL 324. Shakespeare: Histories and Tragedies (3)
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. Prerequisite: ENGL 150. Cross-listed as THTR 334.

ENGL 325. Shakespeare: Comedies and Romances (3)
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. Prerequisite: ENGL 150. Cross-listed as THTR 335.

ENGL 326. Seventeenth-Century Literature (3)
Selected topical readings drawn from a variety of sources: drama, lyric and epic poetry, political and philosophical writings, and prose fiction. Writers studied may include Donne, Jonson, Herrick, Milton, Marvell, Herbert, Finch, Behn, Dryden, and Cavendish. Maximum 6 credits. Prerequisite: ENGL 150.

ENGL 327. Eighteenth-Century Literature (3)
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. Prerequisite: ENGL 150.

ENGL 328. Studies in the Eighteenth Century (3)
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. Prerequisite: ENGL 150.

ENGL 329. English Literature, 1780-1837 (3)
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 the Wordsworth, Coleridge, Blake, Austen, Byron, the Shelleys. Maximum 6 credits. Prerequisite: ENGL 150.

ENGL 330. Victorian Literature (3)
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. Prerequisite: ENGL 150.

ENGL 331. Studies in the Nineteenth Century (3)
Individual topics in English literary culture of the 19th century. Topics might be thematic or formal, such as literature and science, medicine, labor, sexuality, or Empire; literature and other arts; Gothic fiction, decadence. Maximum 6 credits. Prerequisite: ENGL 150.

ENGL 332. Twentieth-Century British Literature (3)
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. Prerequisite: ENGL 150.

ENGL 333. Studies in the Twentieth Century (3)
Individual topics in twentieth-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. Prerequisite: ENGL 150.

ENGL 334. American Literature (3)
Aspects of American literature and its contexts from the Civil War to the First World War. Genres studied might include poetry, prose fiction, political and philosophical writings, and prose fiction. Writers such as Whitman and Dickinson, Twain, Howells, James, Chopin, Wharton. Maximum 6 credits. Prerequisite: ENGL 150.

ENGL 335. American Literature 1914-1945 (3)
Aspects of American literature and its contexts from the Civil War to the First World War. Genres studied might include poetry, prose fiction, political and philosophical writings, and prose fiction. 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. Prerequisite: ENGL 150.

ENGL 336. African-American Literature (3)
Aspects of American literature and its contexts from the First World War to the Cold War. Genres studied might include poetry, prose fiction, political and philosophical writings, and prose fiction. 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. Prerequisite: ENGL 150.

ENGL 337. The Immigrant Experience (3)
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. Prerequisite: ENGL 150.
ENGL 365N. Topics in African-American Literature (3)
Selected topics and writers from nineteenth and twentieth-century African-American literature. May focus on a genre, a single author or a group of authors, a theme or themes. Maximum 6 credits. Prerequisite: ENGL 150.
ENGL 365Q. Post-Colonial Literature (3)
Readings in national and regional literatures from former European colonies such as Australia and African countries. Maximum 6 credits. Prerequisite: ENGL 150.
ENGL 366G. Minority Literatures (3)
A course dealing with literature produced by ethnic and racial minority groups within the U.S. Individual offerings may include works from several groups studied comparatively, or focus on a single group, such as Native Americans, Chicano/Chicana, Asian-Americans, Caribbean-Americans, African-American works may also be included. May cover the entire history of the U.S. or shorter periods. Maximum 6 credits. Prerequisite: ENGL 150.
ENGL 368A. Introduction to Film Studies (3)
This course will help students develop a sophisticated awareness of some of the major schools of thought employed in analyzing Hollywood and world cinema, such as formalism, psychoanalytic theory, Marxist criticism, postmodernism, feminist film theory, and reception theory, among other interpretive approaches. Attention will also be paid to the role of the cinema in a world of rapidly changing technologies. Prerequisites: ENGL 150 and ENGL 268 or permission of the department. Cross-listed as CMPL 368A.
ENGL 368B. History of Film (3)
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. Prerequisite: ENGL 150.
ENGL 368C. Topics in Film (3)
Individual topics in film, such as a particular national cinema, images of women in film, film comedy, New Wave film, literature and film. Maximum 12 credits. Cross-listed as CMPL 368C.
ENGL 370. Women Writers (3)
Study of the work of a selection of women writers oriented toward their themes, forms, reception, relationships; may cross national boundaries or temporal eras. Maximum 6 credits. Prerequisite: ENGL 150.
ENGL 371. Topics in Women's Studies (3)
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. Prerequisite: ENGL 150.
ENGL 372. Studies in the Novel (3)
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. Prerequisite: ENGL 150.
ENGL 373. Studies in Poetry (3)
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. Prerequisite: ENGL 150.
ENGL 374. Internship in Journalism (3-6)
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. Prerequisite: ENGL 204 or permission of the department.
ENGL 375. Internship in Technical Communication (3-6)
Students create technical and professional documents in a selected corporate or organizational setting, do assigned reading, and meet as a class to participate in seminar discussions and review of work. Students must pre-arrange internship assignment with instructor prior to semester. Prerequisites: ENGL 317 or ENGL 398N and permission of department.
ENGL 376. Studies in Genre (3)
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. Prerequisite: ENGL 150.
ENGL 377. Topics in Language Studies (3)
Aspects of contemporary language studies. Topics such as history of rhetoric, Saussurean linguistics, generative grammar, psycholinguistics, sociolinguistics, cognitive and construction grammars, metaphor, language acquisition, stylistics. Maximum 9 credits. Prerequisites: ENGL 150 and ENGL 301.
ENGL 378. Senior Seminar (3)
Capstone course required of all English majors in the senior year. Limited to senior English majors. Maximum 6 credits.
ENGL 379. Special Topics in Literature (3)
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. Prerequisite: ENGL 150.
ENGL 380. Studies in Literature and Culture (3)
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, gay and lesbian literature, Asian/Western literary relations, emotion in literature, philosophy and literature, music and music. Maximum 9 credits. Prerequisite: ENGL 150.
ENGL 387. Literary and Critical Theory (3)
A survey of major schools and texts of literary and critical theory. May be historically or thematically organized. Maximum 6 credits. Prerequisite: ENGL 150.
ENGL 390. Independent Study and Creative Projects (1-6)
Up to six 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 392. Classroom Teaching (3)
For undergraduate students who assist in the teaching of ENGL 150, 180, or 181. Interested students should check with the director of composition (for ENGL 150, 180, 181) before the beginning of the semester in which they wish to participate. May be repeated only once; not more than three semester hours in ENGL 392
may be counted toward the major. May also include up to three semester hours of supervised peer tutoring at the University Writing Center.

ENGL 393. Seminar and Practicum in Literacy (3)
Taken for credit in conjunction with tutoring in Project STEP-UP, a University-sponsored collaboration with city middle schools. Students must commit to 60 hours of tutoring at one of the approved sites during the term they take ENGL 393, as well as participating in weekly one-hour seminar sessions and completing reading and writing assignments.

ENGL 398. Professional Communication for Engineers (2)
A writing course for engineering majors only. Subjects covered include audience adaptation, problem/solution formats, lab reports, journal articles, proposals, feasibility studies, and oral presentations. Corequisite is a particular engineering lab course; students should consult advisors. Prerequisite: ENGL 150. Corequisite: Concurrent enrollment in appropriate engineering course.

ENGL 398N. Professional Communication for Engineers (3)
Principles and practices of effective communication in the workplace, with an emphasis on computer-mediated communication. Topics include analyzing audience needs in context, visual communication, computer-mediated documents, ethics, and team writing. Typical assignments include e-mail, memos, letters, reports, documentation, oral presentations. Prerequisite: ENGL 150.

ENGL 399. Senior Thesis (3)
Elective research or creative project. Should be used for Honors Projects option. By department approval only. Maximum 6 credits. Prerequisite: Consent of department.

GRADUATE COURSES

ENGL 401. Linguistic Analysis (3)
(See ENGL 301.)

ENGL 406. Advanced Creative Writing (3)
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. Prerequisite: Consent of department.

ENGL 410. History of the English Language (3)
(See ENGL 310.) Prerequisite: ENGL 150.

ENGL 420. Renaissance Literature (3)
(See ENGL 320.)

ENGL 423. Milton (3)
(See ENGL 323.)

ENGL 424. Shakespeare: Histories and Tragedies (3)
(See ENGL 324.)

ENGL 425. Shakespeare: Comedies and Romances (3)
(See ENGL 325.)

ENGL 426. Seventeenth-Century Literature (3)
(See ENGL 326.)

ENGL 427. Eighteenth-Century Literature (3)
(See ENGL 327.)

ENGL 428. Studies in the Eighteenth Century (3)
(See ENGL 328.)

ENGL 429. English Literature, 1780-1837 (3)
(See ENGL 329.)

ENGL 430. Victorian Literature (3)
(See ENGL 330.)

ENGL 431. Studies in the Nineteenth Century (3)
(See ENGL 331.)

ENGL 432. Twentieth-Century British Literature (3)
(See ENGL 332.)

ENGL 433. Studies in the Twentieth Century (3)
(See ENGL 333.)

ENGL 453. Major Writers (3)
(See ENGL 353.)

ENGL 456. American Literature Before 1865 (3)
(See ENGL 356.)

ENGL 457. American Literature 1865-1914 (3)
(See ENGL 357.)

ENGL 458. American Literature 1914-1960 (3)
(See ENGL 358.)

ENGL 459. Studies in Contemporary American Literature (3)
(See ENGL 359.)

ENGL 460. Studies in American Literature (3)
(See ENGL 360.)

ENGL 463H. African-American Literature (3)
(See ENGL 363H.)

ENGL 465E. The Immigrant Experience (3)
(See ENGL 365E.)

ENGL 465N. Topics in African-American Literature (3)
(See ENGL 365N.)

ENGL 465Q. Post-Colonial Literature (3)
(See ENGL 365Q.)

ENGL 466G. Minority Literatures (3)
(See ENGL 366G.)

ENGL 468A. Introduction to Film Studies (3)
(See ENGL 368A.)

ENGL 468B. History of Film (3)
(See ENGL 368B.)

ENGL 468C. Topics in Film (3)
(See ENGL 368C.)

ENGL 470. Women Writers (3)
(See ENGL 370.)

ENGL 471. Women’s Studies (3)
(See ENGL 371.)

ENGL 472. Studies in the Novel (3)
(See ENGL 372.)

ENGL 473. Studies in Poetry (3)
(See ENGL 373.)

ENGL 476. Studies in Genre (3)
(See ENGL 376.)

ENGL 479. Topics in Language Studies (3)
(See ENGL 379.)

ENGL 480. ESL Composition Theory (3)
Study of theories related to teaching ESL composition, including second language acquisition; specialized grammar related to common ESL problems; cultural and affective issues; different Englishes; composition theory and research as it relates to ESL.

ENGL 485. Special Topics in Literature (3)
(See ENGL 385.)

ENGL 486. Studies in Literature and Culture (3)
(See ENGL 386.)

ENGL 487. Literary and Critical Theory (3)
(See ENGL 387.)

ENGL 500. Rhetoric and Teaching of Writing (3)
Classical and modern theories of rhetoric; their application in the classroom. Required of graduate assistants and tutors in the department who have had no prior experience in the teaching of composition.
ENGL 501. Theories of Rhetoric (3)
ENGL 502. Critical Theory (3)
Theories and methods of contemporary literary study. Required of all graduate degree-seeking students.

ENGL 506. Teaching Technical and Professional Communication (3)
Prepares graduate students to teach technical and professional writing in academic and non-academic settings. Prerequisite: ENGL 500.

ENGL 508. Seminar: English Literature 1550-1660 (3)

ENGL 517. Seminar: American Literature (3)

ENGL 518. Seminar: English Literature 1660-1800 (3)

ENGL 519. Seminar: English Literature 1800-1900 (3)

ENGL 520. Seminar: 20th Century Literature (3)

ENGL 521. Seminar: The Novel (3)

ENGL 522. Seminar: Topics in Poetry (3)

ENGL 523. Seminar: Critical and Other Special Topics (3)

ENGL 590. Special Reading or Research (3)

ENGL 591.Directed Reading (1-6)
Preparation for the Ph.D. general examination. Graded S/U. Prerequisite: Graduate status or consent of department.

ENGL 601. Thesis M.A. (1-18)

ENGL 701. Dissertation Ph.D. (1-18)
Prerequisite: Ph.D. candidates only.

ENGL 702. Appointed Dissertation Fellow (9)

**UNDERGRADUATE PROGRAM**

Environmental studies is an interdisciplinary program that introduces students to the societal determinants and implications of environmental problems. Emphasis is given to the moral, cultural, and political dimensions of environmental problems and solutions. It brings to bear the issues and methods of the humanities and social sciences as well as the sciences and professions on environmental questions. The program is designed to serve the needs of students seeking a liberal education as well as those who desire a broad intellectual base for more technical training in environmental sciences. Students in environmental studies can pursue a major, a minor, or Engineering Core sequence.

**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 multi-disciplinary perspective offered by the program may be complemented by a concentrated disciplinary major. To declare the major, students should have declared a first major and have sophomore or junior standing. Up to six credits in required and elective courses taken by students for their first major may be applied to their environmental studies major. None of the required courses may be taken pass/no pass.

The required courses are:

**ESTD 101**
**ESTD 398**

and one course from each of the three following areas of emphasis:

**Humanities**
ENGL 273. Literature and Environment
HSTY 378. History of the American Environment

**Social Policy**
ECON 368. Environmental Economics
GEOL 303. Environmental Law

**Science and Engineering**
ESCI 340. Introduction to Global Issues
BIOL 350. Introduction to Ecosystem Analysis

GEOL 201. Global Environmental Problems
At least 15 credit hours must be taken from a list of approved electives. This list will change from time to time as departmental offerings change. An approved Washington Semester internship may be used to satisfy part or all of the elective requirement. Students should consult with the program director for current information. All student programs must be approved by the director.

**Minor**
The minor in the College of Arts and Sciences (15 credit hours) consists of ESTD 101, one course from two of the three disciplinary groups above, and two of the approved electives, which may include courses from the third unselected disciplinary grouping.

**Sequence**
The sequence in environmental studies in the Case School of Engineering consists of 9 credit hours comprising ESTD 101 and two courses from the above disciplinary list.

**UNDERGRADUATE COURSES**

**ESTD 101. Introduction to Environmental Thinking (3)**
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 387. Multidisciplinary Approach to Environmental Problems (1-3)**
This course is designed to illustrate, using a different topic each year, the necessity for a multidisciplinary approach to environmental problems in order to unde-
stand and manage environmental problems. Multiple faculty and community leaders participate in the teaching. Students registering for 1 credit attend weekly seminars; those registering for 2-3 credits do an individual research project in addition. Past topics include: lead poisoning in the urban environment, sustainability and the Great Lakes, setting environmental priorities, and reducing CWRU’s environmental impacts.

ESTD 398. Seminar in Environmental Studies (3)
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. Prerequisite: ESTD 101.

ESTD 487. Multidisciplinary Approach to Environmental Problems (1-3)
(See ESTD 387.)

French Studies

201 Guilford House
Phone: 216-368-3071; Fax 216-368-2216
Marie-Pierre Le Hir, Director

French Studies Program Committee and Advisers
Marie-Pierre Le Hir, Director French Studies
Elizabeth M. and William C. Treuhaft
Associate Professor of French and Chair, Department of Modern Languages and Literatures
John Barberet
Visiting Assistant Professor of French
Christine Cano
Assistant Professor of French
Dario Gamboni
Professor of Art
Miriam Levin
Associate Professor of History
Vincent McHale
Director, International Studies
Professor of Political Science and Chair, Department of Political Science
Colin McLarty
Associate Professor of Philosophy
Catherine B. Scallen
Assistant Professor of History
Laura Tartakoff
Associate Professor of Political Science

The French Studies Program
Designed to develop cross-cultural awareness and to foster international understanding in a global world, the French Studies Program adds an exciting new dimension to the traditional liberal arts curriculum. The French studies major differs from the traditional French major in two respects: by its interdisciplinary nature and by its greater flexibility to accommodate students’ own areas of interest. Unlike the traditional French major, which primarily serves to prepare future teachers of French, the French studies major answers the needs of students with a strong interest in cultural issues in general and in French history and society in particular, who do not necessarily wish to pursue a career in teaching.

The French Studies Program is an interdisciplinary, integrated program that understands the term “French” in its broadest sense, in an effort to represent the diversity characteristic of the field of French studies today as reflected in a variety of cultures of Francophone expression: Canada, the Caribbean, Africa. Reaching beyond disciplinary and national boundaries, the program encourages students to study in several disciplines, choosing from a large selection of courses in the humanities, the arts, the social sciences and economics. The program takes advantage of the varied resources this major research university has to offer in order to provide a meaningful course of study and an outstanding preparation for the various professional schools or for careers in international business and finance, law, journalism and the foreign service.

French Studies Major
Each student must prepare a program of study, indicating specific course selections to meet the two area requirements below, in close consultation with a faculty adviser drawn from the Steering Committee membership. Students should also discuss their choice of a minor or a second major with their advisor. The major in French studies requires a minimum of 33 credit hours in the following areas:

I. Foundations in French History and Culture (9)
These required courses introduce French civilization and culture from a contemporary (FRCH 316) and a historical perspective (FRCH 318, FRCH 319 or HYST 330). They also expose students to a variety of themes and issues particular to French culture and history.

II. French Area Courses (6)
From the list of French offerings, students select two courses that concentrate on a single historical period or cultural area. Three to four French area courses are offered in a given semester:
FRCH 315 Business French
FRCH 317 French Cinema
FRCH 320 Introduction to French Literature
FRCH 321 French Literature to 1600
FRCH 331 Seventeenth-Century French Literature
FRCH 341 Eighteenth-Century French Literature
FRCH 351 Nineteenth-Century French Literature
FRCH 361 Twentieth-Century French Literature
FRCH 371 Topics in Poetry
FRCH 372 Topics in Drama
FRCH 373 The Novel and the Novella
FRCH 374 Major Writers and Movements
FRCH 375 Francophone Literature
FRCH 376 Women Writers
FRCH 377 Special Topics
FRCH 399 Directed Reading

III. Courses in Other Disciplines (15)
Courses in disciplines other than French provide an international and interdisciplinary perspective on French and Francophone cultures. They foster an appreciation for complexity through the study of particular historical periods, issues, and disciplinary methods.

Students have the opportunity to experiment or tailor the program to suit their particular interests.

When designing their program, they select five courses from a list of suggested courses in the following disciplines:
Anthropology (Prereq: ANTH 102)
ANTH 337 Comparative Medical Systems
ANTH 356 Mediterranean Culture and Society
ANTH 399 Independent Study

Art History (Prereq: None)
ARTH 260 Art in the Age of Grandeur
ARTH 284 History of Photography
ARTH 376 Seventeenth- and Eighteenth-Century French Art
ARTH 374 Impressionism to Symbolism
ARTH 377 Post-Impressionism  
ARTH 379 Issues in Nineteenth-Century Painting  
ARTH 381 Neoclassicism to Impressionism  
ARTH 392 Problems in Twentieth-Century Art  
ARTH 398 Independent Study  
Comparative Literature (Prereq: None)  
CMPL 190 Introduction to Comparative Literature  
CMPL 211 Great Books: Middle Ages/Renaissance  
CMPL 212 Great Books: 1600 to the Present  
CMPL 300 Turning Points of Modern Culture (Paris)  
CMPL 315 Utopias and Utopianism  
CMPL 390 Topics in Comparative Literature  
CMPL 399 Independent Study  
CMPL 390 Topics in Comparative Literature  
ECON 306 History of Economic Thought  
ECON 375 Economics of Developing Countries  
English (Prereq: ENGL 150)  
ECON 374 International Economics  
ENGL 368A Introduction to Film Studies  
ENGL 368B History of the Film  
ENGL 368C Topics in Film  
ENGL 371 Topics in Women’s Studies  
ENGL 385 Special Topics in Literature  
ENGL 386 Studies in Literature and Culture  
ENGL 387 Literary and Critical Theory History (Prereq: None)  
HSTY 151 Technology in European Civilization  
HSTY 201/202 Science in Western Thought  
HSTY 212 Modern European History  
HSTY 309 Reformation Europe, 1500-1650  
HSTY 310 The French Revolutionary Era  
HSTY 313 Women in Modern European History  
HSTY 330 French Society and Culture: 1789-Present  
HSTY 332 European Diplomacy in the Age of Nationalism: 1789-1945  
HSTY 348 Political and Social Thought in the Machine Age  
HSTY 397 Undergraduate Tutorial Music (Prereq: MUSC 221 or Consent)  
MUSC 222 The Listening Experience II  
MUSC 321 History of Western Music I  
MUSC 322 History of Western Music II  
MUSC 336 History of Western Music III  
Philosophy (Prereq: PHIL 101 or Consent)  
PHIL 302 Modern Philosophy  
PHIL 315 Selected Topics in Philosophy  
PHIL 320 Phenomenology, Existentialism, and Hermeneutics  
PHIL 355 19th/Early 20th Century Philosophy  
PHIL 370 Philosophy and Literature  
PHIL 399 Directed Study  
Political Science (Prereq: None)  
POSC 260 Introduction to Comparative Politics  
POSC 366 Government and Politics of Africa  
POSC 367 Western European Political Systems  
POSC 374 Third World in Global Politics  
POSC 395 Special Projects  
THTR 124 Theater in Culture II  
THTR 228 Theater History I  
THTR 229 Theater History II  
THTR 399 Independent Study  
THTR 399 Independent Study (required courses, 3)  
In the last semester of the senior year, the student’s experiences in French area courses as well as in courses in other disciplines are integrated in a colloquium (FRCH Studies colloquium) which involves the writing of a substantial research paper in French or English. A faculty director will approve the selection of the topics, facilitate discussion of research with other faculty and students through periodic colloquia, and direct the research and writing of individual papers. Students will be expected to identify their faculty directors and topics by the end of their junior year. Exceptional papers may be considered for honors.  
Language requirement  
All 300-level FRCH courses are taught in French. FRCH 202 or equivalent is a prerequisite for Foundations in French History and Culture courses.  
Study Abroad:  
A year of study abroad in France, Belgium, Switzerland, Canada or a Francophone African country is strongly encouraged but not required for French Studies majors. French Studies majors are expected to have completed the Foundations in French History and Culture courses at CWRU before embarking on a study-abroad program.  
Minor And Sequence Requirements  
The minor in French studies requires at least one course from among FRCH 316, FRCH 318, FRCH 319 or HSTY 330; four additional 300-level courses on the list of French studies courses from any two departments; or a thematic course of study (12 hours) approved in advanced by the director of the French studies program.  
The sequence in French studies consists of one of the following courses: FRCH 316, FRCH 318, FRCH 319 or HSTY 330; and two additional 300-level courses.  

Department of Geological Sciences  
112 A.W. Smith Building  
Phone 216-368-3690; Fax 216-368-3691  
Gerald Matisoff, Chair  
The geological 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 major 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.

The Department of Geological Sciences offers degree programs leading to the B.A. and B.S. in geological sciences, B.A. in environmental geology, Master of Science (M.S.), and Doctor of Philosophy (Ph.D.).

**FACULTY**

Gerald Matisoff, Ph.D. (Johns Hopkins University)
*Professor and Chair*
Sedimentary and environmental geochemistry

Philip O. Banks, Ph.D. (California Institute of Technology)
*Associate Professor*
Geochemistry, geophysics

Ralph P. Harvey, Ph.D. (University of Pittsburgh)
*Assistant Professor*
Planetary geology

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**BACHELOR OF ARTS DEGREE**

**Major in Geological Sciences***

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<thead>
<tr>
<th>Fall Semester</th>
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<td>CHEM 106, Principles of Chemistry II ........................................... (3)</td>
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<td>GEOL 210, Historical Geology and Paleontology .......... .................... (3)</td>
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<td>Approved elective ................................................................. (3)</td>
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<td>PHYS 115, Introductory Physics I ................................................. (4)</td>
<td>PHYS 116, Introductory Physics II ................................................. (4)</td>
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<td>Approved elective ................................................................. (3)</td>
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<td>or GEOL 341, Introductory Mineralogy and Petrology ........................................ (4)</td>
<td>or GEOL 210, Historical Geology and Paleontology .......... .................... (3)</td>
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<td>GEOL 317, Spring Field Course ................................................. (2)</td>
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<td>GEOL 392, Professional Presentation ............................................. (2)</td>
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<td><strong>Minor in Geological Sciences</strong></td>
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<td>Up to three courses from GEOL 101, 110, 115, and 117, plus GEOL 119 and sufficient upper level GEOL courses to total at least 15 hours.</td>
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* Suggested outline only. Program is finalized in consultation with the departmental advisor.
* GEOL 101 or 115 may be substituted for GEOL 110.
* GEOL 210 is offered even-numbered years.

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GEOL 301 (3 credits) is offered even-numbered years, GEOL 341 (4 credits) odd-numbered years.

GEOL 315 (3 credits) is offered odd-numbered years, GEOL 344 (4 credits) even-numbered years.

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### BACHELOR OF SCIENCE IN GEOLOGICAL SCIENCES DEGREE*

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<td>ENGL 150, Expository Writing</td>
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<td>PHED 101, Physical Education Activities ..........</td>
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<td>PHED 102, Physical Education Activities ...............</td>
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<td><strong>SOPHOMORE</strong></td>
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<td>GEOL 110, Physical Geology</td>
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<td>GEOL 119, Geology Laboratory</td>
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<td>PHYS 122, General Physics II</td>
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<td>Upper level MATH or STAT course</td>
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<td>GEOL 301, Stratigraphy and Sedimentation</td>
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<td>or GEOL 341, Introductory Mineralogy and Petrology ..</td>
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<td>Upper level Science or Math course</td>
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<td><strong>SUMMER between Junior and Senior years</strong></td>
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<td>GEOL 360, Summer Field Camp</td>
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<td><strong>SENIOR</strong></td>
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<td>GEOL 341, Introductory Mineralogy and Petrology ....</td>
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<td>or GEOL 301, Stratigraphy and Sedimentation</td>
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<td>GEOL 391, Senior Project</td>
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* Suggested outline only. Program is finalized in consultation with the departmental advisor.
* Another computer programming course may be substituted for ECES 131.
* GEOL 101 or 115 may be substituted for GEOL 110.
* GEOL 210 is offered even-numbered years.
* GEOL 301 (3 credits) is offered even-numbered years, GEOL 341 (4 credits) odd-numbered years.
* Upper level Science course must be in a discipline other than geology.
* GEOL 315 (3 credits) is offered odd-numbered years, GEOL 344 (4 credits) even-numbered years.

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**ADJUNCT FACULTY**

James Aronson, Ph.D. (California Institute of Technology)
- Adjunct Professor
- Geochronology, igneous petrology
- Geomicroscopy

Enriqueta Barrera, Ph.D. (Case Western Reserve University)
- Adjunct Associate Professor
- Geochronology, paleoecology

Beverly Z. Saylor, Ph.D. (Massachusetts Institute of Technology)
- Assistant Professor
- Sedimentary geology

Peter J. Whiting, Ph.D. (University of California, Berkeley)
- Associate Professor
- Geomorphology and environmental geology

Samuel M. Savin, Ph.D. (California Institute of Technology)
- Professor; Interim Dean, College of Arts and Sciences
- Geochemistry

Peter L. McCall, Ph.D. (Yale University)
- Professor; Director, Environmental Studies Program; Director, College Scholars Program
- Benthic ecology, paleoecology

---

Enriqueta Barrera, Ph.D. (Case Western Reserve University)

Geochemistry

Beverly Z. Saylor, Ph.D. (Massachusetts Institute of Technology)

Geochronology, igneous petrology

Samuel M. Savin, Ph.D. (California Institute of Technology)

Professor; Interim Dean, College of Arts and Sciences

Samuel M. Savin, Ph.D. (California Institute of Technology)

Professor; Interim Dean, College of Arts and Sciences

Benthic ecology, paleoecology

Samuel M. Savin, Ph.D. (California Institute of Technology)

Professor; Interim Dean, College of Arts and Sciences

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* Another computer programming course may be substituted for ECES 131.
* GEOL 101 or 115 may be substituted for GEOL 110.
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* GEOL 301 (3 credits) is offered even-numbered years, GEOL 341 (4 credits) odd-numbered years.
* Upper level Science course must be in a discipline other than geology.
* GEOL 315 (3 credits) is offered odd-numbered years, GEOL 344 (4 credits) even-numbered years.
Roger Burtner, Ph.D. (Harvard University)  
_Auxiliary Professor_  
_Aqueous geochemistry, clastic petrology_  
Joseph T. Hannibal, Ph.D. (Kent State University)  
_Auxiliary Assistant Professor; Cleveland Museum of Natural History_  
_Invertebrate paleontology_  
Michael Ketterer, Ph.D. (University of Colorado)  
_Auxiliary Assistant Professor; Northern Arizona University_  
_Analytical chemistry_  

Richard C. Schmidt, Ph.D. (McGill University, Canada)  
_Auxiliary Professor_  
_Economic geology_  
Michael J. Tevesz, Ph.D. (Yale University)  
_Auxiliary Professor; Cleveland State University_  
_Paleontology_  

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**UNDERGRADUATE PROGRAMS**

**Major Programs**

Students in the geological 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

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**BACHELOR OF ARTS DEGREE**

**Major in Environmental Geology**

* Suggested outline only. Program is finalized in consultation with the departmental advisor.

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**FRESHMAN**

Fall Semester

CHEM 105, Principles of Chemistry I (3)  
or equivalent  
MATH 125, Calculus I (4)  
ENGL 150, Expository Writing (3)  
GER course (3)  
GER course (3)  
PHED 101, Physical Education Activities (0)

**SOPHOMORE**

GEOL 110, Physical Geology (3)  
GEOL 119, Geology Laboratory (1)  
PHYS 115, Introductory Physics I (4)  
GER course (3)  
Electives (6)

**JUNIOR**

ESTD 101, Introduction to Environmental Thinking (3)  
BIOL 110, Principles of Biology (3)  
Approved elective (3)  
or  
GEOL 303, Environment and Law (3)  
STAT 201, Basic Statistics for Social and Life Sciences (3)  
or  
GEOL 322, Hydrogeology with Lab (4)  
GER course (3)

**SENIOR**

GEOL 303, Environment and Law (3)  
or Approved elective (3)  
GEOL 322, Hydrogeology with Lab (4)  
or  
STAT 201, Basic Statistics for Social and Life Sciences (3)  
GEOL 391, Senior Project (3)  
Elective (3)  

Spring Semester

**FRESHMAN**

CHEM 106, Principles of Chemistry II (3)  
or equivalent  
CHEM 113, Principles of Chemistry Laboratory (2)  
MATH 126, Calculus II (4)  
GER course (3)  
GER course (3)  
PHED 102, Physical Education Activities (0)

**SOPHOMORE**

GEOL 210, Historical Geology and Paleontology (3)  
or Approved elective (3)  
GER course (3)  
Approved elective (3)  
Electives (6)

**JUNIOR**

Approved elective (3)  
or  
GEOL 210, Historical Geology and Paleontology (3)  
GEOL 220, Environmental Geology (3)  
Elective (3)  
or  
GEOL 305, Geomorphology and Remote Sensing (3)  
GEOL 390, Introduction to Geological Research (2)  
GER course (3)  
Electives (3)

**SENIOR**

GEOL 305, Geomorphology and Remote Sensing (3)  
or Elective (3)  
GEOL 317, Spring Field Course (2)  
GEOL 392, Professional Presentation (2)  
Electives (6)

*a Suggested outline only. Program is finalized in consultation with the departmental advisor.
*b GEOL 210, 305, and 317 are offered even-numbered years.
*c GEOL 303 and 322 are offered odd-numbered years.
*d GEOL 202 (offered in Fall of even-numbered years) may be substituted for GEOL 303.
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 field work 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. 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**

The minimum requirements set by the department include 8 hours each of chemistry, physics, and calculus, plus any one of GEOL 101, 110, and 115, plus GEOL 119, 210, 301, 315, 317, 318, 341, 344, 360, 390, 391, and 392. GEOL 360 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 Geology Major**

The minimum requirements set by the department include 8 hours each of chemistry and calculus, plus BIOL 110, ESTD 101, PHYS 115, and STAT 201, plus GEOL 110, 119, 210, 220, 303, 305, 317, 322, 390, 391, and 392.

In the above majors, the student and his or her advisor will design the remainder of the curriculum based on individual interests, consonant with departmental and college requirements. An integrated undergraduate-graduate program leading to a master’s degree in five years is available. Special programs, such as interdisciplinary majors, also may be arranged.

**Minor in Geological Sciences**

Students may complete a minor in geological sciences by taking up to three of GEOL 101, 110, 115, and 117, plus GEOL 119 and sufficient upper level GEOL courses to total 15 hours.

**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, biostatigraphy and paleontology, environmental and urban geology, geomorphology, limnology, paleoecology, and sedimentation and stratigraphy, stable isotope studies, meteoritics, and planetary geology. More specific information will be furnished upon request by the departmental office and the Office of Admission of the School of Graduate Studies.

**FACILITIES**

The department is housed in the Albert W. Smith Building. Research facilities include thin sectioning and mineral separation facilities; laboratories for chemical analysis of water including an ion chromatograph, colorimetric spectrometer, various electrodes, and an environmental glove box; alpha and gamma spectroscopic facilities for analysis of environmental radionuclides; equipment for studying animal-sediment relations, including a scanning gamma spectrometer; scanning electron microscope; electron microscope; and two double collecting gas source mass spectrometers and extraction equipment for stable isotope studies. 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.

**Geological Sciences (GEOL)**

**UNDERGRADUATE COURSES**

**GEOL 101. The Earth and Planets (3)**

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.

**GEOL 105. Living on Earth (3)**

The impact of Earth’s features and processes on human society. Interactions between the lithosphere, hydrosphere, and biosphere, and how humans adapt to and alter the resulting environment. How cultural relationships with the environment are expressed in art, architecture, religion, and social policies. Topics include origin and societal impact of landforms, climate patterns, natural hazards, and natural resources.

**GEOL 110. Physical Geology (3)**

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 GEOL 119 concurrently.

**GEOL 115. Introduction to Oceanography (3)**

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.

**GEOL 117. Weather and Climate (3)**

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.

**GEOL 119. Geology Laboratory (1)**

Principles and techniques common to the geological sciences including rock and mineral identification, map interpreta-
tation, land form analysis, application of geological information to engineering works, and more. One three-hour laboratory or field trip weekly. Prerequisite: GEOL 110.

**GEOL 196. Energy and Society (3)** Cross-listed as PHYS 196.

**GEOL 202. Global Environmental Problems (3)** Science, policy and ethics of environmental problems that affect the entire planet. Examination of problems of current interest, such as population growth, climate change, ozone depletion, and fisheries, from a variety of viewpoints. Construction of simple computer models of a global process using Stella II. No previous computer experience or knowledge of numerical methods is required.

**GEOL 210. Historical Geology/Paleontology (3)** 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.


**GEOL 225. Evolution (3)** Cross-listed as PHIL 225.

**GEOL 301. Stratigraphy and Sedimentation (3)** 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.

**GEOL 303. Environmental Law (3)** Problems in the environmental geosciences and the legal response. Types of pollution regulation, regulation of petroleum and coal exploration and development, water rights, wildlife and public lands management, common law remedies, and the role of scientific experts. Topics of current social interest.

**GEOL 305. Geomorphology and Remote Sensing (3)** 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. Prerequisites: GEOL 110 and GEOL 119.

**GEOL 307. Evolutionary Biology and Paleobiology of Invertebrates (3)** Important events in the evolution of invertebrate life; structure, function, and phylogeny of major invertebrate groups.


**GEOL 315. Structural Geology (3)** Geometrical characteristics and theoretical analysis of deformation in earth materials, with illustrations of deformational styles in various tectonic settings. Two lectures and one laboratory weekly. Prerequisite: GEOL 110.

**GEOL 317. Field Methods/Spring Field Course: Environmental Geology (2)** Practice in field procedures, geologic mapping, and environmental site analysis. Requires spring vacation field trip. Students will be required to pay for meals and lodging. Prerequisite: GEOL 119.

**GEOL 318. Field Methods/Spring Field Course: Sedimentary Rocks and Deformation (2)** Field procedures, recognition and testing of hypotheses in the field, and geologic mapping in the folded and faulted strata of the Appalachian mountains. Two Saturday sessions plus Spring vacation field trip. Students will be required to pay for meals and lodging. Prerequisite: GEOL 119.

**GEOL 321. Hydrogeology (3)** Basic and applied concepts pertaining to the occurrence and movement of groundwater. Definitions, basic equations, applications to a variety of geologic settings, wells.

**GEOL 322. Hydrogeology and Laboratory (4)** Basic and applied concepts pertaining to the occurrence and movement of groundwater. Definitions, basic equations, applications to a variety of geologic settings, wells. Requires students to make field measurements, analyze data, and prepare reports.

**GEOL 330. Geophysical Field Methods and Laboratory (4)** 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. Three lectures and one three-hour laboratory weekly.

**GEOL 331. Geophysical Field Methods (3)** Same as GEOL 330 but without laboratory and field report.


**GEOL 341. Mineralogy (4)** Crystallography, hand specimen mineralogy and petrology, principles of crystal structure and crystal chemistry, and an introduction to the petrographic microscope. Three lectures and one three-hour laboratory weekly. Prerequisite: GEOL 119.

**GEOL 344. Igneous and Metamorphic Petrology (4)** 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. Prerequisite: GEOL 341.

**GEOL 345. Planetary Materials (1-3)** 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.

**GEOL 349. Geological Problems (1-3)** Special work arranged according to the qualifications of the student.

**GEOL 352. Environmental Geochemistry (3)** The role of geochemistry in environmental problems. Basic principles and engineering techniques applied to local, regional and global problems such as acid mine drainage, landfills, septic tanks, leaky underground storage tanks, soil and groundwater contamination, hazardous waste remediation, nuclear wastes, water and wastewater treatment; smog, lake
eutrophication, radon, oil spills, global warming, ozone depletion. Prerequisite: CHEM 106.

**GEOL 414. Economic Geology (3)**
Distribution and mechanisms of formation of metallic ore deposits. Nature and origin of building and industrial materials. Exploration and mining techniques, and the problem of diminishing resources. Prerequisite: GEOL 110.

**GEOL 416. Animal-Sediment Relations (3)**
Distribution, community structure, and adaptive strategies of marine and freshwater benthos; animal sediment relations and the influence of benthic animals on chemical and physical properties of the sea floor. Prerequisites: GEOL 307 and BIOL 336.

**GEOL 421. Hydrogeology (3)**
Basic and applied concepts pertaining to the occurrence and movement of groundwater. Definitions, basic equations, applications to a variety of geologic settings, wells.

**GEOL 422. Hydrogeology and Laboratory (4)**
Basic and applied concepts pertaining to the occurrence and movement of groundwater. Definitions, basic equations, applications to a variety of geologic settings, wells. Requires students to make field measurements, analyze data, and prepare reports.

**GEOL 425. Geotectonics (3)**
Interpretation of the major crustal features of the earth in terms of plate tectonics and associated phenomena.

**GEOL 436. Aquatic Chemistry (4)**
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.

**GEOL 437. Chemistry of Natural Waters (3)**
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.

**GEOL 444. Flow and Sediment Transport (3)**
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.

**GEOL 445. Planetary Materials (1-3)**
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.

**GEOL 455. Isotope Geochemistry (3)**
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. Prerequisite: Consent of department.

**GEOL 494. Seminar in Evolutionary Biology (3)**
Cross-listed as PHIL 494.

**GEOL 504. Seminar: Geomorphology/ Glacial Geology (1)**

**GEOL 509. Seminar: Graduate Research (1)**

**GEOL 511. Special Readings in Geology (1-6)**
Detailed study of a selected topic in geology under the guidance of a faculty member.

**GEOL 512. Special Readings in Geology (1-6)**
Detailed study of a selected topic in geology under the guidance of a faculty member.

**GEOL 536. Seminar in Great Lakes Issues (1-3)**
Selected topics related to Great Lakes basin studies: research problems, scientific processes, classic research papers, current events, policy issues, and legislative initiatives. Course content will vary depending on interests of students and faculty. Cross-listed as BIOL 536.
GEOL 601. Special Problems and Research (1-18)  
(Credit as arranged.)
GEOL 651. Thesis M.S. (1-18)  
(Credit as arranged.)
GEOL 701. Dissertation Ph.D. (1-18)  
(Credit as arranged.)
GEOL 702. Appointed Dissertation Fellow (9)

German Studies Program

Max Kade Center for German Studies  
Clark Hall Room 112  
Phone: 216-368-4087  
Kenneth F. Ledford, Director

German Studies Program Committee.
Kenneth F. Ledford  
Associate Professor of History and Law, and  
Director, German Studies Program
David Benseler  
Emile B. de Sauge Professor of Modern Languages
Margaretyr Daley  
Associate Professor of German
Martin Helzle  
Associate Professor of Classics
Jutta Ittner  
Assistant Professor of German
Barbara Krasner  
Assistant Professor of Philosophy
Vincent E. McHale  
Professor of Political Science
Alan J. Rocke  
Henry Eldridge Bourne Professor of History
Peter Jianhua Yang  
Jesse Hauk Shera Assistant Professor of German

The 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, of German contributions to the development of western civilization, more important to—and worthy of study by—American students than at any other time since 1945.

Based on the premise that understanding is beneficial to the citizens of both nations in a variety of ways, Case Western Reserve University has responded to Americans’ need for preparation for the challenges of the 21st century by establishing the German Studies Program, an integrated program of study leading to the B.A. degree. The German Studies Program prepares students for life-long learning, enables and encourages them to pursue a course of study that helps prepare them for a career in international business, for study toward a graduate degree in a variety of disciplines, or for future study in professional programs such as law, business administration, and others.

The German studies major differs from the traditional German language and literature major by the breadth of its offerings. A German studies major encourages students to study in several disciplines from a generous selection of approved courses in the humanities, arts, social sciences, and economics. A graduate of the German Studies Program is expected: to be prepared for lifelong learning; to be knowledgeable about and conversant in German contributions to western culture in such areas as literature, film, philosophy, and music; to be proficient in the German language; to understand and be able to discuss German history, government, attitudes about religion; and to use all of the above as the mark of an educated person in pursuit of a career in business or in study toward a graduate or professional degree.

Facilities available to students in the German Studies Program include the many printed and other resources available in the Max Kade Reading Room, Clark Hall Room 113.

Requirements for the major in German studies

Thirty hours from the list of approved German studies courses, including German 303 and 304, German Studies 398 (Senior Colloquium), and 21 additional hours from the approved list, no more than 9 of which may be in any one department.

Sample concentrations for the German studies major

History and philosophy; German literature and theater history; political science and history; art history, music history, and religion; etc. Note that the above combinations are examples only, within program requirements, students are free to shape the major as they wish based on their own intellectual interests.

Requirements for a minor in German studies

At least one of German 303 or 304; four additional 300-level courses on the approved list of German studies courses from any two departments; or a thematic course of study (12 hours) approved in advance by the director of the German Studies Program.

Approved German Studies Courses

Complete course descriptions are given under the appropriate departmental listings in this General Bulletin.

Art History Courses (Prerequisite: None)
ARTH 374 Impressionism to Symbolism
ARTH 381 Neoclassicism through Realism
ARTH 382 Twentieth-Century European Painting and Sculpture
ARTH 399 Independent Studies
Comparative Literature Courses (Prerequisite: None)
CMPL 190 Introduction to Comparative Literature
CMPL 300 Turning Points in Modern Culture
CMPL 399 Independent Studies
Economics Courses (Prerequisite: ECON 102; 103)
ECON 335 Comparative Economic Systems
ECON 374 International Economics
ECON 399 Independent Studies
English Courses
ENGL 366K Feminist Theory
ENGL 368A Introduction to the Film
ENGL 368B International Cinema since 1940
ENGL 368M History of Cinema to 1940
ENGL 390 Independent Study & Creative Projects
German Language & Literature Courses (Prerequisite: GRMN 202)
GRMN 302 Advanced Written and Spoken German
GRMN 303 Studies in German Civilization I
GRMN 304 Studies in German Civilization II
GRMN 311 Advanced Conversation
GRMN 313 Introduction to German
Literature
GRMN 330 The German Novella
GRMN 365 Literature of Enlightenment/Storm & Stress
GRMN 366 From Lessing to Young Goethe
GRMN 367 German Classicism/Romanticism
GRMN 375 19th-Century Literature
GRMN 380 20th-Century Literature I
GRMN 386 20th-Century Literature II
GRMN 395 Special Topics in German Literature
GRMN 399 Independent Studies.

German Studies Course (Prerequisite: Senior Status in GRST)
GRST 398 Senior Colloquium

History Courses (Prerequisite: None)
HSTY 309 Reformation Europe
HSTY 313 Women in Modern European History
HSTY 334 History of Nineteenth-Century Germany
HSTY 335 History of Twentieth-Century Germany
HSTY 397 Independent Studies

Music History Courses (Prerequisite: Music History Courses)
MUSC 221 Intro to Music: The Listening Experience I [if student has no significant musical background]
MUSC 222 Intro to Music: The Listening Experience II
MUSC 322 History of Western Music II
MUSC 326 Symphonic Literature
MUSC 327 Vocal Literature
MUSC 399 Independent Studies

Philosophy Courses (Prerequisite: PHIL 101)
PHIL 355 Nineteenth and Twentieth-Century Philosophy
PHIL 358 The Frankfurt School
PHIL 399 Independent Studies

Political Science Courses (Prerequisite: None)
POSC 260 Introduction to Comparative Politics
POSC 367 Western Political Systems
POSC 399 Independent Studies

Religion Courses (Prerequisite: None)
RLGN 254 The Holocaust
RLGN 314/414 Jews and Christians in Germany
RLGN 331/431 German-Jewish Thought & History
RLGN 374 (same as HSTY 309)
RLGN 399 Independent Studies

Theater History Courses (Prerequisite: None)
THTR 228 Theater History I
THTR 229 Theater History II
THTR 399 Independent Studies in Theater Arts

**Gerontological Studies**

226 Mather Memorial
Phone: 216-368-5173; Fax 216-368-2676

**Gary Deimling, Director**

The gerontological studies program is a multi-disciplinary program designed to integrate research and theory about aging and old age. Prompted in part by 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, the meaning of aging to individuals, and the physical changes that accompany aging. 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 four departments: anthropology, communication sciences, history, 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 old and that problems with which they must deal will be related to the aged. The perspective provided by participating in the Gerontological Studies Program will provide students with excellent background in working with older populations. This background is particularly important for students who plan to pursue careers in human services, business, law, medicine, academics, or the sciences.

**Current Areas of Research**

Faculty members associated with the program are engaged in a variety of funded research projects which 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.

**PROGRAM FACULTY**

Cynthia Beall, Ph.D. (Pennsylvania State University)
Professor, Anthropology
Physical anthropology; human growth and development; human and medical ecology; biology of aging; Andes; Himalayas

Robert Binstock, Ph.D. (Harvard University)
Henry R. Luce Professor, School of Medicine
Public policy and aging; Health care policy

Gary T. Deimling, Ph.D. (Bowling Green State University)
Professor, Sociology
Sociological of aging; medical sociology; family sociology

Atwood Gaines, Ph.D. (University of California, Berkeley), M.P.H.(University of California, Berkeley, School of Public Health)
Professor, Anthropology
Medical and psychiatric anthropology; cultural anthropology, religion, urban...
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 courses and 15 are in approved elective courses. The required courses are:

- ANTH 304, Anthropology of Aging (3)
- COSI 345, Communication and Aging (3)
- PSCL 369, Adult Development and Aging
- SOCI 369, Aging in American Society (3)
- SOCI 396, Public Policy and Aging (3)

At least 15 credit hours must be earned in the approved electives listed below. This list changes from time to time as departmental offerings change. Check with the director of the gerontological studies program for current information.

- ANTH 215, Health Culture, and Disease: An Introduction to Medical Anthropology (3)
- ANTH 301/401, Biological Aging in Humans (3)
- ANTH 318, Death and Dying (3)
- ENGL 364M, Autobiography and Biography (3)
- SOCI 311, Health, Illness, and Social Behavior (3)
- SOCI 313, Social Factors in Stress and Coping (3)
- SOCI 319, Social Factors in Institutional Care (3)
- SOCI 370, Family Process (3)
- GER 397, Special Studies in Gerontology (1-3)
- GER 398, Seminar in Gerontological Studies (3)
- GER 399, Independent Studies in Gerontology (1-3)

**Minor**

The minor consists of 15 credits, including at least two of the core gerontology courses (ANTH 304, COSI 345, PSCL 369, SOCI 369 and SOCI 396), and any three of the approved electives or remaining core courses.

**Sequence**

A sequence in gerontological studies consists of 9 credit hours in three courses chosen from among the following courses: ANTH 304, COSI 345, PSCL 369, SOCI 369 and SOCI 396.
The Department of History offers comprehensive undergraduate and graduate programs in American history; the history of science, technology, environment and medicine; social history and policy; and the history of law. 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 cultural, political, and economic frameworks that have formed the customary 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, women’s history, 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, journalism, and such public history activities as archival administration, historical museum administration, restoration and preservation of historic sites, and writing.

**FACULTY**

Carroll W. Pursell, Ph.D. (University of California, Berkeley)
Adeline Barry Davee Distinguished Professor and Chair
History of technology; U.S. science and technology policy

Michael Altshul, Ph.D. (Johns Hopkins University)
Professor
Middle ages and Renaissance; medieval England

John Grabowski, Ph.D. (Case Western Reserve University)

Kreiger-Muller Associate Professor in Applied History

David C. Hammack, Ph.D. (Columbia University)
Hiram C. Haydn Professor
American social and urban history; economic history

Elisabeth Köll, D.Phil. (Oxford University)
Assistant Professor
East Asian history; Chinese economic history

Kenneth F. Ledford, Ph.D. (Johns Hopkins University), J.D. (University of North Carolina)
Associate Professor; Secondary Appointment, School of Law
Modern German history; Modern European history; European legal history; history of the professions

Miriam R. Levin, Ph.D. (University of Massachusetts)
Associate Professor
Industrial culture; European technology; French cultural history

Alan Rocke, Ph.D. (University of Wisconsin, Madison)
Henry Eldridge Bourne Professor
History of science; science, technology, and society

Jonathan Sadowsky, Ph.D. (Johns Hopkins University)
Theodore J. Castele Associate Professor of Medical History; Secondary Appointment, School of Medicine
African history; comparative history; cultural anthropology; medical history

Renée Sentilles, Ph.D. (College of William and Mary)
Assistant Professor
American women’s history; cultural history; American studies

Theodore L. Steinberg, Ph.D. (Brandeis University)
Professor; Secondary Appointment, School of Law
U.S. environmental and legal history

Rhonda Williams, Ph.D. (University of Pennsylvania)
Assistant Professor
African-American history; U.S. social history

Angela Woolacott, Ph.D. (University of California, Santa Barbara)
Associate Professor; Associate Dean, College of Arts and Sciences
Modern British Empire; women’s history; Feminist theory

**ADJUNCT FACULTY**

James M. Edmonson, Ph.D. (University of Delaware)
Adjunct Associate Professor and Director, Dittrick Medical History Center
History of technology; history of medicine; museum studies

Dennis Harrison, Ph.D. (Case Western Reserve University)
Adjunct Assistant Professor and University Archivist

**UNDERGRADUATE PROGRAM**

The department offers these basic undergraduate history programs: the history major leading to the Bachelor of Arts degree, available in two options (the regular major, and the teacher licensure major); the history minor and sequence; and the Integrated Graduate Studies Program (IGS). The department encourages student participation in the Junior Year Abroad program. Students who elect a major, a minor, or a sequence in history must consult the departmental advisor each semester for guidance in planning their schedules. In addition, the Department of History and the Department of Philosophy together offer an undergraduate major in the history and philosophy of science and technology. The History Department also participates in, and contributes courses to, American studies, Asian studies, Environmental studies, French studies, German studies, International studies, and Women’s studies.

**Major**

The history major may be elected in one of two formats: the regular major and the teacher licensure major.

A. The regular major requires a minimum of 30 hours in history courses, including HSTY 112, HSTY 113, HSTY 250 (Issues and Methods in History), and HSTY 398 (Senior Research Seminar), as well as six additional courses in history, agreed upon in consultation with the departmental advisor.

B. The teacher licensure major requires thirty 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, Latin American studies. Candidates for teacher licensure must also work with the Director of Teacher Licensure to take courses in economics, political science, and sociology at CWRU, and 36 hours in education courses offered through CWRU and John Carroll University. Students interested in pursuing this option would confer with the department’s undergraduate advisor.

The Department of History confers commencement honors in history to majors who successfully complete HSTY 399: Senior Honors Colloquium. Participation in this spring course is by invitation only, extended in fall of the senior
Minors and Sequences
A minor in history is available to all undergraduate students. It consists of 15 hours in history, including 112-113 (history core courses) and three additional courses, chosen in consultation with the departmental advisor; the courses must form a coherent field of historical inquiry. A 9-hour sequence is also available to all students in the Case School of Engineering. It includes HSTY 112 or 113 (history core courses), plus two additional courses chosen in consultation with the departmental advisor; the courses must form a coherent field of historical inquiry.

Integrated Graduate Studies
The Department of History participates in the Integrated Graduate Studies program. 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.

Advanced Placement Credit
Students with Advanced Placement (AP) scores of 4 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 and 113 core courses. Credit by way of AP examination in U.S. history is given for HSTY 256: American Political History, in European history for HSTY 212: Modern European History.

GRADUATE PROGRAMS
The Department of History offers both the M.A. and the Ph.D. in history, but it emphasizes its two focused Ph.D. programs, in Social History and Policy and in the History of Science, Technology, Environment and Medicine. In practice, these two programs are closely related. The department also joins with the Law School to offer an M.A. in History/J.D. double-degree program. Informally, students can combine graduate study in History with the certificate or degree programs of the Mandel Center for Nonprofit Organizations. All applicants for graduate degrees in history must submit transcripts from all previous undergraduate, graduate, and professional study, scores on the GRE aptitude test or a comparable standardized test, and three letters of recommendation. The department recommends, but does not require, an undergraduate major in history. The M.A. 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), and can be completed in as few as three semesters. It is possible to earn an M.A. in African, American, Asian, or European history; the strengths of the department are in U.S. and European history. For the joint J.D./M.A. program, students must be admitted to both the history graduate and law schools, and they can complete their degrees 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). 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 may be required to complete that degree in the department before moving on to the Ph.D.; those who have earned graduate or professional degrees closely related to their Ph.D. programs may petition for direct admission to the Ph.D. program. Students who first complete their M.A. in history at Case Western Reserve must complete an additional 18 hours of course work, pass the qualifying exams required by their program of study, and prepare a Ph.D. 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 CWRU must complete at least 18 hours of course work before taking their qualifying exams.

Program in Social History and Policy
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. Applicants for the Social History and Policy Ph.D. program must submit scores on the GRE aptitude test and three letters of recommendation. The program does not require an M.A. in history, and has admitted several students with J.D., M.S.W., library science, and other degrees, but it often requires students with limited backgrounds in U.S. history to take extra course work. More tightly structured than the traditional Ph.D., 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 completed 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. The program was established in 1988; students who have completed its requirements have accepted positions at social and hospital agencies in Cleveland, at the Educational Testing Service in Princeton, at the Universities of Notre Dame, of Dayton, and Idaho; at California State University, Los Angeles, Cleveland State and Kent State universities, at the Bank Street School of Education in New York City, and at Oberlin, Beloit, and Westminster of Pennsylvania colleges.

Program in the History of Science, Technology, Environment and Medicine
The program in the History of Science, Technology, Environment and Medicine 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 Ph.D. in the History of Science, Technology, Environment and Medicine includes the M.A. requirements, written and oral qualifying examinations, and a dissertation. While most graduates of the program teach in universities, others work in museums, archives, or deal with science policy questions. The Department of History also offers a traditional Ph.D. program in U.S. history. For this program, which does not admit students every year, an M.A. in history is strongly recommended. This program requires 18 hours of course work beyond the M.A., comprehensive oral examinations in the general field (U.S. history from the colonial period to the present), in a major field (a period or subfield of U.S. history), and in two cognate fields, at least one of which is in a field other than U.S. history.

FACILITIES FOR HISTORICAL RESEARCH AT CWRU

Case Western Reserve University, the other institutions in the University Circle neighborhood, 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 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 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. CWRU has also pioneered in 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.

History (HSTY)

UNDERGRADUATE COURSES

HSTY 112. Introduction to American History (3)
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, industrialization, and national cultures.

HSTY 113. Introduction to Modern World History (3)
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. Introduction to American Studies (3)
Cross-listed as AMST 117.

HSTY 133. Introduction to Chinese History and Civilization (3)
This course tries to explain 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, socio-economic, and political issues such as Confucianism, Buddhism, trade relations, imperialism, and intellectual discourse in the overall Asian context (with particular reference to Korea and China) we shall discuss the historical development of Japan and the country’s position on entering the 21st century. We shall examine the emergence of Japan as a modern nation-state and the fundamental transformation of its society in the post-war period. Cross-listed as ASIA 134.

HSTY 135. Introduction to Modern African History (3)
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.

HSTY 151. Technology in European Civilization (3)
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)
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 196. Energy and Society (3)
Cross-listed as PHYS 196.

HSTY 200. The Ancient World (3)
Ancient history from the origins of civilization in Mesopotamia to the dissolution of the Roman Empire in the West. Cross-listed as CLSC 201.

HSTY 201. Science in Western Thought I (3)
The development of Western thinking about the universe 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)
The development of Western thinking about the universe and our relation to it, as part of culture, from Newton to the modern age.

HSTY 203. Natural Philosophy (3)
Cross-listed as PHIL 203.

HSTY 204. Introduction to the Nonprofit Sector (3)
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 will consider 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 will have the option of writing either a standard term paper, or a study of strategic challenges facing a contemporary nonprofit organization.

HSTY 207. Natural Philosophy II (3)
Cross-listed as PHIL 204.

HSTY 208. Social History of Crime (3)
This course explores the relationship between law and history in American society. It uses social history methodology to suggest new ways of understanding the role of law in society, such as how the law works as a system of power to advance certain interests in society 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 industrial complex.

HSTY 209. Women in Industrial America 1820-1930 (3)
The history of American women from 1820 to 1930, set within the context of the United States' transformation to an industrial nation. Explores the differing perspectives that race, class, and region bring to the changing nature of women’s work, their spatial and material world, efforts at national reform, and the struggle for women’s rights.

HSTY 210. Byzantine World 300-1453 (3)
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. Cross-listed as CLSC 210.

HSTY 211. The Medieval World, 300-1500 (3)
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)
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 will provide a solid foundation for those wishing to take more specialized courses in European history.

HSTY 211. Medieval and Tudor/Stuart England (3)
English history from Anglo-Saxon times through the Tudor and Stuart age; kings and kingship, the growth of Parliament, the common law, international politics, and England’s relations with Celtic Britain.

HSTY 222. History of Modern England (3)
Survey of English history, 1700-present, with some attention also to Wales, Scotland, and Ireland, as well as the effects of the British Empire “at home.” Themes include political change, the industrial revolution, nineteenth-century global power and twentieth-century decline, and the roles of gender, class, race, and region in British social and cultural history.

HSTY 223. The Rise and Decline of the British Empire (3)
This course traces the history of the British empire, the geographically largest and perhaps politically most powerful empire of the modern world. Begins with the eighteenth century and the loss of most of the British colonies in the Americas, traces through the height of the Empire in the late 19th century and then follows its decline and the process of decolonization in the 20th century. Examines the British Empire in its military, political, economic, social, cultural, gendered and ideological facets.

HSTY 225. Evolution (3)
Cross-listed as PHIL 225.

HSTY 240. The Body in History (3)
This course examines the changing experiences of human bodies in history. It shows how science and culture have shaped diverse human experiences which often appear immutable, including sexuality, eating, race, and sickness.

HSTY 250. Issues and Methods in History (3)
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 253. Technology and American Culture (3)
American technology is a cultural phenomenon, a part of, rather than separate from, common concerns. Examines technology through historical writings, literature, images, and both material and popular culture.

HSTY 254. The Holocaust (3)
Cross-listed as RLGN 254.

HSTY 255. Economic History of the United States (3)
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. Cross-listed as ECON 255 and PLCY 255.

HSTY 256. American Political History (3)
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)
The history of American immigration within the context of international migration patterns; U.S. immigration historiography.

HSTY 258. History of Southern Africa (3)
A survey of southern Africa from about 1600. Topics include the social structure of pre-colonial African societies, the beginnings of European settlement, the rise of Shaka, the discovery of minerals and the development of industry, Zimbabwe’s guerrilla war and independence, and rise and apparent demise of apartheid.

HSTY 260. Slavery and Emancipation (3)
Begins with the African encounter with Europeans during the emergence of the modern slave trade. Students will be 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.

HSTY 261. African-American History 1865-1945 (3)
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.

HSTY 262. African-American History Since 1945 (3)
Completess 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.

HSTY 265. History of the Professions (3)
Professions are one of the central occupational structures of modern society. This course teaches about the historical context of the professions that many students seek to join. It covers the three classic “learned” professions of clergy, law, and medicine, and newer ones such as accounting, engineering, management, and nursing. It is comparative and interdisciplinary, examining the liberal, small-state contexts of England and the United States, and the contrasting strong-state contexts of France, Germany, and Russia, applying theory from sociology, anthropology, and gender studies.

HSTY 266. The Engineer in America (3)
History, culture, politics, ethical considerations, and gender issues of the engineering profession in the United States.

HSTY 268. Colonialism in Africa (3)
Examines the immense social and cultural changes which took place in Africa as a result of colonial occupations, in the period roughly from 1880 to 1965. It is organized around three major rubrics which were central to the colonial experience: the spread of Christianity, economic forces which led to new forms of labor, and the growth of nationalist resistance.

HSTY 270. Introduction to Gender Studies (3)
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, and art history. It is the required introductory course for students taking the women’s studies major. Cross-listed as WSTD 201.

HSTY 272. Sports in America: From Play to Profit (3)
This course reviews the history of sports in America from the colonial period to the present, paying particular attention to the evolution of sports as a major business and to the roles of gender, ethnicity, and race in the history of American sport.

HSTY 282. Modern China (3)
Modern China, concentrating on the continuous upheavals that have shaped its history in the nineteenth and early twentieth century, from Taiping Rebellion and Opium Wars of the mid-nineteenth century to the end of the Civil War. The Western challenge, the fall of the last dynasty, the Nationalist and Communist revolutions.

HSTY 285. Modern Japan (3)
From the Meiji restoration to the Occupation. The transition from a traditional society to a modern nation-state, the nature of capitalism and democracy in Japan, the crisis of imperialism.

HSTY 302. Ancient Greece: Archaic, Classical, and Hellenistic Periods (3)
The rise of Hellenic thought and institutions from the eighth to the third centuries B.C., the rise of 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. Cross-listed as CLSC 302.

HSTY 303. History of the Early Church: First Through Fourth Centuries (3)
Explores the development of the diverse traditions of Christianity in the Roman Empire from the first through the fourth centuries A.D. A variety of New Testament and extra Biblical sources are to be 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. Cross-listed as RLGN 373.

HSTY 304. Ancient Rome: Republic and Empire (3)
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 crises 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. Cross-listed as CLSC 304.

HSTY 305. Museums in a Developing World (3)
This course will be global and interdisciplinary in character. Its content will cover the history of museums in creating visions of the world, in economic development, and in the process of nation building in the older nations of the west and in emerging nations of Asia, Latin America and Africa in the post-colonial world. Through a variety of activities, including visits from specialists, visits to museums, and specially designed web-based projects, including the design of a class web-page and exhibit, students will be engaged in actively learning about the history of museums, their institutional structures, social and economic roles, and global cultural significance.

HSTY 307. Development of Chemistry and Chemical Engineering (3)
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.

HSTY 308. Italian Renaissance 1350-1600 (3)
Political and cultural history of Renaissance Italy. Florence, Venice, Rome, and the development of humanism. Extensive reading of major writers such as Machiavelli.

HSTY 309. Reformation Europe, 1500-1650 (3)
Origins and development of Protestantism, the Catholic Counter-reformation, and the interaction between secular power and religious identity in Christian Europe. Cross-listed as RLGN 374.

HSTY 310. The French Revolutionary Era (3)
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)**
This seminar will examine 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 will 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.

**HSTY 312. European Legal History (3)**
Examines the development of the legal systems of Central and Western Europe since the reception of Roman law. Focus will fall upon the alliance of Roman law and the absolutist state, the rise of bureaucratic absolutism, codification and the rise of liberal constitutional and legal thought, the Central European Rechtsstaat tradition, the historical school and legal positivism, the differing trajectories of development of bars in private practice, and the shape of modern European civil law systems, all in their social contexts.

**HSTY 313. Women in Modern European History (3)**
Examines modern European history from the perspective of women’s experiences. Considers how women’s productive and reproductive roles have changed, as well as changes in their political and legal rights, their social and cultural contexts, and their participation in historical movements and events.

**HSTY 315. Heresy and Dissidence in the Middle Ages (3)**
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. Cross-listed as RLGN 315.

**HSTY 318. History of Black Women in the U.S. (3)**
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.

**HSTY 321. Colonialism, Sex, Race, and Gender (3)**
This course is an exploration of four extended historical episodes in which categories of race, gender, and, inevitably, sexuality have interacted and shifted as a result of colonial encounters. In different parts of the globe and at different moments in the last three centuries, these encounters between expanding imperial cultures and indigenous cultures produced societies with racial and gender hierarchies, where sex was a site of colonial anxiety, exploitation and regulation.

**HSTY 325. U.S. Politics, Culture, and Society: 1787-1865 (3)**
Explores politics, culture, and society in the United States between the War for Independence and the Civil War. Topics include the transformation of political ideology, the political process, capitalist development in cities, factories, and the countryside, and changing dynamics of class, race, and gender in both the North and South.

**HSTY 328. European Diplomacy in the Age of Nationalism: 1789-1945 (3)**
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.

**HSTY 332. History of 20th Century Germany (3)**
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 333. History of 20th Century Germany (3)**
Examines the tumultuous history of Germany from 1914 to the unification of the two Germanys 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, 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 342. Russia Since the Revolution (3)**
Beginning with the background to the Russian Revolutions of 1905 and 1917, this course explores the rise and fall of the communist system of the Soviet Union. It examines the radical upheavals imposed upon the Russian and other peoples of the Soviet Union, the Stalinist autocracy, post-Stalinist attempts to make the system work, the superpower era, sclerosis and stagnation, Glasnost and Perestroika, coup and collapse.

**HSTY 348. Political and Social Thought in the Machine Age (3)**
Explores the responses of economist writers, philosophers, cultural critics, and public policy makers to changes in Western society wrought by industrialization, by focusing on their concerns with technological change. Cross-listed as POSC 348.

**HSTY 351. Colonial America 1607-1763 (3)**
The formative years of American society and culture. Slavery and racism, expansionism, regionalism, the modern family, pluralism, sense of mission, and republican ideology.

**HSTY 352. The Creation of the American Republic: 1763-1815 (3)**
The causes and consequences of the American Revolution, the formation of the American Republic, and the early years of the new nation. Federalism and republicanism as theories and in application, and the role of the Americans’ experience in the age of democratic revolutions.

**HSTY 353. Women in American History I (3)**
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.

**HSTY 354. Women in American History II (3)**
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 355 not a prerequisite.)

HSTY 355. Age of American Civil War 1815-80 (3)
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 356. Industrial America: 1880-1940 (3)
The social, economic, and political adaptation of American society to the industrial age. The impact of industrialism on such recurrent historical problems as technological change, race relations, social reform, urbanization, and political participation.

HSTY 358. America Since 1940 (3)
A comprehensive introduction to the recent history of the United States, organized around changes in national policy and politics. Special emphasis on the impact of World War II and the Cold War; the expansion of the federal government through the Great Society and beyond; the Civil Rights and Women’s Rights movements; challenges to the legitimacy of politics; and to the efforts to maintain economic growth.

HSTY 359. Race in American Social and Cultural Thought (3)
Explores the social and cultural construction of race in American social thought. Topics for discussion range from race in the age of European exploration to slavery and the postbellum years, to 20th century cultural thought. In addition, the course addresses the ways in which racial thought has shaped American politics, social policy, and culture. The readings, lectures, discussions, and assignments stress the interrelated, but unique experiences of the various racial groups in the U.S.

HSTY 360. American Foreign Policy since 1900 (3)
The underlying economic, political, and cultural forces that influenced policy formation from the end of the Spanish-American War through the aftermath of the Vietnam War. The development and function of the national and international apparatus of foreign relations from the consular service, world court and cartels to the CIA, United Nations, and international corporations.

HSTY 362. American Social and Cultural History since 1865 (3)
History of the nationalization of new economic, political, social, scientific, and aesthetic ideas and their embodiment in the development of professions, social movements, and cultural institutions.

HSTY 364. City, Town, and Suburban American History (3)
Nearly all Americans now live in the big cities, suburbs, and nearby towns of large metropolitan regions; one hundred years ago most Americans lived in the countryside. This course explores the rise of cities and metropolitan regions as the settings for American life. It will consider the timing of the urban and suburban movements, explanations for urbanization and suburbanization, and the changing character of city, suburban, and small town life. The course will pay special attention to the consequences of urban and metropolitan growth for economic opportunity, for metropolitan government, for social life and conflict, and for cultural expression and cultural change.

HSTY 366. Science, Technology, and Government (3)
Traces the development and effects of federal technology and science policies from colonial times to the present, with emphasis on the 20th century. Cross-listed as POSC 365.

HSTY 368. Modern American Legal History (3)
Examines the workings of the modern American legal system from the Civil War to the present. Focus on the relationships between the law and social, economic, and professional change. Lectures, discussions, and analysis of legal documents.

HSTY 377. Nuclear Weapons and Arms Control (3)
National and international problems concerning nuclear weapons, and the past and present attempts both to control their spread and to prevent their use. Topics covered include the science and technology of fission and fusion warheads and delivery vehicles; history, domestic policies, and international relations concerning nuclear weapons; and arms control treaties and their verification. Cross-listed as POSC 375.

HSTY 378. Environmental History of North America (3)
Explores the way nature has shaped history as well as the ecological consequences of development. Focus is on the relationship between the natural and the cultural with special attention to such topics as economic growth, wilderness, disease, environmental justice, and the conquest of the American West.

HSTY 379. America in the ’50s (3)
American life and culture in the decade of Elvis, Eisenhower, McCarthy and the beginnings of the Civil Rights Movement. Films, novels and recordings will supplement lectures and discussions on such topics as the Cold War, conformity, the role of women, television, the Korean War and beatniks.

HSTY 382. Chinese Business and Economic History (3)
China’s business history from the opening of the treaty ports to the post-war socialist economy, market liberalization, and recent developments in the 1990s. One major focus of the course is the introduction of industrialization and modern enterprises into China. By examining the socio-economic background of Chinese business, students will learn about its cultural and social aspects that are still relevant for business transactions and institutions in China today.

HSTY 383. The People’s Republic of China (3)
The development of Chinese Communist theory and practice from 1949 to the current reforms. The problems involved in attempting to establish a socialist state and society while engaging in industrial development. The cultural, political and economic analysis is of the various segments of Chinese society. Cross-listed as POSC 368.

HSTY 390. Seminar: History and Philosophy of Science and Technology (3)
Required of majors in the History and Philosophy of Science and Technology.

HSTY 391. Food in History (3)
Nothing is more basic than food to all of our daily lives, and therefore to our cultures, our social interactions, and our very identities. This has been true throughout history. 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.

**HSTY 394. Seminar in Evolutionary Biology (3)**
Cross-listed as PHIL 394.

**HSTY 395. History of Medicine (3)**
This course treats selected topics in the history of medicine, with an emphasis on social and cultural history. Focusing on the modern period, we will examine illnesses, patients, and healers, with attention to the ways sickness and medicine touch larger questions of politics, social relations and identity.

**HSTY 397. Undergraduate Tutorial (1-3)**
Individual instruction with members of the history faculty. Prerequisite: 12 hours of History.

**HSTY 398. Senior Research Seminar (3)**
Training in the nature and methods of historical writing and research. Prerequisites: Majors only, Senior standing.

**GRADUATE COURSES**

**HSTY 400. Graduate Topical Seminar (3)**
A rotating graduate seminar, offered every semester by a different faculty member. Each semester focuses on a topic of central historiographical or methodological importance.

**HSTY 402. Survey of the History of Science (3)**
A graduate-level historiographic review of the history of the sciences from the seventeenth century to the present.

**HSTY 404. Introduction to the Nonprofit Sector (3)**
(See HSTY 204.)

**HSTY 405. Museums in a Developing World (3)**
(See HSTY 305.)

**HSTY 410. Seminar: Early American Historiography (3)**
This seminar will examine 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.

**HSTY 411. Seminar: Modern American Historiography (3)**
(See HSTY 311.)

**HSTY 451. Seminar in the History of European Technology (3)**
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.

**HSTY 452. Readings in the History of American Technology (3)**
A graduate-level review of the history of American technology.

**HSTY 470. History & Cultural Studies (3)**
This course explores the uses of cultural and critical theory by historians, in particular relevant developments in anthropology, literary criticism, and philosophy. Topics include collective memory, the social construction of knowledge, theories of narrativity, the concept of post-modernity, and the historical formations of class, race, gender, and nation.

**HSTY 475. Nuclear Weapons and Arms Control (3)**
(See HSTY 377.) Cross-listed as POSC 475.

**HSTY 476. U.S. Social History and Policy (3)**
Seminar that explores the literature of early American social history from the colonial period through the mid-nineteenth century with an eye toward its relevance from a policy standpoint. Topics include environment, family, law, work and race relations.

**HSTY 477. Modern Policy History of the United States (3)**
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. Prerequisite: Consent of department for undergrads.

**HSTY 478. Comparative History (3)**
Focuses on the principles and methodology of comparative history. It is also designed as an experience in the research and writing of history. Students read theoretical and exemplary works in comparative history, choose their own well-defined topic, conduct research in both primary and secondary sources, and present their work to the seminar.

**HSTY 480. Public Policy and Aging (3)**
Cross-listed as EPBI 408.

**HSTY 494. Seminar in Evolutionary Biology (3)**
Cross-listed as PHIL 494.

**HSTY 495. History of Medicine (3)**
(See HSTY 395.)

**HSTY 497. Graduate Independent Study (1-3)**
Independent reading and research programs with individual members of the faculty.

**HSTY 601. Independent Studies (1-18)**
(Credit as arranged.)

**HSTY 611. Introduction to Historiography (3)**
Required seminar for all M.A. and Ph.D. students. Introduces students to historiographical and methodological issues.

(Credit as arranged.)

**HSTY 694. Tutorial in U.S. History (3)**
Supervised independent reading in preparation for the doctoral comprehensive examination. Limited to Ph.D. candidates.

**HSTY 701. Dissertation Ph.D. (1-18)**
(Credit as arranged.) Limited to Ph.D. candidates actively engaged in the research and writing of their dissertations.

**History and Philosophy of Science and Technology**

104 Mather House
Phone 368-2614; Fax 368-4681
Alan Rocke, Director

**PROGRAM FACULTY**

Alan J. Rocke, Ph.D. (University of Wisconsin-Madison)
Henry Eldridge Bourne Professor of History and Director

James M. Edmonson, Ph.D. (University of Delaware)
Director, Dittrick Medical History Center, and Adjunct Associate Professor

Miriam R. Levin, Ph.D. (University of Massachusetts)
The Department of Philosophy and the Department of History together offer an undergraduate major in the history and philosophy of science and technology. The purpose of the major is to develop a humanistic understanding of the nature and development of technology and 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 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 technology, physical science, or biological and medically related science.

Major

The history and philosophy of science and technology major requires 33 credit hours from courses in philosophy and in history of science and technology. In addition, there is a science requirement of at least 15 hours of science and engineering courses. Required are PHIL 101, 201, and 303; HSTY 390 or PHIL 390; and four of the following five courses: PHIL 302, HSTY 151, 152, 201, 202. Upon petition, PHIL 203 and 204 may substitute for HSTY 201 and 202. Three more PHIL and HSTY courses relating to technology or science at the 300 level or above must be taken, only two of which may be from the same department. Science Requirement: A coherent sequence of at least 15 hours of science and/or engineering courses, 6 hours of which normally must be at the 300 level or above, is required. The intent is to provide a sequence roughly equivalent to a minor in science or engineering. Any science minor will satisfy this requirement. There is no minor or sequence in history and philosophy of science and technology. Students who major in the history and philosophy of science and technology are not permitted to take a second major in philosophy or to minor in philosophy.

Human Development

223B Mather Memorial
Phone: 216-368-2697
Richard Settersten, Director

Program Faculty

Richard A. Settersten, Ph.D. (Northwestern University)
Assistant Professor, Sociology; Co-Coordinator, Human Development
Joseph F. Fagan, Ph.D. (University of Connecticut)
Lucy Adams Leffingwell Professor of Psychology
Grover C. Gilmore, Ph.D. (Johns Hopkins University)
Professor, Psychology
Eva Kahana, Ph.D. (University of Chicago)
Pierce F. and Elizabeth D. Robson Professor and Chair, Sociology; Co-Coordinator, Human Development
Jill E. Korbir, Ph.D. (University of Southern California)
Professor, Anthropology
Jerome Kowal, M.D. (Johns Hopkins University)
Professor, School of Medicine
Baila Miller, Ph.D. (University of Illinois at Chicago)
Associate Professor, Mandel School of Applied Social Sciences Director, Joseph and Florence Mandel Alzheimer Caregiving Institute
Danielle Ripich, Ph.D. (Kent State University)
Professor, Communication Sciences
Julia Rose, Ph.D. (Cornell University)
Assistant Professor of Medicine, Division of Geriatric Medicine
May Wykle, Ph.D., R.N., F.A.A.N. (Case Western Reserve University)
Florence Cellar Professor and Associate Dean, School of Nursing; Director, University Center on Aging and Health

Undergraduate Minor

This interdisciplinary minor examines both medical and social aspects of human development over the life course, and is organized around critical health issues (broadly defined). It brings together in one forum the professional perspectives of medicine, nursing, and social services with the academic perspectives of anthropology, communication sciences, history, psychology, and sociology. It also provides practical, clinical, and research experience for the undergraduate student and puts him or her into contact with students and faculty in the School of Medicine and the other professional schools. A student may begin work on this minor in the sophomore year and continue on through the first semester of the senior year.

The minor is divided into three segments and consists of 15 credit hours.

Required Introductory Courses

During the first year, students participate in an introductory course (HDEV 203/SOCI 203 Human Development: Medical and Social Aspects) which provides an informative overview of human development. This course combines medical perspectives on human development with those of the social sciences. In addition, students are required to enroll in a traditional course in child development (PSCL 230 Child Psychology).

Electives

In the second year of the program, students select two courses from a number of possible electives related to medical and social aspects of human development. The following electives are approved. Other electives are available by petition.

COSI 313, Language Development (3)
PSCL 369, Adult Development and Aging (3)
SOCI 313B, Social Factors in Stress and Coping (3)
SOCI 361, The Life Course (3)
SOCI 369, Aging in American Society (3)
ANTH 104, Human Development in Cross-Cultural Perspective (3)
ANTH 304, Introduction to the Anthropology of Aging (3)
ANTH 306, The Anthropology of Childhood and the Family (3)

Required Capstone Experience

In the third year, students participate in a one-semester capstone experience, HDEV 391/SOCI 391, Practicum in Human Development. Students have the opportunity to participate in an ongoing clinical or research project in a department or school participating in the program. Every effort is made to match stu-
Human Development (HDEV)

UNDERGRADUATE COURSES
DEV 203. Human Development: Medical and Social (3)
Social influences on health and illness across the lifespan. Social determinants of health and health behavior, and delivery of health care. Guest lectures from the medical school and other health care providers address professional practice issues across the lifespan. Issues include: new approaches to birthing; 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. Cross-listed as SOCI 203.

HDEV 391. Practicum in Human Development (3)
Students design a project in consultation with the Human Development program coordinators and a faculty supervisor from the School of Medicine, one of the other professional schools, or the College of Arts and Sciences. The faculty supervisor may be chosen by the student or recommended by the program coordinators. Students meet periodically with program coordinators in a seminar to review practicum experiences and place them in a theoretical context. Prerequisite: PSCCL 230 or consent of instructor. Cross-listed as SOCI 391.

International Studies

111 Mather House
Phone 368-2425; Fax 368-4681
Vincent E. McHale, Director

International studies is a multi-disciplinary program leading to the B.A. degree. Study in the program provides students with the ability to read beyond the headlines, to see world events in terms of how they got to be that way, how they fit into broader issues and systems, and how one might imagine their place in shaping the future. To attain this goal, students are introduced to the methods of conceptualizing international and global issues, as well as to study of a society other than their own. They will learn to think critically about contending and complementary methods and theories, developing an appreciation for both traditional disciplinary approaches and newer cross-disciplinary approaches. Students also will acquire skills that will allow them to recognize and deal with complexity; communicative and analytical skills in a language other than English (or other than their native language); and skills in statistics, in computer-based global analysis, or in negotiation.

It is strongly recommended that all international studies students participate in at least one of several off-campus programs which will facilitate the international perspective: junior year abroad, summer internships in Washington, D.C., or professional practicum-type work experiences in Cleveland which involve an international context. It also is recommended that students have a solid foundation in economics. In addition to forming the groundwork 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 emerging needs of our world. 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.

INTERNATIONAL STUDIES

STEERING COMMITTEE
Vincent E. McHale, Ph.D. (Pennsylvania State University)
Professor and Chair, Political Science; Director, International Studies Program
Comparative politics; Europe; political sociology; methodology

Christine M. Cano, Ph.D. (Yale University)
Assistant Professor, Modern Languages and Literature

20th-century French literature; literary criticism

Bo A. Carlsson, Ph.D. (Stanford University)
William E. Umstattd Professor of Economics
Managerial economics; industrial economics

William E. Deal, Ph.D. (Harvard University)
Severance Associate Professor of the History of Religion; Director, Asian Studies Program
Religions of China and Japan; Asian civilizations

Eileen M. Doherty, Ph.D. (University of California, Berkeley)
Assistant Professor, Political Science; Assistant Professor, Marketing and Policy Studies, Weatherhead School of Management
International relations; U.S. foreign policy; international political economy

Kenneth F. Ledford, Ph.D. (Johns Hopkins University), J.D. (University of North Carolina)
Associate Professor of History; Secondary appointment, School of Law; Director, German Studies Program
Modern German history; European social history; German and European legal history

Mihajlo D. Mesarovic, Ph.D. (Serbian Academy of Science)
Professor and Chair, Political Science; Director, International Studies Program
Large-scale systems theory; multilevel systems world and regional modeling

James T. Pfeiffer, Ph.D. (University of California, Los Angeles)
Assistant Professor, Anthropology
International health and international health policy; development studies; Africa

UNDERGRADUATE PROGRAM
The major in international studies requires a minimum of 33 credit hours taken from the list of approved topical and area studies courses, plus satisfaction of a language competency requirement. Each student will prepare a program of study, indicating specific course selections to meet the six area requirements below, which must be approved by a faculty advisor drawn from the steering committee membership. Students also should discuss the choice of their minor or a second major with their advisor. Among the courses chosen should be at
least one course which involves the development of skills in computer applications, economic analysis, statistics, or other quantitative methods. 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.

1. Multi-disciplinary foundations (required courses, 12 credit hours): An introduction to four major disciplinary understandings of society and culture, principles of economics, change over time, and interactions among nations, simultaneously exposing students to a variety of world societies and issues. International studies majors will be expected to have completed the multi-disciplinary foundations courses at CWRU before embarking on a study abroad program. These courses are:
   - ANTH 102 Being Human: An Introduction to Social and Cultural Anthropology (3)
   - ECON 102 Principles of Microeconomics (3)
   - HSTY 113 Introduction to Modern World History (3)
   - POSC 272 Introduction to International Relations (3)

2. Area Focus (6 credit hours): Two courses that concentrate on a single geographic or culture area. Examples include: Africa, North America, East Asia, Europe, Latin America, and the Middle East.

3. Topical Focus (6 credit hours): A related pair of courses to constitute a discrete perspective on global issues and to foster an appreciation for complexity through study of particular world 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 credit hours): Two additional courses within the topical and area studies course listings, providing an opportunity to experiment or to tailor the program toward particular interests in international or global issues, methodology, or other cultures.

5. Senior Colloquium (required course, 3 credit hours): The integration of prior topical and area foci in a colloquium (INTL 398) taken in the fall semester of the senior year, involving the writing of a substantial research paper. Selection of the topic and the research and writing are under supervision of a faculty tutor. Peer evaluation will be attained through regular sessions, supervised by the colloquium coordinator, at which students 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 may be considered for honors.

6. Language Competency (0 to 16 credit hours): In addition to the 33 credit hours of international studies course work, students must demonstrate competence in a language other than their native language. This may be done by completing a language course at the 300 level or above, or by demonstrating to the Department of Modern Languages and Literatures a nonnative language competency equivalent to the completion of a 300-level or above course, or by the completion of four semesters in a single language.

**APPROVED COURSES**

The International Studies Steering Committee currently recognizes over 150 courses from which the student may choose to satisfy the area and topical foci requirements. Course lists are available from the program advisors. Additional courses may be selected on the basis of individual student interest, or the discretion of the faculty advisor. Courses also may be selected from within existing area studies programs:

- American Studies Program
- Asian Studies Program
- French Studies Program
- German Studies Program
- Japanese Studies Program

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**International Studies (INTL)**

**UNDERGRADUATE COURSES**

**INTL 396, International Independent Study (1-3)**

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. Prerequisites: Consent of program coordinator and program prospectus form.

**INTL 398, International Senior Colloquium (3)**

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. Prerequisite: Consent of colloquium coordinator.

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**Department of Mathematics**

220 Yost Hall
Phone 216-368-2880; Fax 216-368-5163
James C. Alexander, Chair

The Department of Mathematics offers a variety of programs leading to both undergraduate (Bachelor of Arts and Bachelor of Science in Mathematics and Bachelor of Science in Applied Mathematics) and graduate (Master of Science and Doctor of Philosophy) degrees. Prospects for employment in mathematics are good. Because of the central role of mathematics in the physical and social sciences, in engineering, and in business, there should be continuing demand for mathematicians. Applied mathematicians are in demand in industry and government. A student with an undergraduate major in mathematics, including some computer science, and with some concentrated work in an allied field, has excellent career opportunities. There
is a strong demand for high school teachers in mathematics. The bachelor’s degree in mathematics furnishes a strong background for graduate study in many areas (e.g., computer science, medicine, law, economics, etc.). The master’s degree is sufficient for many areas of non-academic employment. The Ph.D. is necessary for college teaching.

The Math Tutoring Center, located in Yost 321A, provides a place within the Mathematics Department where students could work together and receive help as needed. Along with individual assistance, the Math Tutoring Center also conducts supplemental instruction sessions for Math 121, 122, 125 and 126. In these sessions, upperclassmen work with small groups of students on the class material.

**FACULTY**

James C. Alexander, Ph.D. (Johns Hopkins University)

Levi Kerr Professor and Chair

Dynamics, applied mathematics

E. Jerome Benveniste, Ph.D. (University of Chicago)

Assistant Professor

Lie groups and Lie algebraic actions

Alejandro D. de Acosta, Ph.D. (University of California, Berkeley)

Professor

Probability; stochastic processes

Daniela Calvetti, Ph.D. (University of North Carolina)

Associate Professor

Numerical linear algebra, numerical methods for image processing, orthogonal polynomials and quadrature rules, large-scale eigenvalue computations.

David Gurarie, Ph.D. (Hebrew University, Jerusalem, Israel)

Professor

Mathematical physics; differential equations; geophysical modeling; harmonic analysis

Michael G. Hurley, Ph.D. (Northwestern University)

Professor

Differentiable dynamical systems

Steven H. Izen, Ph.D. (Massachusetts Institute of Technology)

Associate Professor

Mathematics of imaging; image reconstruction

Peter Kotelenez, Ph.D. (Universitat Bremen)

Professor

Probability theory, stochastic processes, particle systems

Joel Langer, Ph.D. (University of California, Santa Cruz)

Professor

Differential geometry; calculus of variations

Dong Hoon Lee, Ph.D. (Tulane University)

Professor

Topological groups; Lie groups and algebras

Marshall J. Leitman, Ph.D. (Brown University)

Professor

Integral equations; continuum physics

Arthur E. Obrock, Ph.D. (Washington University)

Associate Professor

Complex analysis

David A. Singer, Ph.D. (University of Pennsylvania)

Professor

Riemannian geometry; differential topology

Stanislaw J. Szarek, Ph.D. (Mathematical Institute, Polish Academy of Science)

Professor

Functional analysis

Elisabeth Werner, Ph.D. (Universite Pierre et Marie Curie, Paris IV)

Associate Professor

Functional analysis, convexity

Ta-Sun Wu, Ph.D. (Tulane University)

Professor

Group Theory

**ASSOCIATE FACULTY**

Kenneth Loparo, Ph.D. (Case Western Reserve University)

Professor of Systems Engineering, Mechanical Engineering and Mathematics

Nonlinear chaotic and stochastic systems, analysis and control

Colin McLarty, Ph.D. (Case Western Reserve University)

Associate Professor of Philosophy

Logic, philosophy of mathematics

Mihajlo D. Mesarovic, Ph.D. (Serbian Academy of Science)

Professor

Mathematical physics; fluid mechanics, heat transfer

Cady Staley Professor of Engineering and Mathematics

**ADJUNCT FACULTY**

Marvin E. Goldstein, Ph.D. (University of Michigan)

Adjunct Professor; Chief Scientist, NASA-Lewis Research Center

Fluid mechanics, heat transfer

Margaret Robinson, M.A. (State University of New York at Stony Brook)

Adjunct Instructor; Dean of Undergraduate Studies

**UNDERGRADUATE PROGRAMS**

A Bachelor of Arts degree in mathematics, a Bachelor of Science in mathematics, and a Bachelor of Science in applied mathematics degrees 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.

**Degree Requirements**

**Bachelor of Arts Degree in Mathematics**

1. **Mathematics Requirements**

The B.A. degree in Mathematics requires at least 38 hours of mathematics courses, including

- (a) MATH 121, 122, 223, and 224, or an equivalent sequence;
- (b) Core Mathematics for the B.A.
  - (i) MATH 307, 308, 321, 322
  - (ii) at least one of MATH 324, 425;
- (c) Three approved technical electives (9 credit hours), no more than one of which can be from outside the department.

2. **Non-mathematics Requirements**

A 3-credit hour course in computer science (ENGR 131 or other approved course).

High school teaching certification is available in the B.A. program in mathematics through a joint program with John Carroll University. The requirements are:

- (a) Completion of the B.A. program in mathematics, including MATH 150, MATH 304, and STAT 312 as the three approved technical electives.
- (b) The completion of a special minor in education. Students interested in this program should contact the director of teacher licensure for further information about eligibility and requirements.

**Bachelor of Science in Mathematics Degree**

1. **Mathematics Requirements**

The B.S. degree in Mathematics requires at least 50 hours of mathematics courses, including

- (a) MATH 121, 122, 223, and 224, or an equivalent sequence;
- (b) Core Mathematics for the B.S. in Mathematics
  - (i) MATH 307, 308, 321, 322
  - (ii) at least one of MATH 324, 425;
- (c) 21 hours (normally seven courses) of approved technical electives, no more than 9 hours of which may be from outside the department.

2. **Non-mathematics Requirements**

The B.S. degree in mathematics requires the following non-mathematics courses:

- (a) PHYS 121, 122, 221, or an equivalent sequence.
- (b) A two-course science sequence
from the following list of physical sciences: ASTR 201-202, CHEM 105-106, CHEM 111-ENGR 145, GEOL 110 and either 115 or 210.

(c) A 3-credit hour course in Computer Science (ENGR 131 or other approved course).

(d) An approved science lab (usually 2 credit hours). (BIOL 314, BIOL 111, CHEM 113, GEOL 119, PHYS 203 are appropriate.)

As this bulletin is being prepared, a joint B.S. program in Mathematics and Physics is in the final stages of University approval; students should contact either the Mathematics or Physics Departments concerning information about the current status of that program.

**Bachelor of Science in Applied Mathematics Degree**

The B.S. degree in Applied Mathematics requires at least 50 hours of mathematics and related subjects, in addition to a professional core that is specific to the area of application in which the student is interested. A student in this degree program must design a program of study (called a “track”) in consultation with his or her academic advisor. This program of study must explicitly list the technical electives and the professional core in the area of application. Some of the tracks offer the possibility of an integrated five year study leading to a B.S. in Applied Mathematics and an M.S. in the area of application. Currently there are four such tracks: computing and information science; operations research; systems engineering - systems; systems engineering - control theory. The general academic requirements for Integrated B.S./M.S. programs must be followed. (Since the graduate courses required for the M.S. degree are determined by the 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 17 hours must be from among the following MATH courses: 121 or 123 or 125, 122, or 124 or 126, 223 or 227, 224 or 228, 150(*), 201(**), 301, 302, 303, 304, 307, 308(**), 321, 322, 323, 324, 331, 338, 343, 345, 380, or any 400-level(**) MATH course.

(b) Core Mathematics for Applied Mathematics

(i) MATH 304, 307, 308, 321, 322
(ii) at least one of MATH 324, 425;

(c) Technical Electives

18 credit hours (normally six courses) of technical electives as follows:

(i) Four approved courses, specific to the area of application in which the student is interested. (Lists of pre-approved courses for the four B.S./M.S. tracks are listed below.)

(ii) Two other courses of MATH at the 300 level or higher, except 470, 471.

Listed below are specific technical electives of the four B.S./M.S. tracks.

**Computing and Information Sciences Track**

The following four courses: ECES 281, ECES 333, ECES 337, ECES 338.

**Operations Research Track**

MATH 380, OPRE 428, OPRE 411, and one of MATH 413, 487, 489 or another approved 400-level course.

**Systems Engineering - Control Theory Track**

The following four ESCI courses: 212, 304, 313, 306.

**Systems Engineering - Systems Track**

MATH 380, ESCI 315, ESCI 416, ECES 251.

(3) Non-mathematics Requirements

The B.S. degree in applied mathematics requires the following non-mathematics courses.

(a) PHYS 121, 122, 221, or an equivalent sequence.

(b) A two-course science sequence from the following list of physical sciences: ASTR 201-202, CHEM 105-106, CHEM 107-108, GEOL 110 and either 115 or 210.

(c) A 3-credit hour course in Computer Science (ENGR 131 or other approved course).

(d) An approved science lab (usually 2 credit hours). (BIOL 314, BIOL 111, CHEM 113, GEOL 119, PHYS 203 are appropriate.)

**NON-MAJOR UNDERGRADUATE PROGRAMS**

**Minor in Mathematics - All undergraduates**

A minor in mathematics is available to all CWRU undergraduates. It consists of 17 credit hours of approved course work in mathematics. 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 17 hours must be from among the following MATH courses: 121 or 123 or 125, 122, or 124 or 126, 223 or 227, 224 or 228, 150(*), 201(**), 301, 302, 303, 304, 307, 308(**), 321, 322, 323, 324, 331, 338, 343, 345, 380, or any 400-level(**) MATH course.

(*) To count toward a minor in mathematics, MATH 150 must be taken in the freshman or sophomore years.

(**) Only one of 201, 308, 470 can be taken for credit.
High School Teaching Licensure
This program is described in the description of the mathematics B.A. degree given above.

GRADUATE PROGRAMS
The department offers programs leading to the Master of Science and Doctor of Philosophy degrees. At the master’s level there are two degrees: the degree of Master of Science in Mathematics and the degree of Master of Science in Applied Mathematics.

Doctor of Philosophy and Master of Science in Mathematics
The Ph.D. program is designed for students who intend to pursue a career in either pure or applied mathematics. The candidate must pass qualifying examinations in approved subjects; demonstrate a reading knowledge of an approved foreign language; and must present a doctoral dissertation representing significant original research. Candidates for the M.S. degree must complete 27 semester hours of approved courses and successfully pass a comprehensive examination. Throughout the student’s graduate career in the department, his or her work will be closely supervised by a faculty advisor.

RESEARCH AND TEACHING
The Department of Mathematics at Case Western Reserve University is an active center for mathematical research. Faculty conduct research in algebra, applied mathematics, analysis, geometry and topology, and probability.

Mathematics (MATH)

UNDERGRADUATE COURSES
MATH 101. Elementary Functions and Analytic Geometry (3)
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. Prerequisite: Three years of high school mathematics.

MATH 110. Introduction to Mathematical Communication and Software (1)

MATH 121. Calculus for Science and Engineering I (4)
Functions, analytic geometry of lines and polynomials, limits, derivatives of algebraic and trigonometric functions. Definite integral, antiderivatives, fundamental theorem of calculus, change of variables. Prerequisite: Three and one half years of high school mathematics.

MATH 122. Calculus for Science and Engineering II (4)
Continuation of MATH 121. Exponentials and logarithms, 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. Prerequisite: MATH 121.

MATH 123. Calculus I (4)
Limits, continuity, derivatives of algebraic and transcendental functions, including applications, basic properties of integration. Techniques of integration and applications. Prerequisite: Placement by the department.

MATH 124. Calculus II (4)

MATH 125. Mathematics I (4)
Discrete and continuous probability; differential and integral calculus of one variable; graphing, related rates, maxima and minima. Integration techniques, numerical methods, volumes, areas. Applications to the physical, life, and social sciences. Students planning to take more than two semesters of introductory mathematics should take MATH 121. Prerequisite: Three and one half years of high school mathematics.

MATH 126. Mathematics II (4)
Continuation of MATH 125 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. Prerequisite: MATH 125.

MATH 150. Mathematics from a Mathematician’s Perspective (3)
An interesting and accessible mathematical topic not covered in the standard curriculum is developed. Students are exposed to methods of mathematical reasoning and historical progression of mathematical concepts. Introduction to the way mathematicians work and their attitude toward their profession. Should be taken in freshman year to count toward a major in mathematics. Prerequisite: Three and one half years of high school mathematics.

MATH 201. Introduction to Linear Algebra (3)
Matrix operations, systems of linear equations, vector spaces, subspaces, bases and linear independence, eigenvalues and eigenvectors, diagonalization of matrices, linear transformations, determinants. Less theoretical than MATH 307. May not be taken for credit by mathematics majors. Only one of MATH 201, MATH 307, or MATH 470 may be taken for credit. Prerequisite: MATH 122 or MATH 126.

MATH 223. Calculus for Science and Engineering III (3)
Introduction to vector algebra; lines and planes. Functions of several variables: partial derivatives, gradients, chain rule, directional derivative, maxima/minima. Multiple integrals, cylindrical and spherical coordinates. Derivatives of vector valued functions, velocity and acceleration. Vector fields, line integrals, Green’s theorem. Prerequisite: MATH 122.

MATH 224. Elementary Differential Equations (3)
A first course in ordinary differential equations. First order equations and applications, linear equations with constant coefficients, linear systems, Laplace transforms, numerical methods of solution. Prerequisite: MATH 223.

MATH 227. Calculus III (3)
Vector algebra and geometry. Linear maps and matrices. Calculus of vector
valued functions. Derivatives of functions of several variables. Multiple integrals. Vector fields and line integrals.

MATH 228. Differential Equations (3) Elementary ordinary differential equations: first order equations; linear systems; applications; numerical methods of solution. Prerequisite: MATH 227.


MATH 301. Undergraduate Reading Course (1-3) 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. Problem Solving Seminar (1) A seminar devoted to methods of solving problems in various areas of mathematics. Content varies. Students may take this course for credit up to four times.


MATH 304. Discrete Mathematics (3) 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. Prerequisite: MATH 122 or MATH 126.

MATH 307. Introduction to Abstract Algebra I (3) 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, MATH 307, or MATH 470 may be taken for credit. Prerequisite: MATH 122.

### BACHELOR OF ARTS DEGREE

#### Major in Mathematics

<table>
<thead>
<tr>
<th>Fall Semester Credit Hours</th>
<th>Spring Semester Credit Hours</th>
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<tbody>
<tr>
<td><strong>FRESHMAN</strong></td>
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<tr>
<td>MATH 121 Calculus for Science and Engineering I .... (4)</td>
<td>MATH 122 Calculus for Science and Engineering II ... (4)</td>
</tr>
<tr>
<td>GER Course .......................................................... (3-4)</td>
<td>ENGR 131 Elementary Computer Programming ........... (3)</td>
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<td>GER Course .......................................................... (3)</td>
<td>GER Course .......................................................... (3)</td>
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<td>Electives .......................................................... (3)</td>
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<td>ENGL 150 Expository Writing ........................................ (3)</td>
<td>PHED 102 Physical Education Activities ............... (0)</td>
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<td>MATH 223 Calculus for Science and Engineering III .. (3)</td>
<td>MATH 224 Elementary Differential Equations .......... (3)</td>
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<td>MATH 308 Abstract and Linear Algebra II ............ (3)</td>
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<td>GER Course .......................................................... (3)</td>
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<tr>
<td>Course in selected minor held .................................. (3)</td>
<td>Electives .......................................................... (6)</td>
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<td>Electives .......................................................... (6)</td>
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<td><strong>JUNIOR</strong></td>
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<tr>
<td>MATH 321 Fundamentals of Analysis I ...................... (3)</td>
<td>MATH 322 Fundamentals of Analysis II ................. (3)</td>
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<td>Approved elective in mathematics ................................ (3)</td>
<td>GER Course .......................................................... (3)</td>
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<tr>
<td>Course in selected minor held .................................. (3)</td>
<td>MATH 324 Introduction to Complex Analysis ............ (3)</td>
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<td>or MATH 425 Complex Analysis I ......................... (3)</td>
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<td><strong>SENIOR</strong></td>
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<tr>
<td>Course in selected minor field ................................ (3)</td>
<td>GER Course .......................................................... (3)</td>
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<td>Approved elective in mathematics ................................ (3)</td>
<td>Approved elective in mathematics ....................... (3)</td>
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<tr>
<td>Electives .......................................................... (9)</td>
<td>Electives .......................................................... (9)</td>
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</table>
MATH 308. Introduction to Abstract Algebra II (3)
Continuation of MATH 307. Prerequisite: MATH 307.

MATH 321. Fundamentals of Analysis I (3)
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. Prerequisite: MATH 223.

MATH 322. Fundamentals of Analysis II (3)
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. Prerequisite: MATH 321.

MATH 323. Advanced Calculus (3)

**BACHELOR OF SCIENCE IN APPLIED MATHEMATICS**

**Fall Semester**

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<tr>
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<tr>
<td>Open elective or humanities/social science</td>
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<tr>
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<tr>
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<td>(1-3-2)e</td>
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<tr>
<td>MATH 121 Calculus for Science and Engineering I</td>
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<tr>
<td>ENGL 150 Expository Writing</td>
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<td>PHED 100 Physical Education Activities</td>
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<tr>
<td>PHYS 122 General Physics II</td>
<td>(4-0-4)c</td>
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<tr>
<td>MATH 223 Calculus for Science and Engineering III</td>
<td>(3-0-3)</td>
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<tr>
<td>MATH 304 Discrete Mathematics</td>
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<td>GER: Humanities or Social Science Sequence III</td>
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<td>MATH 307 Abstract and Linear Algebra I</td>
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<td>MATH 321 Fundamentals of Analysis I</td>
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<td>GER: Humanities or social science elective</td>
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<td>Open elective</td>
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**Spring Semester**

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<td>GER: Science Sequence II</td>
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<td>ENGR 131 Elementary Computer Programming</td>
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<td>MATH 122 Calculus for Science and Engineering II</td>
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<td>PHYS 221 General Physics III</td>
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<td>MATH 224 Elementary Differential Equations</td>
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<tr>
<td>GER: Humanities or Social Science Sequence IV</td>
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<tr>
<td>MATH 308 Abstract and Linear Algebra II</td>
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<tr>
<td>MATH 322 Fundamentals of Analysis II</td>
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<tr>
<td>or MATH 323 Advanced Calculus</td>
<td>(3-0-3)</td>
</tr>
<tr>
<td>MATH 324 Introduction to Complex Analysis</td>
<td>(3-0-3)</td>
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<tr>
<td>or MATH 425 Complex Analysis</td>
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Total hours to graduate between 125-128 depending on option.

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a A suitable open elective is MATH 150, Mathematics from a Mathematician’s Perspective. This course must be taken during the FRESHMAN year to count towards the 50 hours requirement for mathematics courses.
b One of these courses must be a humanities/social science elective.
c Selected students may be invited to take the honors sequence, PHYS 123, 124, 223, in place of PHYS 121, 122, 221.
d These two courses must be one of the following sequences: ASTR 201-202, CHEM 105-106, CHEM 107-108, GEOL 110 and one of GEOL 115, 210

e BIOC 314, BIOL 111, CHEM 113, GEOL 119, PHYS 203 are appropriate.
**BACHELOR OF SCIENCE IN MATHEMATICS DEGREE**

<table>
<thead>
<tr>
<th>Fall Semester</th>
<th>Class/Lab/Credit Hours</th>
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<tr>
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<tr>
<td>Open elective or humanities/social science ..........  (3-0-3)(^a)</td>
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<tr>
<td>GER: Science sequence I ..................................  (3-0-3)(^d)</td>
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<tr>
<td>CMPS 131 Elementary Computer Programming .......... (2-2-3)</td>
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<td>MATH 121 Calculus for Science and Engineering I .. (4-0-4)</td>
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<td>ENGL 150 Expository Writing ................................(3-0-3)</td>
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<td>PHED 101 Physical Education Activities ............... (0-3-0)</td>
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<tr>
<td>GER: Humanities or Social Science Sequence I .......  (3-0-3)</td>
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<tr>
<td>MATH 223 Calculus for Science and Engineering III ..(3-0-3)</td>
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<td>MATH 307 Abstract and Linear Algebra I ............. (3-0-3)</td>
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<td>PHYS 122 General Physics II ............................ (4-0-4)(^c)</td>
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<tr>
<td>GER: Humanities or social science elective .......... (3-0-3)</td>
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<tr>
<td>Approved elective ........................................... (3-0-3)</td>
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<tr>
<td>Approved elective ........................................... (3-0-3)</td>
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<tr>
<td>Open elective.................................................. (3-0-3)</td>
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<tr>
<td>Open elective.................................................. (3-0-3)</td>
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<tr>
<td><strong>Total</strong> ................................................................... (18-0-18)</td>
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</tbody>
</table>

Hours required for graduation: 126.

The Bachelor of Science in Mathematics degree requires a minimum of 50 hours of mathematics courses, which must include MATH 121, 122, 223, or 224, or an equivalent sequence and MATH 307, 308, 321, 322 or 323, 324, or 425.

“Approved electives” must be approved by the student’s major advisor and may include no more than three courses from other departments. In addition the degree allows eleven open electives.

**Spring Semester**

<table>
<thead>
<tr>
<th>Class/Lab/Credit Hours</th>
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<tbody>
<tr>
<td><strong>FRESHMAN</strong></td>
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<tr>
<td>Humanities/social science or open elective ..........  (3-0-3)(^b)</td>
</tr>
<tr>
<td>GER: Science Sequence II ................................ (3-0-3)(^d)</td>
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<tr>
<td>Approved Science Laboratory ................................(1-3-2)</td>
</tr>
<tr>
<td>PHYS 121 General Physics I ............................ (4-0-4)(^c)</td>
</tr>
<tr>
<td>PHED 102 Physical Education Activities ............... (0-3-0)</td>
</tr>
<tr>
<td><strong>Total</strong> ................................................................... (15-6-15)</td>
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<thead>
<tr>
<th><strong>SOPHOMORE</strong></th>
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<tbody>
<tr>
<td>GER: Humanities or Social Science Sequence II .......  (3-0-3)</td>
<td></td>
</tr>
<tr>
<td>MATH 224 Elementary Differential Equations ........ (3-0-3)</td>
<td></td>
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<tr>
<td>MATH 308 Abstract and Linear Algebra II ............. (3-0-3)</td>
<td></td>
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<tr>
<td>PHYS 221 General Physics III .......................... (3-0-3)(^e)</td>
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<tr>
<td>Approved elective ........................................... (3-0-3)</td>
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<tr>
<td><strong>Total</strong> ................................................................... (15-0-15)</td>
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<tr>
<th><strong>JUNIOR</strong></th>
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<tbody>
<tr>
<td>GER: Humanities or Social Science Sequence IV ....... (3-0-3)</td>
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<tr>
<td>MATH 322 Fundamentals of Analysis II .................. (3-0-3)</td>
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<tr>
<td>or MATH 323 Advanced Calculus ........................ (3-0-3)</td>
<td></td>
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<tr>
<td>MATH 324 Introduction to Complex Analysis .......... (3-0-3)</td>
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<tr>
<td>or MATH 425 Complex Analysis I ........................ (3-0-3)</td>
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<tr>
<td>Approved elective ........................................... (3-0-3)</td>
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<tr>
<td><strong>Total</strong> ................................................................... (15-0-15)</td>
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<tr>
<th><strong>SENIOR</strong></th>
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<tr>
<td>GER: Humanities or social science elective .......... (3-0-3)</td>
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<tr>
<td>Approved elective ........................................... (3-0-3)</td>
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<td>Approved elective ........................................... (3-0-3)</td>
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<tr>
<td>Approved elective ........................................... (3-0-3)</td>
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<tr>
<td>Open elective.................................................. (3-0-3)</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong> ................................................................... (15-0-15)</td>
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</tr>
</tbody>
</table>

The following courses cannot be counted towards the 50 hours required for the major: MATH 101, 105, 106, 201, 470.

Students wishing to emphasize computing should take MATH 304, 343, and 410 along with suitable courses from the Department of Computer Engineering and Science.

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\(^a\) A suitable open elective is MATH 150, Mathematics from a Mathematician’s Perspective. This course must be taken during the FRESHMAN year to count towards the 50 hours requirement for mathematics courses.

\(^b\) Selected students may be invited to take the honors sequence, PHYS 121, 122, 123, in place of PHYS 121, 122, 221.

\(^c\) These two courses must be one of the following sequences: ASTR 201-202, CHEM 105-106, CHEM 107-108, GEOL 110 and one of GEOL 115, 210.

\(^d\) One of these courses must be a humanities/social science elective.

\(^e\) BIOL 111, CHEM 113, GEOL 119, PHYS 203 are appropriate.
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. Prerequisite: MATH 223 or consent.

MATH 330. Scientific Computing: Fundamentals and Applications (3)
An introductory survey to Scientific Computing, from principles to applications. Topics include accuracy and efficiency, conditioning and stability, numerical solution of linear and nonlinear systems, optimization, interpolation, quadrature rules, numerical solutions of ODEs and PDEs. Corequisite: MATH 224.

MATH 338. Introduction to Dynamical Systems (3)
Nonlinear discrete dynamical systems in one and two dimensions. Chaotic dynamics, elementary bifurcation theory, hyperbolicity, symbolic dynamics, structural stability, stable manifold theory. Prerequisite: MATH 223.

MATH 343. Theoretical Computer Science (3)
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/ECES 343 and MATH 410 cannot both be taken for credit. Prerequisites: MATH 304 and ECES 340. Cross-listed as ECES 343.

MATH 345. Introduction to Applied Mathematics (3)

MATH 350. Domain Theoretic Methods for Artificial Intelligence (3)

MATH 363. Knot Theory (3)
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. Prerequisite: MATH 223.

MATH 380. Introduction to Probability (3)

GRADUATE COURSES

MATH 401. Abstract Algebra I (3)
Basic properties of groups, rings, modules and fields. Isomorphism theorems for groups; Sylow theorem; nil potency 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. Prerequisite: MATH 308.

MATH 402. Abstract Algebra II (3)
A continuation of MATH 401. Prerequisite: MATH 401.

MATH 406. Mathematical Logic and Model Theory (3)

MATH 408. Introduction to Cryptology (3)
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. Prerequisite: MATH 303.

MATH 410. Automata and Formal Languages (3)
Finite automata, Turing and Post machines, and pushdown automata. The languages generated, accepted, and decided by these machines. Closure properties. Decidability and undecidability. Regular expressions. Right linear, unrestricted, and context-free grammars. MATH 410 and MATH/ECES 343 cannot both be taken for credit. Prerequisite: MATH 304. Cross-listed as ECES 440.

MATH 413. Graph Theory (3)
Building blocks of a graph, trees, connectedness, transversability connectedness, transversability, matching, coverings, planarity, and NP-complete problems; various applications and algorithms. Prerequisite: MATH 201 or MATH 308 or MATH 470.

MATH 415. Group Representation Theory (3)
Representation and character theory of finite groups and certain (infinite) compact groups. Fundamental concepts and methods of the theory together with examples which are useful, particularly in quantum chemistry or physics. Suitable for undergraduates and graduates who have some acquaintance with linear algebra and group theory. Prerequisite: MATH 308.

MATH 421. Fundamentals of Analysis I (3)
(See MATH 321.) Additional work required. (May not be taken for credit by graduate students in the Department of Mathematics.) Corequisite: MATH 223.
MATH 422. Fundamentals of Analysis II (3)
(See MATH 322.) Additional work required. (May not be taken for credit by graduate students in the Department of Mathematics.) Prerequisite: MATH 321.

MATH 423. Introduction to Real Analysis I (3)

MATH 424. Introduction to Real Analysis II (3)

MATH 425. Complex Analysis I (3)
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. Prerequisite: MATH 422.

MATH 427. Convexity and Optimization (3)
(See MATH 327.) Cross-listed as OPRE 427.

MATH 428. Fourier Analysis (3)

MATH 431. Introduction to Numerical Analysis I (3)
Numerical linear algebra for scientists and engineers. Matrix and vector norms, computer arithmetic, conditioning and stability, orthogonality. Least squares problems: QR factorization, normal equations and Singular Value Decomposition. Direct solution of linear system: Gaussian elimination and Cholesky factorization. Eigenvalues and eigenvectors: the QR algorithm, Rayleigh quotient, inverse iteration. Introduction to iterative methods. Students will be introduced to MATLAB. Prerequisite: One of MATH 201, MATH 308, or MATH 470.

MATH 432. Numerical Differential Equations (3)

MATH 434. Optimization of Dynamic Systems (3)

MATH 445. Introduction to Partial Differential Equations (3)
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. Prerequisites: MATH 201 and MATH 224.

MATH 448. Applied Partial Differential Equations (3)
Continuation of MATH 445. Linear and nonlinear partial differential equations, with emphasis on applications. Variational methods; asymptotic and perturbation methods: regular and singular perturbations; boundary layer, multiple scales, method of geometric optics and stationary phase. Applications to fluid dynamics, elasticity; optics; wave propagation. Topics depend upon instructor and may vary from year to year. Appropriate for seniors and graduate students in science, engineering and mathematics. Prerequisite: MATH 445.

MATH 450. Domain Theoretic Methods for Artificial Intelligence (3)

MATH 452. Continuum Mechanics (3)

MATH 460. Mathematics and the Imagination (3)
This course explores mathematical ideas in geometry, algebra, and combinatorics relating to content areas in the secondary school curriculum. The course is structured around a series of problems and projects not generally covered in the undergraduate curriculum. This course is designed for present and future mathematics teachers in secondary schools. It is offered as an intensive, three-week seminar. Requirements for the class include daily reading assignments and problems taken from the readings. Considerable time will be devoted to group work. Each student will be required to prepare a report and make a 30-minute
presentation to the class on a topic relevant to the materials developed in the course.

MATH 461. Introduction to Topology (3)

MATH 462. Algebraic Topology (3)
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. Prerequisite: MATH 461.

MATH 465. Differential Geometry (3)
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. Prerequisite: MATH 321.

MATH 466. Vector Bundles (3)
Theory of vector bundles and fiber bundles. Vector bundles; structure groups; Lie groups and homogeneous spaces; Grassmann and Stiefel manifolds; classifying spaces for vector bundles; characteristic homotopy and homology classes. MATH 201 or MATH 307 recommended. Prerequisite: MATH 321.

MATH 467. Differentiable Manifolds (3)
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. Prerequisite: MATH 322.

MATH 469. Calculus of Variations (3)
Examples of variational problems; variation of a functional; linear spaces; Frechet derivative; Euler Lagrange equations; Lagrange multipliers; Hamiltonian formulation; canonical coordinates; Noether’s theorem; second variation; conjugate points; direct methods. Other topics such as existence and regularity of solutions; Sobolev spaces; depending on audience. Prerequisite: MATH 224.

MATH 470. Matrix Theory (3)
Matrix theory with emphasis on techniques useful for applications. Matrices, determinants, orthogonality, some linear algebra, material on canonical forms, applications to systems of equations, differential equations, variational principles. Students may take only one of MATH 201, MATH 307, or MATH 470 for credit. Prerequisite: MATH 224.

MATH 471. Advanced Engineering Mathematics (3)
Vector analysis, Fourier series and integrals. Laplace transforms, separable partial differential equations, and boundary value problems. Bessel and Legendre functions. Emphasis on techniques and applications. Students may not take both MATH 345 and MATH 471 for credit. Prerequisite: MATH 224.

MATH 475. Mathematics of Imaging in Industry and Medicine (3)
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 NMR; survey of applications. Prerequisites: PHYS 431 and MATH 345 or MATH 471.

MATH 487. Stochastic Processes in Engineering and Science (3)

MATH 491. Probability I (3)

MATH 492. Probability II (3)

MATH 495. Combinatorics (3)

MATH 501. Topics in Algebra (3)
Selected topics from fields, rings, and modules. Prerequisite: MATH 402.

MATH 504. Algebra Seminar (1-3)

MATH 527. Functional Analysis (3)
Prerequisites: MATH 424 and MATH 425.

MATH 529. Analysis Seminar (1-3)

MATH 531. Advanced Numerical Analysis (3)
Special topics course. Prerequisite: MATH 431.

MATH 541. Partial Differential Equations (3)
Special topics course. Prerequisites: MATH 424 and MATH 445.

MATH 553. Applied Mathematics Seminar (1-3)

MATH 563. Topology Seminar (1-3)
Continuing seminar on areas of current interest in topology and geometry. Topics may include: minimal submanifolds; hyperbolic geometry and diffeomorphisms of surfaces; global analysis; discrete dynamical systems; gauge theory; symplectic geometry; closed geodesics. May be taken more than once for credit.

MATH 592. Stochastic Processes II (3)
Einstein-Smoluchowski and Ornstein-Uhlenbeck models of Brownian motion. Stochastic integration. The Ito and Stratonovich integrals. The stochastic Ito calculus and stochastic differential equa-
tions (SDEs). Stochastic flows in a random environment. Approximation of SDEs by random ordinary differential equations. SDEs as diffusion processes and partial differential equations. Comparison theorems and positivity results for SDEs. Stationary solutions and stability properties of SDEs. Prerequisites: MATH 424 and MATH 492.

**MATH 595. Special Topics in Probability (3)**
Topics of current research interest in probability and stochastic processes. Topics may change from year to year.

**MATH 601. Reading and Research Problems (1-18)**
Presentation of individual research, discussion, and investigation of research papers in a specialized field of mathematics.

**MATH 651. Thesis (M.S.) (1-18)**
**MATH 701. Dissertation (Ph.D.) (1-18)**
**MATH 702. Appointed Dissertation Fellow (9)**

### Department of Modern Languages and Literatures

**Chinese**
*Comparative Literature*

**French**

**German**

**Italian**

**Japanese**

**Literature**

**Russian**

**Spanish**

201 Guilford House
Phone 216-368-3071; Fax 216-368-2216

**FACULTY**

Marie-Pierre Le Hir, Chair

**Christine Cano, Ph.D. (Yale University)**

**Marie-Pierre Le Hir, Chair**

**201 Guilford House**

**Spanish**

201 Guilford House
Phone 216-368-3071; Fax 216-368-2216

**FACULTY**

Marie-Pierre Le Hir, Ph.D. (University of Iowa)

Elizabeth C. and William M. Treuhaft
University Associate Professor of Humanities and Chair of the Department

Nineteenth-century French literature; literary criticism & theory; cultural history; women’s studies.

Christine Cano, Ph.D. (Yale University)

Assistant Professor of French and Comparative Literature

Nineteenth- and Twentieth-century French literature; Proust studies; literary history; 19th century organismism; critical theory.

David P. Bensler, Ph.D. (University of Oregon)

Emile B.de Saucé Professor of Modern Languages

German literature, emphasis on eighteen- and nineteenth-century drama and prose; folklore and tales; modern German culture; methods and bibliography; history of the profession.

Margaretmary Daley, Ph.D. (Yale University)

Associate Professor of German and Comparative Literature

Eighteenth- and nineteenth-century German literature; German women writers; women’s studies; feminist literary criticism.

Linda C. Ehrlich, Ph.D. (University of Hawaii/ East-West Center)

Associate Professor of Japanese and Comparative Literature

Cinema and art; emphasis on Asian (Japanese) cinema; traditional Asian theatre; set design, landscape architecture and film; Japanese poetry; literature and film; cinema of Spain.

J. Christopher Eustis, Ph.D. (Indiana University)

Visiting Associate Professor of Spanish

Portuguese and Comparative Literature

Twentieth-century Spanish literature; contemporary women writers; poetry; literary translation; German culture

Takao Hagiwara, Ph.D. (University of British Columbia)

Assistant Professor of Japanese and Comparative Literature

Japanese literature, especially modern prose and poetry; classical and modern Japanese literature; pre-modern Japanese sensibilities and postmodernism.

Jacqueline C. Nanfito, Ph.D. (University of California, Los Angeles)

Assistant Professor of Spanish and Comparative Literature

Colonial and nineteenth-century Latin American literature; Golden Age Hispanic literature; literary theory; Chicano literature; contemporary Latin American women writers.

Peter Jianhua Yang, Ph.D. (University of Utah)

Jesse Hauk Shera Assistant Professor of German, Chinese, and Comparative Literature; Director, Language Laboratory

German literature, emphasis on twentieth-century German literature; German theater; technology-enhanced language teaching; teaching pedagogy; business German; theatricality.

Armando F. Zubizarreta, Ph.D. (University of Salamanca, Spain)

Professor Emeritus of Spanish and

Comparative Literature

Twentieth-century Spanish and Latin American literature; literary theory.

**LECTURERS & ADJUNCT FACULTY**

Gerd Bayer
Lecturer in German
Margaret Fitzgerald, M.A. (Ohio State University)
Lecturer in Japanese
Estefania Herschel-Junyent
Lecturer in Spanish
Yuxiu Liang, M.A. (Beijing Foreign Language Institute)
Lecturer in Chinese
Sharon Scinicariello, Ph.D. (University of North Carolina, Chapel Hill)

Adjunct Assistant Professor in French
Christine Valadon, M.A. (University of Akron)

Lecturer in French

**PROGRAMS**

The Department of Modern Languages and Literatures offers courses of study leading to the Bachelor of Arts with a major or minor in comparative literature, French, German, Japanese, and Spanish. In addition, course work and a minor is available in Chinese, Italian and Russian. Unless an individual General Bulletin description indicates otherwise, all courses on the 200 level and higher in modern languages and literatures are taught primarily in the language being learned. In addition to class meetings, language resource center attendance is an integral part of all elementary and intermediate language courses taught by the department. At the graduate level, the Master of Arts degree may also be earned as detailed below. Career opportunities exist in college and university teaching, translation and interpretation, diplomatic and other government service, and business, and are often enhanced by a double major, one of which is a modern language. A program leading to the Teacher License in French (Grades K-12) is also available.

**Departmental Objectives**

The department (DMLL) offers students key components of a liberal arts education by helping them learn additional languages, compare literatures, and study cultures. Students become informed citizens of a diverse world, individuals who are able to compete in and enjoy a wide variety of linguistic and glo-
abal contexts. We encourage students both to embark on a new language and also to build on their prior knowledge. The department enjoys strong interdisciplinary ties with Asian Studies, French Studies, German Studies, International Studies, and Women’s Studies (all described elsewhere in this Bulletin). The department is proud of its German Program Abroad, “The Munich Experience” (offered every two years) and is currently establishing a similar program in Spain, “The Madrid Experience.”

The principal objectives of the department are: 1) to prepare students for lifelong learning in an increasingly multilingual, multicultural world by enabling them to learn to understand, speak, read, and write the language(s) of their choice; 2) to teach selected foreign cultures and their literatures, both in the original language(s) and in translation; 3) to encourage students to study abroad in order to reinforce and strengthen their language skills and to acquire new cultural perspectives and appreciation; 4) to prepare students for graduate study in a number of disciplines; 5) to work as closely as possible with other CWRU departments to provide their majors with useful ancillary skills in languages, literatures, and cultures.

Placement Procedure
Students with prior experience in French, German, and or Spanish, however gained (e.g. in high school with or without AP courses, at another institution, via study abroad, etc.), 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. For exact information on placement testing, please contact, Professor Peter Yang, Director of the Language Resource Center.

UNDERGRADUATE PROGRAMS

Major in Comparative Literature
Majors in comparative literature must complete the following requirements.

1) One sequence: CMPL 211-212, CMPL 290-291, or ENGL 200 and one of those CMPL courses;

2) Language (minimum of four hours): 202 in any language taught in the department. 3) Electives in literature (24 hours): these are to be selected with the approval of the student’s advisor from CMPL, ENGL, JAPN, LITR, FRCH, GRMN, and SPAN offerings. At least 21 hours of electives must be at the 300-level or above, including four 300-level courses in FRCH, GRMN, JAPN, or SPAN as available.

Minor In Comparative Literature (Bachelor of Arts)
Requirements include five 200 and 300 courses in CMPL, including at least CMPL 211-212, CMPL 290-290, or a combination of one of those courses and ENGL 200. Total hours required for the minor: 15.

Major In French, German, Japanese Studies, or Spanish (30-32 hours)
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; 2) to develop a sound understanding of their cultures and literatures. The major in French, German, Japanese Studies, or Spanish consists of 30-32 hours of course work and will vary based on students’ background in the language. Individual counseling and placement tests are provided by the department.

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 CMPL or other related courses).

Related courses are those outside the DMLL offerings which are closely related to French, German, Japanese, Spanish, or Latin American culture as well as those inside DMLL offered in another language or literature. For students placed into the 300-level: ten 300-level courses taught in the language; (or eight 300-level courses plus two CMPL courses or other related courses.)

Minors in Foreign Languages
(CHIN, FRCH, GRMN, JAPN, RUSN, SPAN: 15-19 hours)
The academic policy of Case Western Reserve University is to award credit for a 101 course in any language only upon completion of 102 in that language.

For students placed at the introductory level (no previous knowledge of the language): 101, 102, 201, 202 and one 300-level course.

For students placed at the 200-level or higher: five courses at the 200 and 300 levels.

Undergraduate Honors in Modern Languages and Literatures
The Departmental Honors Program is for especially talented and dedicated majors. Requirements for Honors in Modern Languages and Literatures are: 1) a grade point average of at least 3.5 in the major; 2) an honors thesis (six semester hours of CMPL, FRCH, GRMN, JAPN, or SPAN 398 or 399 beyond the 30-32 hours required for the major) devoted to the investigation of a literary, linguistic, or cultural topic. The thesis 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 in Modern Languages and Literatures is available in the departmental office.

Integrated Graduate Studies Program
The Department of Modern Languages and Literatures participates in the Integrated Graduate Studies Program, which makes it possible to complete both a B.A. and an M.A. in Modern Languages and Literatures within 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 Ph.D. programs. Interested students should note the general requirements and the admission procedures listed elsewhere in this publication.

GRADUATE PROGRAMS
The department offers the Master of Arts degree in French, German, and Spanish and is authorized for doctoral studies as well. The Master of Arts in comparative literature is administered
Chinese Courses (CHIN)

CHIN 101. Elementary Chinese I (4)
(Credit for CHIN 101 only upon completion of CHIN 102.) 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)
Continuation of CHIN 101.

CHIN 201. Intermediate Chinese I (4)
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. Prerequisite: CHIN 102 or equivalent.

CHIN 202. Intermediate Chinese II (4)
Continuation of CHIN 201. Students must attend Language Resource Center in addition to class meetings. Prerequisite: CHIN 201.

CHIN 301. Advanced Chinese I (4)
Students work to achieve fluency in listening, speaking, reading and writing. Students must attend Language Resource Center in addition to class meetings. Prerequisite: CHIN 202 or equivalent.

CHIN 302. Advanced Chinese II (4)
Continuation of CHIN 301.

CHIN 303. Topics in Chinese (3)

CHIN 304. Topics in Chinese (3)

CHIN 399. Independent Studies (1-3)
Directed study for those students who have progressed beyond available course offerings. Prerequisite: Permission of department.

Comparative Literature Courses (CMPL)

CMPL 190. Introduction to Comparative Literature (3)
An introduction to one or more theoretical approaches to literature, combined with practical applications.

CMPL 211. Great Books: Middle Ages to 1600 (3)
St. Augustine; concentration on Dante and major texts of the Renaissance, such as Boccaccio, Machiavelli, Rabelais, Erasmus, and Montaigne.

CMPL 212. Great Books: 1600 to Present (3)
Readings of major authors, such as Behn, Voltaire, Goethe, and selected writers and thinkers from the 17th century to the present.

CMPL 215. Japanese Popular Culture (3)
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 and Banana Yoshimoto. The course introduces students to essential aspects of modern Japanese popular culture and sensibility. Cross-listed as JAPN 215.

CMPL 228. Theater History I (3)
Prerequisites: THTR 123 and THTR 124.

CMPL 229. Theater History II (3)
Modern periods in Western theater history, from the sixteenth century to the turn of the twentieth. The course investigates materials, texts, and artifacts of theaters from the Renaissance to the Modern era. Prerequisites: THTR 123 and THTR 124. Cross-listed as THTR 229.

CMPL 230. Asian Cinema and Drama (3)
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. Cross-listed as ASIA 230.

CMPL 240. Modern Japanese Literature in Translation (3)
Focus on the major genres of modern Japanese literature, including haikai and renga poetry, kabuki, travel diary, short story, and novel (Shosetsu). The approach is chronological, from 1600 to the present, placing the texts, their writers, and readers in the historical and social context of each age. No knowledge of Japanese language or history is assumed. Lectures, readings, and discussions are in English. Films and slides complement course readings. Cross-listed as JAPN 240.

CMPL 241. Classical Japanese Literature in Translation (3)
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/contrasted with those of Western and other cultures. Cross-listed as JAPN 241.

CMPL 275. Postcolonial Francophone Literature (3)
Study of literary and cinematic works from the postcolonial Francophone world. Includes examination of the issue of identity (individual, cultural, national) and of the ways these works negotiate their respective cultural and colonial legacies. May include writers such as Beyala, Jen Jelloun, Conde, Ba, Cesaire, and Khatibi.

CMPL 290. Masterpieces of Continental Fiction (3)
Major works of fiction from the 19th century and earlier. Cross-listed as ENGL 290.

CMPL 291. Masterpieces of Modern Fiction (3)
Major works of fiction of the 20th century. Cross-listed as ENGL 291.

CMPL 300. Turning Points in Modern Culture (3)
Focus on major west European cities as catalysts and reflectors of cultural and historical change; in-depth study of theory and practice using literature, music, painting, and philosophy: e.g., Vienna at the turn of the century; berlin and the Weimar Republic; Paris at the turn of the century.
CMPL 314. Love Poetry from Sappho to Shakespeare (3)
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. Cross-listed as CLSC 314.

CMPL 315. Utopia and Utopianism (3)
Sir Thomas More’s Utopia (1515) inaugurated a literary genre depicting the ideal community. This class traces this genre from More to recent science fiction (Piercy, Calvino, Butler), pausing to consider the writings of the “Utopian socialists” (Saint Simon, Fourier).

CMPL 330. Studies in Fiction: The Novella (3)
Development of the novella since Boccaccio and Cervantes; emphasis on 19th and 20th century German and Russian authors (Goethe, Mann, Kafka, Dostoevsky, Tolstoy, Chekhov, and others); some French, Spanish, and Italian novellas. Taught in English, with additional instruction for students reading texts in the original language.

CMPL 338. Trends in Recent Fiction (3)
Readings, in English translation, of contemporary fiction from around the world; analysis and comparison of recent literary trends in various national settings.

CMPL 341. Japanese Women Writers (3)
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. Cross-listed as JAPN 341.

CMPL 361. Modern Japanese Novels and the West (3)
Comparing a selection of modern Japanese novels with their western counterparts, this course will clarify Japan’s premodern sensibility and its transformation after the Meiji Restoration (1868). Comparisons will focus on a group of interrelated themes such as modernity/modernism, alienation, innocence, death, male-female relationships, and Nature. All readings are in English translation. No prior training in Japanese language of culture required.

CMPL 368A. Introduction to Film Studies (3)
Cross-listed as ENGL 368A.

CMPL 368C. Topics in Film (3)
Individual topics in film, such as a particular national cinema, images of women in film, film comedy, New Wave film, literature and film. Maximum 12 credits. Prerequisite: ENGL 150. Cross-listed as ENGL 368C.

CMPL 370. The Divine Comedy (3)
A study of one of the major works of world literature, La Commedia, beginning with a reading of La Vita Nuova as background. Discussion centers on: 1) the social, literary, political, philosophical, and theological contexts of the work; 2) its enduring impact on Western literature and thought.

CMPL 371. Philosophy and Literature (3)
Affinities and tensions between philosophy and literature and issues that arise in their interface. Topics include: philosophical use of literary devices; literary use of philosophical ideas; literary philosophy and philosophical literature; and hermeneutics of literature and philosophy. Readings in philosophy and literature from both traditional and contemporary sources. Team-taught by faculty of the philosophy and literature departments. Cross-listed as PHIL 370.

CMPL 390. Topics in Comparative Literature (3)
In-depth examination of specific critical and literary theories and of their relevance for literature and culture studies. Authors, works and instructor may vary.

CMPL 399. Independent Studies (1-3)
For qualified students with special interests and commitments that are not fully addressed in regular courses. Directed readings and meetings. Prerequisite: Consent of department.

CMPL 590. Seminar on Pierre Bourdieu (3)
Examination of Pierre Bourdieu’s critical work, including the analysis of particular case studies. Participants in the seminar build on acquired theoretical knowledge to complete a research project using Bourdieu’s approach. Prerequisite: Graduate standing.

CMPL 595. Independent Studies (1-3)
For qualified graduate students with special interests and commitments that are not fully addressed in regular courses. Directed readings and meetings. Prerequisite: Graduate standing. Corequisite: Consent of department.

CMPL 601. Independent Study (1-18)
Prerequisite: Consent of department.

FRENCH COURSES (FRCH)
FRCH 101. Elementary French I (4)
(Credit for FRCH 101 only upon completion of FRCH 102.) Emphasizes conversational skills. Students expected to achieve control of sound system and basic sentence structures of French. Students must attend Language Resource Center in addition to scheduled class meetings.
FRCH 102. Elementary French II (4)
Continuation of FRCH 101. Prerequisite: FRCH 101.
FRCH 103. Basic Conversational French (5)
FRCH 201. Intermediate French I (4)
Intensive review of grammar and usage through readings, discussions and other activities that emphasize contemporary French life. Students must attend Language Resource Center in addition to scheduled class meetings. Prerequisite: FRCH 102 or equivalent.
FRCH 202. Intermediate French II (4)
A continuation of FRCH 201, the course focuses on the acquisition of intermediate-level skills in language and culture while providing insights into the nature of language. Participation in multi-media activities in Language Resource Center is a requirement. Prerequisite: FRCH 201 or equivalent.
FRCH 308. Supervised Study in France (3)
Three-week immersion learning experience living and studying in France, specifically in Bordeaux. Students devote three hours per day to formal study of the French language and its culture while taking advantage of the numerous cul-
tural institutions of the city and the surrounding countryside. Prerequisite: FRCH 202.

FRCH 310. Advanced Composition and Reading (3)
An initiation to the literature of Francophone expression with a focus on close reading. Students engage in the discussion of authentic, unabridged literary texts of compelling interest and progressive length and learn how to express their ideas both orally and in written form. Prerequisite: FRCH 202.

FRCH 311. Advanced Conversation I (3)
Designed to enhance pronunciation, speaking and listening-comprehension through the discussion of French literature and media for children. Required for Teacher candidates. Prerequisite: FRCH 202 or equivalent.

FRCH 312. Advanced Conversation II (3)
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. Prerequisite: FRCH 202.

FRCH 314. Translation Techniques (3)
Contrastive grammar analysis and stylistics are used to foster linguistic awareness and to introduce students to the methods and skills of translation. Prerequisite: FRCH 202 or equivalent.

FRCH 315. Business French (3)
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. Prerequisite: FRCH 202.

FRCH 316. Contemporary France (3)
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. Prerequisite: FRCH 202.

FRCH 317. French Cinema (3)
An exploration of contemporary France, its images and values as presented in French films of the last ten years. French press reviews are used for discussion. A unique linguistic and cultural immersion.

Taught in French. Prerequisite: FRCH 202.

FRCH 318. The Origins of France (3)
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 formation of modern France and continue to influence French actions. Prerequisite: FRCH 202.

FRCH 319. Modern France (3)
A study of France’s political, social and cultural history from the French Revolution to World War II with emphasis on events, movements and people that shaped Modern France. Highly recommended for students of Nineteenth- and Twentieth-Century French Literature. Prerequisite: FRCH 202.

FRCH 320. Introduction to French Literature (3)
Major literary movements, principal writers and outstanding works of French literature. Prerequisite: FRCH 202.

FRCH 321. French Literature to 1600 (3)
Faith. Honor. Passion. Politics. An exploration of these issues in French literature from 900 to 1600 in the context of the development of narrative, lyric and theater and as an expression of culture and thought. Prerequisite: Any 300-level FRCH course.

FRCH 322. French Literature to 1800 (3)
The Age of Classicism, from Descartes to Mme. de Lafayette. Emphasis on Baroque literature and Classical drama. Authors, works and topics may vary. One 300-level French course suggested prerequisite. Prerequisite: Any 300-level FRCH course.

FRCH 323. French Literature to 1900 (3)
The Age of Romanticism, realist novel, detective novel). The tale (the fantastic tale, the fairy tale) or novella. Prerequisite: Any 300-level FRCH course.

FRCH 324. French Literature to 1950 (3)
Faith. Honor. Passion. Politics. An exploration of these issues in French literature from 1600 to 1950 in the context of the development of narrative, lyric and theater and as an expression of culture and thought. Prerequisite: Any 300-level FRCH course.

FRCH 325. French Literature to 2000 (3)
The Age of Modernism, realist novel, detective novel). The tale (the fantastic tale, the fairy tale) or novella. Prerequisite: Any 300-level FRCH course.

FRCH 326. French Literature to 2000 (3)
The Age of the Fantastic, from the Johannine to Kafka. Emphasis on Baroque literature and Classical drama. Authors, works and topics may vary. One 300-level French course suggested prerequisite. Prerequisite: Any 300-level FRCH course.

FRCH 327. French Literature to 2000 (3)
The Age of the Fantastic, from the Johannine to Kafka. Emphasis on Baroque literature and Classical drama. Authors, works and topics may vary. One 300-level French course suggested prerequisite. Prerequisite: Any 300-level FRCH course.

FRCH 328. French Literature to 2000 (3)
The Age of the Fantastic, from the Johannine to Kafka. Emphasis on Baroque literature and Classical drama. Authors, works and topics may vary. One 300-level French course suggested prerequisite. Prerequisite: Any 300-level FRCH course.

FRCH 329. French Literature to 2000 (3)
The Age of the Fantastic, from the Johannine to Kafka. Emphasis on Baroque literature and Classical drama. Authors, works and topics may vary. One 300-level French course suggested prerequisite. Prerequisite: Any 300-level FRCH course.

FRCH 330. French Literature to 2000 (3)
The Age of the Fantastic, from the Johannine to Kafka. Emphasis on Baroque literature and Classical drama. Authors, works and topics may vary. One 300-level French course suggested prerequisite. Prerequisite: Any 300-level FRCH course.

FRCH 331. Seventeenth-Century French Literature (3)
The Age of Classicism, from Descartes to Mme. de Lafayette. Emphasis on Baroque literature and Classical drama. Authors, works and topics may vary. One 300-level French course suggested prerequisite. Prerequisite: Any 300-level FRCH course.

FRCH 332. Eighteenth-Century French Literature (3)
Le siecle des Lumières in representative texts of the Enlightenment and pre-Romanticism. Authors, works and topics vary. Prerequisite: Any 300-level FRCH course.

FRCH 333. Nineteenth-Century French Literature (3)
Romanticism, realism and naturalism in the novel and the drama. Authors, works and topics vary. Prerequisite: Any 300-level FRCH course.

FRCH 334. Twentieth-Century French Literature (3)
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 vary. Prerequisite: Any 300-level FRCH course.

FRCH 335. Topics in French Poetry (3)
Nineteenth- and twentieth-century poetry. Topics include French romanticism, symbolism and surrealism. Prerequisite: Any 300-level FRCH course.

FRCH 336. Topics in French Drama (3)
A topical approach to issues and problems specific to drama. Plays, playwrights, aesthetic theories and historical periods studied in this course may vary. Prerequisite: Any 300-level FRCH course.

FRCH 337. The Novel and the Novella (3)
A study of narrative fiction focused on either the analysis of a particular genre (the novel, the short story) or a particular type of novel (e.g., psychological novel, realist novel, detective novel); the tale (the fantastic tale, the fairy tale) or novella. Prerequisite: Any 300-level FRCH course.

FRCH 338. Major Writers and Literary Movements (3)
In-depth study of the work of a major writer, cineast, or intellectual figure; or of a significant literary, intellectual or artistic movement. Approaches, content, and instructor will vary. Prerequisite: Any 300-level FRCH course.

FRCH 339. Francophone Literature (3)
An examination of Francophone literature focused on the problems of identity within the colonial and post-colonial context. Writers and works may vary. Prerequisite: Any 300-level FRCH course.

FRCH 340. Women Writers (3)
Examination of literary texts by French women writers; emphasizes women’s important contributions to French literature. Critical essays are also studied to address women’s relation to literature and to evaluate its importance from historical and theoretical perspectives. Prerequisite: Any 300-level FRCH course.

FRCH 341. Special Topics (3)
The special topics course is designed to respond to students’ and faculty’s interest in specific themes or issues not otherwise covered in the curriculum. Approaches, content and instructor will vary. Prerequisite: Any 300-level FRCH course.

FRCH 342. Honors Thesis (3)
Prerequisite: Permission of department.
FRCH 399. Directed Reading (1-3)
For students who wish to work independently on a topic, literary or nonliterary, in French. Prerequisite: Permission of department.

FRCH 421. French Literature to 1600 (3)
(See FRCH 321.)

FRCH 431. Seventeenth-Century French Literature (3)
(See FRCH 331.)

FRCH 441. Eighteenth-Century French Literature (3)
(See FRCH 341.)

FRCH 451. Nineteenth-Century French Literature (3)
(See FRCH 351.)

FRCH 461. Twentieth-Century French Literature (3)
(See FRCH 361.)

FRCH 471. Topics in French Poetry (3)
(See FRCH 371.)

FRCH 472. Topics in French Drama (3)
(See FRCH 372.)

FRCH 473. The Novel and the Novella (3)
(See FRCH 373.)

FRCH 474. Major Writers and Literary Movements (3)
(See FRCH 374.)

FRCH 475. Francophone Literature (3)
(See FRCH 375.)

FRCH 476. Women Writers (3)
(See FRCH 376.)

FRCH 477. Special Topics (3)
(See FRCH 377.)

FRCH 595. Independent Research (1-3)
Graded independent work on a literary topic arranged individually with the instructor. Prerequisite: Graduate standing.

FRCH 601. Independent Studies (1-18)
For individual students or larger groups with special interests. Prerequisite: Consent of department.

GERMAN COURSES

GRMN 101. Elementary German I (4)
(Credit for GRMN 101 only upon completion of GRMN 102.) Introductory course emphasizing conversational skills. Students achieve control of sound system and basic sentence structures of spoken and written German. Students must attend the Language Resource Center in addition to class meetings.

GRMN 102. Elementary German II (4)
Continuation of GRMN 101, emphasizing conversational skills. Prerequisite: GRMN 101 or equivalent.

GRMN 201. Intermediate German I (4)
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. Prerequisite: GRMN 102 or equivalent.

GRMN 202. Intermediate German II (4)
Continuation of GRMN 201; conducted in German. Study of texts and videotapes which focus on contemporary life in Germany. Prerequisite: GRMN 201 or equivalent.

GRMN 303. German Culture and Civilization (3)
Examines aspects of contemporary Germany, including political and social systems and cultural life through study of texts, films, and other media. Prerequisite: GRMN 202.

GRMN 308. Supervised Study in German (3)
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. Prerequisite: GRMN 202 or equivalent.

GRMN 310. Advanced Composition and Reading (3)
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 and also to produce increasingly sophisticated expository compositions in German. Read contemporary newspaper and magazine articles; practice composition skills by composing objective summaries, reviews, precis, letters, e-mail, short creative texts, and other miscellaneous written forms. Readings increase progressively in length and vary in genre. Includes instruction on use of English- and German-language research tools, German-German dictionaries, and study guides. Concludes with a short, sophisticated literary work, such as Fontane’s Effi Briest or Mann’s Death in Venice. Satisfies prerequisite for upper-level Germanics seminars or may be taken simultaneously with an upper-level course (321 or higher); taught in German. Prerequisite: GRMN 202 or equivalent.

GRMN 311. Advanced Conversation (3)
Students work to improve fluency in spoken German. Topics include contemporary issues; current vocabulary is stressed. Students practice using speech appropriate to various situations. Prerequisite: GRMN 202 or equivalent.

GRMN 312. German Proficiency Through Drama (3)
Focus on reading, enacting, and discussing of authentic dramatic texts. 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. Although we will pay attention to the cultural and theatrical milieu from which each play arose, we will focus on the dramatic text as literature and as a text written for performance. Elements of drama, such as dialogue, character and dramatic structure, as well as the genres of tragedy, comedy, and tragicomedy are introduced. Prerequisite: GRMN 202 or equivalent.

GRMN 313. Introduction to German Literature (3)
Introduction to German literature and the cultural issues it addresses. Prerequisite: GRMN 202 or equivalent.

GRMN 315. The Female Self: German Women Writers (3)
Intensive study of several German women authors whose writing seeks to delineate a female self. An ultimate objective of the course is to debate the gender-specific approach asking whether women write differently than men and whether we read women authors differently than we do men.

GRMN 326. Witches, Weddings, and Wolves (3)
Intensive study of German Folk Tales as collected and altered by the Brothers Grimm. The Maerchen as both children’s and adult literature.

GRMN 330. The German Novelle (3)
Study of exemplary short prose fiction by authors from the eighteenth to the twentieth century. Continues development of communicative ability in German; introduces students to German literature’s arguably richest genre. Prerequisite: GRMN 202 or equivalent.

GRMN 331. Topics in German Cinema (3)
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. Prerequisites: GRMN 202 and one GRMN 300-level course or equivalent.

**GRMN 366. From Lessing to Young Goethe (3)**
Theory and literature of the mid-eighteenth century. Focus on the works of Lessing, young Goethe and young Schiller and the writers of the Storm and Stress. Prerequisite: GRMN 202 or equivalent.

**GRMN 367. German Classicism/Romanticism (3)**
Selected works of Goethe, Schiller, Hölderlin, von Kleist, and others. Prerequisite: GRMN 202.

**GRMN 375. 19th-Century German Literature (3)**
Major works chosen to present prominent themes and problems and/or important developments within the period; topic varies. Prerequisite: GRMN 202.

**GRMN 380. 20th-Century German Literature I (3)**
Study of major works chosen to present themes and problems in naturalism, expressionism, and other important literary and cultural developments within the period before World War II. Prerequisite: GRMN 202 or equivalent.

**GRMN 386. 20th-Century German Literature II (3)**
Post World War II German literary and cultural developments. Focus on efforts to come to grips with German history from 1933 to German reunification. Prerequisite: GRMN 202 or equivalent.

**GRMN 395. Special Topics (3)**
Special topics in German literature, literary criticism, and culture. Prerequisite: GRMN 202 or equivalent.

**GRMN 398. Senior Thesis (3)**
An elective which involves the writing of a substantial research paper in German. Exceptional papers may be considered for departmental honors. Prerequisites: Senior status and consent of department.

**GRMN 399. Independent Study in German (1-3)**
For majors and advanced students under special circumstances. Prerequisite: Consent of department.

**GRMN 405. Literature and Life in Contemporary German-Speaking Countries (3)**
Exploration and analysis of selected German, Austrian, and Swiss writers and of the critical and popular media around them. Focus on representative examples of various genres; drama, fiction, autobiographical prose, interviews, lyric poetry; selections from Spiegel, FAZ, Zeit, and other major representatives of the media. Prerequisite: GRMN 202.

**GRMN 408. Supervised Study in Germany (3)**
(See GRMN 308.)

**GRMN 415. The Female Self: German Women Writers (3)**
(See GRMN 315.)

**GRMN 426. Witches, Weddings, and Wolves (3)**
(See GRMN 326.)

**GRMN 430. The German Novelle (3)**
(See GRMN 330.)

**GRMN 466. From Lessing to Young Goethe (3)**
(See GRMN 366.)

**GRMN 467. German Classicism/Romanticism (3)**
(See GRMN 367.)

**GRMN 475. 19th-Century German Literature (3)**
(See GRMN 375.)

**GRMN 480. 20th-Century German Literature I (3)**
(See GRMN 380.)

**GRMN 486. 20th-Century German Literature II (3)**
(See GRMN 386.)

**GRMN 495. Special Topics (3)**
(See GRMN 395.)

**GRMN 499. Independent Study in German (1-3)**
(See GRMN 399.)

**JAPANESE COURSES (See also CMPL)**

**JAPN 101. Elementary Japanese I (4)**
(Credit for JAPN 101 only upon completion of JAPN 102.) Introduction to speaking, understanding, reading, and writing Japanese. Students expected to achieve control of the sound system and basic structure of the language. Emphasizes aural comprehension and speaking.

**JAPN 102. Intermediate Japanese II (4)**
Continuation of JAPN 101. Emphasizes aural comprehension speaking and reading of Katakana. Prerequisite: JAPN 101.

**JAPN 201. Intermediate Japanese I (4)**
Emphasizes basic structures of Japanese and helps students improve reading, writing, listening and speaking abilities. Students read Hiragana as well as Katakana. Prerequisite: JAPN 102 or equivalent.

**JAPN 202. Intermediate Japanese II (4)**
Continuation of JAPN 201. Students read Kanji as well as Katakana and Hiragana. Prerequisite: JAPN 201.

**JAPN 215. Japanese Popular Culture (3)**
Cross-listed as CMPL 215.

**JAPN 240. Modern Japanese Literature in Translation (3)**
Focus on the major genres of modern Japanese literature, including haikai and renga poetry, kabuki, travel diary, short story, and novel (Shosetsu). The approach is chronological, from 1600 to the present, placing the texts, their writers, and readers in the historical and social context of each age. No knowledge of Japanese language or history is assumed. Lectures, readings, and discussions are in English. Films and slides complement course readings. Cross-listed as CMPL 240.

**JAPN 241. Classical Japanese Literature in Translation (3)**
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/contrasted with those of Western and other cultures. Cross-listed as CMPL 241.

**JAPN 301. Advanced Japanese I (4)**
Emphasizes conversational proficiency and reading Kanji. Students must attend the language lab in addition to class meetings. Prerequisite: JAPN 202 or equivalent.

**JAPN 302. Advanced Japanese II (4)**
Continuation of JAPN 301; emphasizes conversational proficiency and reading. Japanese life and culture introduced through supplemental materials and activities. Students must attend the language lab in addition to regular scheduled class meetings. Prerequisite: JAPN 301.

**JAPN 303. Topics in Japanese I (3)**
Students in this course will work with authentic materials to improve proficiency in Japanese. Subject matter varies but emphasis is on contemporary culture of Japan. Prerequisite: JAPN 302.

**JAPN 341. Japanese Women Writers (3)**
Contributions of women writers to the literature of pre-modern and modern Japan; investigations of how their works ex-
emphasize and diverge from “mainstream” literary practices. Emphasis on the social and cultural contexts of the texts. Crosslisted as CMPL 341.

**JAPN 350. Readings in Japanese (3)**
Stress on development of sophisticated communication skills in Japanese. Reading and discussion of various texts in the original, such as comics (manga), video scripts, essays, news scripts, and literary works. Enhancement of writing and au-
oral/oral proficiency through presentations, listening drills, viewing of videos, and classroom discussion. Prerequisite: JAPN 301 or permission.

**JAPN 351. Japanese in Cultural Context (3)**
Exploration and analysis of selected Japanese writers and the critical and popular media around them. Focus on continued development of skills from JAPN 350 and on representative text samples of various genres: drama, fiction, autobiographical prose, interview, lyric poetry and the press. Prerequisite: JAPN 350 or permission.

**JAPN 398. Senior Colloquium (3)**
A capstone course for the Japanese Studies major. Involves the writing of a substantial research paper in Japanese or English. Exceptional papers may be consid-
ered for honors. Prerequisite: Permission of department.

**JAPN 399. Independent Studies (1-3)**
Directed study for students who have progressed beyond available course offerings. Prerequisite: Permission of department.

**SPANISH COURSES**

**SPAN 101. Elementary Spanish I (4)**
(Credit for SPAN 101 only upon completion of SPAN 102.) Introductory course emphasizing conversational skills. Students achieve control of alphabet, sound system, and basic sentence structures in spoken and written Spanish. Students must attend the Language Resource Center in addition to class meetings.

**SPAN 102. Elementary Spanish II (4)**
Continuation of SPAN 101, emphasizing audiolingual practice. Prerequisite: SPAN 101.

**SPAN 201. Intermediate Spanish (4)**
Intensive review of grammar and usage through readings, discussions, and other activities. Prerequisite: SPAN 102.

**SPAN 202. Introduction to Contemporary Civilization (4)**
Introduction to contemporary Hispanic civilization. Continues grammar review of SPAN 201 with an emphasis on subjunctive mood. Students will study texts and cultural documents which focus on contemporary life in Hispanic countries. Prerequisite: SPAN 201.

**SPAN 203. Latin American Cultural Conflicts (3)**
Evolution of Latin American socioeco-
nomic characteristics and artistic produc-
tion 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 iden-
tity, and educational problems. Prerequisite:
SPAN 202 or equivalent.

**SPAN 304. Studies in Civilization (3)**
Major historical, intellectual and artistic influences that have shaped the evolution of Spanish civilization. Prerequisite: SPAN 202.

**SPAN 310. Advanced Composition and Reading (3)**
Designed to facilitate the transition be-
tween lower and upper division courses in Spanish, and focus upon the simulta-
neous development of the reading and writing skills expected of students in all advanced Spanish courses. Prerequisite: SPAN 202 or equivalent.

**SPAN 311. Advanced Spanish Conversation (3)**
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. Prerequisite: SPAN 202.

**SPAN 312. Introduction to Readings in Spanish Literature (3)**
Introduction to major literary movements and outstanding works of Spanish literature. Prerequisite: SPAN 202.

**SPAN 322. Latin American Short Story (3)**
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 charac-

**RUSSIAN COURSES**

**RUSN 101. Elementary Russian I (4)**
Continuation of RUSN 102; introduces contemporary Russian culture through readings and discussion. Prerequisite: RUSN 101.

**RUSN 102. Introduction to Contemporary Civilization (4)**
Continuation of RUSN 201; introduces contemporary Russian culture through readings and discussion. Prerequisite: RUSN 201.

**RUSN 301. Introduction to Russian Literature (3)**
Introduction to major literary movements, principal writers, and outstanding works of Russian literature. Prerequisite: RUSN 201.

**RUSN 311. Advanced Conversation (3)**
Students work to improve fluency in spoken Russian. Topics of conversation include aspects of contemporary civilization; current vocabulary is stressed. Prerequisite: RUSN 202.

**RUSN 318. Studies in Russian Civilization (3)**
Examination of major historical, intellectual, and artistic influences that have shaped the evolution of Russian civilization. Students attempt to identify major influences on the formation of modern Russia. Prerequisite: RUSN 202.

**RUSN 319. Life in Modern Russia (3)**
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. Prerequisite: RUSN 202.

**RUSN 320. Introduction to Russian Literature (3)**
Introduction to major literary movements, principal writers, and outstanding works of Russian literature. Prerequisite: RUSN 202 or equivalent.

**RUSN 321. Life in Modern Russia (3)**
Students work to improve fluency in spoken Russian. Topics of conversation include aspects of contemporary civilization; current vocabulary is stressed. Prerequisite: RUSN 202.

**RUSN 310. Advanced Composition and Reading (3)**
Designed to facilitate the transition be-
tween lower and upper division courses in Spanish, and focus upon the simulta-
neous development of the reading and writing skills expected of students in all advanced Spanish courses. Prerequisite: SPAN 202 or equivalent.

**RUSN 311. Advanced Spanish Conversation (3)**
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. Prerequisite: SPAN 202.

**RUSN 312. Introduction to Readings in Spanish Literature (3)**
Introduction to major literary movements and outstanding works of Spanish literature. Prerequisite: SPAN 202.

**RUSN 322. Latin American Short Story (3)**
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 charac-

teristics of the works. Male and female authors. Prerequisite: SPAN 202.

SPAN 326. The Fantastic in Latin American Prose (3)
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. Prerequisite: SPAN 202.

SPAN 336. Chicana/o Literature (3)
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.

SPAN 339. Latin American Poetic Revolt (3)
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. Prerequisite: SPAN 202.

SPAN 340. Contemporary Latin-American Narrative (3)
Students explore the most significant narrative techniques since 1945 in Latin American fiction: Borges, Cortázar, García Márquez, Vargas Llosa, Isabel Allende. Prerequisite: SPAN 202.

SPAN 342. Latin American Feminist Voices (3)
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. Prerequisite: SPAN 202.

SPAN 343. The New Drama in Latin America (3)
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. Prerequisite: SPAN 202.

SPAN 350. Spanish Fiction (3)
Narrative masterpieces from Cervantes and the picaresque (El Lazarillo) to the short stories of 19th and 20th century authors. Prerequisite: SPAN 202 or equivalent.

SPAN 351. Spanish Generation of 1898 (3)
The course studies the so-called second Golden Age of Spanish literature. The Generation of 1898 rebelled at the end of the XIX Century against the “Restauracion,” an inefficient and corrupt political system. To find a solution to a period of economic and cultural decadence, it demanded “Europeanization.” Though these writers failed to produce any immediate political change, they succeeded in replacing the old Spanish rhetoric and in creating a superb expression of the new spirit. Prerequisite: SPAN 202.

SPAN 360. Hispanic Self-Conscious Literature (3)
Since the Seventeenth Century, Hispanic literature has revealed its fictional nature, commented on the building of its fictional world, mirrored itself (fiction within a fiction), and invited and compelled the reader to participate in the work of art. The texts of the course, selected from Peninsular and Latin-American literatures, show the most relevant characteristics of contemporary self-conscious art and allow students to become acquainted with some of the main concepts of literary criticism today. Prerequisite: SPAN 202.

SPAN 370. Special Topics in Spanish (3)
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. Prerequisite: SPAN 313 or equivalent.

SPAN 398. Senior Thesis (3)
An elective which involves the writing of substantial research paper in Spanish. Exceptional papers may be considered for departmental honors. Prerequisites: Senior status and consent of department.

SPAN 399. Independent Studies (1-3)
Prerequisite: Permission of department.

SPAN 430. Landmarks of Spanish Literature (3)
SPAN 440. Contemporary Latin-American Narrative (3)
(See SPAN 340.)

SPAN 451. Spanish Generation of 1898 (3)
(See SPAN 351.)

SPAN 460. Hispanic Self-Conscious Literature (3)
Since the Seventeenth Century, Hispanic literature has revealed its fictional nature, commented on the building of its fictional world, mirrored itself (fiction within a fiction), and invited and compelled the reader to participate in the work of art. The texts of the course, selected from Peninsular and Latin-American literatures, show the most relevant characteristics of contemporary self-conscious art and allow students to become acquainted with some of the main concepts of literary criticism today. Prerequisite: SPAN 202.

SPAN 470. Special Topics in Spanish (3)
(See SPAN 370.)

Department of Music

Music education
Music history
Early music performance
Applied music
Haydn Hall
Phone 216-368-2400; Fax 216-368-6557
Quentin W. Quereau, Chair
Robert E. Dunn (Music Education)
The Department of Music is committed to creating the best possible educational opportunities and professional programs in music. The department’s aim is to offer superior programs that balance humanistic knowledge of music with excellence in performance. Individual professional interests are encouraged and promoted. To
foster this aim, the Department of Music has established major degree programs in music and music education and has collaborated with the Cleveland Institute of Music in a Joint Music Program.

FACULTY

Quentin W. Quereau, Ph.D. (Yale University)  
Associate Professor and Chair  
Medieval; Renaissance; opera

Gary M. Ciepluch, Ph.D. (University of Wisconsin, Madison)  
Associate Professor  
Director of bands; conducting

Mary E. Davis, Ph.D. (Harvard University)  
Assistant Professor  
20th century; piano music; world music

Ross W. Duffin, D.M.A. (Stanford University)  
Fynette H. Kulas Professor  
Medieval; Renaissance; Baroque; performance practices; Collegium Musicum

Robert E. Dunn, Ph.D. (Northwestern University)  
Associate Professor; Director, Music Education  
Music education; music listening, vocal music

Stephen E. Heffing, Ph.D. (Yale University)  
Professor  
18th and 19th centuries; chamber music

John G. Suess, Ph.D. (Yale University)  
Professor  
Baroque and 20th century; string performance practices

ASSOCIATE FACULTY

Cleveland Institute of Music Academic Faculty  
Offering Courses for CWRU Students

Margaret Brouwer  
David N. Brown  
Joanne Caputo  
Eric Charnofsky  
Jeanette Davis  
David Gilson  
Mark George  
Marshall Griffith  
Dean Guy  
Thomas Knab  
Steven Kohn  
Richard Nelson  
Nadia Tarnawsky  
Mark Tessi  
Jim Yeats

Artist Faculty of the Cleveland Institute of Music  
(Consult the current CIM catalogue)

DEGREE OFFERINGS AND AREAS OF CONCENTRATION

Areas of Degree Offerings

Music education (Bachelor of Science, Master of Arts, Doctor of Philosophy)  
Early music performance practices (Master of Arts, Doctor of Philosophy, Doctor of Musical Arts)

Music (within the context of liberal arts; see subsequent list of concentrations)  
(Bachelor of Arts)

Music history and literature (Master of Arts)

Musicology (Doctor of Philosophy)

Concentrations within the Bachelor of Arts in Music are:

Music history and literature  
Music theory  
Early music performance practices  
Performance General musicianship (particularly suitable for students interested in music as part of a double major or double degree)

Audio recording technology

Students interested in these programs should apply to the University with the understanding that many courses in music performance, music theory, and related studies will be taken at the Cleveland Institute of Music.

CIM JOINT MUSIC PROGRAM

The Cleveland Institute of Music and Case Western Reserve University participate in an integrated music program at both the undergraduate and the graduate levels. Students at either institution have the benefit of pursuing studies at both schools, thus enjoying the intimacy and intense specialization of a professional conservatory, together with access to the resources of a major university. Both institutions share a campus setting in University Circle. Severance Hall (home of the Cleveland Orchestra), the Cleveland Museum of Art, the Cleveland Music School Settlement, and several other cultural organizations are within a short walking distance of both schools.

The Cleveland Institute of Music concentrates on the education of students whose professional interests include the following:

• Performance (Bachelor of Music, Master of Music, and Doctor of Musical Arts)

• Composition (Bachelor of Music, Master of Music, and Doctor of Musical Arts)

• Eurhythmics (Bachelor of Music)

• Music theory (Bachelor of Music)

• Audio recording (Bachelor of Music)

• Piano accompanying (Master of Music, Doctor of Musical Arts)

• Suzuki Pedagogy (Master of Music)

Students who are interested in these majors in the context of intensive conservatory training should matriculate at the Cleveland Institute of Music with the understanding that courses in music history, music education, and the liberal arts will be taken at the University. Contact the Admissions Officer, Cleveland Institute of Music, 11021 East Boulevard, Cleveland, Ohio 44106, for a description of programs and the appropriate admissions materials.

DEPARTMENTAL SPECIALTIES

The Department of Music is distinctive in offering special areas of concentration to the student on both the undergraduate and the graduate level, and in both the music and music education programs.

Early Music Performance Practices

One such area of special interest is early music performance practices, where musical research in early music, instruments, and performance problems is directly applied to performance. The supporting performance organizations are the Case Western Reserve University Collegium Musicum and Baroque Orchestra, which are devoted to the performance of early music on authentic reproductions of Medieval, Renaissance, and Baroque instruments. Faculty, staff and visiting artists provide professional instruction and coaching. The Collegium Musicum and Baroque Orchestra use the Kulas Collection of Historical Instruments.

Music Education

Music education programs at Case Western Reserve University are committed to the idea that excellence in teaching follows excellence in musicianship, scholarship, and professional development. In both the undergraduate and graduate programs, the faculty stresses practical and philosophical foundations regarding music in education. This nationally recognized music education program specializes in research in music education, including musical creativity, wind conducting and literature, and computer music technology. The department’s nationally-prominent faculty are active in their respective professional organiza-
tions as guest clinicians, conductors, and lecturers.

UNDERGRADUATE PROGRAMS

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 with the department. Once admitted as a music major, students are required each semester to participate in one or more of the University musical organizations and to attend recital class. Performance juries are required during each semester that the music major is enrolled in applied music instruction.

Double Major and Double Degree Opportunities

The department encourages qualified students to consider a double major in music and another subject. As many as 1/3 to 1/2 of music majors are pursuing a double major. Typical combinations include the Bachelor of Arts in music with theater, English, classics, psychology, sociology, and the natural sciences. Once the Arts & Sciences General Education Requirements (39 hours) have been met, a B.A. 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 double 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 double 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 is concerned with studies in music and the liberal arts. This degree program stresses an essentially humanistic orientation. It is not intended to lead a student toward a professional career in performance.

Approximately one half of the total 120 semester credit hours necessary for the degree is devoted to music study, with the remaining credit devoted to the General Education Requirements (39 hours), a possible minor program, and a liberal selection of elective courses. This arrangement differs from student to student. The department offers several concentrations within the music portion of the degree (listed above). Core music courses for these programs are:

1. Music theory:
   - MUSC 101, 102, 105, 106, 201, 202, 205, 206, and 318 for a total of 19 semester hours;
2. Music history and literature:
   - MUSC 321, 322, and 336 * (the first two of these courses fulfill the Arts and Sciences General Education Requirements for Music Majors) and one music literature elective from the 300 level for a total of 9 semester hours;
3. Performance instruction (applied music) for a minimum of 15 semester hours; and
4. Additional Requirements:
   - Participation in assigned musical ensemble every semester of major
   - Participation in additional musical ensemble for one year
   - Recital Class attendance and performance every year of major
   - Two semesters of eurhythmics (fulfills physical education requirement)

Additional course work in music is required for each concentration as follows:

Music History and Literature

Additional Applied Music study at the 300 level (3); MUSC 393, Introduction to Early Music Performance Practices (3); Two electives from music literature courses at the 300 level (6); Foreign language, preferably German (6)

Music Theory

Additional Applied Music study at the 300 level (3); MUSC 311, 312, Counterpoint I and II (4); One elective from music literature courses at the 300 level (3)

Early Music Performance Practices

Additional Applied Music study at the 300 level (3); MUSC 393, Introduction to Early Music Performance Practices (3); MUSC 394, Seminar in Early Music Performance Practices (3); One elective from music literature courses at the 300 level (3); Foreign language, preferably German (6)

Performance

Additional Applied Music study at the 300 and 400 levels (9); One elective from music literature courses at the 300 level (3); Foreign language, preferably German (6)

General Musicianship

One elective from music literature courses at the 300 level (3)

Audio Recording Technology

MUSC 151B, 251B, Audio internship (4 sem. of each req.) (4); MUSC 383, 384, Audio Recording I and II (2,2); MUSC 385, 386, Advanced Recording Techniques I and II (2,2); MUSC 387, 388, Multi-track Recording Techniques I and II (2,2); MUSC 391, MUSC 392, Recording Studio Maintenance I and II (1,1); MUSC 350B, Junior Audio Recording Thesis (3); MUSC 351C, Senior Audio Recording Thesis (6); MUSC 399C, Acoustics of Music (1 credit hr., taken 3 times) (3); MUSC 451, Recording Studio Internship (Commercial) (4)

A Minor in Electronics is available from the Electrical Engineering and Computer Science Department. A five-year, double degree program is also available where the student earns a B.A. in music/audio and a B.S. in an elective field of engineering. See double-degree section above.

Career Opportunities within the Bachelor of Arts Degree

Students choosing the audio recording technology concentration are prepared to enter professional positions in that field immediately upon graduation. Graduates of the other concentrations are prepared to enter programs of advanced study in music or in other professional programs such as those in medicine, law, and management. Because of the humanistic orientation of the degree and the stress on the liberal arts, students are also able to pursue careers in a wide assortment of fields such as communications, publications, business, and arts criticism.
Bachelor of Science in Music Education

The curriculum for the Bachelor of Science in Music Education degree prepares the student to be eligible for the Ohio Multi-age License in Music (all areas of music, pre-K through adult). This license may also be transferred to other states with little or no additional work needed. CWRU music education graduates have the highest rate of job placement in Ohio. 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” experience by teaching sample lessons and conducting rehearsals in actual teaching situations. Requirements for the Bachelor of Science in Music Education degree:

Music, Music Education and Education courses

Applied Music (major and minor areas) ........................................... 15
Music Theory: (MUSC 101, 102, 105, 106, 201, 202, 205, 206, 318 ... ... 19
Music History: (MUSC 321, 322) ........................................... 6
Literature: One elective from
300-level Music Literature courses ........................................... 3
Elements of Conducting (MUSC 275) .. . 2
Advanced Conducting (MUSC 276) ........... 2
Arranging for Voices and Instruments (MUSC 310) ................. 3
Introduction to Education (EDUC 301) ........................................... 3
*Foundations of Music Education (MUSC 241) ..................... 3
Elementary General Music Methods (MUSC 341) ....................... 3
Two of the following music methods electives: MUSC 342, 377, 378 ........ 6
Electives from various instrument classes (1 credit for each class) ... 5
Practice Teaching (MUSC 396) ............. 12
Total ........................................................................... 82

Courses to fulfill graduation requirements and the general requirements of the Ohio Department of Education:

*ENGL 150 ................................................................. 6
PHED (two semesters-Lifetime) ........................................... 0
*GER: Mathematics ..................................................... 3
*GER: Natural sciences sequences ....... 6
*GER: History, Philosophy, Religion .. 6
*Social and Behavioral Sciences:
PSCL 101, EDUC 304 .................. 6
*GER: Global and Cultural Diversity ... 3
Electives outside of MUSC & EDUC .. 6
Open electives ....................................................... 4
Total .......................................................... 37

Additional Requirements:
Participation in assigned musical ensemble every semester of major
Participation in additional musical ensemble for one year
Recital Class attendance and performance every year of major
Two semesters of eurhythmics (fulfills physical education requirement)

Admission, Retention, and Advanced Standing

Students must pass an interview with the music education faculty to be admitted into the program. Evaluations will take place after each methods course to monitor student progress. Students who expect to meet licensure requirements must apply for Advanced Standing by the end of their sophomore year. To apply, students must submit to the music education faculty information about grade point average, personal goals, and self-analysis of performance in the program up to the point of evaluation. Music education faculty may (1) accept a student for advanced standing; (2) accept student with reservation, with a remedial plan; or (3) reject a student and recommend a career change.

A 2.5 cumulative grade point average is required to enter student teaching.

A 3.0 grade point average must be maintained in all professional education courses.

Completion of the Bachelor of Science degree does not ensure that the State of Ohio Music Teacher License will be awarded. The State of Ohio requires a passing score on the General Knowledge and Professional Knowledge sections of the Praxis II Examination plus additional state requirements, in addition to the requirements stated above. Students must take the examinations prior to graduation.

Minor

A minor in music requires five courses, two in music theory (generally MUSC 103, 104), two in music history (either MUSC 221 and MUSC 222, or MUSC 321 and MUSC 322), and one other, which may be in applied music. A minor in music education may be devised in consultation with a music education advisor. The department welcomes students’ initiative in the development of minor programs suited to their needs.

Sequences

A sequence requires three courses. The department welcomes students’ initiatives in developing sequences suited to their needs. The following are sample sequences:

Music and its theory
MUSC 103, 104, 222
MUSC 221, 103, 104
Music and its history
MUSC 103, 104, and 321 or 322
MUSC 221, 103, 222
Music and computers
MUSC 103, 104, 308
MUSC 221, 103, 308
Music history and jazz
MUSC 103 or 104, 222, 229
MUSC 221, 222, 229
Music and performance
MUSC 103, 221, APMU
MUSC 103 or 104, 222, APMU

Electives for Non-Music Majors

Electives designed for students not majoring in music are MUSC 103, 104, 221, 222, and 229. MUSC 308 is designed for music majors but is open to non-music majors with the permission of the instructor. MUSC 221 and 222 are offered as courses which satisfy the Arts portion of the GER. APMU 380, 382, 385, 383, 381A, and 381B are available, normally by audition. Individual instruction in piano, harpsichord, organ, voice, violin, and all other orchestral instruments is available with consent of the department. See further information under Applied Music.

Departmental Honors

Departmental Honors Programs for the Bachelor of Arts and Bachelor of Science degrees have the following admission and completion requirements:

Bachelor of Arts Students

Admission to honors status:
1. Second-semester sophomore or junior standing
2. Overall grade point average of 3.2,
with music grade point average no lower than overall grade point average
3. Evidence of exceptional musicianship and scholarly interests
4. Nomination by a faculty member and acceptance by the music faculty

Program description: successful completion of the following:
1. Final overall grade point average of 3.2
2. Overall grade point average of 3.2 and music grade point average of 3.2
3. Evidence of strong interest in becoming a teacher and of originality in teaching
4. Nomination by a faculty member and acceptance by the music faculty.

Program description: successful completion of the following:
1. Final overall grade point average of 3.2 and music grade point average of 3.2
2. Junior or senior teaching experience prior to Practice Teaching (MUSC 396)
3. Special project in teaching methods and materials.
4. MUSC 399, Undergraduate Independent Studies or MUSC 390, Undergraduate Seminar in Music for three credits

Bachelor of Science Students
Admission to honors status:
1. Junior or Senior standing
2. Overall grade point average of 3.2 and music grade point average of 3.2
3. Evidence of strong interest in becoming a teacher and of originality in teaching
4. Nomination by a faculty member and acceptance by the music faculty.

GRADUATE PROGRAMS

The following graduate degree programs, administered by the University, are offered as part of the Joint Music Program with the Cleveland Institute of Music. General descriptions are given here; however, complete information on all degrees is available from the department. Admission to each degree follows established guidelines of the School of Graduate Studies. Scores from the Graduate Record Examination are required for programs in Music History, Musicology, and Early Music Performance Practices, and an audition is necessary for students interested in the Early Music Performance Practices programs.

Master of Arts Degree
The Master of Arts degree is offered in the fields of music history and music education. Within music history, students may choose concentrations in music history and literature or in early music performance practices. Master’s degree candidates in music education may also choose to add State of Ohio teaching licensure.

Double Degree Opportunity
One possibility exists for a double master’s degree between the Department of Music (M.A. in Music History) and the Mandel Center for Nonprofit Organizations (M.N.O.). This program reduces the combined requirements of both programs to 60 credit hours, including practicums with local arts organizations. The program can be completed in two years and results in two separate master’s degrees. All admissions requirements must be met for each school, including an undergraduate degree in music, a diagnostic examination in music history and theory, the Graduate Management Aptitude Test (GMAT), a sample essay, as well as references, transcripts, etc. Prospective students should contact both schools for advice from faculty and admissions information.

Master of Arts in Music History
The concentration in music history and literature emphasizes research, history, literature, and the theory of music. The early music performance practices program 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 30 hours required for either concentration, the following are minimum requirements: history-literature, 9 hours; research, 6 hours; theory-analysis, 3 hours.

Remaining hours are more freely elected with advisor’s approval, but 9 hours of applied music are required for performance practices students. Ensemble participation is required for performance practices students but does not earn credit hours toward the degree. Examinations include initial placement tests in history and theory, a reading test in German or French, and final written and oral examinations. In addition, performance practices students must audition as part of the admissions process and must present a lecture-recital near the completion of the degree program. At least 18 credit hours must be at the 400 level or higher.

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.

Students may pursue one of three degree options. Persons in Plan A write a thesis based on original research and defend the thesis in an oral examination. Persons in Plan B complete a comprehensive examination in music education. Applicants for plans A or B should have a bachelor’s degree in music education, a good undergraduate academic record, and at least one year of successful teaching experience.

Persons seeking teacher licensure credentials pursue Plan C. The program includes a core of graduate music education courses, graduate music courses, undergraduate music methods courses, and one semester of practice teaching. Applicants for Plan C should have a bachelor’s degree in music (B.A. or B.M.), a good undergraduate academic record, and some prior experience in working with children. The regulations in the B.S. program regarding advanced standing, grade point averages, and the Praxis II Exam apply to graduate students in Plan C as well.

Foundation courses for all master’s degrees in music education include a music education core of philosophy, curriculum, and research (12 hours); a music core of history, theory (3-9 hours), and performance (0-6 hours); and electives (0-9 hours). Persons in Plan A receive 6 credit hours for thesis research. A minimum of 30 credit hours is required for Plans A and B. Plan C combines music education methods courses (10 hours), general edu-
cation courses (6 hours), the graduate music education core (12 hours), the graduate music core (9 hours), and practice teaching (12 hours). The music education advisor may allow certain music education and general education courses taken as an undergraduate to count towards the degree requirements. (Plan C requires a minimum of 49 hours.) Entering master’s students take placement tests in music history and theory. A comprehensive written examination at the conclusion of course work is also required for persons in Plans B and C.

Doctor of Philosophy Degree

The Doctor of Philosophy degree is offered in two fields: musicology, with concentrations in music history and early music performance practices; and music education.

Doctor of Philosophy in Musicology

This doctorate 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 are formulated to suit the individual needs of the student and require the consent of the advisor. A minimum of 48 hours (36 for students with a master’s degree) of course work, seminars, and tutorials is required. The last 36 hours (24 for students with masters degree) must be completed at the University.

For performance practices students, course work distribution is as follows: applied music, 9-12 hours (6-9 with master’s degree); course work, 36-39 hours (27-30 with master’s degree).

For other musicology students, private lessons at the 400 level, although not required, may be counted to a maximum of six credits at the discretion of the advisor.

Examinations include initial placement tests in history, theory, and an audition for performance practices students; reading tests in German and one other foreign language; qualifying examinations in history and theory prior to admission to candidacy; and a general examination with history, theory, style analysis, and oral sections. Upon completion of the dissertation, an oral defense is held. In addition, performance practices students must audit as part of the admissions process and must present a lecture-recital in conjunction with the dissertation. The candidate must teach a college-level course in music history and literature (or early music performance practices) under the supervision of a faculty member, or have had the equivalent experience before the dissertation is completed.

Normally all performance practices students will participate in the Collegium Musicum or Baroque Orchestra during each semester in which they are on campus. Credit hours obtained for this participation are not applicable toward the degree.

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. Applicants must have competed three years of teaching. 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 major advisor in order to ensure a balance between individual interests and traditional graduate expectations.

A total of 54 credit hours is required for the doctoral degree beyond the master’s level.

A typical division would be:

- Music education: philosophy, psychology, curriculum, research, measurement (15 hours)
- Music: theory, history, performance (9-15)
- Non-music electives: psychology, art, education, sociology, others (0-3)
- Seminars and special readings (6-12)
- Dissertation (18)

Examinations include placement exams in music history and theory; and a final general examination which covers music education philosophy and curriculum, research and evaluation, and music history and theory. Upon completion of the dissertation, an oral defense is held. The dissertation topic is chosen by the student in consultation with the faculty. There is no restriction on the method of investigation.

Doctor of Musical Arts in Early Music

This doctorate is granted in recognition of outstanding performing ability in early music combined with superior scholarly ability in the field of early music performance practices. All programs are formulated to suit the needs of the individual student and require the consent of the major advisor. A minimum of 24 hours (after the master’s degree) of course work, seminars, and tutorials is required. 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 German and one other foreign language; an advisory examination after one year of full-time study and a comprehensive examination with history, theory, performance practices, and oral sections. Three juryed recitals are required, each to be accompanied by a research document and preceded by a short lecture. Exceptional students may be admitted to a combined M.A./D.M.A. degree program in early music.

SPECIAL FACILITIES

Kulas Music Library

Kulas Music Library, a branch of the University Library, is located on the first floor of Haydn Hall, the home of the Department of Music. The library contains approximately 45,000 music scores, books on music, sound recordings, videos, bound periodical volumes, and microforms. Particularly strong are the collections in historical musicology and early music performance practice. Listening equipment is available in the library in order to listen to or view the sound recording and video collections. The music library participates in the OhioLINK
consortium of academic libraries, which shares a central on-line catalog and liberal interlibrary lending policies. Access to interlibrary loan with libraries outside of Ohio is also available. The music library is connected to CWRU net, the University’s communication network, which provides access to many on-line catalogs, databases, and CD-ROMs. The collections and services of the Kulas Music Library are available to all University students, whether or not they are music majors. Music majors at the University also have access to the library of the Cleveland Institute of Music, which collects performing materials for solo and chamber music of all kinds and scores for large orchestral, vocal, and dramatic works, as well as selected musicological works.

Center for Music and Technology
The department supports a computer laboratory/resource center devoted to furthering the use of technology in music. The Center for Music and Technology houses Macintosh-based music workstations that are linked by CWRUnet, the University’s fast fiber optic network system and gateway to the Internet. This state-of-the-art network allows extremely fast access to a multitude of resources both on and off campus. Using CWRUnet, students working in the center are able to access computers and databases as well as share ideas and research with colleagues around the world. Through the use of MIDI (Musical Instrument Digital Interface) keyboards, users may explore computer-assisted composition and sequencing, music synthesis and sampling, and computer-generated musical calligraphy. By supporting the most current music copying software, the center provides a resource for the production of professional typeset-quality scores and papers by faculty and students. The center works closely with faculty in providing support facilities for the department’s technology-related courses. For example, students enrolled in Computers and Music use the center to explore sequencing, MIDI communication, and musical score production. Designed to meet the specific needs of music students and faculty, the center supports an array of non-musical software including word processing, database, and graphics applications. As the department becomes increasingly technology-oriented, and CWRUnet is increasingly utilized by the faculty in their curricula, the Center for Music & Technology plays an ever increasing role by providing technical support and a necessary focal point for the interchange of ideas and creative solutions.

Kulas Collection of Historical Instruments
The Department of Music maintains an impressive collection of modern reproductions of medieval, Renaissance, and baroque instruments. The instruments are used by the Collegium Musicum and the department’s program in Early Music Performance Practices. The collection includes recorders, crumhorns, shawms, sackbuts, cornetti, viols, and baroque strings and woodwinds.

Music Education Resource Center
The department provides a resource center for music education students to prepare educational materials and research projects. The center contains a variety of audio-visual 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.

The Music Education & Technology Software Registry (MET) is a collection of over 90 music software packages designed for all ages of learners and for a wide range of musical tasks. This workstation is available to all music students and area music teachers so they can use and evaluate most of the music software that is commercially marketed today. Use of the MET is encouraged, and sometimes required, for many of the projects and assignments in courses throughout the music education curriculum.

APPLIED MUSIC
Private Instruction
The Department of Music offers private instruction on Renaissance and Baroque instruments, as well as the usual orchestral instruments, piano, and voice. Students have the unique opportunity to study with outstanding teachers, many of whom are faculty at the Cleveland Institute of Music. Students interested in private instruction should come to the department prior to registration in order to complete the Applied Music Permit form and to learn of further details.

Private lessons carrying credit are available to all University students. Permission for study, level of study, and amount of credit are determined by the faculty of the Department of Music in consultation with the Cleveland Institute of Music. Charges for private lessons are covered by the University tuition rate for undergraduate music and music education majors only; all other students pay an additional fee. The amount of the fee depends on the faculty involved and the length of the lessons. The minimum is $250 per semester. Students normally earn 1.5 or 3 semester hours of credit for private instruction based on either half-hour or hour lessons. All Master of Arts and Doctor of Philosophy degree students in the department must satisfy the applied music requirements specified in their degree requirements. 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.

Ensembles
A number of music ensembles are available within the Joint Music Program. These ensembles are available to qualified University students. Entrance into ensembles may also be subject to space limitations. Students may elect to earn one credit per semester for participation. Auditions for ensembles are held during the first week of classes of each semester. Dates are available from the department.

Undergraduate Courses
Courses in musical pedagogy, interpretation, and practical understanding are offered under the APMU classification. Those courses which have a direct programmatic role in University degree programs are provided with descriptions.
Consult the catalog of the Cleveland Institute of Music for additional offerings in this classification. CIM courses other than applied music lessons are open only to music and music education majors.

### Music (MUSC)

#### UNDERGRADUATE COURSES

**MUSC 003. Pre-conservatory Theory (3)**
Development of security in knowledge and skills related to basic materials of musical structure (scales, key signatures, intervals, triads, etc.); general introduction to literature of Western music. Preparation for MUSC 101/105. Credit not applicable toward fulfillment of degree requirements in music major.

**MUSC 088. Composition Seminar (0)**
Open only to audio recording majors.

**MUSC 101. Harmony-Keyboard I (2)**
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 MUSC 105 and 106. Both aspects of the course must be passed in order to complete requirements.

**MUSC 102. Harmony-Keyboard II (2)**
(See MUSC 101.)

**MUSC 103. Theory I (3)**
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.

**MUSC 104. Theory II (3)**
(See MUSC 103.) Prerequisite: MUSC 103 or consent of department.

**MUSC 105. Sightsinging-Eartraining I (2)**
Aural and vocal study of isolated and contextual rhythmic patterns, scales, intervals, triads, seventh chords, and traditional and contemporary songs in treble and bass clefs. Correlated and taken concurrently with MUSC 101 and 102. Both aspects of the course must be passed in order to complete requirements.

**MUSC 106. Sightsinging-Eartraining II (2)**
(See MUSC 105.)

**MUSC 151B. CWRU Audio Internship I (1)**
Development of recording engineering skills through professional level work in the Harkness audio service. Prerequisite: Open only to audio recording majors.

**MUSC 153. Eurhythmics I (0)**
Physical expression of rhythm in which large bodily movements form the reference for rhythmic analysis. Study of pulse, meter, patterns, crossrhythms, improvisation, rhythmic canons, and bodily coordination emphasizing proper tension and relaxation.

**MUSC 154. Eurhythmics II (0)**
(See MUSC 153.)

**MUSC 201. Harmony-Keyboard III (2)**
Continuation of MUSC 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 MUSC 205 and 206. Both aspects of the course must be passed in order to complete requirements. Prerequisite: MUSC 102 or placement examination.

**MUSC 202. Harmony-Keyboard IV (2)**
(See MUSC 201.) Prerequisite: MUSC 102 or placement examination.

**MUSC 205. Sightsinging-Eartraining III (2)**
Aural and vocal study using alto and tenor clefs, in addition to treble and bass. Correlated and taken concurrently with MUSC 201 and 202. Both aspects of the course must be passed in order to complete requirements. Prerequisite: MUSC 106 or placement examination.

**MUSC 206. Sightsinging-Eartraining IV (2)**
(See MUSC 205.) Prerequisite: MUSC 205 or placement examination.

**MUSC 211. Introduction to Music: Listening Experience I (3)**
A flexible approach to the study of the materials and literature of music. Aural and analytical skills primarily for classical music.

**MUSC 222. Introduction to Music: Listening Experience II (3)**
Application of the skills developed in MUSC 221 to the understanding of historical and stylistic content of Western music. Focus is on particular works in context with the era of composition. Prerequisite: MUSC 221 or consent of department.

**MUSC 229. History and Styles of Jazz (3)**
Musical styles and structures of jazz and American popular music since 1900. Prerequisite: MUSC 221.

**MUSC 241. Foundations of Music Education (3)**
Application of philosophical, historical, and psychological principles to music instruction. Examines various philosophical approaches to music education, and each student analyzes his/her personal philosophy of music education. Approaches to music teaching and learning, the processes involved in lesson planning, and student motivation. The importance of active learning is discussed and demonstrated, and a diversity of learning styles are examined. Examines learners of all ages and a variety of cultural backgrounds, and deals with developmental stages and musical abilities from beginners to professionals. The Ohio Competency-Based Arts Model and the National Standards are introduced. Clinical/Field experiences required.

**MUSC 251B. CWRU Audio Internship II (0)**
Professional level work in the Case Western Reserve University Harkness audio service.

**MUSC 253. Eurhythmics III (0)**
Continuation of MUSC 154. Material of increased difficulty as well as study of syncopation, rhythmic counterpoint, and conducting movements.

**MUSC 254. Eurhythmics IV (0)**
(See MUSC 253.)

**MUSC 271. Choral Conducting I (1)**
Study of the techniques of choral conducting and a general survey of choral literature.

**MUSC 273. Orchestral Conducting I (1)**
Study of orchestral scores, covering elements of style, form, and interpretation. Development of baton technique through conducting of small instrumental ensembles.

**MUSC 274. Orchestral Conducting II (1)**
(See MUSC 273.)

**MUSC 275. Elements of Conducting (2)**
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/selfevaluation 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.

**MUSC 276. Advanced Conducting (2)**
This course continues in-depth development of the physical tools, and philosophical and aesthetic ideologies presented in MUSC 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.

**MUSC 301. Introduction to Analysis of 20th Century (2)**
A study of compositional techniques as used in selected works by major 20th century composers. Prerequisite: MUSC 202 and MUSC 206.

**MUSC 305. Sightsinging-Eartraining V (3)**
Continuing emphasis on the development of aural and vocal skills in all clefs, with particular attention to contemporary music, and increased emphasis on performance at sight of a wide range of literature. Prerequisite: MUSC 206.

**MUSC 308. Computers and Music (3)**
Emphasis on development of music notation and sequencing skills with some attention to word-processing and graphics.

Introduction to data management and page layout software. Designed primarily for music majors but also open to non-majors with sufficient background in music theory. Use of the University’s software library, CWRUnet and the music department’s Center for Music and Technology. No formal training in computers required. Prerequisite: Music majors only.

**MUSC 310. Instrumentation and Choral Arrangement (3)**
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.

**MUSC 311. 16th Century Counterpoint (2)**
Sixteenth century modal counterpoint. Exercises in the five species. Writing of short compositions and motets in two, three and four voices. Prerequisite: MUSC 202 or MUSC 206.

**MUSC 312. 18th Century Counterpoint (2)**
Eighteenth century tonal counterpoint. Analysis and writing of inventions in two parts, and fugues in three and four parts. Prerequisite: MUSC 202 or MUSC 206.

**MUSC 315. Orchestration I (2)**
The problems and techniques of scoring for strings and woodwinds, for brasses and percussion. Transcriptions and scoring for diverse combinations from chamber group to full orchestra.

**MUSC 316. Orchestration II (2)**
(See MUSC 315.)

**MUSC 318. Form and Analysis (3)**
Aural and visual analysis of structural and stylistic features of 16th through 20th century music. Prerequisite: MUSC 202 or MUSC 206.

**MUSC 321. History of Western Music I (3)**
Developments in Western music from Early Christian times to the present, especially great periods and composers. Reference to life and thought; illustrated lectures; style analysis. Prescribed listening and reading. Prerequisite: MUSC 102 or MUSC 106.

**MUSC 322. History of Western Music II (3)**
(See MUSC 321.) Prerequisite: MUSC 102 or MUSC 106.

**MUSC 323. Piano Literature (3)**
Chronological survey of keyboard literature from the 17th century to the present. Detailed analysis of representative works; study and comparison of keyboard styles. Prerequisite: MUSC 202 or MUSC 322.

**MUSC 324. Chamber Music Literature (3)**
Chronological survey of important chamber literature. Analysis of representative sonatas, trios, quartets, and large ensembles. Prerequisite: MUSC 202 or MUSC 322.

**MUSC 326. Symphonic Literature (3)**
Representative masterworks of symphonic literature. Analysis and discussion of essential details, form, style, and instrumentation. Prerequisite: MUSC 202 or MUSC 322.

**MUSC 327. Vocal Literature (3)**
Nonoperatic. Detailed analysis of representative works. Comparison of styles. Prerequisites: MUSC 321 and MUSC 322.

**MUSC 328. Opera Literature (3)**
Historical development of opera from the 17th century to the present. Detailed analysis of representative works. Prerequisite: MUSC 322.

**MUSC 329. Jazz and American Popular Music Literature (3)**
Musical styles and structures of jazz and American popular music; emphasis on music since 1900. Prerequisite: MUSC 202 or MUSC 322.

**MUSC 336. History of Western Music III (3)**
Music of the twentieth century, covering history, analysis, and aesthetic issues. Prerequisite: MUSC 322.

**MUSC 337. Music Cultures of the World: Music of Asia and Africa (3)**
A one-semester introduction to musics of Asia and Africa, focusing on the relationship of musical traditions and practices to culture and society. Prerequisite: MUSC 106.

**MUSC 338. Music Cultures of the World II: Music of the Americas (3)**
Introduction to selected multicultural musics of North America and Latin America, focusing on the relationship of musical traditions and practices to culture and society. Prerequisite: MUSC 106.

**MUSC 341. General Music Methods A (3)**
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.

MUSC 342. General Music Methods B (3)
General Music B provides a more indepth exploration of general music methods and materials for all ages, with concentration in grades 7 through adults. Topics of the course include: characteristics/needs of children, especially adolescents and young adults; creating a supportive learning environment through curriculum planning and design; instructional planning, implementation, and record keeping; involving students in moving, performing, creating and listening experiences with music, including individual and collaborative learning; music for exceptional children; using technology for music instruction; developing a personal philosophy of music education; teaching the arts together and integrating music into the school curriculum; multicultural musical experiences; motivation and classroom management; national, state, and professional standards; and assessments. Clinical/Field experiences (Clinical-all ages; Field-focus on middle school through adult) required.

MUSC 350B. Junior Recording Techniques Thesis (3)

MUSC 351C. Senior Recording Techniques Thesis (6)

MUSC 353. Eurhythmics V (1)

MUSC 354. Eurhythmics VI (1)

MUSC 357. Instrumental Methods and Materials (3)
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.

MUSC 358. Choral Methods and Materials (3)
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. Prerequisite: MUSC 276.

MUSC 361. Composition for Non-Majors I (2)
Techniques of motive development and composition in small forms. Prerequisite: Consent of department.

MUSC 362. Composition for Non-Majors II (2)
(See MUSC 361.)

MUSC 363. General Music Methods A (3)
General Music A provides an in-depth exploration of general music methods and materials for all ages, with concentration in grades K through adults. Topics of the course include: characteristics/needs of children, especially young children; creating a supportive learning environment through curriculum planning and design; instructional planning, implementation, and record keeping; involving students in moving, performing, creating and listening experiences with music, including individual and collaborative learning; music for exceptional children; using technology for music instruction; developing a personal philosophy of music education; teaching the arts together and integrating music into the school curriculum; multicultural musical experiences; motivation and classroom management; national, state, and professional standards; and assessment. Clinical/Field experiences (Clinical-all ages; Field-focus on Pre-K through elementary) required.

MUSC 364. Eurhythmics Pedagogy I (2)
Practice teaching; discussion of problems in class organization, interdepartmental integration; application of Dalerozzo principles to the teaching of adults. A comprehensive paper illustrative of application of Dalerozzo principles in music education and the arts must be submitted and approved for completion of pedagogy requirements.

MUSC 365. Eurhythmics Pedagogy II (2)
(See MUSC 364.) Prerequisite: MUSC 364.

MUSC 366. Eurhythmics Pedagogy III (2)
Topics and content include: characteris-tics/needs of children, especially adolescents and young adults; creating a supportive learning environment through curriculum planning and design; instructional planning, implementation, and record keeping; involving students in moving, performing, creating and listening experiences with music, including individual and collaborative learning; music for exceptional children; using technology for music instruction; developing a personal philosophy of music education; teaching the arts together and integrating music into the school curriculum; multicultural musical experiences; motivation and classroom management; national, state, and professional standards; and assessment. Clinical/Field experiences (Clinical-all ages; Field-focus on Pre-K through elementary) required.

MUSC 367. Eurhythmics Pedagogy IV (2)
(See MUSC 365.) Prerequisite: MUSC 365.

MUSC 368. Eurhythmics Pedagogy V (2)
MUSC 369. Undergraduate Research Seminar (3)
Special projects appropriate to individual interests and needs.
GRADUATE COURSES

MUSC 400A. Review of Musical Structure (3)
Instruction of fundamentals of form, counterpoint, and four-part harmony. Designed for graduate students; credit not applicable toward degree requirements.

MUSC 400B. Sightsinging and Eartraining Review (2)
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.

MUSC 401. Special Reading - Undergraduate (1-4)

MUSC 408. Analysis of Musical Styles (3)
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.

MUSC 416. Pre-common Practice Theory and Analysis (3)
An exploration of treatises and analytical methods appropriate to music of the Medieval and Renaissance eras.

MUSC 417. Analytic Techniques I (3)
Exploration of several approaches to the examination of musical structures, emphasizing hierarchic functional analysis and the interaction of the elements. Focus on music in traditional forms.

MUSC 421. Methodologies of Music History (3)
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 oral presentations and research papers on musical topics. Required of first-year students in the Master of Music degree program.

MUSC 423. Music History and Ideas (3)
Music aesthetics in relation to historical trends in cultural and intellectual thought.

MUSC 431. Medieval Music: Early Christian to 1425 (3)
The mass, liturgical drama, and early polyphony through the Ars Nova.

MUSC 432. Music of the Renaissance (3)
Vocal polyphonic music from the Burgundian school through the Elizabethan madrigal.

MUSC 433. Music of the Baroque (3)
Musical developments from Monteverdi to Bach and Handel.

MUSC 434. Viennese Classicism (3)
Development of the symphony, concerto, chamber music, and opera in the works of the Mannheim composers, Haydn, Mozart, and Beethoven.

MUSC 435. Nineteenth Century Music (3)
Romanticism and other 19th century trends in music up to impressionism.

MUSC 436. Twentieth Century Music (3)
Critical and analytical study of music since 1900. Examination and discussion of stylistic characteristics and aesthetic aims of contemporary composers.

MUSC 441. Philosophical Foundations of Music Education (3)
In this course, students explore major aesthetic philosophies that have influenced contemporary music education, and discuss current issues central to our field. Among topics include: 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.

MUSC 442. Learning and Curriculum Development in Music (3)
Students explore (1) different theories regarding how people learn from birth through adulthood, including learning styles and special learners; (2) what is known regarding how children and adults acquire musical understanding/skill; (3) curriculum content, including the use of technology; (4) approaches to the organization of instructional content, including national and state standards; (5) development of music curricula. Students will work toward development of a curriculum in an area of their interest and expertise.

MUSC 443. Cognitive Psychology of Music (3)
Survey and critical review of research in the cognitive psychology of music as it re-
lates to music education and music performance. Specific topics of study include physiology of the ear, auditory nerve, and brain; sound perception and cognition; foundations and measurement of music aptitude and achievement, the assessment of all types of music learning, and the validity and reliability of such measurement instruments; technology in research and teaching; cultural, ethnic, and socioeconomic differences among learners and their effects on music learning, teaching, and research; disabilities and giftedness and their effects on music learning, teaching, and research.

MUSC 444. Research and Measurement in Music Education (3)
Introduction to types and methodologies of research used in music education. Principles and procedures for developing and analyzing criterion measures used in research and the classroom. Development of research purposes, problems, literature reviews, designs, and procedure. Individual research projects are required. Topics include introduction to and uses of statistics; technology in research and teaching; cultural, ethnic, and socioeconomic differences among learners of all ages and their effects on music learning, teaching, and research; disabilities and giftedness and their effect on music learning, teaching, and research; measurement and assessment of all types of learning, and the validity and reliability of such measurement instruments.

MUSC 445. Research and Measurement in Music Education II (3)
In-depth critical review of current research in music education. Examination of techniques for data analysis. Individual research projects are required, aimed toward the development of larger research efforts (especially thesis or dissertation). Topics include computer programs for statistical analysis; technology in research and teaching; cultural, ethnic, and socioeconomic differences among learners and their effects on music learning, teaching, and research; disabilities and giftedness and their effects on music learning, teaching, and research; measurement and assessment of all types of learning, and the validity and reliability of such measurement instruments.

MUSC 451. Recording Studio Internship (4)

MUSC 453. Eurhythmics VII (1)
Problems of musical rhythm as expressed in words of Classical and Contemporary composers; participation in all areas of eurhythmics. Discussion and experimentation with various methods, approaches and ideas.

MUSC 454. Eurhythmics VIII (1)
(See MUSC 453.)

MUSC 461. Theory Pedagogy I (2)
Principles of the teaching of theory at all levels, with examination and appraisal of teaching methods, textbooks, recent concepts, etc.

MUSC 462. Theory Pedagogy II (2)
(See MUSC 461.)

MUSC 471. Graduate Choral Conducting I (1)
Study of the techniques of choral conducting and a general survey of choral literature.

MUSC 483. Electronic Sound Production I (2)
A practical study of computer assisted electronic music composition covering traditional concepts of analog and digital synthesis, midi sequencing, sampling techniques, and video soundtrack production.

MUSC 484. Electronic Sound Production II (2)
A practical study of computer assisted electronic music composition covering traditional concepts, analog and digital synthesis, midi sequencing, sampling techniques and video soundtrack production. Prerequisite: MUSC 483.

MUSC 490. Medieval/Renaissance Notation (3)
Theory of chant, modal, mensural, and tablature notations. Practice in making literal transcriptions, editing, and preparing scores for performances.

MUSC 493. Introduction to Early Music Performance Practice (3)
(See MUSC 393.)

MUSC 494. Seminar in Early Music Performance Practice (3)
(See MUSC 394.)

MUSC 496. Practice Teaching in Music (12)
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 communication and the arts, technology in learning, interdisciplinary learning, collaborative learning and teaching, creating a supportive learning environment, and professional development. Development of skills needed for self-assessment as well as student assessment. Clinical/Field experiences (all ages) required.

MUSC 499. Clinical/Field Experience (3)
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. Instruction with special needs students, both disabled and gifted. Clinical/Field experiences (all ages) required.

MUSC 501. Special Reading (M.A. and M.M.) (1-18)

MUSC 529. Bibliography and Research Methods in Music (3)
Seminar in research methods and techniques, stressing the analytic and functional approaches to bibliography.

MUSC 539. Doctor of Musical Arts Seminar (3)
Prerequisite: MUSC 529.

MUSC 590. Seminar in Music (3)
Problems in musical criticism, aesthetics, and analysis, as well as historical style.

MUSC 591A. Music Education Seminar: Creativity (3)
In this seminar, we will explore issues and theories involving creative thinking in general, and examine how creative thinking and musical experience interact. Topics include: definitions and theories of creativity; the creative process; the creative product; assessment; creativity in gifted education; teaching for creative growth; creative thinking and music composition (including improvisation), performance and listening; designing creative activities for the music classroom and rehearsal; available resources and professional organizations; and creativity as encouraged by state/national standards. Students will work toward development of a personal definition of creative thinking and how it can be applied to teaching in the music classroom.

MUSC 591C. Music Education Seminar: Conducting (3)
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.

MUSC 595A. Seminar in Music Theory: Analytical Projects (1-2)
Individual projects in analysis for graduate students only.

MUSC 601. Special Readings (Ph.D./D.M.A.) (1-18)
MUSC 651. Thesis: (M.A. and M.M.) (1-6)
MUSC 696. College Teaching Practicum (0)
MUSC 701. Dissertation Ph.D. (1-18)
MUSC 702. Appointed Dissertation Fellow (9)
MUSC 751. Recital Document I-D.M.A. (3)
MUSC 752. Recital Document II-D.M.A. (3)
MUSC 753. Recital Document III-D.M.A. (1-6)
MUSC 782. Composition Document-D.M.A. (3)

Applied Music (APMU)

UNDERGRADUATE COURSES

APMU 011. Recital Class (0)
APMU 101. Principal Performance Area I (1.5-3)
Limited to music and music education majors.
APMU 102. Principal Performance Area II (1.5-3)
Limited to music and music education majors.
APMU 111. Secondary Performance Area I (1.5-3)
Open to all university students.
APMU 112. Secondary Performance Area II (1.5-3)
Open to all university students.
APMU 120B. Voice Class (1)
This course examines vocal skills from beginner through advanced level, both in the techniques of performing and the pedagogy of teaching. Students learn to sing to a proficient level. Vocal concepts and skills are developed; methods, materials and practices of teaching, singing, and assessing the voice are examined, with special focus on teaching large groups. All ability and age levels are addressed. Multiple learning styles, modes, and strategies are modeled by the teacher and practiced by the student in clinical and/or field experiences. Appropriate modification of instruction for disabilities, cultural diversity, and technological advances are also included. State, national, and professional standards as they apply to the voice are discussed. Clinical/Field experiences required.

APMU 120D. Guitar Class (1)
This course examines guitar skills from beginner through advanced level, both in the techniques of performing and the pedagogy of teaching. Students learn to play to a proficient level. Guitar concepts and skills are developed; methods, materials and practices of teaching, playing, and assessing the guitar are examined, with special focus on teaching large groups. All ability and age levels are addressed. Multiple learning styles, modes, and strategies are modeled by the teacher and practiced by the student in clinical and/or field experiences. Appropriate modification of instruction for disabilities, cultural diversity, and technological advances are also included. State, national, and professional standards as they apply to the guitar are discussed. Clinical/Field experiences required.

APMU 120F. Trumpet Class (1)
This course examines trumpet skills from beginner through advanced level, both in the techniques of performing and the pedagogy of teaching. Students learn to apply to the trumpet are discussed. Clinical/Field experiences required.

APMU 120G. Trumpet Class (1)
This course examines trumpet skills from beginner through advanced level, both in the techniques of performing and the pedagogy of teaching. Students learn to play to a proficient level. Trumpet concepts and skill are developed; method, materials and practices of teaching, playing, and assessing the trumpet are examined, with special focus on teaching large groups. All ability and age levels are addressed. Multiple learning styles, modes, and strategies are modeled by the teacher and practiced by the student in clinical and/or field experiences. Appropriate modification of instruction for disabilities, cultural diversity, and technological advances are also included. State, national, and professional standards as they apply to the trumpet are discussed. Clinical/Field experiences required.

APMU 120H. Violin Class (1)
This course examines violin skills from beginner through advanced level, both in the techniques of performing and the pedagogy of teaching. Students learn to play to a proficient level. Violin concepts and skills are developed; methods, materials and practices of teaching, playing, and assessing the violin are examined, with special focus on teaching large groups. All ability and age levels are addressed. Multiple learning styles, modes, and strategies are modeled by the teacher and practiced by the student in clinical and/or field experiences. Appropriate modification of instruction for disabilities, cultural diversity, and technological advances are also included. State, national, and professional standards as they apply to the violin are discussed. Clinical/Field experiences required.

APMU 120J. String Class (1)
This course examines string skills from beginner through advanced level, both in the techniques of performing and the pedagogy of teaching. Students learn to play to a proficient level. String concepts and skills are developed; methods, materials and practices of teaching, playing, and assessing strings are examined, with special focus on teaching large groups. All ability and age levels are addressed. Multiple learning styles, modes, and strategies are modeled by the teacher and practiced by the student in clinical and/or field experiences. Appropriate modification of instruction for disabilities, cultural diversity, and technological advances are also included. State, national, and professional standards as they apply to strings are discussed. Clinical/Field experiences required.

APMU 120K. Brass Class (1)
This course examines brass skills from beginner through advanced level, both in the techniques of performing and the pedagogy of teaching. Students learn to play to a proficient level. Brass concepts and skills are developed; methods, materials and practices of teaching, playing, and assessing brass are examined, with special focus on teaching large groups. All ability and age levels are addressed. Multiple learning styles, modes, and strategies are modeled by the teacher and practiced by the student in clinical and/or field experiences. Appropriate modification of instruction for disabilities, cultural diversity, and technological advances are also included. State, national, and professional standards as they apply to brass are discussed. Clinical/Field experiences required.

APMU 120L. Clarinet Class (1)
This course examines clarinet skills from beginner through advanced level, both in the techniques of performing and the pedagogy of teaching. Students learn to play to a proficient level. Clarinet concepts and skills are developed; methods, materials and practices of teaching, play-
ing, and assessing the clarinet are examined, with special focus on teaching large groups. All ability and age levels are addressed. Multiple learning styles, modes, and strategies are modeled by the teacher and practiced by the student in clinical and/or field experiences. Appropriate modification of instruction for disabilities, cultural diversity, and technological advances are also included. State, national, and professional standards as they apply to the clarinet are discussed. Clinical/Field experiences required.

APMU 120M. Woodwind Class (1)
This course examines woodwind skills from beginner through advanced level, both in the techniques of performing and the pedagogy of teaching. Students learn to play to a proficient level. Woodwind concepts and skills are developed; methods, materials and practices of teaching, playing, and assessing woodwinds are examined, with special focus on teaching large groups. All ability and age levels are addressed. Multiple learning styles, modes, and strategies are molded by the teacher and practiced by the student in clinical and/or field experiences. Appropriate modification of instruction for disabilities, cultural diversity, and technological advances are also included. State, national, and professional standards as they apply to woodwinds are discussed. Clinical/Field experiences required.

APMU 120N. Percussion Class (1)
This course examines percussion skills from beginner through advanced level, both in the techniques of performing and the pedagogy of teaching. Percussion skills are developed; methods, materials and practices of teaching, playing, and assessing percussion are examined, with special focus on teaching large groups. All ability and age levels are addressed. Multiple learning styles, modes, and strategies are modeled by the teacher and practiced by the student in clinical and/or field experiences. Appropriate modification of instruction for disabilities, cultural diversity, and technological advances are also included. State, national, and professional standards as they apply to percussion are discussed. Clinical/Field experiences required.

APMU 201. Principal Performance Area III (1.5-3)
Limited to music and music education majors.

APMU 202. Principal Performance Area IV (1.5-3)
Limited to music and music education majors.

APMU 211. Secondary Performance Area III (1.5-3)
Open to all university students.

APMU 212. Secondary Performance Area IV (1.5-3)
Open to all university students.

APMU 241. Piano Pedagogy I (1)
APMU 242. Piano Pedagogy II (1)

APMU 301. Principal Performance Area V (1.5-3)
Limited to music and music education majors.

APMU 302. Principal Performance Area VI (1.5-3)
Limited to music and music education majors.

APMU 311. Secondary Performance Area V (1.5-3)
Open to all university students.

APMU 312. Secondary Performance Area VI (1.5-3)
Open to all university students.

APMU 326. Introduction to the Harpsichord (2)
Introduction to the harpsichord technique and the interpretation of 17th- and 18th-Century Baroque keyboard music. Study of national styles, ornamentation, articulation, tempi, dynamics, fingering, and registration. Focus is on short representative works of Byrd, Couperin, Rameau, Duphly, Bach, Scarlatti, and Soler, as well as other works chosen by participating students. Limited to six students. Prerequisites: Open to CIM and CWRU music majors with keyboard background; consent of department.

APMU 327. Accompanying at the Harpsichord (2)
A practical introduction to accompanying a variety of Baroque vocal and instrumental works in a stylistically appropriate manner. Particular emphasis on the Bach sonatas for flute, violin, and viola da gamba. Students who are accompanying in recitals are encouraged to perform in class and receive coaching. Limited to six students. Prerequisites: APMU 326 and consent of department.

APMU 333F. Guitar Seminar (1)

APMU 333G. Organ Practicum (1)

APMU 341. Piano Pedagogy III (1)
Organizing piano literature into levels of difficulty; appropriate use of published materials; in-depth study of psychological/developmental differences in the various age groups; problems pertaining to the adult pupil and the pupil who has had inadequate previous training; teaching of secondary piano at the collegiate level. The class meets one hour weekly. Class members observe instruction within the CIM Conservatory and Preparatory Departments.

APMU 342. Piano Pedagogy IV (1)
(See APMU 341.)

APMU 366. Wind Ensemble (0-1)

APMU 368A. String/Piano Chamber Music (1)

APMU 368B. Intensive Quartet Seminar (2)

APMU 369A. Miscellaneous Ensembles (0-2)

APMU 369B. Contemporary Music Ensemble (1-2)

APMU 380A. Renaissance Instrumental and Vocal Ensemble (0-1)

APMU 380B. Early Music Singers (0-1)

APMU 380C. Other Early Music Ensembles (0-1)

APMU 380D. Baroque Orchestra (0-1)

APMU 381A. CIM Symphony Orchestra (0-1)

APMU 382A. University Circle Chorale (0-1)

APMU 382C. Cleveland Orchestra Chorus (0-1)

APMU 382D. University Singers (0-1)

APMU 383A. Jazz Ensemble I (0-1)

APMU 383B. Jazz Ensemble II (0-1)

APMU 383C. Symphonic Winds (0-1)

APMU 383D. Spartan Marching Band (0-1)

APMU 383F. Handbell Choir (0)

APMU 385. University Circle Chamber Orchestra (0-1)

APMU 386. Keyboard Repertory Seminar (0-1)

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.

GRADUATE COURSES

APMU 401. Principal Performance Area VII (1.5-3)
Limited to music and music education majors.
APMU 402. Principal Performance Area VIII (1.5-3)
Limited to music and music education majors.
APMU 411. Secondary Performance Area VII (1.5-3)
Open to all university students.
APMU 412. Secondary Performance Area VIII (1.5-3)
Open to all university students.
APMU 445. Suzuki Pedagogy I (2)
APMU 446. Suzuki Pedagogy II (2)
APMU 447. Suzuki Pedagogy III (3)
APMU 448. Suzuki Pedagogy IV (3)
APMU 501. Principal Performance Area IX (1.5-3)
Limited to music and music education majors.
APMU 502. Principal Performance Area X (1.5-3)
Limited to music and music education majors.
APMU 511. Secondary Performance Area IX (1.5-3)
Open to all university students.
APMU 512. Secondary Performance Area X (1.5-3)
Open to all university students.
APMU 601. Principal Performance Area XI (1.5-3)
Limited to D.M.A. students.

Natural Sciences

102 Baker Building
Phone 216-368-2928; Fax 216-368-4718
Joanne Westin, director

UNDERGRADUATE PROGRAMS

Major
The natural sciences major is an interdepartmental science program that leads to the Bachelor of Arts degree. It is intended to serve students whose interests and objectives call for a major in the humanities or social sciences that is accompanied by broad background in the natural sciences; e.g. history and philosophy of science and technology. Natural sciences may be taken only as a second major. The student also must declare and complete a major in one of the humanities or social sciences, except for the program in gerontological studies. 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, geological sciences, and physics. The student must complete a minimum of 20 hours in one of the departments, a minimum of 8 hours each in two other of these departments, and 3 hours each in the remaining two departments. In addition, all natural sciences majors must complete MATH 125 and 126 or higher-level courses in mathematics. The courses selected in each of these departments must generally be courses that also satisfy major or related course requirements of an existing science major (though ASTR 201-202 is acceptable).

MINOR
A minor is achieved through completion of the requirements specified below for any four of the five departments listed.

Biology
BIOL 110 and 220, and one of the following courses: BIOL 111, 221.
Chemistry
Completion of one of the following sequences:
CHEM 105, 106, 113 or CHEM 111, 113, ENGR 145
Geological Sciences
Any one of GEOL 101, 110, 115 or 117; and GEOL 119; and one other GEOL course.
Mathematics
Completion of one of the following sequences:
MATH 125, 126 or MATH 121, 122
Physics
Completion of one of the following sequences:
PHYS 115, 116 or PHYS 121, 122, 221

Department of Nutrition

2123 Abington Road, Room 201
216-368-2440; Fax 216-368-6644
Dr. Henri Brunengraber, Chair

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 dietsetics, public health nutrition, medicine, dentistry or nursing. Graduate programs emphasize dietsetics, public health nutrition, nutritional biochemistry and molecular nutrition.

The Department of Nutrition offers programs leading to the following: 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. Speciality programs are available in areas such as maternal and child nutrition or gerontology. The specialty is in addition to the basic graduate degree.

Special announcements describing the various programs and providing additional information are available from the department.

FACULTY
Henri Brunengraber, M.D., Ph.D. (Universite de Liege)
Professor and Chairman of Department
Edith Lerner, Ph.D. (University of Wisconsin - Madison)
Associate Professor and Vice-Chairman of Department
Margaret M. Cicirella, M.A., M.S. (Case Western Reserve University)
Instructor
Blandine Comte, Ph.D., (University of Lyon, France)
Assistant Professor
Paul Ernsberger, Ph.D. (Northwestern University)
Associate Professor
Karen M. Fiedler, Ph.D. (University of Tennessee)
Associate Professor
Jacob E. Friedman, Ph.D. (Kent State University)
Associate Professor
BACHELOR OF SCIENCE DEGREE IN NUTRITION: HUMAN NUTRITION MAJOR
(with dietetics requirements)

Fall Semester

FRESHMAN
CHEM 105 Principles of Chemistry I (3)
ENGL 150 Expository Writing (3)
MATH* (3-4)
GER: Social Sciences (3)
GER: Arts/Humanities (3)
PHED 101 Physical Education (0)

SOPHOMORE
NTRN 342 Food Science (3)
BIOL 110 Principles of Biology (3)
STAT 201 Basic Statistics for the Social and Life Sciences I (3)
CHEM 223 Introductory Organic Chemistry I (3)
CHEM 233 Introductory Organic Chemistry Laboratory * (2)
BIOL 111 Introduction to Experimental Biology Laboratory (2)

JUNIOR
NTRN 363 Energy, Protein, and Minerals (3)
DEND 307 Biochemistry (3)
GER: Arts/Humanities (3)
GER: Global Diversity (3)
Elective (3)

SENIOR
NTRN Elective (3)
Electives (12)
  * Strongly recommended but not required.

Spring Semester

FRESHMAN
CHEM 106 Principles of Chemistry II (3)
CHEM 113 Principles of Chemistry Laboratory (2)
NTRN 201 Nutrition (3)
MATH* (3-4)
GER: Social Sciences (3)
PHED 102 Physical Education Activities (0)

SOPHOMORE
NTRN 343 Dietary Patterns (3)
BIOL 220 Organismal Biology (3)
CHEM 224 Introductory Organic Chemistry II* (3)
CHEM 234 Introductory Organic Chemistry Laboratory II* (2)
GER: Social Sciences (3)
GER: Arts/Humanities (3)

JUNIOR
NTRN 364 Vitamins (3)
Nutrition elective (3)
GER: Arts/Humanities (3)
Elective (6)

SENIOR
BIOL 343 Microbiology* (3)
BIOL 344 Laboratory for Microbiology* (2)
NTRN elective (3)
Electives (6)
  * Strongly recommended but not required.
BACHELOR OF ARTS DEGREE IN NUTRITION: NUTRITIONAL BIOCHEMISTRY AND METABOLISM MAJOR

<table>
<thead>
<tr>
<th>Fall Semester</th>
<th>Credit hours</th>
<th>Spring Semester</th>
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<td><strong>FRESHMAN</strong></td>
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<tr>
<td>MATH 125 Mathematics I</td>
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<td>MATH 126 Mathematics II</td>
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<td>CHEM 105 Principles of Chemistry I</td>
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<td>CHEM 106 Principles of Chemistry II</td>
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<td>ENGL 150 Expository Writing</td>
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<td>CHEM 113 Principles of Chemistry Laboratory</td>
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<td>GER: Arts/Humanities</td>
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<td>NTRN 201 Nutrition</td>
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<td>GER: Social Sciences</td>
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<td>GER: Arts/Humanities</td>
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<td>PHED XXX Physical Education</td>
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<td><strong>SOPHOMORE</strong></td>
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<td>CHEM 223 Introductory Organic Chemistry I</td>
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<td>CHEM 233 Introductory Organic Chemistry Laboratory</td>
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<td>PHYS 115 Introductory Physics I</td>
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<td>BIOL 110 Principles of Biology</td>
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<td>PHYS 116 Introductory Physics II</td>
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<td>GER: Social Sciences</td>
<td>(3)</td>
<td>BIOL 220 Organismal Biology</td>
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<td><strong>JUNIOR</strong></td>
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<td>GER: Arts/Humanities</td>
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<tr>
<td>NTRN 342 Food Science</td>
<td>(3)</td>
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<td>CHEM 301 Physical Chemistry I</td>
<td>(3)</td>
<td><strong>JUNIOR</strong></td>
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<tr>
<td>BIOC 307 General Biochemistry</td>
<td>(4)</td>
<td>BIOL 326 Genetics</td>
<td>(3)</td>
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<td>BIOL 210 Cell Biology</td>
<td>(3)</td>
<td>GER: Global Diversity</td>
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<tr>
<td>BIOL 211 Cell Biology Laboratory</td>
<td>(2)</td>
<td>GER: Arts/Humanities</td>
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<td><strong>SENIOR</strong></td>
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<td>GER: Social Sciences</td>
<td>(3)</td>
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<tr>
<td>NTRN 363 Energy, Protein, Minerals</td>
<td>(3)</td>
<td>Elective</td>
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<td>NTRN 452 Nutritional Biochemistry</td>
<td>(3)</td>
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<td>BIOC 334 Protein and Enzymes</td>
<td>(3)</td>
<td><strong>SENIOR</strong></td>
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<td>Electives</td>
<td>(5)</td>
<td>NTRN 364 Human Nutrition II: Vitamins</td>
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<td>Nutrition elective</td>
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<td>Electives</td>
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der 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 students' 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 as established by the American Dietetic Association. A department advisor should be consulted in the freshman or sophomore year to plan the dietetics coursework.

**NUTRITION**

Bachelor of Science degree requires the completion of the Arts and Sciences General Education Requirements (GER), PHED 101, 102, and the following courses:

NTRN 201, 342, 363, 364, and three NTRN electives
CHEM 105, 106, 113, 223
BIOL 110, 111, 220 or 348 or PHOL 480
BIOC 307 or DEND 307
STAT 201 or 243 or 312 or 313

Bachelor of Arts degree requires the completion of the Arts and Sciences GER, PHED 101, 102, and the following courses:

NTRN 201; 342, 363, 364, 399 and two NTRN electives
CHEM 105 or 107, 106 or 108, 223
BIOL 110, 220 or 348 or PHOL 480
BIOC 307 or DEND 307

**NUTRITIONAL BIOCHEMISTRY AND METABOLISM**

Bachelor of Arts degree requires the completion of the Arts and Sciences GER, PHED 101, 102, and the following courses:

NTRN 201, 342, 363, 364, 452 and one NTRN elective
MATH 121, 122, 223, 224
CMPS 131
CHEM 105 or 107, 106 or 108, 113, 223, 224, 233, 234, 301, 302
BIOL 110, 210, 211, 212, 213, 326
BIOL 220 or 348 or PHOL 480
PHYS 121 and 122 or 123 and 124, 221
BIOC 307, 334

**Minor Programs**

The basic sequence for a minor program consists of NTRN 201, Nutrition (3), NTRN 343, Dietary Patterns (3), and an additional 9 hours of nutrition courses, selected with the guidance of an advisor.

**Nutrition (NTRN)**

### UNDERGRADUATE COURSES

**NTRN 201. Nutrition (3)**
The nutrients, their functions, food sources, and factors affecting human needs throughout life.

**NTRN 328. Child Development and Health (3)**
Growth and development of the child from prenatal through adolescence, including individuality, maturation, and biological needs.

**NTRN 342. Food Science (5)**
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. Laboratory and lecture. Prerequisite: CHEM 106.

**NTRN 343. Dietary Patterns (3)**
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. Prerequisite: NTRN 201 or consent.

**NTRN 351. Food Service Systems Management (3)**
The application of organizational theory and skills in the preparation and service of quantity food. Laboratory experience in professional food services are included. Prerequisite: Nutrition major or consent of instructor.

**NTRN 360. Guided Study in Nutrition Practice (3)**
Methods for the provision of nutrition services to individuals and groups. Principles of professional practice including ethics, standards, and regulatory issues. Prerequisite: NTRN 363 or NTRN 433 or consent.

**NTRN 363. Human Nutrition I: Energy, Protein, Minerals (3)**
Chemical and physiological properties of specific nutrients, including interrelationships and multiple factors, in meeting nutritional needs throughout the life cycle. Prerequisites: NTRN 201, CHEM 223 and BIOL 220 or equivalent.

**NTRN 364. Human Nutrition II: Vitamins (3)**
Chemical and physiological properties of vitamins, including interrelationships and multiple factors, in meeting nutritional needs throughout the life cycle. Prerequisite: NTRN 363 or consent.

**NTRN 365. Nutrition in Disease (4)**
Application of nutrition principles to the problems of diet in disease. Prerequisites: NTRN 363 and BIOC 307 or equivalent.

**NTRN 371. Special Problems (1-3)**
Independent reading, research, or special projects supervised by a member of the nutrition faculty.

**NTRN 372. Special Problems (1-3)**
Independent reading, research, or special projects supervised by a member of the nutrition faculty.

**NTRN 388. Seminar in Nutrition (1-3)**
Prerequisite: Junior or Senior standing.

**NTRN 390. Undergraduate Research (3-9)**
Guided laboratory research in nutritional biochemistry or molecular nutrition under the sponsorship of a nutrition faculty member. Prerequisite: Written consent of faculty sponsor.

**NTRN 399. Senior Project (3)**
Formal investigation of a topic in nutrition culminating in a paper and oral presentation. Requires definition of a problem, evaluation of the scientific literature and delineation of problem-solving approaches. Prerequisites: Twenty-one
hours of nutrition and consent of supervising instructor.

GRADUATE COURSES

NTRN 410. History of Food and Nutrition (3)
Institutions of the development of nutrition as a science and interactions with medicine, agriculture, public health and dietetics. Food and technological effects on health. Prerequisite: Consent of instructor.

NTRN 433. Advanced Human Nutrition I (4)
Emphasis on reading original research literature in energy, protein and minerals with development of critical evaluation and thinking skills. Prerequisites: NTRN 201 and CHEM 223 and BIOL 220 or equivalent.

NTRN 434. Advanced Human Nutrition II (3)
Emphasis on reading original research literature on vitamins with development of critical evaluation and thinking skills. Prerequisite: NTRN 433 or consent.

NTRN 435. Maternal and Child Nutrition (3)
Study of current research literature on nutrition for pregnancy, lactation, infancy and childhood, including assessment and requirements. Prerequisite: Nutrition major or consent of instructor.

NTRN 437. Evaluation of Nutrition Literature (3)
Reading and appraisal of food and nutrition literature written for the general public, including books, periodicals and audio and visual sources. Prerequisite: Nutrition major or consent of instructor.

NTRN 438. Trends in Diet Therapy (3)
Evaluation and interpretation of modern concepts of nutrition related to abnormalities requiring dietary modifications. Prerequisite: NTRN 365 or equivalent.

NTRN 440. Nutrition for the Aging and Aged (3)
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. Prerequisite: Nutrition major or consent of instructor.

NTRN 446. Advanced Maternal Nutrition: Special Topics (3)
Analysis of the problems commonly associated with high-risk pregnancies and fetal outcome. Discussion of causes, mechanisms, management and current research. Prerequisite: NTRN 435 or consent.

NTRN 451. Food Service Systems Management (3)
Application of organizational theory and skills in the preparation and service of quantity food. Laboratory experiences in professional food services are included. Students will analyze one aspect of food service management in depth. Prerequisite: Nutrition Major or consent.

NTRN 452. Nutritional Biochemistry and Metabolism (3)
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. Prerequisite: BIOC 307 or equivalent. Cross-listed as BIOC 452.

NTRN 454. Isotope Tracer Methodology (3)
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. Prerequisite: BIOC 407.

NTRN 455. Molecular Nutrition (3)
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. Prerequisite: BIOC 407.

NTRN 460. Sports Nutrition (3)
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. Prerequisite: NTRN 363 or NTRN 433 or consent.

NTRN 516. Seminar in Dietetics I (4)
Study of scientific basis for clinical and community nutrition practice and developments in food service systems management. Prerequisite: Dietetic internship.

NTRN 517. Seminar in Dietetics II (4)
Study of scientific basis for clinical and community nutrition practice and developments in food service systems management. Prerequisite: Dietetic internship.
management and dietetics. Designing research proposals. Prerequisite: Nutrition major or consent of instructor.

NTRN 601. Special Problems (1-18)
NTRN 651. Thesis M.S. (1-18)
NTRN 701. Dissertation Ph.D. (1-18)
NTRN 702. Appointed Dissertation Fellow (9)

Department of Philosophy

203 Clark Hall
Phone 216-368-2810; Fax 216-368-0814
Colin McLarty, Chair

The Department of Philosophy offers an undergraduate major leading to the Bachelor of Arts degree. A student majoring in philosophy must satisfy the requirements of the Arts and Sciences General Education Requirements. The department participates in the Integrated Graduate Studies Program leading to the Master of Arts degree in philosophy. It offers minor programs and sequences for the undergraduate; it offers graduate-level courses for candidates for the Master of Arts degree in philosophy and in other fields. 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, and disciplines in 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 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.

The department participates in an interdisciplinary major program in the history and philosophy of science and technology leading to the Bachelor of Arts degree in collaboration with the Department of History. The department also participates in, and contributes courses to, the interdisciplinary minor in artificial intelligence.

FACULTY
Colin McLarty, Ph.D. (Case Western Reserve University)
Associate Professor and Chair
Logic; philosophy of logic; philosophy of mathematics; philosophy of science; contemporary French philosophy
Laura E. Heneghel Ph.D. (Loyola University)
Assistant Professor
Political and social philosophy; philosophy of law; philosophy of feminism; Hegel; contemporary continental philosophy
Chin-Tai Kim, Ph.D. (Harvard University)
Professor
History of philosophy (17th-, 18th-, and 19th-century philosophy); theory of knowledge, metaphysics; ethics; phenomenology
Caroline A. Whitbeck, Ph.D. (Massachusetts Institute of Technology)
The Elmer G. Beamer-Hubert H. Schneider Professor of Ethics
Ethics; practical ethics; professional ethics

ASSOCIATE FACULTY
Stephen Post, Ph.D. (University of Chicago)
Associate Professor of Biomedical Ethics
Biomedical ethics; applied ethics

ADJUNCT FACULTY
Scott A. Dowling, M.D. (University of Rochester)
Adjunct Associate Professor of Philosophy
Psychoanalytic Theory and Philosophy
Joel Levin, Ph.D (University of Oxford)
Adjunct Associate Professor of Philosophy
Adjunct Professor of Law

UNDERGRADUATE PROGRAMS

Major
The major consists of 30 hours (ten 3-credit courses) in philosophy, including PHIL 101, 201, 301, 302, and six other courses to be determined in consultation with the department’s undergraduate advisor. However, a student may request of the advisor that up to 6 hours (two 3-credit courses) of the required 18 hours in six 3-credit philosophy electives be taken 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.

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.

Sequences for students in the Engineering Core
All sequences must include PHIL 101 and two other philosophy courses at the 200- or 300-levels (excluding PHIL 390 and 399) as approved by the undergraduate advisor. A typical sequence, for example, will consist of PHIL 101 and two courses from one of the following groups:

Logic and Scientific Methodology
PHIL 201, Introduction to Logic (3)
PHIL 203, Natural Philosophy I (3)
PHIL 204, Natural Philosophy II (3)
PHIL 303, Evolution, Creation and Science (3)

Logic, Formal Systems, and Philosophy of Mathematics
PHIL 201, Introduction to Logic (3)
PHIL 306, Mathematical Logic (3)
PHIL 310, Topics in Philosophy of Logic (3)
PHIL 313, Philosophy of Mathematics (3)

Value Theory
PHIL 305, Ethics (3)
PHIL 205, Contemporary Moral Problems (3)
Phil 304, Science and Engineering Ethics
PHIL 325, Philosophy of Feminism (3)
PHIL 334, Political and Social Philosophy (3)
PHIL 335, Philosophy of Law (3)
PHIL 375, Aesthetics (3)

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Language, Mind and Cognition
PHIL 201, Introduction to Logic (3)
PHIL 345, Epistemology and Metaphysics (3)
PHIL 365, Philosophy of Mind (3)
PHIL 385, Philosophy of Language (3)

Philosophy and Culture
Phil 225, Evolution
PHIL 301, Ancient Philosophy (3)
PHIL 320, Phenomenology, Existentialism, and Hermeneutics (3)
PHIL 345, Epistemology and Metaphysics (3)
PHIL 355, Nineteenth and Twentieth-Century Philosophy (3)
PHIL 356, Comparative Philosophy (3)
PHIL 358, Philosophy of the Frankfurt School (3)
PHIL 370, Philosophy and Literature (3)
PHIL 375, Aesthetics (3)

There are other possible sequences.

Philosophy Courses for the General Education Requirement:
PHIL 201 may be used to satisfy the Mathematical Reasoning and Analysis requirement.
PHIL 101, with any one of the following courses, 204, 205, 302, 305, 334, 345, and 370, may be used to satisfy the sequence requirement in History, Philosophy and Religion.
PHIL 356, Comparative Philosophy may be used to satisfy the Global and Cultural Diversity requirement.

Departmental Honors
The department offers an Honors Program for students enrolled in its major program which involves completing a substantial thesis, passing an oral examination on the thesis, and maintaining a B average in philosophy courses taken while in the program. 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. An interested student should apply for admission to the program during the first semester of junior year.

Integrated Graduate Studies
The Department of Philosophy participates in the Integrated Graduate Studies Program. Interested students should note the general requirements and the general admission procedures in this bulletin and consult the department for further information. The Honors Program and the Integrated Graduate Studies Program may be combined with the department’s approval. Students wishing more information about any aspect of the undergraduate programs should consult the department.

GRADUATE PROGRAMS
The department offers graduate-level courses for the Master of Arts degree through the Integrated Graduate Studies Program and for graduate students in other fields.

Philosophy (PHIL)

UNDERGRADUATE COURSES
PHIL 101. Introduction to Philosophy (3) Basic problems of philosophy and methods of philosophical thinking. Problems raised by science, morality, religion, politics, and art. Readings from classical and contemporary philosophers. Normally given in multiple sections with different instructors and possibly with different texts. All sections share core materials in theory of knowledge, metaphysics, and ethics despite differences that may exist in emphasis.

PHIL 201. Introduction to Logic (3) 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) 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. Cross-listed as HSTY 203.

PHIL 204. Natural Philosophy II (3) 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. Cross-listed as HSTY 207.

PHIL 205. Contemporary Moral Problems (3) Examination of selected contemporary moral problems and contemporary faces of perennial moral problems such as: when, if ever, lying is justified; the value of honesty and of confidentiality; under what circumstances, if any, various types of killing (suicide, execution, in war, euthanasia, killing of lower animals or ecosystems) are justified. Additional moral problems raised by new knowledge (such as genetic information) or new technology (such as rights to digital information, or the ability to), and responsible uses of these and other sources of power. Clarification of the concepts of value, ethical evaluation and justification, ethical argument, moral relevance, and the notion of a moral problem itself. Readings will draw on classical and contemporary sources in philosophy.

PHIL 225. Evolution (3) 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. Cross-listed as ANTH 225, BIOL 225, GEOL 225, and HSTY 225.

PHIL 270. Introduction to Gender Studies (3) 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, and art
PHIL 271. Bioethics: Dilemmas in Research and Clinical Practice (3) Cross-listed as BETH 271.

PHIL 301. Ancient Philosophy (3) Western philosophy from the early Greeks to the Skeptics. Emphasis on the pre-Socratics, Plato, and Aristotle. Prerequisite: PHIL 101. Cross-listed as CLSC 301.


PHIL 303. Topics in Philosophy of Science (3) 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. Prerequisite: PHIL 101 or PHIL 201 or PHIL 203.

PHIL 304. Science and Engineering Ethics (3) 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? Prerequisite: PHIL 101 or PHIL 205.

PHIL 305. Ethics (3) 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. Prerequisite: PHIL 101.

PHIL 306. Mathematical Logic and Model Theory (3) Propositional calculus and quantification theory; consistency and completeness theorems; goedel incompleteness results and their philosophical significance; introduction to basic concepts of model theory; problems of formulation of arguments in philosophy and the sciences.

PHIL 309. Philosophical Issues in Genetics (3) A philosophical examination of the history and cultural connections of the science of genetics and its precursors. Genetics is a phenomenon of the twentieth century. Thus, it is new. Yet, its implications and dilemmas are enmeshed in old traditions and stereotypes, and the dynamics of cultural change. To explore the breadth of philosophical repercussions of genetics, this course will draw on science, technology, medicine, and their histories, but will also range wider to include aspects of the social history of racism and class relations, changing attitudes toward sexuality, the intricacies of big business and international cooperation, and other such diverse areas. Prerequisite: PHIL 101 or PHIL 203 or PHIL 204.

PHIL 313. Philosophy of Mathematics (3) Logical paradoxes and their effects on foundations of mathematics. Status of mathematical entities and nature of mathematical truths. Formalist, logicist, and intuitionist positions. Prerequisite: PHIL 101 or PHIL 201.

PHIL 325. Philosophy of Feminism (3) 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. Prerequisite: PHIL 101.

PHIL 333. Philosophy of Religion (3) 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. Prerequisite: PHIL 101. Cross-listed as RLGN 333.

PHIL 334. Political and Social Philosophy (3) 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. Prerequisite: PHIL 101. Cross-listed as LAWS 353.

PHIL 335. Philosophy of Law (3) Nature of law and legal systems; bearing of moral justice on legal validity; nature and justification of criminal law and punishment; nature of legal rules and of obligations to law in legal systems; logic of legal reasoning; distinctions of concepts such as legal responsibility and causation. Readings from classical and contemporary sources. Prerequisite: PHIL 101. Cross-listed as POSC 354.

PHIL 345. Epistemology and Metaphysics (3) 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. Prerequisite: PHIL 101.

PHIL 355. 19th and Early 20th Century Philosophy (3) 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. Prerequisite: PHIL 101.

PHIL 356. Comparative Philosophy (3) Comparison of significant philosophers or philosophical schools of non-Western traditions with Western counterparts on
metaphysical, epistemological, ethical, aesthetic, and sociopolitical theoretic issues. The non-Western traditions to be considered include the Indian and the Far Eastern, but not exclusively. Discussion, in context, of the problems of comparative hermeneutics. Readings will include original sources in English translation. Prerequisite: PHIL 101.

PHIL 365. Philosophy of Mind (3)
Traditional problems such as the relation of mind and body, knowledge of other minds, free will and determination, and nature of psychological explanation. Analysis of chief theories of mind. Analysis of mental concepts such as intention, action, decision, emotion, and will. Prerequisite: PHIL 101.

PHIL 370. Philosophy and Literature (3)
Affinities and tensions between philosophy and literature and issues that arise in their interface. Topics include: philosophical use of literary devices; literary use of philosophical ideas; literary philosophy and philosophical literature; and hermeneutics of literature and philosophy. Readings in philosophy and literature from both traditional and contemporary sources. Team-taught by faculty of the philosophy and literature departments. Prerequisite: PHIL 101. Cross-listed as CMPL 371.

PHIL 385. Philosophy of Language (3)
Nature of language; problems of meaning, reference, and truth. Prerequisite: PHIL 101.

PHIL 394. Seminar in Evolutionary Biology (3)
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. Cross-listed as ANTH 394, BIOL 394, GEOL 394, and HSTY 394.

PHIL 399. Directed Study (3)
Open to students in either of the major programs and to minors.

GRADUATE COURSES

PHIL 403. Topics in Philosophy of Science (3)
(See PHIL 303.)

PHIL 404. Science and Engineering Ethics (3)
(See PHIL 304.)

PHIL 405. Ethics (3)
(See PHIL 305.)

PHIL 406. Mathematical Logic and Model Theory (3)

PHIL 409. Philosophical Issues in Genetics (3)
(See PHIL 309.)

PHIL 413. Philosophy of Mathematics (3)
(See PHIL 313.)

PHIL 425. Philosophy of Feminism (3)
(See PHIL 325.) Prerequisite: PHIL 101.

PHIL 433. Philosophy of Religion (3)
(See PHIL 333.) Prerequisite: PHIL 101. Cross-listed as RLGN 433.

PHIL 434. Political and Social Philosophy (3)
(See PHIL 334.) Cross-listed as POSC 454.

PHIL 435. Philosophy of Law (3)
(See PHIL 335.) Prerequisite: PHIL 101.

PHIL 445. Epistemology and Metaphysics (3)
(See PHIL 345.)

PHIL 455. 19th and Early 20th Century Philosophy (3)
(See PHIL 355.)

PHIL 456. Comparative Philosophy (3)
(See PHIL 356.) Prerequisite: PHIL 101.

PHIL 465. Philosophy of Mind (3)
(See PHIL 365.)

PHIL 470. Philosophy and Literature (3)
(See PHIL 370.)

PHIL 485. Philosophy of Language (3)
(See PHIL 385.)

PHIL 494. Seminar in Evolutionary Biology (3)
(See PHIL 394.) Cross-listed as ANTH 494, BIOL 494, GEOL 494, and HSTY 494.

PHIL 600. Tutorial (1-18)

PHIL 651. Thesis M.A. (1-6)

PHIL 700. Advanced Tutorial and Dissertation (1-18)
For Ph.D. candidates in fields related to philosophy.

DEPARTMENT OF PHYSICAL EDUCATION AND ATHLETICS

Veale Convocation, Recreation, Athletic Center
Phone 216-368-2867; Fax 216-368-5475
David M. Hutter, Chair
The Department of Physical Education offers the student a variety of opportunities from challenging academic classes to vigorous recreational activities.

FACULTY

David M. Hutter, Ph.D. (Ohio State University)
Professor and Chair
Todd Clark, B.A. (Kenyon College)
Instructor
Men and women’s swim coach
Robert Del Rosa, M.A. (Western Reserve College)
Associate Professor
Wrestling coach; assistant director of athletics
Nancy Gray, M.Ed. (Kent State University)
Associate Professor
Associate director of athletics; coordinator physical education
Peter C. Germana, M.Ed. (Bowling Green State University)
Assistant Professor
Football and assistant track coach
Gerald Harbak, M.S. (Western Reserve University)
Assistant Professor
Soccer coach; golf coach
Kristin Hughes, M.S. (Smith College)
Instructor
Women’s basketball coach
Dennis Harris, B.S. (The Ohio State University)
Instructor
Women’s track and field coach; assistant football coach
Patrick Kennedy, M.S. (University of Maryland)
Assistant Professor
Director of intramurals, coordinator of club sports and coordinator of facilities
Mina Moore, B.S. (Wayne State University)
Instructor
Associate director, intramurals
Nancy Rahn, M.S. (West Chester University)
Instructor
Tennis coach
Regis Scafe, M.S., (Cleveland State University)
Assistant Professor
Football and assistant track coach
Jerry Seimon, B.S. (Kent State University)
Instructor
Baseball; assistant football coach
Kim Shaw, M.S. (Cleveland State University)
Assistant Professor
Soccer; assistant track and field coach

UNDERGRADUATE PROGRAMS

Sports Medicine
The purpose of the sports medicine minor is to expose students to the theory and practical aspects of prevention, recognition, and treatment of athletic injuries.

Required: PHED 332, 334, 339, 340, 341, 342

Lifetime Sports Program
The department has designed an instructional program of modern activities and lifetime sports. Each semester 15 to 25 coeducational lifetime sports classes are offered. Freshmen, who have a one-year physical education requirement, have first priority in electing PHED 010 to 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 to 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: residence hall, fraternity, women, coed, graduate, and open. Intercollegiate varsity athletic competition is available in 12 sports for men and 10 sports for women.

PHED 012. Tennis (0)
PHED 016. Cross Country Skiing (0)
PHED 017. Dance Aerobics (0)
PHED 019. Golf (0)
PHED 024. Jogging (0)
PHED 025. Power Volleyball (0)
PHED 026. Racquetball (0)
PHED 028. Squash (0)
PHED 029. Swimming: Beginners/Intermediate (0)
PHED 030. Swimming: Endurance (0)
PHED 031. Tennis (0)
PHED 034. Weight Training (0)
PHED 039. Bowling (0)
PHED 040. Basketball (0)
PHED 041. Softball (0)
PHED 050. Personal Safety Awareness (0)

Full-Semester Courses
PHED 102. Archery (0)
PHED 105. CPR/First Aid (0)
PHED 108. Fencing - All Levels (0)
PHED 110. Hiking and Exploring (0)
PHED 114. Modern Dance (0)
PHED 119. Skin and Scuba Diving (0)
Prerequisite: Advanced swimming skills.
PHED 120. Skin and Scuba Diving - Advanced (0)
Prerequisite: Skin and Scuba Certification.
PHED 127. Water Safety Instructors (0)
Prerequisite: Emergency Water Safety or Lifeguarding Certificate.
PHED 128. Weight Training I (0)
Prerequisite: Consent of instructor.
PHED 129. Life Guarding (0)
Prerequisite: Advanced swimming skills.
PHED 130. Wellness (0)
PHED 131. Personal Fitness (0)
PHED 140. Modern Jazz Dance (0)
PHED 141. Folk Dance (0)
PHED 142. Social Dance (0)
PHED 170. Varsity Baseball (0)
PHED 171. Varsity Basketball - Men (0)
PHED 172. Varsity Basketball - Women (0)
PHED 173. Varsity Cheerleaders (0)
PHED 174. Varsity Cross Country - Men (0)
PHED 175. Varsity Cross Country - Women (0)
PHED 176. Varsity Fencing - Men (0)
PHED 177. Varsity Fencing - Women (0)
PHED 178. Varsity Football (0)
PHED 179. Varsity Golf (0)
PHED 180. Varsity Soccer - Men (0)
PHED 181. Varsity Soccer - Women (0)
PHED 182. Varsity Swimming - Men (0)
PHED 183. Varsity Swimming - Women (0)
PHED 184. Varsity Tennis - Men (0)
PHED 185. Varsity Tennis - Women (0)
PHED 186. Varsity Track and Field - Men (0)
PHED 187. Varsity Track and Field - Women (0)
PHED 188. Varsity Volleyball (0)
PHED 189. Varsity Wrestling (0)
PHED 190. Varsity Softball - Women (0)
PHED 203. Body Conditioning - Advanced (1)
PHED 204. CPR/First Aid (1)
PHED 208. Racquetball - Advanced (1)
PHED 210. Skin and Scuba Diving (1)
Prerequisite: Advanced swimming skills.
PHED 211. Skin and Scuba Diving - Advanced (1)
Prerequisite: Skin and Scuba Certification.
PHED 215. Water Safety Instructors (1)
Prerequisite: Emergency Water Safety or Lifeguarding Certificate.
PHED 216. Weight Training II (1)
Prerequisite: PHED 128 or PHED 034.
PHED 217. Life Guarding (1)
Advanced physical education activities. Advanced instruction in sports, limited to upperclassmen. This course may lead to certification in lifeguarding. Prerequisite: Advanced swimming skills.
PHED 218. Wellness (1)
PHED 219. Weight Training III (1)
Prerequisite: PHED 216.
PHED 320. Psychology of Sport (2)
The major psychological dimension underlying an individual’s participation in sport. Selected areas that influence the acquisition of physical skill and performance in sports.

PHED 325. Officiating Basketball (2)
Administrative procedures, promotion, managerial relationships, scheduling, tournaments, budgeting, scoring systems, and officiating.

PHED 332. Care and Prevention of Athletic Injuries (3)
Designed as introduction to field of athletic training. Students become acquainted with various responsibilities of athletic trainers. Helps students better understand injury prevention and basis foundations of sports trauma. Study includes injury evaluation and treatment of the foot, ankle, knee, and lower leg.

PHED 334. Advanced Athletic Training I (3)
Introduces students to sports medicine management, including emergency procedures and general assessment skills. Principles underlying therapeutic modalities and exercise rehabilitation are discussed. Injury evaluation and treatment for the abdomen, shoulder, forearm, wrist, and hand are included. Prerequisites: PHED 332 and PHED 340.

PHED 337. Perspectives in Sex (3)
The many facts of human sexuality; incorporating this information into an effective healthy program of living.

PHED 339. Advanced Athletic Training II (3)
Concentrates on rehabilitation and modality application. Special topics such as drugs, nutrition, health conditions related to sports and gender issues are covered. Care and management of head, spinal, thoracic, and hip injuries included. Students participate in physical therapy clinic. Prerequisites: PHED 332 and PHED 340 and PHED 334.

PHED 340. Human Anatomy (3)
The purpose of this course is to instruct the student in basic anatomy. Joint and muscle action as it relates to performance is covered.

PHED 341. Physiology of Exercise (3)
Exercise physiology is an aspect of sports medicine that involves the study of how the body, from a functional standpoint, responds and adjusts to exercise. The study of exercise physiology is based on factual information derived primarily from experimental research. Laboratory work is an integral part of this course. Prerequisite: PHED 340.

PHED 342. Biomechanics (3)
The purpose of this course is to give the students an understanding of biomechanics. This course will help students better understand why specific mechanisms result in specific injuries. Topics include strength vs. power, dynamics, closed kinetic chain, open kinetic chain, and biomechanical analysis of specific joints. Prerequisite: PHED 340.

PHED 357. Principles of Coaching (2)
Designed to provide methods and techniques for coaching sport. Topics include teaching skill, motivating participants, training, conditioning, practice organization, budget, equipment, and facility management, and psychological, sociological and philosophical implications.

Department of Physics

Rockefeller Building
Phone 216-368-4000; 800-368-PHYS (7497)
FAX 216-368-4671
Lawrence M. Krauss, Chairman

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. It also offers the graduate degrees, Master of Science and Doctor of Philosophy. 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 can thus 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 individual student’s interests and career plans. Individualized programs are developed with the aid of an advisor. A similar flexibility exists in the first few years of graduate study. The research leading to the Ph.D. is normally confined to a specific area of physics. However, even at this stage, the broad background and training characteristic of a physics degree are emphasized.

FACULTY

Lawrence M. Krauss, Ph.D. (Massachusetts Institute of Technology)
Ambrose Swasey Professor of Physics and Chairman of the Department, Professor of Astronomy (lmk9@po.cwru.edu)
Theoretical physics, particle physics, astrophysics, cosmology.
Daniel Akerib, Ph.D. (Princeton University)
Assistant Professor (dsa5@po.cwru.edu)
Experimental astrophysics.
Robert W. Brown, Ph.D. (Massachusetts Institute of Technology)
Institute Professor (rwb@po.cwru.edu)
Particle physics theory, cosmology, medical imaging, industrial physics.
Gary Chottiner, Ph.D. (University of Maryland)
Professor (gc2@po.cwru.edu)
Experimental physics of surfaces and thin films.
Corbin E. Covault, Ph.D. (Harvard University)
Associate Professor
Experimental high energy astrophysics
Arnold Dahm, Ph.D. (University of Minnesota)
Professor (ajd3@po.cwru.edu)
Low temperature experimental physics, twodimensional systems, quantum phenomena.
Thomas G. Eck, Ph.D. (Columbia University)
Professor (tge@po.cwru.edu)
Experimental atomic physics.
David E. Farrell, Ph.D. (University of London)
Professor (def@po.cwru.edu)
Experimental condensed matter physics, superconductors.
Kathleen Kash, Ph.D. (Massachusetts Institute of Technology)
Associate Professor (kxk43@po.cwru.edu)
Experimental condensed matter and mesoscopic physics, quantum semiconducting structures.
Kenneth L. Kowalski, Ph.D. (Brown University)
Professor (kjk3@po.cwru.edu)
Theoretical and experimental particle physics.
Walter Lambrecht, Ph.D. (University of Ghent)
Professor (wlt2@po.cwru.edu)
Theoretical condensed matter physics; electronic structure based physics of materials.
Harsh Mathur, Ph.D. (Yale University)
Warren Rupp Assistant Professor (hxm7@po.cwru.edu)
Condensed matter theory.
Rolfe G. Petschek, Ph.D. (Harvard University)
Professor (rgp@po.cwru.edu)
Theoretical condensed matter, optical materials.
D. Keith Robinson, D. Phil. (University of Oxford)
Professor (ktr2@po.cwru.edu)
Particle physics experiments, accelerator based.
THE BACHELOR OF SCIENCE IN PHYSICS

The Bachelor of Science in Physics requires completion of the Arts and Sciences General Education Requirements (GER), the courses listed in the following table and 127 total credits.

<table>
<thead>
<tr>
<th>Course</th>
<th>Year*</th>
<th>Cr.</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYS 121 or 123. Physics I, Mechanics</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 122 or 124. Physics II, Electric. &amp; Magnetism</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 221. Introduction to Modern Physics</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 203. Analog and Digital Electronics</td>
<td>2F</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 204. Advanced Instrumentation Laboratory</td>
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<tr>
<td>PHYS 250. Mathematics, Physics, and Computing</td>
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<tr>
<td>PHYS 310. Classical Mechanics</td>
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<tr>
<td>PHYS 301. Advanced Laboratory Physics I</td>
<td>3F</td>
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<td>PHYS 313. Thermodynamics &amp; Statist. Mechanics</td>
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<td>PHYS 331. Introduction to Quantum Mechanics I</td>
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<td>PHYS 324. Electricity and Magnetism I</td>
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<td>PHYS 325. Electricity and Magnetism II</td>
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<td>PHYS 351. Physics Senior Project</td>
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<td>PHYS 316. Intro. to Nuclear and Particle Physics</td>
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Subtotal 60

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Subtotal 25(27)

Open electives*** 15***
A&S GER 39
Major/GER overlap —12

Total 127

* course usually taken in this year, offered only in F = fall, S = spring
** or other approved computational course
*** The number of open electives may vary as determined by the degree requirement that the total number of credits add to 127 or more.

Courses required for the B.S. in Physics satisfy the 12 credit GER for Natural and Mathematical Sciences.
Mark Trodden, Ph.D. (Brown University)
Assistant Professor of Physics
(303) 861-0176
Theoretical cosmology and particle physics

UNDERGRADUATE PROGRAMS

The Department of Physics offers Bachelor of Arts and Bachelor of Science degrees in Physics, as well as a Bachelor of Science in Mathematics and Physics. It also offers a Bachelor of Science in Engineering (B.S.E.) with a major in Engineering Physics. The B.A. and B.S. programs are traditional degrees offered by the College of Arts and Sciences. These liberal arts degrees carry the General Education Requirements of the College of Arts and Sciences. Both can lead to immediate employment or to graduate study in physics or related fields. A variety of electives within and outside of the department are available in these programs to provide the breadth and flexibility that will considerably enhance the student’s opportunities at the best graduate schools and in industrial and government organizations.

The B.A. 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. The B.S.E. degree in Engineering Physics supplies a very good background for graduate studies in physics, but is designed for students who value an engineering credential and who are considering a career in engineering either through employment following the B.S.E. or 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 a specific engineering area.

The B.S. in Mathematics and Physics degree is a single degree for students interested in both advanced mathematics and theoretical physics and their relationships. The program is administered by a committee chosen from the faculties of both the mathematics and physics departments. The student will complete a significant number of advanced mathematics courses and somewhat fewer experimental laboratory courses than in the B.S. in Physics program.

All B.S., B.A. and B.S.E. candidates complete a year-long senior project in which the student works one-on-one with a faculty researcher, writes a senior thesis and presents a short seminar on the project.

Employment opportunities at the bachelor’s level include research, development and technical assistance (engineering, computer programming and management) in industrial, government and university settings.

A program in teacher certification (grades 7 through 12), based on the BA degree, is available for students interested in a career in teaching physics at the secondary level.

Physics Minor Program
PHYS 115, 121 or 123 and
PHYS 116, 122 or 124 and
PHYS 221
plus two or three* of the following courses:
PHYS 196, PHYS 204 or 208, PHYS 309,
PHYS 310, PHYS 313.

THE BACHELOR OF ARTS DEGREE WITH PHYSICS MAJOR

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 56 are specified by the Physics Department as shown below. Courses specified for this major satisfy the 12-credit Arts and Sciences GER for Natural and Mathematical Sciences.

<table>
<thead>
<tr>
<th>Course</th>
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<th>Cr.</th>
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<td>PHYS 116, 122 or 124. Intro Electricity &amp; Magnetism</td>
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<td>PHYS 221</td>
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<td>PHYS 250. Mathematics, Physics, and Computing</td>
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<td>PHYS 309. Selected Physics Experiments</td>
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<td>PHYS 313. Thermodynamics &amp; Statistical Mechanics</td>
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<td>PHYS 331. Introduction to Quantum Mechanics I</td>
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<td>PHYS 351. Physics Senior Project</td>
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2 of the following:

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<td>PHYS 315. Introduction to Solid State Physics</td>
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<td>PHYS 316. Intro. to Nuclear &amp; Particle Physics</td>
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<td>PHYS 326. Physical Optics</td>
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<td>PHYS 328. Cosmology &amp; Structure of the Universe</td>
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Subtotal 36

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<td>MATH 121, 123 or 125. Calculus 1</td>
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Subtotal 20

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<td>A&amp;S Core</td>
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<td>Major/GER overlap</td>
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</table>

Total 120

* course usually taken in this year, offered only in F = fall, S = spring
** A two course science sequence chosen from : CHEM 105 and 106, CHEM 111 and ENGR 145; BIOL 110 and either BIOL 210 or BIOL 220; 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 BA degree requires a minimum of 30 semester hours at the 300-400 level, of which only 22 are specified as PHYS courses.
PHYS 315, PHYS 316, PHYS 326, PHYS 331, PHYS 332, PHYS 324, PHYS 328

**GRADUATE PROGRAMS AND RESEARCH**

The physics department offers programs of study and research leading to both the Master of Science and Doctor of Philosophy degrees. Graduate assistantships are available for the full-time support of qualified students. All M.S. programs in physics with or without a thesis can normally be completed in less than two years. The requirements for the Ph.D. in physics include a flexible program of courses that is typically completed within three years, and a concurrent program of directed research with less coursework and more research in each succeeding year.

For the Ph.D 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 can be carried out in five areas:

- Condensed-Matter Physics. An exten-

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**THE BACHELOR OF SCIENCE DEGREE IN MATHEMATICS AND PHYSICS**

In contrast to an applied mathematics degree or the B.S. in Physics with a Mathematical Physics Concentration, this is a synergistic, coherent, and parallel education in mathematics and physics. A graduate in this program will understand the theory and applications in both mathematics and physics and may endeavor to work and make advances in either world. To a close approximation, the challenging coursework corresponds to combining the mathematics and physics cores, with the physics laboratory cluster replaced by a single senior-year laboratory semester.

Also required is a two-semester senior research project under the guidance of a faculty member from either department. The General Education Requirements, a computer science course, a science sequence and laboratory, and open electives round out the curriculum. 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. Not only an excellent preparation for either mathematics or physics graduate schools, the B.S. in Mathematics and Physics is quite suitable for careers in industry. The breadth of its training, from pure mathematical analysis to a hands-on instrumentation experience, is uniquely attractive. It is appropriate for computational science and all professional and graduate schools where an excellent education in logical thinking and an in-depth, broad technical problem-solving ability are prized.

The total number of required credits is 126 (35 MATH, 38 PHYS, 6 senior project, 11-13 ENGR and CHEM, 27 A&S GER with 12 of the normal 39 GER credits satisfied by MATH and PHYS courses). There are 7-9 credits of open electives.

<table>
<thead>
<tr>
<th>Course</th>
<th>Year*</th>
<th>Cr.</th>
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<tr>
<td>PHYS 121 or 123. Physics I, Mechanics</td>
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<td>PHYS 122 or 124. Physics II, Electricity &amp; Magnetism</td>
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<td>ENGR 131. Elementary Computer Programming</td>
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<td>CHEM 105 or 111. Principles of Chemistry**</td>
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<td>MATH 122 or 124. Calculus II</td>
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<td>MP group I***</td>
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<td>MATH 223 or 227. Calculus III</td>
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<td>MATH 224. Elementary Differential Equations</td>
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<tr>
<td>MATH 307. Introduction to Abstract Algebra I</td>
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<td>PHYS 331 or 481. Quantum Mechanics I</td>
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<td>MP group II***</td>
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<td>MP group III***</td>
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<td>MATH 321. Fundamentals of Analysis I</td>
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<td>MATH 307. Introduction to Abstract Algebra I</td>
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<tr>
<td>or PHYS 316. Intro. to Nuclear and Particle Physics</td>
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<td>MP group IV***</td>
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<td>PHYS 472. Graduate Physics Laboratory</td>
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</table>

* course usually taken in this year, offered only in F = fall, S = spring
** If approved by the M&P committee, other science sequence courses may be substituted.
*** The “MP group” of four courses corresponds to two physics courses and two mathematics courses. The physics courses would be chosen from P250, P349, and P350. The mathematics courses are subject to approval by the advisory committee and are thereby 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, it may be possible to choose a course from outside of the mathematics and physics departments as a substitute in the MP group.
sive experimental and theoretical program in the electronic properties of solids (including superconductivity), quantum liquids, mesoscopic physics, localization and quantum Hall effect, the physics of polymers, liquid crystals and complex fluids, the equations of state of solids, thin films, fluids in a microgravity environment, and the physics of surfaces and interfaces, semiconducting and rare-earth based magnetic materials.

- Particle/Astrophysics and Cosmology. The experimental efforts in this area include the study of the nature of dark matter in the universe and observations of high energy gamma rays. New studies are underway that concern the observation of gravitational microlensing, and detection of planets around nearby stars. Theoretical studies include neutrino astrophysics, stellar evolution, the cosmic microwave background, gravitational lensing, dark matter, large scale structure, topological defects, phase transitions, and early-universe cosmology. Other related work includes activities in general relativity.

- 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

THE MATHEMATICAL PHYSICS CONCENTRATION IN THE BACHELOR OF SCIENCE IN PHYSICS DEGREE PROGRAM

Students who are interested in theoretical physics and who have a strong background in mathematics may consider applying for admission to the variation on the B.S. in physics, officially a “B.S. in Physics with a Mathematical Physics concentration.” This program is based on the B.S. 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.

<table>
<thead>
<tr>
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<td>PHYS 122 or 124. Physics II, Electricity &amp; Magnetism</td>
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<td>PHYS 310. Classical Mechanics</td>
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Subtotal 64

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Subtotal 25(27)

[Open electives] 15
Open Electives **** 11
A&S GER 39
Major/GER overlap -12

Total 127

* course usually taken in this year, offered only in F = fall, S = spring
** M-group 1, 2 and 3 are to be chosen from among approved advanced mathematics or statistics courses.
*** or other approved computational course
**** The number of open electives may vary as determined by the degree requirement that the total number of credits add to 127 or more.
experimental and theoretical programs in nonlinear optics, integrated optics, and the optical properties of fluids, liquid crystals, polymers, and crystals, including semiconductors and semiconductor mesoscopic systems.

- Imaging Physics and Inverse Problems. An experimental and theoretical program in aspects of magnetic resonance imaging, computed tomography, ultrasound, and positron-emission tomography. Industrial and medical applications in electromagnetic field modeling.

In addition to a traditional physics program, the Department maintains a Physics Entrepreneurship Masters degree program. The program is designed to empower physicists as entrepreneurs and to enable students and graduates to build on their physics skills to start new hi-tech businesses or to launch new product lines in existing companies.

**FACILITIES**

The Department of Physics maintains research laboratories in experimental and theoretical astrophysics and cosmology, elementary particle physics, low-temperature physics, optics, condensed matter physics, surface physics, medical physics and industrial physics

In collaboration with the Center for Particle Astrophysics at Berkeley, the experimental particle-astrophysics group is leading a search to discover the identity of possible weakly interacting massive elementary particles which may make up the bulk of the matter in the universe. In collaboration with the NASA-Caltech Jet Propulsion Laboratory, in Pasadena, the particle-astrophysics group is developing plans to launch a satellite to do ultra-high resolution and high contrast astronomical observations. In collaboration with researchers at the University of Chicago and McGill University, the particle-astrophysics group is also operating a new experiment for gamma-ray astronomy in the energy range from 20 to 500 GeV, called STACEE (Solar Tower Solar Cherenkov Effect Experiment) located at the National Solar Thermal Test Facility (NSTTF) at Sandia National Laboratories in Albuquerque, New Mexico.

STACEE has been in preparation since 1998, and makes use of a large field of heliostat mirrors to detect gamma-rays from energetic astrophysical sources including pulsars, supernova remnants, and active galactic nuclei. Detector design and data analysis software and computing

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**THE BACHELOR OF SCIENCE IN ENGINEERING DEGREE: WITH ENGINEERING PHYSICS MAJOR**

The B.S.E., major in engineering physics, requires completion of the Case School of Engineering’s Engineering Core Curriculum and completion of at least 12 hours of coursework in an engineering concentration area. Required courses are listed in the following table:

<table>
<thead>
<tr>
<th>Course</th>
<th>Year*</th>
<th>Cr.</th>
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</thead>
<tbody>
<tr>
<td>PHYS 121 or 123. Physics I, Mechanics</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 122 or 124. Physics II, Electricity &amp; Magnetism</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 221. Introduction to Modern Physics</td>
<td>2</td>
<td>3</td>
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<tr>
<td>PHYS 208. Instrumentation &amp; Signal Analysis Laboratory</td>
<td>2S</td>
<td>4</td>
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<tr>
<td>PHYS 250. Mathematics, Physics, and Computing</td>
<td>2S</td>
<td>3</td>
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<tr>
<td>PHYS 317. Engineering Physics Laboratory I</td>
<td>3F</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 313. Thermodynamics &amp; Statistical Mechanics</td>
<td>3F</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 331. Introduction to Quantum Mechanics I</td>
<td>3F</td>
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<tr>
<td>PHYS 318. Engineering Physics Laboratory II</td>
<td>3S</td>
<td>4</td>
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<tr>
<td>PHYS 324. Electricity and Magnetism I</td>
<td>3S</td>
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<tr>
<td>PHYS 315. Introduction to Solid State Physics</td>
<td>4F</td>
<td>3</td>
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<td>PHYS 325. Electricity and Magnetism II</td>
<td>4F</td>
<td>3</td>
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<tr>
<td>PHYS 353. Senior Project</td>
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<td><strong>Subtotal</strong></td>
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<th>Cr.</th>
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<td>MATH 121 or 123. Calculus 1</td>
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<tr>
<td>MATH 122 or 124. Calculus 2</td>
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<tr>
<td>MATH 223 or 227. Calculus 3</td>
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<tr>
<td>MATH 224. Elementary Differential Equations</td>
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<tr>
<td>CHEM 111. Principles of Chemistry I</td>
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<td>4</td>
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<tr>
<td>CHEM 113. Principles of Chemistry Laboratory</td>
<td>1</td>
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<tr>
<td>ENGR 145. Chemistry of Materials</td>
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<tr>
<td>ENGR 131. Elementary Computer Programming</td>
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<tr>
<td>ENGR 200. Statics and Strength of Materials</td>
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<tr>
<td>ENGR 210. Intro. to Circuits and Instrumentation</td>
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<tr>
<td>ENGR 225. Thermodynamics</td>
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<tr>
<td>Appl. Quantum Mechanics**</td>
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<td>Hum &amp; Soc Sci</td>
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<td>Engr Concentration***</td>
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<td>English &amp; Communications</td>
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<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>127</strong></td>
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</tbody>
</table>

* course usually taken in this year, offered only in F = fall, S = spring
** PHYS 332, EEAP 321, EEAP 420, EMSE 314, or EMSE 405
*** 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:

- 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
facilities are located in the department. The optics and optical materials group utilizes facilities for linear, nonlinear, and light scattering studies including gas ion, titanium sapphire, and ring dye lasers for continuous wave studies, a tunable picosecond and femtosecond pulsed laser system, and a tunable nanosecond laser system for nonlinear optical studies. Facilities also include video image acquisition and analysis, microscopy, holography, refractometry, and absorption and reflection spectroscopy. The optical materials center houses a full array of equipment, including photolithography for sample preparation.

The condensed matter experimentalists make use of a wide range of techniques and associated instrumentation to study properties of materials in bulk and in thin films and surfaces. Among these techniques are electron-positron annihilation, optical harmonic generation, photoconductivity, magnetic susceptibility, precision dielectric constants, photoluminescence spectroscopy, and electron energy loss spectroscopy.

Among the special facilities available within the department for condensed matter research are a 15-inch Varian electromagnet; helium 3He-4He dilution refrigerators (15 mK and 5 mK); superconducting magnets, including 6T, 9T, and 14T magnets and an 8.2 T warm-bore superconducting magnet with optical access along the three Cartesian axes. Low-temperature facilities are available for research on two-dimensional arrays on liquid helium and superconductors. Other equipment includes dynamic light scattering and high resolution birefringence apparatus; high resolution differential scanning calorimeter; instrumentation for conducting experiments up to pressures of 225,000 psi at room temperature and to pressures of 30,000 psi with the temperature variable from 4.2K to 400K; ultrahigh vacuum equipment; and a complete array of surface analysis equipment including low-energy and reflection high-energy electron diffraction, X-ray and ultraviolet photoemission spectrometers, Auger electron spectrometers, and atomic force and scanning tunneling microscopes usable in both “read” and “write” modes.

Theoretical physics research utilizes a wide variety of computers, both on and off campus. The particle-astrophysics theory group maintains a UNIX cluster of RISC machines as well as a cluster of Pentium II’s with which it performs intensive numerical calculations in such areas as Big Bang nucleosynthesis, neutrino astrophysics, dark matter studies, stellar evolution, physics of the very early universe, and large scale structure in the Universe. Molecular modeling and other simulations are performed on Silicon Graphics workstations. The electronic structure group uses a cluster of high speed UNIX workstations and links to the Ohio Supercomputer Center to perform computational physics of materials.

Well-equipped undergraduate laboratory facilities are provided. Experiments in the junior and senior years are selected from a large number of possibilities, with the general level of sophistication increasing as the student advances. All students participate in research as described above through the senior project.

The new Physics Entrepreneurship Master’s degree program will enable the students and graduates of the program to build on their physics skills to start new high-tech businesses or launch new product lines in existing companies, and then successfully grow these ventures. The purpose of this new degree track is to provide students having a background in physics and an interest in technological innovation with the training and experience needed to efficiently play leading roles in new high-tech ventures. While many physicists have traditionally pursued such career paths, this is the first physics program designed to prepare them for such a role.

Physics (PHYS)

UNDERGRADUATE COURSES

PHYS 100. Space, Time, and Motion (3)
An introductory course in physics for students of the liberal arts. Discussion of how physics is performed, what important discoveries about natural phenomena have been made by physicists, and what are the most exciting questions being tackled by physicists today. Connections to current work appearing in various popular media will be made. In particular, emphasis is made on the connections between the fundamental discoveries that led to our understanding of motion and the light, and much of the ongoing research at the forefront of modern physics.

PHYS 101. Distinguishing Science from Pseudo-Science (3)
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 viability of these ideas. A seminar format will be utilized with specific topics presented by students and by the instructor. Prerequisite: PHYS 100, PHYS 115, PHYS 121, or PHYS 123.

PHYS 113. Principles of Physics Laboratory (2)
The laboratory portion of the first two semesters of introductory physics. (A two-semester course.) Prerequisite: Departmental permission.

PHYS 113A. Principles of Physics Laboratory - Mechanics (1)
The laboratory portion of first semester introductory physics. Prerequisite: Departmental permission.

PHYS 113B. Principles of Physics Laboratory - Electricity and Magnetism (1)
The laboratory portion of the second semester of physics. Prerequisite: Departmental permission.

PHYS 115. Introductory Physics I (4)
First part of a two-semester calculus-based sequence directed primarily towards students working towards a B.A. in science, with an emphasis on the life science. 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. Prerequisite: MATH 121, MATH 123 or MATH 125.

PHYS 116. Introductory Physics II (4)
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. Prerequisite: PHYS 115.

**PHYS 121. General Physics I—Mechanics (4)**
Particle dynamics, Newton’s laws of motion, energy and momentum conservation, rotational motion, and angular momentum conservation. This course has a laboratory component. Prerequisite: MATH 121 or MATH 123 or MATH 125 or one year of high school calculus.

**PHYS 122. General Physics II—Electricity and Magnetism (4)**
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. Prerequisite: PHYS 121 or PHYS 123. Corequisite: MATH 122, MATH 124, or MATH 126.

**PHYS 123. Physics and Frontiers I—Mechanics (4)**
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)**
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. Prerequisite: PHYS 123 or consent of department. Corequisite: MATH 122 or MATH 124.

**PHYS 196. Energy and Society (3)**
Global and national perspectives on the problems of energy supply and demand, global warming, oil cartels, solar, nuclear and wind energy, energy history, politics and economics of fossil fuels, and alternative energy sources. Cross-listed as GEOL 196, HSTY 196, and POSC 196.

**PHYS 203. Analog and Digital Electronics (4)**
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. Prerequisite: PHYS 122 or PHYS 124.

**PHYS 204. Advanced Instrumentation Laboratory (4)**
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. Prerequisites: PHYS 203 and PHYS 221.

**PHYS 208. Instrumentation and Signal Analysis Laboratory (4)**
AC circuit theory, Fourier series, discrete 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. Prerequisites: PHYS 221 and ENGR 210.

**PHYS 221. Introduction to Modern Physics (3)**
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. Prerequisite: PHYS 116 or PHYS 122 or PHYS 124.

**PHYS 250. Mathematics, Physics, and Computing (3)**

**PHYS 301. Advanced Laboratory Physics I (4)**
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. Prerequisite: PHYS 204.

**PHYS 302. Advanced Laboratory Physics II (4)**
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, ultra-high vacuum surface science. Prerequisite: PHYS 301.

**PHYS 309. Selected Physics Experiments (4)**
An introduction to analog electronics and experimental physics. The first few weeks focus on DC and AC circuits, including circuit elements and measurements including nonlinear elements and operational amplifiers. The remainder of the semester includes selected experiments from classical and modern physics with an emphasis on experimental techniques, data and error analysis and the formal presentation of work. Prerequisite: PHYS 116 or PHYS 122 or PHYS 124.

**PHYS 310. Classical Mechanics (3)**
Lagrangian formulation of mechanics and its application to central force motion, scattering theory, rigid body motion, and systems of many degrees of freedom. Prerequisites: PHYS 221 and either MATH 223 or MATH 227.

**PHYS 313. Thermodynamics and Statistical Mechanics (3)**
Thermodynamic laws, entropy, and phase transitions from the quantum mechanical viewpoint. Gibbs and Boltzmann factors. Ideal, degenerate fermion, degenerate boson, photon, and phonon gases. Correlation functions and transport phenomena. Applications ranging from solid state physics to astrophysics. Prerequisite: PHYS 221.

**PHYS 315. Introduction to Solid State Physics (3)**
Characterization and properties of solids; crystal structure, thermal properties of lattices, quantum statistics, electronic
structure of metals and semiconductors. Prerequisite: PHYS 331.

**PHYS 316. Introduction to Nuclear and Particle Physics (3)**
The physics of nuclei and elementary particles; experimental methods used to determine their properties; models and theories developed to describe their structure. Prerequisite: PHYS 331.

**PHYS 317. Engineering Physics Laboratory I (4)**
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. Prerequisite: PHYS 208.

**PHYS 318. Engineering Physics Laboratory II (4)**
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. Prerequisite: PHYS 317.

**PHYS 324. Electricity and Magnetism I (3)**
First half of a year-long sequence that constitutes a detailed study of the basics of electromagnetic theory and many of its applications. Electrostatics and magnetostatics of free space, dielectrics, conductors and magnetic materials, Maxwell's equations and time-dependent effects, electromagnetic waves and their interaction with matter. Basic theory amply illustrated with applications drawn from condensed matter physics, optics, plasma physics, and physical electronics. Prerequisite: PHYS 122 or PHYS 124.

**PHYS 325. Electricity and Magnetism II (3)**
Continuation of PHYS 324. Prerequisite: PHYS 324.

**PHYS 326. Physical Optics (3)**
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. Prerequisite: PHYS 122 or PHYS 124.

**PHYS 328. Cosmology and Structure of the Universe (3)**
Cross-listed as ASTR 328.

**PHYS 329. Independent Study (1-4)**
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)**
Quantum nature of energy and angular momentum, wave nature of matter, Schrodinger equation in one and three dimensions; matrix methods; Dirac notation; quantum mechanical scattering. Two particle wave functions. Prerequisite: PHYS 221.

**PHYS 332. Introduction to Quantum Mechanics II (3)**
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. Prerequisite: PHYS 331.

**PHYS 339. Seminar (1-3)**
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. Prerequisite: Consent of department.

**PHYS 340. Teaching Electricity (2)**
This lab-based course is directed at in-service and prospective teachers of science in the middle and high schools. The course content will cover the basics of electricity (current, voltage, power, energy, Kirchhoff's laws and their relation to the laws of conservation of charge and energy, Ohm's law). Some elements of magnetism will also be introduced, time-permitting. The sessions will be hands-on and activity-based. The sessions will also model and discuss teaching pedagogy such as cooperative learning, interactive lectures, learning styles, constructivism and inquiry-learning. The technology used will involve simple and cheap equipment that can be easily replicated in classrooms. Evaluation will be based on attendance, participation, pre- and post tests, and journals.

**PHYS 349. Methods of Mathematical Physics I (3)**
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. Prerequisite: MATH 224.

**PHYS 350. Methods of Mathematical Physics II (3)**
(Continuation of PHYS 349.) Special functions, orthogonal polynomials, partial differential equations, linear operators, group theory, tensors, selected special topics. Prerequisite: PHYS 349.

**PHYS 351. Physics Senior Project (3)**
A two-semester course required for senior physics majors. Both semesters must be taken consecutively; for 6 credit hours. Project based on experimental, theoretical or teaching research under the supervision of a physics faculty member, possibly jointly with a faculty member from another department. Study of the techniques currently utilized in a specific research area and of the recent literature associated with the project. Experimental or theoretical 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 and progress reports made twice each semester to the Physics Senior Project Committee to ensure successful completion of the work. Prerequisite: PHYS 302 or PHYS 309.

**PHYS 353. Senior Engineering Physics Project (3)**
A two-semester course required for senior engineering physics majors (3 credits each semester). The project will be in the student’s engineering physics concentration area and will be supervised by a faculty advisor who will review progress with the student on a regular basis. The project may be calculational, experimental or theoretical, and will address both the underlying physics and appropriate engineering design principles. The project requirements include short oral presentations twice each semester before the senior project committee and a term paper and an oral presentation at the end of the second semester. Prerequisite: PHYS 318.
PHYS 365. General Relativity (3)
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. Prerequisite: Consent of department.

GRADUATE COURSES

PHYS 413. Classical and Statistical Mechanics I (3)
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)
A continuation of PHYS 413. Noninteracting systems, statistical mechanics of solids, liquids, gases, fluctuations, irreversible processes, phase transformations. Prerequisites: PHYS 413 and consent of department.

PHYS 415. Introduction to Solid State Physics (3)
(See PHYS 315.) For graduate students in engineering and science. (May not be taken for credit by graduate students in the Department of Physics.) Prerequisite may be waived with consent of department. Prerequisite: PHYS 331.

PHYS 423. Classical Electromagnetism (3)
Electromagnetic theory in the classical limit. Gauge invariance and special relativity. Applications to electrostatic, magnetostatic, and radiation problems using advanced mathematical techniques. Dielectric, magnetic, and conducting materials. Wave propagation in open and confined geometries. Radiation from accelerators and detection techniques; phenomena of particle reactions, decays and hadronic structure; space, time and internal symmetries; symmetries; symmetry breaking. Prerequisite: Consent of department.

PHYS 426. Physical Optics (3)
(See PHYS 326.) Additional work required.

PHYS 428. Cosmology and Structure of the Universe (3)
Cross-listed as ASTR 428.

PHYS 431. Physics of Imaging (3)
Description of physical principles underlying the spin behavior in MR and Fou-
unsuccessful) physics-based venture creation, and will illustrate characteristics for success. Prerequisite: Permission of department.

PHYS 492. Modern Physics for Innovation II (3)
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. Prerequisite: PHYS 491.

PHYS 522. Nonlinear Optics (3)

PHYS 539. Special Topics Seminar (1-3)
Consult the roster of courses for specific topics and credit. May include low-temperature physics, liquid helium, group theory in solid state, surface physics, astrophysics, critical phenomena and phase transitions, and nonlinear topics in physics.

PHYS 541. Quantum Theory of Solids I (3)

PHYS 544. Advanced Theory of Materials (3)

PHYS 545. Advanced Topics in Many Part Physics I (3)
Prerequisite: PHYS 482.

PHYS 566. Cosmology (3)

PHYS 579. Special Topics Seminar (3)
(See PHYS 539.)

PHYS 581. Quantum Mechanics III (3)
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. Prerequisites: PHYS 482 and consent of department.

PHYS 591. Gauge Field Theory I (3)
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. Prerequisites: PHYS 581 and consent of department.

PHYS 592. Gauge Field Theory II (3)
(See PHYS 591.) Prerequisite: PHYS 591.

PHYS 601. Research in Physics (1-9)

PHYS 651. Thesis M.S. (1-9)

PHYS 666. Frontiers in Physics (0)
Weekly colloquia given by eminent physicists from around the world on topics of current interest in physics.

PHYS 701. Dissertation Ph.D. (1-9)

PHYS 702. Appointed Dissertation Fellow (9)

PHYS 820. Teaching Physics: Hands-On and Inquiry-Based (2)
This lab-based course is directed at inservice teachers of science in the middle and high schools. The course content will cover the basics of electricity (current, voltage, power, energy, Kirchhoff’s laws and their relation to the laws of conservation of charge and energy, Ohm’s law). Some elements of magnetism will also be introduced, time permitting. The sessions will be hands-on and activity-based. The sessions will also model and discuss teaching pedagogy such as cooperative learning, interactive lectures, learning styles, constructivism and inquiry-learning. The technology used will involve simple and cheap equipment that can be easily replicated in classrooms. Evaluation will be based on attendance, participation, pre- and post-tests, and journals.

PHYS 882. Physics Teacher Retraining (1)
For pre-college teachers who have taken PHYS 820 and who wish to develop similar courses for other teachers. Will involve working with students in PHYS 820 to help them improve their understanding of concepts, and working with the instructors on ways to make courses such as this more effective. Enrollment limited to five. Prerequisites: PHYS 820 and consent of department.

PHYS 884. Teaching Electricity (2)
This lab-based course is directed at inservice and prospective teachers of science in the middle and high schools. The course content will cover the basics of electricity (current, voltage, power, energy, Kirchhoff’s laws and their relation to the laws of conservation of charge and energy, Ohm’s law). Some elements of magnetism will also be introduced, time permitting. The sessions will be hands-on and activity-based. The sessions will also model and discuss teaching pedagogy such as cooperative learning, interactive lectures, learning styles, constructivism and inquiry-learning. The technology used will involve simple and cheap equipment that can be easily replicated in classrooms. Evaluation will be based on attendance, participation, pre- and post-tests, and journals.

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Department of Political Science

111 Mather House
Phone 216-368-2424;
Fax 216-368-4681

Vincent E. McHale, Chair

The study of political science is primarily concerned with governmental structures and processes in world societies, including who governs, why, and how. Faculty specialties in the department include American politics and governmental institutions; violence and civil disorder; public policy analysis; international relations; the politics of world technology and resources; research methods; the political systems of Africa, Asia, Europe, and North America; political economy;
and comparative politics with various regional concentrations. In its programs leading to the B.A., M.A., and Ph.D., the department makes a strong effort to relate the study of politics to students’ needs and concerns and tries 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 or teaching, in public administration, or jobs in private industry and business. Both the public and private sectors hold career possibilities for the political science major.

**FACULTY**

Vincent E. McHale, Ph.D. (Pennsylvania State University)  
Professor and Chair, Director, International Studies Program  
Comparative politics; Europe; political sociology; methodology

Eileen M. Doherty, Ph.D. (University of California, Berkeley)  
Assistant Professor  
International relations; U.S. foreign policy; international political economy

Kenneth W. Grundy, Ph.D. (Pennsylvania State University)  
Marcus A. Hanna Professor of Political Science  
International relations; African politics

Alexander P. Lamis, Ph.D. (Vanderbilt University, J.D. (University of Maryland)  
Associate Professor  
American government; electoral politics; constitutional law

Frances E. Lee, Ph.D. (Vanderbilt University)  
Assistant Professor  
American government, Congress, legislative policy-making

Joseph White, Ph.D. (University of California, Berkeley)  
Professor  
American government; Congress; public policy; health and welfare policy

**ASSOCIATE FACULTY**

Robert H. Binstock, Ph.D. (Harvard University)  
Henry R. Luce Professor of Aging, Health and Society, Department of Epidemiology and Biostatistics, School of Medicine; and Professor of Political Science  
American government; public policy; health care and aging

Charles F. Dunbar, M.A. (Columbia University)  
Adjunct Associate Professor of Political Science  
International relations; Middle East; U.S. foreign policy

Jonathan L. Entin, J.D. (Northwestern University)  
Professor of Law, CWRU School of Law; and Professor of Political Science  
American constitutional law; social science and the law

Laura Y. Tartakoff, J.D. (Case Western Reserve University); M.A. (Fletcher School, Tufts University)  
Adjunct Associate Professor of Political Science  
Constitutional law, civil liberties, comparative constitutionalism

**UNDERGRADUATE PROGRAMS**

**Major**

The major in political science leads to the Bachelor of Arts degree. While the specific courses to be taken are determined by the student’s interest, with approval of a faculty advisor, those majoring in political science must complete 30 hours of course work in the department, distributed as follows:

- Three hours of POSC 109
- Six hours of POSC courses at the 200 level
- Eighteen hours of POSC courses at the 300 level
- Three hours of a senior project, POSC 396

No more than six hours of independent study (i.e., POSC 395 and/or POSC 396 or POSC 397/398, Honors Program) may count toward the major. Independent study completed through the Washington Semester program or the Washington Center program is excluded from this limitation.

**Minor**

A minor in political science consists of 15 hours (5 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.

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. The public policy minor consists of 15 credit hours, ordinarily including:

- ECON 205 and POSC 386
- One course from the following list of approved courses: HSTY 256, HSTY 358, POSC 308, POSC 310, POSC 385

- Two courses in a specific policy field (e.g., health care, the environment, business and the economy, science and technology policy, nonprofit and charitable organizations, social policy, etc.), as approved by the public policy minor advisor.

**Sequences (Engineering Core curriculum)**

All sequences must include POSC 109 (3 hours), POSC 272 (3 hours), and one additional course (3 hours) selected in consultation with the department’s sequence advisor. Contact the department chairman, for advice about all Case sequences.

**Arts and Sciences General Education Requirements**

For the Arts and Sciences GER, POSC 109, 260, 308, 310, 320E, 321, 325, 326, 327, 328, 360B, 367, 370J, and 386 may be used to fulfill the Social Institutions requirement. POSC 360D, 360E, 366, 370K, 374, and 379 will fulfill the Global and Cultural Diversity requirement.

**Departmental Honors**

A junior or senior political science major who has a minimum grade point average of 3.7 in political science courses and a 3.3 average overall, and who has completed all course work in the department except for six hours at the 300 level, may request permission to enroll in the Political Science Honors Program by contacting a Political Science faculty project advisor before registration for POSC 397. Completion of both courses in the two-semester sequence (POSC 397 and POSC 398) is mandatory for honors consideration. During the two semesters, the student carries out research and writes a substantial paper. (No other form of project is acceptable for Honors.) It is expected that the student will meet frequently with his or her project advisor throughout both semesters to discuss and evaluate the work in progress. The student’s work in POSC 397 will receive a grade of A, B, C, D, or F based on work completed to date; a letter grade of A, B, C, D, or F also will be assigned to POSC 398 upon completion of the project.
Completion of the two-course sequence requires that the final paper be submitted to the project advisor at a specified time during the second semester, usually by the twelfth week of the semester. The student also is required to present his/her honors project at a special departmental colloquium to be held toward the end of each Spring semester. If the department judges the paper to be of high quality and if a political science GPA of 3.7 is maintained, the student will receive honors in political science upon graduation.

**Integrated Graduate Studies**

Application to the Integrated Graduate Studies program 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 B.A., including at least 23 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 B.A. will be awarded upon completion of all requirements for that degree, including total hours; the M.A. will be awarded upon successful completion of the 30 hours of graduate-level courses and the M.A. examination.

**GRADUATE PROGRAMS**

**Master of Arts**

Requirements for admission to the Master of Arts program in political science are three letters of recommendation from former instructors; a minimum score of 500 on each required segment of the Graduate Record Examination (GRE) (verbal, quantitative, analytical); for students from other countries, a minimum score of 550 on the Test of English as a Foreign Language (TOEFL), in addition to 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 which included a grade point average of 3.2 overall and 3.5 in political science courses. 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 political science Master of Arts, 12 hours must be distributed as follows:

- three hours in American government and politics;
- three hours in comparative politics; and
- three hours in international affairs.

Among the remaining 18 hours of “electives,” the student may take courses oriented toward a general Master of Arts (i.e., covering the four broad areas listed above) or may elect to specialize in one of these or some other proposed and approved area. Excluding those hours taken to fulfill degree requirements in quantitative methods, a maximum of six hours may be taken outside the Department of Political Science, with prior approval, for specialized work related to the Master of Arts degree for which no political science course is appropriate. A maximum of nine hours of independent study (POSC 601) may count toward the degree. A minimum grade point average of 3.0 must be maintained throughout the Master of Arts program. Upon completion of no less than 30 hours and no more than 42 hours of Master of Arts course work, the student must request scheduling of the political science Master of Arts examination. The examination will cover the four broad areas listed above, the political science Master of Arts reading list, and any elected area of concentration. Complete information on the Master of Arts program in political science is available from the department office.

**Doctor of Philosophy**

Requirements for admission to the Doctor of Philosophy program in political science are three letters of recommendation from former instructors; a minimum score of 500 on each required segment of the Graduate Record Examination (GRE) (verbal, quantitative, analytical); for students from other countries, a minimum score of 550 on the Test of English as a Foreign Language (TOEFL), in addition to the minimum GRE scores indicated above; and transcripts of all prior undergraduate and graduate study, indicating a minimum grade point average of 3.3 for all previous undergraduate and/or graduate work.

All Ph.D. 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:

- 12 hours in primary subfield (American, comparative, or international relations)
- 9 hours in secondary subfield (one of the remaining two fields)
- 6 hours in the remaining subfield
- 6 hours in research methods
- 12 hours of electives

A maximum of 9 hours of independent study (POSC 601) may be undertaken. Electives and research methods courses may be taken outside of the department, but only with prior approval from his or her political science advisor.

Complete information for all aspects of the Doctor of Philosophy program in political science (e.g., comprehensive examination; dissertation requirements; etc.) is available in a special announcement from the department office.

**Political Science (POSC)**

**UNDERGRADUATE COURSES**

**POSC 109. The American Political System (3)**

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.
POS 196. Energy and Society (3)
Global and national perspectives on the problems of energy supply and demand, global warming, oil cartels, solar, nuclear and wind energy, energy history, politics and economics of fossil fuels, and alternative energy sources. Cross-listed as PHYS 196.

POS 260. Introduction to Comparative Politics (3)
Comparison of selected national political systems organized around the concept of political development. Examination of the interrelationships between the cultural, social and economic characteristics of the nations and their government structure and political behavior.

POS 272. Introduction to International Relations (3)
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.

POS 305. Urban Politics and Policy (3)
The social, economic, participatory, service, fiscal, and planning challenges of metropolitan areas. Consideration of proposals for reforming urban government through new structures of greater centralization or decentralization, and the implications such structures may have on urban policy-making.

POS 308. The American Presidency (3)
The sources, strategies and restraints of presidential leadership in the United States. Emphasis on problems of policy formation, presidential relations with Congress and executive agencies, and the electoral process.

POS 310. The Legislative Process (3)
Legislative, representative, and other functions of Congress and state legislatures; legislative relations with the executive and with private interests; limitations of the legislature as a policy-making institution.

POS 315. Black Americans and the Political Process (3)
An examination of the relationship between black Americans and the U.S. political process from three interconnected perspectives. First, the historical struggle that surrounded but excluded blacks in this country, from slavery to the 1954 Brown v. Board of Education ruling. Second, the ways in which blacks have participated directly in the political process in contemporary times. Third, the political implications of black separatist movements.

POS 320B. The U.S. Midterm Elections (3)
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.

POS 320C. The Presidential Election (3)
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.

POS 320D. Politics of the American South (3)
Analysis of forces that have transformed the political landscape of the American south since World War II, changing the region from an economically backward bastion of white supremacy to a prospering, biracial society fast on the way to rejoining the national mainstream.

POS 325. American Constitutional Law (3)
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.

POS 326. Comparative Constitutions (3)
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, Hungary, India, Switzerland, and the United States.

POS 327. Civil Liberties in America I (3)
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, obscenity, and commercial speech. Survey of content-neutral regulation, symbolic expression, and current efforts to limit expression (campus speech codes and the feminist anti-pornography movement).

POS 328. Topics in Civil Liberties (3)
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.

POS 334. Violence and the Political System (3)
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.

POS 341. Elections, Voters, and Political Parties (3)
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 linkage between citizen and party and between party and government.

POS 343. Public Opinion and American Democracy (3)
Examination of theories, concepts and empirical research related to attitudes and the political behavior of mass publics.

POS 345. Psychology and Politics (3)
Application of various psychological concepts, theories, and methodologies to the study of politics.

POS 346. Women and Politics (3)
Examination of the role of women in politics. Topics include: political socialization; sources and implications of gender difference in political participation (voting, candidacy, leadership); and the politics of “women’s issues.”

POS 348. Political and Social Thought in the Machine Age (3)
Explores the responses of economist writers, philosophers, cultural critics, and
POSC 350. Social and Political Theory (3)
This course is designed to provide an understanding of the theoretical foundations of social and political thought. It examines classical and contemporary theories and their applications to contemporary social and political issues. Cross-listed as PHIL 350.

POSC 351. Modern Political Thought (3)
Examines the development of political thought in the modern era, focusing on key figures and movements. Cross-listed as PHIL 351.

POSC 352. American Political Thought (3)
Survey of political thought in America, from the founding fathers to contemporary issues. Cross-listed as PHIL 352.

POSC 353. Comparative Politics (3)
Focuses on the comparative study of political systems, emphasizing case studies from around the world. Cross-listed as PHIL 353.

POSC 354. Political and Social Philosophy (3)
Explores the philosophical underpinnings of political life, including the nature of power, justice, and the role of the state. Cross-listed as PHIL 354.

POSC 355. Modern Political Ideologies (3)
Analyzes the development of political ideologies in the modern era, including liberalism, conservatism, socialism, and nationalism. Cross-listed as PHIL 355.

POSC 356. Government and Politics of Africa (3)
Examines the historical and contemporary political systems of African countries, focusing on the influence of colonialism and post-colonial development. Cross-listed as HSTY 356.

POSC 357. Comparative Politics (3)
Explores the comparative study of political systems, emphasizing case studies from around the world. Cross-listed as PHIL 357.

POSC 358. The People’s Republic of China (3)
Survey of political and social changes in China since the 1949 revolution, focusing on the Mao era and post-Mao developments. Cross-listed as HSTY 358.

POSC 359. Political Science Research Methods (3)
Introduces students to research methods in political science, including quantitative and qualitative methods. Cross-listed as PHIL 359.

POSC 360. Politics of Change in Latin America (3)
Focuses on the impact of changes in Latin American political systems, including the influence of globalization and democratization. Cross-listed as HSTY 360.

POSC 361. Natural Resources and World Politics (3)
Examines the role of natural resources in world politics, focusing on the distribution and conflict over valuable resources. Cross-listed as HSTY 361.

POSC 362. Religion in World Politics (3)
Explores the role of religion in international relations, including the impact of religious movements on world politics. Cross-listed as HSTY 362.

POSC 363. The Global Policy Agenda (3)
Examines the global challenges facing policy makers, including issues of peace, prosperity, and the environment. Cross-listed as HSTY 363.

POSC 364. International Law and Organizations (3)
Focuses on the role of international law and organizations in global governance, including the United Nations and other international bodies. Cross-listed as HSTY 364.

POSC 365. Science, Technology, and Government (3)
Traces the development and effects of federal technology and science policies from colonial times to the present, with emphasis on the 20th century. Cross-listed as HSTY 365.

POSC 366. Western European Political Systems (3)
Comparative analysis of sociopolitical systems of selected Western European industrial democracies, using North American systems as a point of comparison. Cross-listed as HSTY 366.

POSC 367. Political Economy (3)
Focuses on the 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. Cross-listed as HSTY 367.

POSC 368. The United States and Asia (3)
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.” Cross-listed as HSTY 368.

POSC 369. Political Science Research Methods (3)
Research methods in political science and other social sciences. Research design, including development of hypotheses and operational measures, and evaluation of quantitative and qualitative measures. Useful for students going into graduate school, policy analysis, or consulting. Note this course not available to students who previously took POSC 241.

POSC 370. Peaceful Settlement of International Disputes (3)
Role of international law and organizations in the maintenance of world peace. Cross-listed as HSTY 370.

POSC 371. U.S. Intelligence and National Security (3)
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. Cross-listed as HSTY 371.

POSC 372. International Law and Organizations (3)
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. Cross-listed as HSTY 372.

POSC 373. Nationalism, Ethnicity, and Religion in World Politics (3)
Examination of the post-Cold War surge in conflicts among nationalism, ethnic groups, and religions, with particular attention to the former Yugoslavia, Ireland, India, Africa, and the Middle East. Cross-listed as HSTY 373.

POSC 374. Natural Resources and World Politics (3)
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
sea bed. Examination in some detail of selected commodity issues, including petroleum, copper and uranium.

POSC 372. United Nations Peace-Keeping (3)
The history, present state, and future prospects of United Nations peace-keeping operations. Historical antecedents of peace-keeping in the League of Nations, basis of such operations in the U.N. charter, the way peace-keeping evolved prior to the end of the Cold War, and the more complex recent missions.

POSC 375. Nuclear Weapons and Arms Control (3)
National and international problems concerning nuclear weapons, and the past and present attempts both to control their spread and to prevent their use. Topics covered include the science and technology of fission and fusion warheads and delivery vehicles; history, domestic policies, and international relations concerning nuclear weapons; and arms control treaties and their verification. Cross-listed as HSTY 377.

POSC 376. United States Foreign Policy (3)
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.

POSC 378. War and Conflict in the International System (3)
Examination of questions central to the study of international relations such as: What are the causes of war? How can the escalation of conflicts be avoided? Does the end of the Cold War affect the causes and nature of war in the international system? Several case studies of war and conflict will be covered.

POSC 379. Middle East: Politics, Economics, and American Policy (3)
Examination of continuing conflicts, major trends, and internal political and economic developments affecting U.S. policy in the Middle East region. Discussions include human rights, petroleum economics, and Islamic politics.

POSC 384. Ethics and Public Policy (3)
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.

POSC 385. Public Administration in the U.S. (3)
Analysis of the responsibilities, contributions, and activities of public bureaucracies with respect to their efficiency, responsiveness, and productivity.

POSC 386. American Public Policy Process (3)
Focus on the concepts and strategies concerned with moving the public policy process to action. Agenda-setting, issue definition, and feedback techniques will be a particular focus. Assessing political change, support, and obstacles also will be covered, as well as how policy systems operate with regard to different types of issues, such as regulatory, distributive, and redistributive policies, and in different configurations ranging from subgovernments to issue networks and advocacy coalitions.

POSC 389. Political Science Research (1-6)
Completion of POSC 397 and departmental prospectus form. Prerequisite: Departmental prospectus form.

POSC 395. Special Projects (1-6)
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 thus is part of the basis for grading. The prospectus form is available from the departmental office. Contact department for eligibility information. Prerequisite: Departmental prospectus form.

POSC 397. Honors Program I (3)
Open to juniors and seniors majoring in political science. Prerequisites: Junior or senior political science major and departmental prospectus form.

POSC 398. Honors Program II (3)
Continuation of POSC 397. Prerequisites: Completion of POSC 397 and departmental prospectus form.

GRADUATE COURSES

POSC 405. Urban Politics and Policy (3)
(See POSC 305.)

POSC 406. The American Presidency (3)
(See POSC 306.)

POSC 418. The U.S. Midterm Elections (3)
(See POSC 310.)

POSC 420. The U.S. Midterm Elections (3)
(See POSC 320B.)

POSC 420C. The Presidential Election (3)
(See POSC 320C.)

POSC 420D. Politics of the American South (3)
(See POSC 320D.)

POSC 425. American Constitutional Law (3)
(See POSC 325.)

POSC 426. Comparative Constitutions (3)
(See POSC 326.)

POSC 427. Civil Liberties in America I (3)
(See POSC 327.)

POSC 428. Topics in Civil Liberties (3)
(See POSC 328.)

POSC 429. Social Science and the Law (3)
Examines the social impact of law and the use of social research in the legal pro-
cess; assesses efforts to use law to effect social reform, and empirical studies of legal processes and institutions. Crosslisted as LAWS 285.

POSC 434. Violence and the Political System (3) (See POSC 334.)
POSC 441. Elections, Voters, and Political Parties (3) (See POSC 341.)
POSC 443. Public Opinion and American Democracy (3) (See POSC 343.)
POSC 445. Psychology and Politics (3) (See POSC 345.)
POSC 446. Women and Politics (3) (See POSC 346.)
POSC 449. Political Science Research Methods (3) (See POSC 349.)
POSC 451. Modern Political Thought (3) (See POSC 351.)
POSC 452. American Political Thought (3) (See POSC 352.)
POSC 454. Political and Social Philosophy (3) (See POSC 354.) Cross-listed as PHIL 434.
POSC 455. Modern Political Ideologies (3) (See POSC 355.)
POSC 460D. Politics of Change in Latin America (3) (See POSC 360D.)
POSC 466. Government and Politics of Africa (3) (See POSC 366.)
POSC 467. Western European Political Systems (3) (See POSC 367.)
POSC 470A. Political Economy (3) (See POSC 370A.)
POSC 470C. The United States and Asia (3) (See POSC 370C.)
POSC 470D. Peaceful Settlement of International Disputes (3) (See POSC 370D.)
POSC 470F. The Global Policy Agenda (3) (See POSC 370F.)
POSC 470G. U.S. Intelligence and National Security (3) (See POSC 370G.)

POSC 470J. International Law and Organizations (3) (See POSC 370J.)
POSC 470K. Nationalism, Ethnicity, and Religion in World Politics (3) (See POSC 370K.)
POSC 471. Natural Resources and World Politics (3) (See POSC 371.)
POSC 472. United Nations Peacekeeping (3) (See POSC 372.)
POSC 475. Nuclear Weapons and Arms Control (3) (See POSC 375.) Cross-listed as HSTY 475.
POSC 476. United States Foreign Policy (3) (See POSC 376.)
POSC 478. War and Conflict in the International System (3) (See POSC 378.)
POSC 479. Middle East: Politics, Economics, and American Policy (3) (See POSC 379.)
POSC 480. Public Policy and Aging (3) Cross-listed as EPBI 408.
POSC 484. Ethics and Public Policy (3) (See POSC 384.)
POSC 485. Public Administration in the U.S. (3) (See POSC 385.)
POSC 486. American Public Policy Process (3) (See POSC 386.)
POSC 601. Individual Investigation (1-6) 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. Prerequisite: Departmental prospectus form.
POSC 701. Dissertation Ph.D. (1-9) Prerequisite: Consent of department.

Department of Psychology

109 Mather Memorial Building
Phone 216-368-2686; Fax 216-368-4891

Robert L. Greene, Chair
The Department of Psychology offers programs leading both to undergraduate (Bachelor of Arts) and graduate (Master of Arts and Doctor of Philosophy) degrees. Programs in psychology can be selected in preparation for graduate work in the field, or as background for a variety of human service-oriented professions, or to obtain general knowledge and understanding of behavior that is applicable in many different careers.

FACULTY
Robert L. Greene, Ph.D. (Yale University)
Professor and Chair
Human memory and cognition
Roy F. Baumeister, Ph.D. (Princeton University)
Elsie B. Smith Professor of Liberal Arts
Social psychology; personality research; behavioral correlates of self-esteem and self-monitoring; evaluation research
Douglas K. Detterman, Ph.D. (University of Alabama, Tuscaloosa)
Professor
Human intelligence and mental retardation
James C. Overholser, Ph.D. (Ohio State University)
Professor
Adult psychopathology; depression; suicide; personality disorders
Grover C. Gilmore, Ph.D. (Johns Hopkins University)
Professor
Perceptual development and aging; visual information processing; memory; psychophysics
James C. Overholser, Ph.D. (Ohio State University)
Professor
Adult psychopathology; depression; suicide; personality disorders
Sandra W. Russ, Ph.D. (University of Pittsburgh)
Professor
Creativity; affective development in children; personality assessment; coping mechanisms in children
ASSOCIATE FACULTY

Stanley Althof, Ph.D.
Associate Professor
School of Medicine/University Hospitals

Barry Layton, Ph.D.
Assistant Professor
School of Medicine/MetroHealth Medical Center

Dennis Drotar, Ph.D.
Professor
School of Medicine/Department of Psychiatry

Roland Holmes Foliart, Ph.D.
Assistant Professor
School of Medicine, Department of Psychiatry

Howard Hall, Psy.D., Ph.D.
Assistant Professor
School of Medicine/Rainbow Babies and Children’s Hospital

William C. House, Ph.D.
Associate Professor
School of Medicine/MetroHealth Medical Center

Elisabeth Koss, Ph.D.
Assistant Professor
School of Medicine/Department of Neurology

Marian Patterson, Ph.D.
Associate Professor
School of Medicine/Alzheimer Center/University Hospitals

Lynn Singer, Ph.D.
Professor
School of Medicine/University Hospitals

Terry Stancin, Ph.D.
Associate Professor
School of Medicine/MetroHealth Medical Center Hudson

Thomas P. Swales, Ph.D.
Assistant Professor
School of Medicine/MetroHealth Medical Center

Gerry Taylor, Ph.D.
Professor
School of Medicine/Department of Pediatrics

Jane Timmons-Mitchell, Ph.D.

ADJUNCT FACULTY

Cameron Camp, Ph.D.
Adjunct Professor
Myers Research Institute

Ana Maria Carillo, Ph.D.
Adjunct Instructor
Cedar Hill Psychotherapy

Phyllis Dukes, Ph.D.
Adjunct Assistant Professor
Mental Development Center

Robert Goldberg, Ph.D.
Adjunct Assistant Professor
Cleveland Veterans Administration Medical Center

Bettina Katz, Ph.D.
Adjunct Assistant Professor
CWRU/University Counseling Center

Carolyn Landis, Ph.D.
Adjunct Instructor
Rainbow Babies and Children’s Hospital

Jeffrey Rosenbaum, Ph.D.
Adjunct Assistant Professor
Children’s Aid Society/Beech Brook

Philip Safford, Ph.D.
Adjunct Professor
Professor Emeritus, Kent State University

Jes-James Sellers, Ph.D.
Adjunct Assistant Professor
CWRU/University Counseling Center

Jeremy Shapiro, Ph.D.
Adjunct Assistant Professor
The Guidance Centers

Daniel A. Weinberger, Ph.D.
Adjunct Assistant Professor
Family Achievement Clinic/MetroHealth Medical Center

Kenneth Weiss, Ph.D.
Adjunct Assistant Professor
V.A. Medical Center at Brecksville

CLINICAL FACULTY

Karen Kernberg Bardenstein, Ph.D.
Clinical Instructor
Mark Loving and Associates

Robert Benjamin, Ph.D.
Clinical Instructor
Sagamore Hills

Jeffrey Bolek, Ph.D.
Clinical Assistant Professor
Health Hill Hospital for Children

John Bolger, Ph.D.
Clinical Instructor
VA Medical Center, Brecksville

Robert Chwast, Ph.D.
Assistant Clinical Professor
Rocky River Counseling

Sandra L. Curry, Ph.D.
Assistant Clinical Professor

Lori L. D’Angelo, Ph.D.
Clinical Instructor
Hill House

Jennifer Franklin, Ph.D.
Clinical Instructor
Beech Brook Children’s Center

Mathew A. Fuller, Ph.D.
Clinical Instructor
Veterans Affairs Medical Center

Douglas K. Grossman-Mckee, Ph.D.
Clinical Instructor
The Progressive Company

Tom Michael Hagersfeld, Ph.D.
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Northcoast Behavioral Healthcare System

Michelle Harris, Ph.D.
Assistant Clinical Professor
Bellflower Center for the Prevention of Child Abuse

Sally G. Hoyle, Ph.D.
Clinical Instructor
Beech Brook Children’s Center

Janice G. Katz, Ph.D.
Clinical Instructor
Northcoast Behavioral Healthcare System

Susan M. Knell, Ph.D.
Clinical Instructor
Child Guidance Center of Greater Cleveland

Maureen Kreick, Ph.D.
Clinical Instructor
Private Practice

Marilyn Malkin, Ph.D.
Clinical Instructor

Roth Stanley and Associates

David Pincus, Ph.D.
Assistant Clinical Professor

Lawrence Waldman, Ph.D.
Clinical Instructor

Children’s Aid Society

UNDERGRADUATE PROGRAMS

The undergraduate programs in psychology are designed to provide broad education in the science of behavior. The curriculum consists of three levels: an introductory level that is a prerequisite for most other courses in the department; an intermediate level, covering the various
substantive areas of psychology; and an advanced level that offers numerous unique opportunities for undergraduates to engage in specialized and individualized work.

Major
Students completing the B.A. may major in psychology. Psychology majors must complete 30 hours of course work in the department.

Required courses
- PSCL 101, General Psychology I (3)
- PSCL 282, Quantitative Methods in Psychology (3).

Three additional courses chosen from
- PSCL 315, Social Psychology (3)
- PSCL 352, Physiological Psychology (3)
- PSCL 353, Psychology of Learning (3)
- PSCL 355, Sensation and Perception (3)
- PSCL 357, Cognitive Psychology (3)
- PSCL 382, Psychological Measurement (3)
- PSCL 393, Experimental Child Psychology (3)

The remaining hours can be fulfilled by taking psychology electives chosen by the major and his or her advisor.

Minor (15 hours):

Required Course
- PSCL 101 (3 hours)

Electives
A minimum of four courses (12 hours) chosen by the student in consultation with his/her advisor. Practica and independent study are available to minors but cannot be used to satisfy the minor requirement.

Sequence for Engineering Core (9 hours)
The sequence reflects an emphasis on either the cognitive/biological or social/personal aspects of the field. All sequences must include PSCL 101 and two courses from one of the following groups:
Personal and Social Behavior: PSCL 102, 230, 300, 313, 315, 317, 321, 325
Cognitive/Biological Behavior: PSCL 352, 353, 355, 357, 360

Departmental Honors
Junior majors with a 3.0 overall grade point average and a 3.25 average in psychology are encouraged to apply to the department’s Honors Program. This program consists of one three-credit course PSCL 395, during 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.

Integrated Graduate Programs
The Department of Psychology participates in the Integrated Graduate Studies Program. Interested students should note the general requirements and the admission procedures in this bulletin and may consult the department for further information.

GRADUATE PROGRAMS
Graduate programs leading to the Doctor of Philosophy degree are offered in the fields of adult clinical, child clinical, experimental psychology, social psychology, and mental retardation research. The Master of Arts degree can be earned in the department as part of work toward a doctorate. Additional information about graduate work in psychology is available from the departmental office.

Psychology (PSCL)

UNDERGRADUATE COURSES
PSCL 101. General Psychology I (3)
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)
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)
Basic facts and principles of psychological development from the prenatal period through adolescence. Prerequisite: PSCL 101.

PSCL 231. Child Psychology Practicum (1)
The course will involve three hours per week of practicum experience at either the Church of the Covenant day care center or the Mental Development Center School. Student will be given an orientation to child development in the context of a preschool program. Prerequisite: PSCL 101. Corequisite: PSCL 230.

PSCL 282. Quantitative Methods in Psychology (3)
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 300. Interdisciplinary Psychology (3)
This course draws on information from different fields of inquiry to address broad psychological questions about the human condition. Topics may include identity, cultural change, finding meaning in life, the nature of evil, love and family, death, and happiness. Intended for students who like to think, the course will emphasize learning how to cross disciplinary boundaries in pursuit of fundamental insights. Prerequisite: PSCL 101.

PSCL 313. Psychology of Personality (3)
The development and organization of personality; theories of personality and methods for assessing the person; problems of personal adjustment.

PSCL 315. Social Psychology (3)
Empirical studies of typical human responses to situations. First impressions, attitude change, effects of cash incentives, behavior in emergencies, interpersonal attraction, impression management, crowding, stress, vices. Prerequisite: PSCL 101.

PSCL 317. Health Psychology (3)
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 system. Prerequisite: PSCL 315.

PSCL 321. Abnormal Psychology (3)
Major syndromes of mental disorders, their principal symptoms, dynamics, etiology, and treatment. Prerequisite: PSCL 101.
PSCL 325. Psychotherapy and Personality Change (3)
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. Prerequisite: PSCL 101.

PSCL 334A. Seminar and Practicum: Preschool and Daycare (3)
Supervised field placement and attendance at staff conferences in various child and adolescent settings. Regular seminar meetings. Prerequisite: PSCL 230.

PSCL 334C. Seminar and Practicum: Hospitalized Children (3)
Supervised field placement and attendance at staff conferences in various child and adolescent settings. Regular seminar meetings. Prerequisite: PSCL 230.

PSCL 335A. Seminar and Practicum: Preschool and Daycare (3)
Supervised field placement and attendance at staff conferences in various child and adolescent settings. Regular seminar meetings. Prerequisite: PSCL 230.

PSCL 335C. Seminar and Practicum: Hospitalized Child (3)
Supervised field placement and attendance at staff conferences in various child and adolescent settings. Regular seminar meetings. Prerequisites: PSCL 230 and Junior or Senior standing.

PSCL 338. Seminar and Practicum in Adolescence (3)
Cross-listed as EDUC 338 and SOCI 338.

PSCL 339. Seminar and Practicum in Adolescents (3)
Prerequisite: PSCL 230. Cross-listed as SOCI 339.

PSCL 344. Developmental Psychopathology (3)
This course will focus on the interplay of biological, psychological, familial, and social determinants of disorders ranging from autism to delinquency and bulimia. Prerequisite: PSCL 230 or PSCL 321.

PSCL 350. Behavior Genetics (3)
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. Prerequisite: PSCL 101.

PSCL 352. Physiological Psychology (3)
The nervous system as it relates to behavior. Prerequisite: PSCL 101.

PSCL 353. Psychology of Learning (3)
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. Prerequisite: PSCL 101.

PSCL 355. Sensation and Perception (3)

PSCL 357. Cognitive Psychology (3)

PSCL 360. Laboratory and Seminar in Human Experimental Psychology (3)
Methods of research in human learning, cognition, and perception will be examined through seminar discussions and laboratory experiments.

PSCL 369. Adult Development and Aging (3)
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)
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. Prerequisite: PSCL 101.

PSCL 375. Research Design and Analysis (3)
Conceptual and methodological issues confronted by the behavioral scientist conducting research. Major experimental designs and statistical procedures. Intuitive understanding of the mathematical operations. Prerequisite: PSCL 282.

PSCL 382. Psychological Measurement (3)
The problems and methods of measuring behavior. Scaling theory, rating methods, and the theoretical basis of psychological testing. Prerequisite: PSCL 282.

PSCL 390. Seminars in Psychology (1-3)
Surveys of special subject areas. Topics vary in response to faculty and student interests. Small group discussion. Prerequisite depends on content.

PSCL 393. Experimental Child Psychology (3)
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. Prerequisite: PSCL 101.

PSCL 395. Honors Program (3)
Supervision in carrying out an independent research study in the student’s area of interest. Prerequisite: PSCL 375.

PSCL 397. Independent Study (1-3)
Individual study involving specific programs of reading, research, and special projects. Prerequisite: PSCL 101.

GRADUATE COURSES

PSCL 400. Ethics for Professional Researchers (3)
Ethical principles applied to topics including authorship, plagiarism, grants, ownership of intellectual property, conflict of interest, harassment, and treatment of animal or human subjects.

PSCL 401. Sensation and Perception (3)
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)
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)
Fundamental neurological processes controlling behavior.

PSCL 404. Learning Theory (3)
The research literature in learning: theoretical formulations of contemporary learning theorists. Limited to graduate students.

PSCL 405. Personality Theory (3)
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)
Intermediate research design and statistical analysis used in psychological research. Statistical inference from single variables, elementary principles of probability, correlation and regression. Prerequisite: PSCL 282.

PSCL 408. Research Design and Quantitative Analysis II (3)
Advanced research design and statistical analysis used in psychological research. Statistical inference from multiple variables, multiple correlation and regression, analysis of variance, nonparametric statistics. Prerequisite: PSCL 407.

PSCL 409. Advanced Social Psychology (3)
Major theories, methods, and problem areas of social psychology. Psychological development of the individual group structures and dynamics.

PSCL 410. Developmental Psychology (3)
The research literature and theoretical formulation in the area of developmental psychology. Limited to graduate students.

PSCL 412. Measurement of Behavior (3)
Theory and methods of human behavior measurements. Reliability, validity, and test construction in the objective assessments of traits and abilities. Prerequisite: PSCL 282.

PSCL 417. Multivariate Data Analysis (3)
Major statistical techniques used in experimental and survey research containing more than one dependent variable. Techniques discussed include multiple regression, canonical correlation, multivariate analysis of variance, discrimination analysis, cluster analysis and factor analysis. Prerequisite: PSCL 408.

PSCL 418. History and Systems (3)
Historical antecedents of modern psychology.

PSCL 425. Methods of Assessment I (3)
Limited to graduate students in clinical psychology. Prerequisite: Graduate standing in psychology with department permission.

PSCL 426. Methods of Assessment II (3)
Methods of psychological assessment, emphasizing personality and family function in childhood and adulthood. Prerequisite: Limited to Grad students in Clinical Psychology. Requires approval of the Director of Clinical Training.

PSCL 427. Special Assessment Methods with Children with Multiple Problems (3)

PSCL 429. Practicum in Assessment I (1)

PSCL 430. Practicum in Assessment II (1)
Prerequisite: Approval of the Director of Clinical Training. Corequisite: PSCL 426.

PSCL 444. Developmental Psychopathology (3)
This course will focus on the interplay of biological, psychological, familial, and social determinants of disorders ranging from autism to delinquency and bulimia.

PSCL 453. Seminars in Psychology (1-3)
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. Prerequisite: Graduate standing in psychology or consent of department.

PSCL 501. Pediatric Psychology I (1-3)
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)
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. Prerequisite: Limited to Graduate students in Psychology department.

PSCL 524. Advanced Psychopathology (3)
Theoretical issues and current research data bearing on major patterns of psychological disturbance.

PSCL 527. Clinical Psychology: Introduction to Methods of Intervention (3)
PSCL 529A. Practicum in Intervention I: Behavior Therapy (1)
Prerequisite: Graduate standing in clinical psychology.

PSCL 529B. Practicum in Intervention I: Client-centered (1)
Prerequisite: Graduate standing in clinical psychology.

PSCL 529C. Practicum in Intervention I: Psychodynamic (1)
Prerequisite: Graduate standing in clinical psychology.

PSCL 530A. Practicum in Intervention II: Behavior Therapy (1)
Prerequisite: Graduate standing in clinical psychology.

PSCL 530B. Practicum in Intervention II: Client-centered (1)
Prerequisite: Graduate standing in clinical psychology.

PSCL 530C. Practicum in Intervention II: Psychodynamic (1)
Prerequisite: Graduate standing in clinical psychology.

PSCL 531A. Seminar in Intervention I: Behavior Therapy (2)
Theoretical issues and research on psychological interventions. Prerequisite: Graduate standing in clinical psychology.

PSCL 531B. Seminar in Intervention I: Client-centered (2)
Theoretical issues and research on psychological interventions. Prerequisite: Graduate standing in clinical psychology.

PSCL 531C. Seminar in Intervention I: Psychodynamic (2)
Theoretical issues and research on psychological interventions. Prerequisite: Graduate standing in clinical psychology.

PSCL 532A. Seminar in Intervention II: Behavior Therapy (2)
Theoretical issues and research on psychological interventions. Prerequisite: Graduate standing in clinical psychology.

PSCL 532B. Seminar in Intervention II: Client-centered (2)
Theoretical issues and research on psychological interventions. Prerequisite: Graduate standing in clinical psychology.
PSCL 532C. Seminar in Intervention II: Psychodynamic (2)
Theoretical issues and research on psychological interventions. Prerequisite: Graduate standing in clinical psychology.

PSCL 535. Child and Family Intervention (2)
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. Intervention with Parents and Couples (2)
A course for advanced clinical graduate students that covers various approaches to working with parents and couples and special topics in family therapy such as ethnicity and nontraditional families.

PSCL 537. Child and Family Case Seminar I (1)
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)
Clinical graduate students in child and family field placements present and receive group supervision on ongoing cases.

PSCL 601. Special Problems (1-18) (Credit as arranged.)

PSCL 651. Thesis M.A. (1-18) (Credit as arranged.)

PSCL 700. Internship (0)
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.

PSCL 701. Dissertation Ph.D. (1-18) (Credit as arranged.)

PSCL 702. Appointed Dissertation Fellow (9)

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Public Policy Program

Mather House Room 1
Phone 216-368-2690; fax 216-368-4681;
e-mail xx343.
David C. Hammack, Director

FACULTY ADVISORY COMMITTEE
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John Palmer Smith, Ph.D. (Columbia University)
Director, Mandel Center for Nonprofit Organizations; Professor for the Practice of Nonprofit Management, Weatherhead School of Management

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PUBLIC POLICY STUDIES AT CWRU

The Center for Policy Studies and various public policy programs enable faculty and students from across the university to work with one another and with community leaders to study the development, evaluation, and improvement of public policy. Public policy undergraduate and graduate courses are offered through the departments of anthropology, geological sciences, history, political science, and sociology in the college of arts and sciences; through the Department of Economics and other departments of the Weatherhead School of Management; through the schools of law, medicine, and nursing; and through the Mandel School of Applied Social Sciences (social work) and the Mandel Center for Nonprofit Organizations.

The program allows undergraduates to pursue a minor and to take advantage of forums of the Center for Policy Studies and other opportunities to explore public policies. Plans to offer an interdisciplinary master’s degree are being developed. For more information see the Directory of Public Policy Resources at CWRU that is maintained by the Public Policy Program. For courses offered by every school in the university in a given semester see program’s List of Public Policy Courses at CWRU. For offerings in the Master of Business Administration program see the separate statement for the Weatherhead School; for offerings in other schools see their statements.

UNDERGRADUATE PROGRAM

Minor
A public policy minor is available to undergraduates in the College of Arts and Sciences (and to undergraduates in the economics and management programs housed within the Weatherhead School of Management). It consists of 15 credit hours, ordinarily including ECON 205:
and social work.

American Public Policy Process; One course from the following list of approved courses in Policy Institutions:
- HSTY 256: Political History of the United States
- HSTY 358: The US Since 1940
- HSTY 400: Race, Gender and Social Policy

One course from the following list of approved courses in the US:
- POSC 308: The American Presidency
- POSC 310: The Legislative Process
- POSC 384: Ethics and Public Policy
- POSC 385: Public Administration in the US

and two courses from an approved list of courses in such specific fields of policy as health care; the environment; business and the economy; technology; women and gender; nonprofit and charitable organizations; social policy regarding such matters as poverty, families and children, disabilities, and old age; education; and criminal justice. An undergraduate may also propose another specific field of policy, and may petition to have a course added to the approved list of public policy courses.

For further information, contact Professor Vincent McHale in the Department of Political Science, Mather House, at 368-2425 or vem@po.cwru.edu.

Graduate Programs

Several of CWRU’s graduate and professional degree programs offer study in public policy. These include programs in anthropology (M.A. and Ph.D. programs in medical anthropology), history (M.A. and Ph.D. programs in social policy history and the history of technology and science), sociology (M.A. and Ph.D.), and political science; and programs in law, the Master of Business Administration and other management programs, nonprofit organizations (through the Mandel Center for Nonprofit Organizations), nursing, and social work.

Department of Religion

111 Mather House
Phone 216-368-2210; Fax 216-368-4681
William E. Deal, Chair

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 the theories, methods, and technologies employed. The academic study of religion, combined with appropriate courses in other fields, provides an excellent background for any professional career including law, engineering, medicine and health care professions, journalism, social work, and others and for graduate studies in a number of fields. A major in religion provides a well-rounded liberal arts education or can be combined conveniently with a second major. Minors or sequences in religion complement and broaden any field chosen as a major.

Faculty

Alice Bach, Ph.D. (Union Theological Seminary [NY])
- Archbishop Paul J. Hallinan Associate Professor of Catholic Studies
- Literary and cultural studies of the Bible; feminist thought; film studies; society and religion

Timothy K. Beal, Ph.D. (Emory University)
- Harkness Associate Professor of Biblical Literature
- Biblical studies; Near Eastern studies; environmental studies; religion, literature, and culture; gender studies

William E. Deal, Ph.D. (Harvard University)
- Severance Associate Professor of the History of Religion
- Buddhism; Chinese and Japanese religions; methodology of religion; comparative ethics

James W. Flanagan, Ph.D. (University of Notre Dame)
- Professor
- Hebrew scriptures; archaeology; history and religion of Ancient Israel; social world of the Ancient Near East

Peter J. Haas, Ph.D. (Brown University)
- Abba Hillel Silver Professor of Jewish Studies
- Jewish literature and thought; Jewish ethics; science and religion

Associate Faculty

Thomas Csordas, Ph.D. (Duke University)
- Professor of Anthropology; and Professor of Religion
- Comparative religion

Stephen G. Post, Ph.D. (University of Chicago)
- Associate Professor of Biomedical Ethics, School of Medicine; and Associate Professor of Religion
- Biomedical ethics; American religious thought; philosophy of religion

Undergraduate Programs

The Department of Religion offers a major and a minor in religion, as well as a Departmental Honors Program, for students pursuing the Bachelor of Arts degree. Humanities and social science sequences are offered for B.S. degree students in Engineering. Religion courses often involve technological connections to the study of religion, with projects involving Internet research and building Web sites. Both the major and minor programs acquaint the student with the texts and traditions of the ancient Near East, Judaism, Christianity, and Asian religions, as well as cultural and social aspects of religion. Majors are encouraged to participate in study abroad programs. When appropriate, courses are designed to utilize Internet 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, and qualified students may pursue the M.A. degree under the Integrated Graduate Studies Program (IGS). The Department of Religion also contributes courses and supports a number of the college’s interdisciplinary programs such as Asian studies, women’s studies, environmental studies, and international studies programs.

Major

Students majoring in religion must complete a minimum of 30 semester hours of work in the department. courses required of all majors are RLGN 102: Introduction to the Study of Religion and at least three hours of RLGN 399/499: Majors/Minors Seminar (repeatable up to six...
hours). In addition, majors must complete three courses in one of the three areas described below, one course in each of the other two areas outside of the area of concentration, and three elective courses. A list of courses assigned to each area of concentration is available from the department. Additionally, majors are encouraged to develop interdisciplinary competency by taking courses in other departments relevant to their area of concentration. Majors are urged to take a second language related to their interests and concentration.

Area 1: Religious Texts and Traditions
Courses in Area 1 focus on the critical study of religious texts and traditions and their historical development. These courses encourage critical reflection on the methods and theories employed to study them. Interpretive perspectives include those drawn from the academic study of religion and other disciplines in the arts and humanities, social sciences, and natural sciences.

Area 2: Religion and Culture
Courses in Area 2 examine ways that religious discourses and practices are woven into larger webs of culture and are related to other elements within these webs. Through analysis of a wide range of cultural productions, both ancient and contemporary, from visual culture to popular media, these courses focus on the complex ways that religion takes form within particular cultural contexts, and conversely, helps to form cultural artifacts.

Area 3: Religion in Society
Courses in Area 3 investigate the various ways that people practice their religious beliefs within their own social groups and sustain their traditions within the larger society. Within this area are courses on the tensions between religion and science, ethics across religious boundaries and within religious traditions, and how religious groups affect political, economic, and social issues within local and world communities. Some courses in this area offer opportunities for working with social service and advocacy agencies in the community.

Minor
Students minoring in religion must complete 15 semester hours of work in the department. Courses required of all minors are RLGN 102: Introduction to the Study of Religion and three hours of RLGN 399/499: Majors/Minors Seminar. Nine hours of coursework must be chosen in consultation with a departmental advisor. These courses must demonstrate diversity in the study of religion.

Sequences (Engineering Core)
Sequences normally include three courses that demonstrate diversity in the study of religion. Approval for sequences must be obtained from the departmental advisor. In selecting courses, attention will be given to religious pluralism and diversity of approaches to the academic study of religion.

Departmental Honors
Students who are majoring in religion and have an overall grade point average of 3.5 and also a grade point average of 3.5 in religion courses may apply for the honors program. Honors candidates enroll in RLGN 390 each semester during their senior year. A year-long honors project must be accepted by a member of the department faculty and formally approved by a majority of the full-time faculty members in the department. The approval must be granted not later than the end of the first semester. A faculty committee awards departmental honors upon satisfactory completion, defense, and acceptance of the senior project, provided that the required grade point averages are maintained.

Research
Faculty members in the department are engaged in scholarly research, writing, editorial projects, and leadership roles in professional societies.

Religion (RLGN)

UNDERGRADUATE COURSES

RLGN 102. Introduction to the Study of Religion (3)
Introduction to the critical study of religion and of the religious dimension of life.

RLGN 105. Aspects of Jewish and Middle Eastern Religions and Cultures (1)
This mini-course explores a variety of topics in Jewish and Middle Eastern religions and cultures. A one-credit course, repeatable up to three times, taught by distinguished Rosenthal Fellows visiting from Hebrew University in Jerusalem. Intended for students and others interested in an introduction to religion and culture. Participation in lectures and discussions and a final exam are required.

RLGN 120. Comparative Ethics (3)
An exploration of the diversity of ethical claims from a cross-cultural perspective, involving a study of different worldviews, including religious, scientific, humanist, and Marxist perspectives, and the implications of such worldviews on how values are thought about and justified. Consideration also of the force of rhetoric and discourse in persuading others to follow a certain moral course or argument.

RLGN 125. Beginning Hebrew I (3)
(Credit for RLGN 125 only on completion of RLGN 126.) Elements of classical Hebrew grammar, syntax, and vocabulary with reading and translating from classical and other sources. Credit for RLGN 125 may not be used for credit toward a religion major.

RLGN 125A. Supplementary Beginning Classical Hebrew (1)
(Credit for RLGN 125A only on completion of RLGN 126.) Supplementary course of beginning classical Hebrew (10 class hours) for students with a strong background in either classical or modern Hebrew who wish to place into RLGN 126 without RLGN 125. Students who successfully complete a placement exam and RLGN 125A may register for RLGN 126 in the same semester. Credit for RLGN 125A may not be used for credit toward a religion major. Placement procedure: Students with prior knowledge of Hebrew, classical or modern, may take a placement examination before the first week of the semester in which they enroll in RLGN 126. Placement into RLGN 126, and if needed 125A, depends on examination results and consultation with the instructor. Information on placement testing times and location is available in the department office. Prerequisite: Permission of department.

RLGN 126. Beginning Hebrew II (3)
Credit for RLGN 126 may not be used for credit toward a religion major. Prerequisite: RLGN 125 or RLGN 125A.
RLGN 201. Literature and History of Ancient Israel (3)
The Hebrew Bible in the light of the history and religion of Israel and the ancient Near East.

The literature of the New Testament in its historical, ideological, and religious setting.

RLGN 203. Introduction to Judaism (3)
The beliefs, doctrines, and institutions of classical Judaism; their origin and development.

RLGN 204. Introduction to Asian Religions (3)
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 Bhagavad Gita, and the early Buddhist canon.

RLGN 206. Religion and Ecology (3)
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. Religion and Feminism (3)
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.

RLGN 215. Religion In America (3)
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 217. Buddhism (3)
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 223. Religious Roots of Conflict in the Middle East (3)
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 225. Intermediate Classical Hebrew I (3)
Focus on building facility in reading, comprehending, and translating biblical prose. Issues of Hebrew grammar, biblical exegesis, history of interpretation or particular biblical stories are discussed in relation to individual texts. Prerequisites: RLGN 125 and RLGN 126 or equivalent.

RLGN 231. Modern Judaism (3)
Jewish thought since the 18th century, with focus on religious reform movements, Zionist theory, and formulation of Jewish identity.

RLGN 235. Religion and Visual Culture (3)
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 240. Religion and Science (3)
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 241. Religious Experience and the Life Sciences (3)
Examination of religious experience and beliefs in face of advances in the life sciences, especially neuroscience and evolutionary biology. Relation of religion and science, contemporary issues, history of discussions and debates.

RLGN 254. The Holocaust (3)
History of racism in European society from 18th to 20th century; investigation, from perspectives of history, psychology, literature, philosophy, and religion, of how bureaucracy could exterminate six million Jews; responses of individuals, groups, institutions, and nations to deliberate extermination of nearly a whole people. Cross-listed as HSTY 254.

RLGN 266. Bible in Fiction - Fiction in the Bible (3)
Examination of use of biblical themes, tropes, and characters in modern fiction and popular culture, e.g., films, librettos, songs. Readings include Genesis, Exodus, Numbers, Judges, 1-2 Samuel, haggadic Midrashim, Jewish folktales, and modern fiction.

RLGN 270. Introduction to Gender Studies (3)
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, and art history. It is the required introductory course for students taking the women’s studies major. Cross-listed as WSTD 201.

RLGN 271. Bioethics: Dilemmas in Research and Clinical Practice (3)
Cross-listed as BETH 271.

RLGN 275. Jerusalem Perspectives (3)
Topics in the religious, cultural, and historical legacy of past and present Middle Eastern societies. The course is taught by Fellows of the Samuel Rosenthal Center who are faculty members of the Hebrew University in Jerusalem. Course repeatable for credit up to four times.

RLGN 300. Archaeology of Biblical Israel (3)
Religious and social world of biblical Israel as recovered by archaeology and interpreted with aid of comparative history and anthropology.

RLGN 301. History and Ritual in Religion (3)
Religious traditions, including those of the Ancient Near East, as they change throughout history. Selected historical personalities and events that accompany the formulation and reformulation of tra-
tions. Changes such as the rise of liter-acy in oral society, relationship be-tween agrarian and nomadic societies, and devolution of centralized power serve as case studies for religious trans-formation.

RLGN 303. Japanese Religions (3)
Thematic and historical survey of major Japanese religious ideas and institutions. Emphasis on translated readings in primary texts. Issues covered include Shinto and Buddhist traditions, religion and state, and role of religion in modern Japan.

RLGN 306. Interpreting Buddhist Texts (3)
Readings in translation of major texts from the Buddhist tradition. Special em-phasis on problems of textual interpreta-tion, historical context, Buddhist concep-tions of the sacred, and Buddhist ethics. Prerequisite: RLGN 102 or RLGN 204 or RLGN 217 or RLGN 303 or RLGN 341.

RLGN 308. Problem of Historical Jesus (3)
Understanding of Jesus by nascent Chris-tianity and by modern scholarship.

RLGN 314. Jews and Christians in Germany (3)
Jewish and Christian self-understandings and attitudes toward each other in Ger-many from the late eighteenth century to the present. Special attention to the his-tory of modern anti-Semitism and Jewish responses to it, particularly as a factor in the Nazi period.

RLGN 315. Heresy and Dissidence in the Middle Ages (3)
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. Cross-listed as HSTY 315.

RLGN 316. Modern Religious Thought: 1800 to the Present (3)
A survey of some major religious think-ers of Europe and North America from roughly 1800 to the present. A chrono-logical examination of classical texts of theology and philosophy of religion of this period, with consideration of signifi-cant themes: Given the advance in mod-ern rational thought, how can we under-stand traditional religion? What is the re-lationship between religion and reason? Religion and history? Religion and cul-ture? Religion and experience? Is the at-tempt to modernize faith misguided or necessary to prevent faith from being captive to outdated cultural assump-tions?

RLGN 317. Recent Religious Thought (3)
A survey of the variety of forms of reli-gious thought that have emerged in Eu-rop and North America since roughly 1960. A loosely chronological examina-tion of major religious thinkers of this pe-riod, treating such questions as: What does it mean to have faith in the modern age? In the postmodern age? What as-pects of religious tradition can modern and postmodern thinkers dispense with and still be “religious.” How has the feminist critique of gender affected tradi-tional faith? Are those who have sought to modernize religion correct, or has that project been completely mistaken?

RLGN 325. Justice, Religion, and Society (3)
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 di-rec t action to deal with issues of poverty, peace, and social justice. Introduction to writings of prominent social justice activ-ists 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 en-gaged in social justice and urban poverty issues in order to investigate these from the inside.

RLGN 330. Classical Jewish Religious Thought (3)
The thought of some major biblical and Rabbinic writings and of the classic age of medieval Jewish philosophy.

RLGN 332. Jewish Experience in America (3)
Religious, political, and social history of Jews in America from 17th century to the present. Special attention to the question, “How have Jews responded to the openness of American society?” including the definition of Jewish theology in contrast to Christianity, the special culture of Eastern European immigrants, and the struggle of Jewish women to assert Jew-ish commitments against the tide of as-similation in the late 20th century.

RLGN 333. Philosophy of Religion (3)
Topics include: classical and contempo-rary arguments for God’s existence; di-vine foreknowledge and human freedom; the problem of evil and theodicy; nature and significance of religious experience; mysticism; varieties of religious meta-physics; knowledge, belief and faith; na-ture of religious discourse. Readings from traditional and contemporary sources. Prerequisite: PHIL 101 or RLGN 102. Cross-listed as PHIL 333.

RLGN 335. Issues in Roman Catholicism: Current American Experience (3)
Exploration of issues and tensions facing Roman Catholics in America nearly 40 years after the Second Vatican Council, with emphasis on church polity, structure, and reforms on local and national levels as culture and society change. Considers subsidiarity and conciliarity mandated by Vatican II documents; new models for Church governance; culturally diverse local churches; and varying agenda of con-servative and liberal Catholic groups in America. The challenges to Rome and to America of the emerging role of women, the declining numbers of priests and reli-gious, and the increase in lay leadership.

RLGN 341. Religion and Post-modern-ism (3)
Consideration of the impact of postmodern thought on the study of reli-gion. Examination of how recent critical theory informs our understanding of religious texts and religious themes in con-temporary literature, arts and film. Utiliz-ing the theories of Focault, Derrida, Kristeva, and others, the class will explo-re such postmodern concerns as narra-tive, textuality, the author, ideology, gen-der, and rhetoric.

RLGN 345. Religion and Horror (3)
This seminar explores relations between religion, horror, and the monstrous in an-cient scripture and contemporary horror. Course readings, discussions, and re-search projects approach the subject from two distinct but related directions: first, a focus on elements of horror and the mon-strous in biblical and related ancient mythic and ritual texts; second, an exami-nation of religious dimensions in the modern horror, especially as found in representations of monstrosity in litera-ture and film. Prerequisite: RLGN 102 or permission of department.

RLGN 350. Jewish Ethics (3)
An exploration of Jewish moral and ethi-cal 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.

**RLGN 366. Religion and Film (3)**
Study of the cultural use of biblical figures, especially in film: movies as myth; place of myths in American culture; how cinematic images continue the polarization of biblical images and intertwine them with the American myth.

**RLGN 372. Anthropological Approaches to Religion (3)**
The development of, and current approaches to, comparative religion from an anthropological perspective. Topics include witchcraft, ritual, myth, healing, religious language and symbolism, religion and gender, religious experience, the nature of the sacred, religion and social change, altered states of consciousness, and evil. Using material from a wide range of world cultures, critical assessment is made of conventional distinctions such as those between rational/irrational, natural/supernatural, magic/religion, and primitive/civilized. Prerequisite: ANTH 102 or consent. Cross-listed as ANTH 372.

**RLGN 373. History of the Early Church: First Through Fourth Centuries (3)**
Cross-listed as HSTY 303.

**RLGN 374. Reformation Europe, 1500-1650 (3)**
Origins and development of Protestantism, the Catholic counter-reformation, and the interaction between secular power and religious identification in Christian Europe. Cross-listed as HSTY 309.

**RLGN 388. Topics in Religion (3)**
Critical assessment of selected topics of historical or current interest. Project must be accepted by a member of the department faculty prior to registration.

**RLGN 390. Independent Study, Honors (3)**
Generally limited to junior and senior religion majors. Project must be accepted by a member of the department faculty prior to registration.

**RLGN 399. Major/Minor Seminar (3)**
Capstone course primarily for majors and minors in religion. 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.

**GRADUATE COURSES**

**RLGN 400. Archaeology of Biblical Israel (3)**
(See RLGN 300.)

**RLGN 401. History and Ritual in Religion (3)**
(See RLGN 301.)

**RLGN 430. Classical Jewish Religious Thought (3)**
(See RLGN 330.)

**RLGN 432. Jewish Experience in America (3)**
(See RLGN 332.)

**RLGN 433. Philosophy of Religion (3)**
(See RLGN 333.) Cross-listed as PHIL 433.

**RLGN 441. Religion and Post-modernism (3)**
(See RLGN 341.)

**RLGN 445. Religion and Horror (3)**
(See RLGN 345.)

**RLGN 450. Jewish Ethics (3)**
(See RLGN 350.)

**RLGN 466. Religion and Film (3)**
(See RLGN 366.)

**RLGN 488. Topics in Religion (3)**
(See RLGN 388.) Project must be accepted by a member of the department faculty prior to registration.

**RLGN 601. Special Research (1-6)**
Project must be accepted by a member of the department faculty prior to registration.

**RLGN 651. Thesis M.A. (1-9)**
Project must be accepted by a member of the department faculty prior to registration.

**Department of Sociology**

**226 Mather Memorial Building**
**Phone: 216-368-2700; Fax 216-368-2676**

**Eva Kahana, chair**
Sociology is a unique perspective for understanding the social structure and social forces which affect individuals and their relationships with one another and their community. Sociologists explore the roles of age, gender, race, religion, culture, ethnicity, and income in shaping human experience in our changing society. Sociology courses also provide a better understanding of the determinants of social conflict, crime, and deviant behavior, along with humankind’s continuing positive efforts to cope with social problems and social change. Sociologists think creatively and critically about individual values, lifestyles, and options in a rapidly changing world. They also have skills to conduct surveys and other quantitative and qualitative studies for understanding public opinion, social needs and trends, and institutions. The department places special emphasis on issues of health and illness and social influences on health policies and health behaviors throughout the life course. The Department of Sociology offers programs leading to the Bachelor of Arts, Master of Arts and Doctor of Philosophy degrees. Additional options include participation in the Integrated Graduate Studies Bachelor of Arts/Master of Arts sequence and a joint degree program in law and sociology.

The creative and rigorous thinking inherent in sociological analysis is excellent preparation for advanced work in almost any field. The major in sociology provides students with a broad preparation for understanding the social context in which we live, for obtaining positions in diverse work settings and/or for pursuing graduate or professional degrees. The sociology major provides a solid grounding for understanding and researching social processes and institutions ranging from the family to work settings, health care institutions, and other complex organizations. A sociology major will be useful to students considering careers in the health and social service professions, social research, public administration and program development, market research, communications, and business careers. Students may design course work to facilitate entry into the job market, graduate study, or professional study. A sociology major provides excellent preparation for admittance to law school or medical school. Surveys show sociology majors to be among those with the highest rates of acceptance to professional schools. Sociology course work, or a minor or second
major in sociology, also provides excellent preparation to students majoring in other social sciences, natural sciences, or humanities.

**FACULTY**

Eva Kahana, Ph.D. (University of Chicago)  
FACULTY  
Pierce T. and Elizabeth D. Robson  
Professor of Humanities and Chair  
Sociology of aging; medical sociology; social factors in stress and coping.  
Gary Deimling, Ph.D. (Bowling Green State University)  
Professor  
Family sociology; sociology of aging; medical sociology; research methods.  
Susan W. Hinze, Ph.D. (Vanderbilt University)  
Assistant Professor  
Medical sociology; social inequality, sex and gender.  
Kyle Kercher, Ph.D. (University of Washington)  
Associate Professor  
Quantitative methodology; aging/social gerontology.  
Richard A. Settersten, Ph.D. (Northwestern University)  
Assistant Professor  
Adult development and aging; theory; social policy; life course methods.  
Eleanor P. Stoller, Ph.D. (Washington University)  
Selah Chamberlain Professor of Sociology  
Sociology of aging; medical sociology; race, class and gender.

**ASSOCIATE FACULTY**

David E. Beigel, Ph.D. (University of Maryland at Baltimore)  
Henry Zucker Professor, Mandel School of Applied Social Sciences; Professor of Sociology  
Family; social networks; caregiving; mental health.  
Robert Binstock Ph.D. (Harvard University)  
Henry R. Luce Professor of Health, Aging and Society, School of Medicine; Professor of Sociology  
Public policy and aging; health care policy.  
Baila Miller, Ph.D. (University of Illinois at Chicago)  
Professor, Mandel School of Applied Social Sciences; Director, Joseph and Florence Mandel Alzheimer Caregiving Institute; Professor of Sociology  
Sociology of aging; caregiving; sex and gender, research methods.  
Linda Noelker, Ph.D. (Case Western Reserve University)  
Associate Director of Research, Benjamin Rose Institute of Cleveland; Adjunct Professor of Sociology  
Sociology of aging; family sociology; sex and gender.  
Kathleen Smyth, Ph.D. (Case Western Reserve University)  
Associate Professor, Medicine, Epidemiology and Biostatistics; Associate Professor of Sociology  
Medical sociology; research methods; sociology of aging.  
Kurt Stange, M.D., Ph.D. (University of North Carolina)  
Professor, Medicine and Epidemiology and Biostatistics; Associate Professor of Sociology  
Epidemiology; preventative health care; biostatistics; disability prevention in the elderly.

**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 work. All majors complete the common core requirements: (12 hours):  
SOCI 112 Introductory Sociology  
SOCI 303 Research methods  
SOCI 300 Sociological Theory  
STAT 201 or PSCL 282 Statistics  
plus 18 hours of electives, consisting of any six courses in sociology SOCI 375, Independent Study, is available to selected majors in their junior or senior year.

**Minor**

The minor consists of 15 credit hours in sociology, including:  
SOCI 112 Introductory Sociology  
SOCI 300 Sociological Theory  
plus three additional electives, of which at least two must be 300 level courses.

**Sequences for Engineering Core**

Sociology provides the computer science or engineering student a perspective for understanding society. All sociology sequences leading to a sociology degree must include SOCI 112, Introduction to Sociology (3 credits) ands SOCI 113, Critical Problems in Modern Society (3 credits). In addition, students choose two courses from one of the following three sequences: Modern Society: SOCI 208, Dating, Marriage and Family, SOCI 222, Gender in U.S. Society, SOCI 302, Race and Ethnic Minorities, SOCI 310, The Individual in Society Social Problems: SOCI 204, Criminology, SOCI 333, Sociology of Deviant Behavior and SOCI 349, Social Inequality Health and Aging.

**SOCL 311, Health, Illness and Social Behavior, SOCI 313, Sociology of Stress and Coping, SOCI 319, Sociology of Institutional Care, SOCI 369, Aging in American Society**

**Departmental Honors**

Juniors majoring in sociology with a 3.0 overall GPA and a 3.4 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 and SOCI 398. Admission to honors work is by faculty approval.

**Honors Society**

The opportunity to join Alpha Kappa Delta (AKD), the sociology honors fraternity, is available to selected juniors and seniors (Membership requires a 3.4 GPA in sociology and a 3.2 GPA overall.)

**Integrated Graduate Studies**

The Department of Sociology participates in the Integrated Graduate Studies Program. Students in the program are able to obtain B.A. and M.A. 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.

**GRADUATE PROGRAM**

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 aging and medical sociology are the major areas of emphasis in the department. A formal concentration in research methods is also offered as a complement to these areas.

**Master of Arts**

To receive the Masters of Arts degree a student must successfully complete 30 credit hours of course work. Required courses for the degree are SOCI 400, 401, 406, 407, 443, 469, and either 413 or 419; and three general electives in sociology. In addition, the student must pass written comprehensive examinations in Social Theory and 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 66 credit hours past the Bachelor of Arts degree, including 18 credits of 701 (dissertation hours). Required courses are SOCI 400, 401, 406, 407, 443, 469, two additional electives in research methods, two additional electives in medical sociology, two additional electives in aging, and four general electives in sociology. In addition, students must pass three comprehensive examinations (Social Theory; Research Methods; Aging/Medical) and successfully defend the dissertation. To obtain the concentration in Research Methods, students must take SOCI 406; 407; two courses from among 414, 473, and 509; and two additional electives.

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
Funded research projects of the center focus 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 and life-threatening illness in late life. The center is 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. Major research projects focusing on medical sociology deal with life-threatening illness, caregiver burden, and physician-patient interactions. The center serves as a laboratory for student research. Collaborative and cross-national research involves colleges from other disciplines and universities in Israel, Hungary, Britain, and Germany.

Sociology (SOCI)

UNDERGRADUATE COURSES

SOCI 112A. Introduction to Sociology: Computer-based Approach (3)
First-hand experience at understanding contemporary American society using computers to analyze public opinion surveys about social issues of our times. Considers issues of cultural diversity, success in the work place, interpersonal family relations, and public policy issues. Students work with data conducting analyses using state-of-the-art software. Equivalent of SOCI 112B.

SOCI 112B. Introduction to Sociology: Human Interaction (3)
How can so many different people who have competing ideals and lifestyles live together in harmony? What makes one organization successful and another one fold? This course examines such questions from the social scientist’s viewpoint. Topics include: how people learn to be human, families, markets and economic institutions, class structures, crime and deviant behavior, aging, self-identity, and social change. Equivalent of SOCI 112A.

SOCI 113. Critical Problems in Modern Society (3)
Focus is on major social problems present in large, complex, industrial societies. Topics include environmental problems, poverty, drug addiction, social deviance, alienation. Prerequisite: SOCI 112A or SOCI 112B.

SOCI 203. Human Development: Medical and Social (3)
Social influences on health and illness across the lifespan. Social determinants of health and health behavior, and delivery of health care. Guest lectures from the medical school and other health care providers address professional practice issues across the lifespan. Issues include: new approaches to birthing; 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. Cross-listed as HDEV 203.

SOCI 204. Criminology (3)
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)
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 how social institutions affect mate selection, parenting, roles of husbands and wives, and family dysfunction and divorce is discussed in depth.

SOCI 222. Gender in U.S. Society (3)
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.

SOCI 255. Special Topics (1-3)
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 255B. Social Change in the ’60s (3)
The events of the 1960s in our country challenged the values and assumptions upon which most social institutions were previously based. A sociological analysis of the major social movements and broad societal changes that emerged during that time will enable students to understand not only this most confusing period of U.S. society, but the foundations of our current social context as well.

SOCI 269. Young and Old Face the 21st Century (3)
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 300. Modern Sociological Thought (3)
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. Prerequisite: SOCI 112A or SOCI 112B.

SOCI 302. Race and Ethnic Minorities in American Society (3)
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. Prerequisite: SOCI 112A or SOCI 112B.

SOCI 303. Social Research Methods (3)
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. Prerequisite: SOCI 112A or SOCI 112B.

SOCI 310. The Individual in Society (3)
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. Prerequisite: SOCI 112A or SOCI 112B.

SOCI 311. Health, Illness, and Social Behavior (3)
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. Prerequisite: SOCI 112A or SOCI 112B.

SOCI 313. Sociology of Stress and Coping (3)
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. Prerequisite: Sophomore standing.

SOCI 314. Qualitative Methods/Field Research (3)
General introduction to qualitative research methods in which each student conducts research project. Guides students through research process from entering field, data collection, and analysis to writing article suitable for publication. Prerequisite: SOCI 112A or SOCI 112B.

SOCI 319. Sociology of Institutional Care (3)
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. Prerequisite: Sophomore standing.

SOCI 326. Women in Societies in the Modern World (3)
Participation of women in both family and economic institutions in developed and developing societies around the world.

SOCI 333. Sociology of Deviant Behavior (3)
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. Prerequisite: SOCI 112A or SOCI 112B.

SOCI 338. Seminar and Practicum in Adolescence (3)
Cross-listed as EDUC 338 and EDUC 338.

SOCI 339. Seminar and Practicum in Adolescents (3)
(See SOCI 338.) Cross-listed as PSCL 339.

SOCI 349. Social Inequality (3)
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. Prerequisite: SOCI 112A or SOCI 112B.

SOCI 355. Special Topics (3)
One or more sections each semester focusing on selected areas of study in sociology.

SOCI 355E. Religion in American Society (3)
Religion has played a profound role in American society. This course looks at religion first from the perspective of major sociological theories (functionalism, conflict theory, etc.). Following these broad perspectives, the history of religion is examined from a religious economies/ marketplace perspective. The course concludes with a consideration of the role of religion in individuals’ lives. Prerequisite: SOCI 112A or SOCI 112B.

SOCI 355F. Science Technology and Society (3)
Interactions between technology and society. Selected technologies (computers, automobiles, television, pesticides, energy sources, biomedical innovations, factories) serve as case histories. Consequences of technological changes in pattern of work and social life. Major focus on American society, but also patterns of technological change in other cultures. Prerequisite: SOCI 112A or SOCI 112B.

SOCI 360. Criminal Justice and Law (3)
Overview of criminal justice system and procedures and problems concerning police, prosecutors, courts, and corrections. Covers society’s ways of protecting dependent groups and insuring justice, evolution of the current legal system, and relationships between the law and moral behavior. Prerequisite: SOCI 112A or SOCI 112B or consent of department.

SOCI 361. The Life Course (3)
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. Prerequisite: SOCI 112A or SOCI 112B.
SO CI 365. Health Care Delivery (3)
Health care in the U.S. may be approaching a critical cross-road. Limiting care to older persons and the chronically ill have been proposed as a means to combat rising costs and limited access to health care. What are the alternatives to health care rationing? Socialized medicine? 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.

SO CI 368. Aging in American Society (3)
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. Prerequisite: Junior or Senior standing.

SO CI 369. Aging in American Society (3)
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. Prerequisite: Junior or Senior standing.

Graduate Courses

SO CI 400. Development of Sociological Theory (3)
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. Prerequisite: Graduate standing.

SO CI 401. Contemporary Sociological Theory (3)
Current viewpoints in sociological theory are explored using contrasting theoretical perspectives.

SO CI 402. Race and Ethnic Minorities in American Society (3)
(See SO CI 302.)

SO CI 406. Sociological Research Methods I (3)
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 465. Health Care Delivery (3)  
(See SOCI 365.)

SOCI 469. Aging in American Society (3)  
(See SOCI 369.)

SOCI 470. Family Structure and Process (3)  
(See SOCI 370.)

SOCI 472. Work and Family: U.S. and Abroad (3)  
(See SOCI 372.)

SOCI 473. Methods of Life-Course Research (3)  
This course is about how to conduct research on the dynamics of human growth and development over the life course. It draws upon research from several disciplines related to developmental science, and it focuses on the complexities of studying human lives in time and place. For example, we will consider challenges associated with designing research for various kinds of developmental questions; disentangling age, period, and cohort effects; conducting longitudinal research; handling social contexts; conducting multi-level research; analyzing secondary and archival data; and making comparisons in human development. Prerequisite: SOCI 406 or equivalent.

SOCI 496. Public Policy and Aging (3)  
Cross-listed as EPBI 408.

SOCI 500. Advanced Social Theory (3)  
This course focuses on problems and issues relevant to contemporary social theorizing. As such, it deals with the rational roots of mainstream sociological thought and its relation to practice. Attention will also be paid to critical theory, hermeneutics, and current feminist thinking. Prerequisites: SOCI 400 and SOCI 401.

SOCI 509. Problems of Data Analysis (3)  
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. Prerequisites: STAT 301 and SOCI 406 and SOCI 407 or permission of department.

SOCI 601. Reading and Research (1-9)  
Individual study and/or project work.

SOCI 701. Dissertation Ph.D. (1-18)

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**PROTOTYPE PROGRAMS - STATISTICS COURSE WORK**

**Statistics B.A. Program**

**Year 1:**
- MATH 121
- CMPS 131
- ENGL 150
- GER: Science
- GER: Social Science
- Physical Education Requirement
- Total: 16 hours

**Year 2:**
- MATH 223
- STAT 243
- GER: Arts and Humanities
- GER: Social Sciences
- Free Elective
- Total: 15 hours

**Year 3:**
- STAT 345
- EPBI 420
- Substantive Field Requirement
- GER: Arts and Humanities
- Free Elective
- Total: 15 hours

**Year 4:**
- STAT 325
- STAT Elective
- Free Elective
- Free Elective
- Free Elective
- Total: 15 hours

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**Year 1:**
- MATH 122
- GER: Arts and Humanities
- GER: Science
- GER: Social Sciences
- Physical Education Requirement
- Total: 16 hours

**Year 2:**
- MATH 224
- MATH 201
- STAT 244
- GER: Arts and Humanities
- GER: Global and Cultural Diversity
- Total: 15 hours

**Year 3:**
- STAT 346
- STAT Elective
- Substantive Field Requirement
- Free Elective
- Free Elective
- Total: 15 hours

**Year 4:**
- STAT 326
- STAT 395
- STAT 391
- Free Elective
- Free Elective
- Free Elective
- Total: 13 hours
Statistics links mathematics to other disciplines 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 to 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 methodology, and the interdisciplinary collaborations and new fields of application.

FACULTY

Nidhan Choudhuri; Ph.D. (Michigan State University)
Assistant Professor
Bayesian nonparametric, empirical likelihood, bootstrap, multivariate spline
Paula FitzGibbon, M.S. (Miami University)
Instructor
Jiming Jiang, Ph.D. (University of California at Berkeley)
Assistant Professor
Asymptotic theory for restricted maximum likelihood estimation, generalized linear models, small area estimation
Thomas Ryan, Ph.D. (University of Georgia)
Director, CWRU Statistical Consulting
Industrial statistics, control charts, regression
Joseph Sedransk, Ph.D. (Harvard University)
Professor
Bayesian inference, Sample survey theory, methodology and applications
Nell Sedransk, Ph.D. (Iowa State University)
Professor
Topologic foundations for statistical inference, Bayesian design and inference, spatial statistics, Inference for complex systems

Jiayang Sun, Ph.D. (Stanford University)
Associate professor
Methodologies of statistical computing and modern data analysis, semiparametrics, statistics and applications
Wojbor Woyczynski, Ph.D. (Wroclaw University, Poland)
Professor
Stochastic models, probability, random fields, time series, dynamics of chaotic processes, nonlinear diffusion, turbulence
Adjunct Faculty
Mary H. Regier, Ph.D. (University of California at Berkeley)
Adjunct Professor

UNDERGRADUATE PROGRAMS

Students in statistics begin with a foundation in mathematics, then add statistical theory plus intensive modern data analysis and a concentration in a field of each student’s choice where statistics is used. The goal is to develop an appreciation of each facet of the discipline and a mastery of technical skills. This prepares

B.S. Program

Year 1:

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<td>MATH 121</td>
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<td>CMPS 131</td>
<td>GER: Arts and Humanities</td>
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<td>ENGL 150</td>
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<td>GER: Social Sciences</td>
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<td>GER: Social Sciences</td>
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<td>STAT 243</td>
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<td>GER: Arts and Humanities</td>
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<td>GER: Social Sciences</td>
<td>GER: Arts and Humanities</td>
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<td>Free Elective</td>
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Year 3:

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<td>Free Elective</td>
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<td>Science Requirement</td>
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Year 4:

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<td>STAT 391</td>
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<td>Total: 16 hours</td>
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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 the more abstract mathematical level of 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 coursework necessary to prepare for the first 100 credits of professional actuarial examinations (administered by the Society of Actuaries).

All undergraduate majors begin with a foundation in mathematics and a core of courses in mathematical statistics, courses in statistical methodology and courses in modern data analysis. Each student’s program is individualized by the choice of an applied field of concentration according to the student’s own talents and interests and by the choice of appropriate STAT electives which may be drawn from offerings by the Statistics Department and from suitable offerings by other departments at CWRU. The Senior Project option also allows students either to work in a research setting or to participate in interdisciplinary collaboration or in industrial consulting along with a statistics faculty member. The B.A. degree offers flexibility and the chance to pursue a wider range of interests. It also offers the possibility of expanding the interdisciplinary aspect of the program to complete the requirements for majors in two fields. Some examples of particularly attractive double majors combine statistics with computer science, biology (molecular, organismal or ecology), psychology, economics, accounting, or management science.

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**Statistics—Combined B.S.—M.S. Program**

**Year 1:**
- MATH 121
- ECMP 251
- ENGL 150
- GER: Science
- GER: Social Sciences
- Physical Education Requirement
- Total: 16 hours

**Year 2:**
- MATH 223
- STAT 333 (or 243)
- GER: Arts and Humanities
- GER: Social Science
- Science Requirement
- Total: 15 hours

**Year 3:**
- STAT 345
- EPBI 420
- Substantive Field Requirement
- GER: Arts and Humanities
- Free Elective
- Total: 15 hours

**Year 4:**
- STAT 425
- STAT Elective
- STAT 491 (1)
- Free Elective
- Free Elective
- Total: 16 hours

**Year 5:**
- STAT 455
- STAT Elective
- STAT 491 (1)
- Free Elective
- Total: 10 hours
The B.S. 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 B.S. degree is the logical choice of program.

Bachelor of Science in Statistics
The B.S. degree in statistics requires a minimum of 124 hours, including at least 68 hours of approved coursework, including 27 hours in statistics, the remainder in related disciplines and a substantive field of application, to satisfy the following requirements:
(1) MATH 121, 122, 223, 224, and 201 or equivalent;
(2) CMPS 131 or ECMP 251 or approved alternate; plus an additional higher numbered course in computation from CMPS or ECMP offerings or EPBI 414 or EPBI 420;
(3) STAT 325 and 326, STAT 345 and 346;
(4) At least 15 hours of courses in statistical methodology to be chosen from statistics courses numbered 300 and higher offered by the Statistics Department, or approved courses in statistical methodology or probability taught in biostatistics, computer science, economics, mathematics, operations research, systems engineering, etc. At least 6 hours must be in STAT courses; 243 and STAT 244 may be counted;
(5) Two approved courses (or more) numbered 300 or above in an approved discipline outside statistics;
(6) A combined total of 12 hours (or more) in ASTR, BIOL, CHEM, GEOL, PHYS which may be counted toward a major in that field including at least one of PHYS 121 and 122, CHEM 105 and 106 plus 113, CHEM 107 and 108 plus 113, BIOL 110 and 210 plus 211, BIOL 110 and 220 plus 221. Students are strongly encouraged to include advanced expository or technical writing courses in their programs.

Bachelor of Arts
The B.A. degree in statistics requires a minimum of 120 hours, including at least 56 hours of approved coursework, including 27 hours in statistics, the remainder in related disciplines and a substantive field of application, to satisfy the following requirements:
(1) MATH 121, 122, 223, 224, and 201 or equivalent;
(2) CMPS 131 or ECMP 251 or approved alternate; plus an additional higher numbered course in computation from CMPS or ECMP offerings or EPBI 414 or EPBI 420;
(3) STAT 325 and 326, STAT 345 and 346;
(4) At least 15 hours of courses in statistical methodology to be chosen from statistics courses numbered 300 and higher offered by the Statistics Department, or approved courses in statistical methodology or probability taught in biostatistics, computer science, economics, mathematics, operations research, systems engineering, etc. At least 6 hours must be in STAT courses; 243 and STAT 244 may be counted;
(5) MATH 431, OPRE 401, STAT 317. Students ordinarily can expect to be prepared to take Actuarial Exams for at least 100 credits in the Society of Actuaries prior to graduation.

Minor in Statistics
A minor in statistics requires a minimum of 15 hours of approved coursework in statistics. The minor must satisfy the requirements below and must include a minimum of 9 credits in courses from the Statistics Department offerings.
(1) STAT 243 and 244 or STAT 345 and 346 or other approved sequence
(2) STAT 208 or STAT 312 or STAT 313 or STAT 322 or STAT 333 or STAT 325
(3) Two approved elective courses in statistics numbered 300 or above.

Combined Bachelor-Master Degrees
The combined bachelor-master degrees in statistics require a minimum of 21 hours beyond the bachelor’s degree require-
requirements. In total, 42 hours must be inStatistics, including an M.S. thesis or M.S. research project, with the remainder (either 41 or 26 hours for B.S. or B.A., respectively) in approved coursework in related disciplines and a field of application. In addition to the B.S. or B.A. requirements, a combined degree program must include:

1. STAT 455 and three semesters of STAT 491;
2. M.S. research project (STAT 621) or M.S. Thesis (STAT 651);
3. At least 6 additional hours of courses in statistical theory and methodology (making a total of 21 hours including at least 4 STAT courses numbered 400 or higher) to be chosen from Statistics Department offerings numbered 300 and higher, or approved courses in statistical methodology or probability taught in biostatistics, computer science, economics, mathematics, operations research, systems engineering, etc. Students are strongly encouraged to include advanced expository or technical writing courses in their programs.

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 M.S. program is mathematical statistics and modern data analysis. 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 in Statistics

The M.S. degree in statistics requires a minimum of 30 hours of approved coursework in statistics and related disciplines and an M.S. 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:

1. STAT 425 and 426;
2. STAT 445 and 446;
3. STAT 455;
4. STAT 495 (3 credits); with M.S. project option (STAT 621) in (5) below, STAT 491 (3 credits) may be substituted for STAT 495;
5. M.S. research project (STAT 621) or M.S. Thesis (STAT 651);
6. A minimum of 12 hours of approved graduate level statistics elective including at least 2 STAT courses numbered 400 or higher plus other elective courses in statistical methodology or probability taught in biometry, computer science, economics, mathematics, operations research, systems engineering, etc.

The goals of this program are to give each student a balanced view of statistical theory and the application of statistics in practice or in substantive research and at the same time to have the student develop a broad competence in statistical methodology. The required core coursework reflects this balance. The first two requirements are for full-year sequences in data analysis and theory; and the third develops the theory underlying linear modeling. The requirement for applications of statistics can be satisfied either through intensive participation in the Consulting Forum or through an M.S. research project. 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 addres the more specialized statistical demands of the selected field of concentration or the focus of multi disciplinary 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 which will culminate in polished written and oral presentations; in many cases the work will be suitable for presentation at professional society meetings or publishable in a substantive literature. A student coming to school from a position as professional statistician might choose a statistical problem arising in the workplace as the basis for an M.S. research project. A student intending to continue graduate work toward a Ph.D. might choose an M.S. research project to explore the intimate relationship of statistics to substantive fields. Alternatively, either student might choose the thesis option to tailor methodology to a new setting or to make a first essay at mathematical statistical research.

Doctor of Philosophy in Statistics

The focus of the doctoral program is on research and the plan of study emphasizes the theory of statistics so that graduates from this program 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.

Statistics (STAT)

UNDERGRADUATE COURSES

STAT 201. Basic Statistics for Social and Life Sciences (3)

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 207. Statistics for Business and Management Science I (3)

Organizing and summarizing data. Mean, variance, moments. Elementary probability, conditional probability. Commonly encountered distributions including binomial, Poisson, uniform, exponential, normal distributions. Central limit theorem. Sample quantities, empirical distributions. Reference distributions (chi-square, z-, t-, F-distributions). Point and interval estimation; hypothesis tests. Prerequisite: MATH 122 or MATH 126 or equivalent.
STAT 208. Statistics for Business and Management Science II (3)

STAT 243. Statistical Theory with Application I (3)

STAT 244. Statistical Theory with Application II (3)
Extension of inferences to continuous-valued random variables. Common continuous-valued distributions. Expectation operator. Maximum likelihood estimators for the continuous case. Simple linear, multiple and polynomial regression. Properties of regression estimators when errors are Gaussian. Regression diagnostics. Class or student projects gathering real data or generating simulated data, fitting models and analyzing residuals from fit. Prerequisite: STAT 243.

STAT 301. Statistics for Social and Life Sciences (3)
Principles and practice of data presentation and basic models including analysis of variance and multiple linear regression. Content includes analysis of discrete data in contingency tables, sensitivity and specificity, odds ratios, tests of goodness of fit, display and summarization of data, hypothesis testing and interval estimation. Taught in case-based format with individual and/or collaborative student projects. Primarily for graduate students in nursing and health sciences. Not for credit toward undergraduate major or minor in Statistics or for credit toward any graduate degree in Statistics. Prerequisite: STAT 201.

STAT 312. Basic Statistics for Engineering and Science (3)
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. Prerequisite: MATH 122 or equivalent.

STAT 313. Statistics for Experimenters (3)
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. Prerequisite: MATH 122 or equivalent.

STAT 317. Theory of Interest and Life Contingencies (3)
Mathematical formulation for calculation of compound interest, present and accumulated values of single investments and of portfolios. 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. Problem solving using actual insurance record data. Topics covered include areas examined in the American Society of Actuaries examination over ASA courses 150 and 160. Prerequisites: MATH 223 and STAT 346 or STAT 446.

STAT 325. Data Analysis I (3)
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. Prerequisites: MATH 201 and EPBI 414 or EPBI 420.

STAT 326. Data Analysis II (3)
Extensions of exploratory data analysis and modeling to multivariate response observations and to non-Gaussian data. Singular value decomposition and projection, principal components, factor analysis and latent structure analysis, discriminant analysis and clustering techniques, cross-validation, E-M algorithm, CART. Introduction to generalized linear modeling. Case studies of complex data sets with multiple objectives for analysis. Prerequisite: STAT 325.

STAT 332. Statistics for Signal Processing (3)

STAT 333. Uncertainty in Engineering and Science (3)
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. Prerequisite: MATH 122.

STAT 345. Theoretical Statistics I (3)
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. Prerequisite: MATH 122 or MATH 223.

STAT 346. Theoretical Statistics II (3)

STAT 391. Statistics Student Seminar (1)
Seminar run collaboratively by students to investigate an area of current research, the topic chosen each semester. All students participate in presentation of material each semester. Recommended for all students majoring in statistics in their senior year. Emphasis on written and oral presentation of statistical summaries, reports and projects. Prerequisites: Statistics major or minor and 9 credits approved statistics courses numbered 240 or above.

STAT 395. Senior Project in Statistics (3)
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. Prerequisites: STAT 312 or 313, 322, 333 or 433.

STAT 413. Reliability and Calibration (3)
Failure distributions related to life testing; extreme value distributions and their hazard functions. Static reliability of series, parallel and mixed systems. Coherent systems and system reliability approximations. Dynamic reliability models. Linear estimation, maximum likelihood, EM estimation, estimation from censored data. Calibration procedures. Distributions from uncalibrated processes, optimization of calibration procedures. Examples from industrial research and production processes. Prerequisite: One (1) of: STAT 244 or STAT 312, 313, 322, 333 or 433.

STAT 414. Industrial Statistics (3)
Introduction to statistical methods and techniques that are being used in industry, and especially in various company-wide quality improvement programs such as Six Sigma. The course covers control charts and process capability with considerable breadth and depth. The classical and alternative approaches that have been used in designing industrial experiments are also covered extensively. Linear regression, analysis of means (ANOM), and evolutionary operation (EVP) are other techniques that are covered. Prerequisite: STAT 312 or equivalent.

STAT 417. Theory of Interest and Life Contingencies (3)
For graduate students interested in actuarial science. Mathematical formulation for calculation of compound interest, present and accumulated values of single investments and of portfolios. 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. Problem solving using actual insurance record data. Topics covered include areas examined in the American Society of Actuaries examination over ASA courses 150 and 160. Additional work is expected from graduate students. Prerequisites: MATH 223 and STAT 346 or STAT 446.

STAT 425. Data Analysis I (3)
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/biased data. Knowledge of regression is helpful. Prerequisites: MATH 201 and EPBI 414 or EPBI 420.

STAT 426. Data Analysis II (3)
Extensions of exploratory data analysis and modeling to multivariate response observations and to non-Gaussian data. Singular value decomposition and projection, principal components, factor analysis and latent structure analysis, discriminant analysis and clustering techniques, cross-validation, E-M algorithm, and CART. Introduction to generalized linear modeling. Case studies of complex data sets with multiple objectives for analysis. Graduate students give both written and oral presentations of data analyses. Prerequisite: STAT 425.

STAT 427. Statistical Computing (3)
Basic topics in statistical computing: floating point arithmetic; seminumerical computation including generation and tests 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; statistical computing, e.g., resampling methods, EM algorithms, Gibbs sampling and projection pursuit. Prerequisites: EPBI 414 and EPBI 420 or STAT 425 and STAT 345, or permission of department.

STAT 433. Uncertainty in Engineering and Science (3)
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). Mathematica notebooks and simulations will be used. Random number generators and their testing. Monte Carlo methods. Note: Credit given for only one (1) of STAT 312, 313, 333, 433.

Graduate students are required to do an extra project. Prerequisite: MATH 223 or MATH 122.

STAT 437. Stochastic Modeling of Scientific Data (3)
Introduction to stochastic modeling of data. Emphasis on models and statistical analysis of data with a significant temporal or/and spatial structure. Markovian and semi-Markovian models, point processes, point cluster models, queuing models, likelihood methods, estimating equations. Note: Restricted to declared graduate and undergraduate majors and minors in Statistics and Biostatistics only. Prerequisite: STAT 333 or STAT 433 (preferred) or STAT 325, STAT 425, or STAT 445.

STAT 445. Theoretical Statistics I (3)
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. Graduate students are responsible for mathematical derivations, and full proofs of principal theorems. Prerequisite: MATH 122 or MATH 223. Cross-listed as EPBI 481.

STAT 446. Theoretical Statistics II (3)
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. Prerequisite: STAT 445. Cross-listed as EPBI 482.

STAT 448. Bayesian Theory with Applications (3)
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. Prerequisite: STAT 445.

STAT 453. Time Series and Wavelets I (3)

STAT 455. Linear Models (3)
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. Prerequisites: MATH 201 and STAT 346 or STAT 446.

STAT 456. Theory and Methods of Experimental Design (3)
Experimental design for polynomial regression models and for multi-factor models. Theory for construction of increased efficiency designs including fractional factorials, Latin squares. Designs for response surfaces. GOSSETT-generated optimal designs for nonstandard problems. Knowledge of regression required. Prerequisite: STAT 425. Cross-listed as EPBI 446.

STAT 468. Sampling from Finite Populations: Theory and Applications (3)
Introduction to the theory and methodology of sampling from finite populations. Simple random, stratified random, systematic and multistage cluster sampling. Linear, ratio and regression estimators. Methodology for handling missing data, inference for small geographical areas or for small subpopulations, inference for quantiles. Application to large-scale personal interview and telephone surveys. Prerequisite: STAT 345 or STAT 445. Cross-listed as EPBI 447.

STAT 471. Special Topics in Statistics (1-3)
Topics in specialized areas of statistical theory and methodology, with emphasis on recent advances in theory and development of new methodology. 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. Prerequisite: Consent of department.

STAT 476. Advances in Statistics and Modeling (1-3)
Topics in specialized areas of statistics and stochastic modeling, with emphasis on recent advances in theory and formulation of models. Investigation of new areas of application for statistical or stochastic models. 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. Prerequisite: Consent of department.

STAT 491. Graduate Student Seminar (1-2)
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. Prerequisite: Graduate standing.

STAT 495A. Consulting Forum (1)
This course examines the principles of statistical consulting. Included are the views and practices of prominent statistical consultants, as obtained from the literature and from other sources. This includes responsibilities of the consultant and of the client. Role playing is used in an attempt to simulate actual consulting scenarios. The course also serves to unify what the students have learned in their course work in preparation for applying their knowledge in consulting work. Prerequisite: STAT 325 or STAT 425.

STAT 495B. Consulting Forum with Practicum (3)
Graduate students become involved in actual consulting projects under the guidance of the instructor. The students’ involvement can result from consulting problems presented by guest lecturers, or by assisting the instructor on projects that have come to the department. The stu-
STAT 525. Advanced Techniques in Data Analysis (3)
Topics drawn from resampling methods (including bootstrapping), MCMC (Gibbs sampling), nonparametric curve and surface fitting, kernel density estimation, projection pursuit, some time series (time permitting), approaches to model uncertainty, models for repeated measures and structural-functional models, statistical inference for non-statistical mathematical models of large systems. Prerequisite: STAT 426 or permission.

STAT 527. Advanced Statistical Computing (3)
Special topics drawn from statistical computing, complex system and dynamic computation. Oriented to research. Prerequisite: STAT 427.

STAT 537. Advanced Stochastic Modeling of Scientific Data I (3)
Spatial statistics. Theory and techniques for spatial or spatial-temporal relationships in high dimensional data, point pattern analysis, estimation of spatial covariance either stationary or non-stationary in space, applications to environmental sciences. Characterizations and solutions for mapping problems, for image reconstruction, for analysis of fractal spatial-temporal processes with particular application to environmental sciences. Prerequisites: STAT 446 and STAT 437.

STAT 538. Advanced Stochastic Modeling of Scientific Data II (3)

STAT 545. Advanced Theory of Statistics I (3)

STAT 546. Advanced Theory of Statistics II (3)

STAT 547. Advanced Theory of Statistics III (3)
Development of empirical process theory with application to censored data with random, fixed or arbitrary censoring mechanism. Characterization of quantile processes, spacings and large deviations as empirical processes. Asymptotic results for nonparametric regression, bootstrap and other resampling estimators. Prerequisite: STAT 546.

STAT 553. Time Series and Wavelets II (3)
Advanced topics in time series including nonstationary series, nonlinear models. In-depth development and application of wavelet theory. Wavelets as computational tool. Extensive use of computing to illustrate and investigate modeling with wavelets. Prerequisites: STAT 453 and STAT 446 and MATH 491.

STAT 555. Generalized Linear Models (3)

STAT 571. Advanced Topics in Statistics (1-3)
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. Prerequisite: Consent of department.

STAT 576. Advanced Topics in Modeling (1-3)
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. Prerequisite: Consent of department.

STAT 591. Statistical Research Seminar (1-3)
Seminar to prepare and explore current research topics presented by faculty and invited statistics colloquium speakers. Graduate students lecture on background material for colloquia using recent publications. Following each colloquium, students lead discussion and clarify further the contributions of the research. Newer students are paired with senior students; colloquium assignments coincide with students’ research interests insofar as possible. Attendance at statistics colloquia is required. Satisfies requirement for every full-time graduate student to enroll in a participatory seminar every semester while registered in any graduate degree program. Number of credit hours will be determined by prior agreement with the instructor and depends on the extent of the student’s responsibility. Prerequisite: Consent of department.

STAT 601. Reading and Research (1-9)
Individual study and/or project work. Prerequisite: Permission of department.

STAT 621. M.S. Research Project (1-9)
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. Prerequisite: Permission of department.

**STAT 651. Thesis M.S. (1-18)**
(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. Prerequisite: Permission of department.

**STAT 701. Dissertation Ph.D. (1-18)**
(Credit as arranged.) Prerequisite: Permission of department.

**STAT 702. Appointed Dissertation Fellow (9)**

### Department of Theater Arts

#### DRAMA AND DANCE

**Eldred Hall:** Phone (216) 368-2858; Fax (216) 368-5184  
**Mather Dance Center:** Phone (216) 368-2854; Fax 368-6936

**Ron Wilson, Chair**

The Department of Theater Arts offers education and participation in all aspects of drama and dance with course offerings in acting, dance technique, choreography, stagecraft, costume, scene design, directing, and playwriting. Students have the opportunity to perform on stage as well as serve on the technical crews in dance concerts and mainstage 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.

### FACULTY

**Ron Wilson, B.G.S. (Wichita State University)**  
**Katharine Bakeless Nason Professor in Theater and Chair**  
**Movement for the actor; acting; playwriting**  
**Catherine Albers, M.F.A. (University of Minnesota)**  
**Associate Professor and Director of Undergraduate Theater Studies**  
**Acting; audition laboratory; acting theory; business of the business; directing**

**Russ Borski, M.F.A. (Northwestern University)**  
**Associate Professor**  
**Stage and lighting design; visual text; portfolio; production**

**Christa Carvajal, Ph.D. (University of Texas, Austin)**  
**Professor**  
**History of theater; semiotics**

**Gary Galbraith, M.F.A. (Case Western Reserve University)**  
**Associate Professor**  
**Contemporary dance technique; choreography; dance history; production**

**Shanna Beth McGee, M.F.A. (University of Georgia)**  
**Associate Professor**  
**Voice; acting; Shakespearean text**

**John M. Orlock, M.F.A. (Pennsylvania State University)**  
**Professor**  
**Samuel B. and Virginia C. Knight Professor of Humanities**  
**Acting; performance theory; playwriting; screenwriting; theater history**

**Karen Potter, M.F.A. (Case Western Reserve University)**  
**Associate Professor and Director of Dance Contemporary dance technique; choreography; pedagogy; kinesiology**

### ADJUNCT FACULTY

**James Bundy, M.F.A. (Yale University)**  
**Adjunct Associate Professor and Artistic Director, Great Lakes Theater Festival**  
**Acting; directing**

**David Colacci, M.F.A. (Southern Methodist University)**  
**Adjunct Associate Professor and Director of the Graduate Acting Program**  
**Acting; script analysis**

**Peter Hackett, M.F.A. (University of California, San Diego)**  
**Adjunct Associate Professor and Artistic Director, The Cleveland Play House**  
**Script analysis; directing**

**Scott Kanoff, B.A. (University of Pennsylvania)**  
**Adjunct Associate Professor and Literary Manager, The Cleveland Play House Dramaturgy**

### CAREER OPPORTUNITIES

**Acting**

Actor education in the Department of Theater Arts prepares majors for acting career opportunities in the American theater and in theater education. Graduates are currently employed nationally and regionally. The Graduate Acting Program collaboration between CWRU and The Cleveland Play House provides a unique alliance between one of the oldest theater programs in the United States and the nation’s first regional theater.

**Stage Design and Technical Theater**

Employment opportunities for stage designers and technicians continue to be ample; demand for the services of the talented, well-trained designer and technician is constant. One aspect of the job market is in college or university theater, where qualifications include the required M.F.A. degree or, in rare instances, equivalent professional experience. Careers also may be pursued in regional theater, as well as in areas of film, television, and industrial scenic design.

### Dance Training Program

Graduates of the dance program are currently employed as modern dance company members (regionally and nationally), company directors/choreographers, dance production managers, and dance educators in state and private universities. Others have pursued specialized advanced training and work as dance therapists and physicians.

### UNDERGRADUATE PROGRAMS

An undergraduate major in the department can lead to the Bachelor of Arts degree. The Bachelor of Arts program is a diverse course of study in all the basic crafts of the theater: acting, dance, design, costume, playwriting, and theater history. The undergraduate program is designed to integrate the various elements of theater to prepare students to pursue their chosen field of specialization after graduation. This degree requires a minimum of 56 semester hours in theater and is available with areas of concentration in performance and design/technical theater.

### Bachelor of Arts

The Bachelor of Arts program in theater offers concentrations in general theater, acting, contemporary dance, or design/technical theater.

In addition to GER courses, Bachelor of Arts theater majors must complete:

- **A. Required Theater Courses (30-37 hours):**
  - THTR 101, Beginning Acting I (3)
  - THTR 102, Beginning Acting II (3)
  - THTR 103, First-Year Contemporary Theater
Dance Technique I (3)
THTR 104, First-Year Contemporary Dance Technique II (3) (not acting track)
THTR 123, Theater in Culture I (3)
THTR 124, Theater in Culture II (3)
THTR 223, Scenic Design (3)
THTR 224, Lighting Design (3)
THTR 352, Costume Design & Construction (3), and one of the following: THTR 227, 228, 229, 312, 327, or 329

Majors must enroll for four semesters of THTR 385 or THTR 386, with no more than two credit hours in acting.

B. Courses required for concentrations:

1. General Theater (17 hours without THTR 385 or THTR 386):
   a. THTR 213, Acting Technique I (3) or THTR 232 (Acting Technique II (3)
   b. THTR THTR 227, Visual Culture (3) or THTR 329, Dramatic Literature (3)
   c. THTR 331, Play Directing I (3)
   d. THTR 375, Voice for the Stage I (2), and two of the following: THTR 228, 229, or 338

2. Acting (20 hours without THTR 385/386):
   a. (THTR 201, Movement for the Actor I (3) substitutes for required THTR 104)
   b. THTR 231, Acting Technique I (3)
   c. THTR 232, Acting Technique II (3)
   d. THTR 306, Advanced Acting I (3)
   e. THTR 311, Audition Laboratory (1)
   f. THTR 331, Play Directing I (3)
   g. THTR 375, Voice for the Stage I (2)
   h. THTR 376, Voice for the Stage II (2)

3. Design/Technical Theater (15 hours)
   a. THTR 105, Introduction to Stagecraft (3)
   b. THTR 227, Visual Culture (3) or THTR 329, Dramatic Literature (3)
   c. THTR 331, Play Directing I (3)
   d. THTR 380, Stage Management (3) plus one of the following: THTR 228, 229, 424, or 440

4. Dance (17 hours):
   a. THTR 189, Improvisation I (1)
   b. THTR 190, Improvisation II (1)
   c. THTR 203, Second-Year Contemporary Dance Technique I (3)
   d. THTR 204, Second-Year Contemporary Dance Tech. II (3)
   e. THTR 303, Third-Year Contemporary Dance Technique I (3)
   f. THTR 304, Third-Year Contemporary Dance Technique II (3)
   g. THTR 413, Choreography I (1-3)

C. Required courses in other departments:

Nine semester hours of English, comprising ENGL 150 and six additional Hours above the 300 level under advisement (ENGL 150 is not acceptable toward the completion of a minor program in English); ENGL 324 and 325 (Shakespeare) are recommended.

NOTE: At least 24 and no more than 42 semester hours in theater courses above the 100 level. Total theater hours (including 100 level courses) should not exceed 60.

Minors - 18 hours

A minor in theater may be taken in one of the following areas:

Acting
THTR 101, Beginning Acting I (3)
THTR 102, Beginning Acting II (3)
THTR 123, Theater in Culture I (3)
THTR 124, Theater in Culture II (3)
THTR 231, Acting Technique I (3)
THTR 375, Voice for the Stage I (2)
THTR 385, Rehearsal and Production (1-3) or Rehearsal and Performance (1-3)

Dance
THTR 103, First-Year Contemporary Dance Technique I (3)
THTR 104, First-Year Contemporary Dance Technique II (3)
THTR 203, Second-Year Contemporary Dance Technique I (3)
THTR 204, Second-Year Contemporary Dance Technique II (3)
THTR 303, Third-Year Contemporary Dance Technique I (3)
THTR 304, Third-Year Contemporary Dance Technique II (3)

Sequence (Engineering core)

All sequences must include THTR 123 or 124 and two additional courses under advisement (9 hours). Sample programs follow:

Acting
THTR 123 or 124; 101 and 102

Dance
THTR 123 or 124; 103 and 104

Stagecraft
THTR 105, 123 or 124; and 223 or 224

Costume Construction and History
THTR 123 or 124; THTR 352 and one of the following: THTR 228, 229, 312, or 327

Departmental Honors

Majors wishing to take a Bachelor of Arts degree with honors in theater must make written application to the department no later than May 1 of the 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 honors committee chairperson. Those accepted must register for THTR 397, 398 (Honors Studies) during their senior year, a total of six hours. The honors thesis is defined as a production thesis in acting, design, playwriting, or modern dance. A supporting paper discussing the concept, execution, and performance of the production element must be filed with the chairman no later than one week after the thesis presentation. Preparation of the thesis will be supervised by a theater department faculty member. This thesis may be accepted for honors only if it receives a grade of A from both the thesis advisor and the thesis evaluator.

Students who qualify will receive the notation “Departmental Honors in The-
**GRADUATE PROGRAM**

The Master of Fine Arts degree, available with concentrations in acting and contemporary dance, is a terminal pre-professional degree with candidacy limited to students who wish to serve the professional theater. Candidacy for the Master of Fine Arts program requires either an undergraduate major in the field of theater arts, equivalent training and experience, or demonstrable potential for work in theater at the Master of Fine Arts level. In addition, each candidate must provide evidence of technical skill and creative ability in his or her area of concentration.

At the end of each semester in residence, the student’s skill and creative ability are evaluated in light of their work in the department. Only students who have clearly demonstrated growth and excellence are permitted to remain in the program. The award of the Master of Fine Arts 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 serve the theater on a professional level.

Requirements for the Master of Fine Arts 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 M.F.A. Thesis Portfolio.
4. Performance in the Eldred Theater or Mather Dance Center mainstage season.

Specific requirements in each area of emphasis include:

**Acting**

1. Eighteen semester hours of acting including script analysis, implementation of acting theory, characterization, and Shakespeare.
2. Seven to twelve semester hours of movement chosen from period movement, stage combat, and contemporary dance.
3. Ten to twelve semester hours of voice chosen from voice production, articulation, and interpretation, dialects, verse and lyric drama, and Shakespeare.
4. Twelve semester hours of performance theory, theater history, and professional seminar.
5. Up to six semester hours, under advisement, in allied fields.

**Contemporary Dance**

1. Eighteen semester hours of dance technique.
2. Twelve semester hours of choreography.
3. Six semester hours of stagecraft.
4. Four semester hours of eurythmics.
5. Three semester hours of contemporary dance history.
6. Two semester hours of MUSC 501.
7. Nine semester hours, under advisement, in allied fields.
8. Six semester hours of creative thesis.

**SPECIAL PROGRAM**

**The Marc A. Klein Playwriting Award**

The Department of Theater Arts serves as the production agency for the Marc A. Klein Playwriting Competition, an annual national award designed to encourage and stimulate artistic growth among student playwrights, which features a cash prize of $1,000 and a full mainstage production. The Klein award has been responsible for the pre-professional production of a number of scripts that have moved on to Broadway, Off-Broadway, and regional theaters.

**NATIONAL THEATER INSTITUTE**

The Department of Theater Arts has an affiliation with the National Theater Institute, located in Waterford, Connecticut, for both their Moscow semester and the semester at NTI. This prestigious program gives our students the opportunity to be exposed to the best in concentrated theater training, as well as providing a different and unique cultural perspective. Full credit is available with no loss of scholarship aid. This is available for either semester. See the Director of Undergraduate Theater Studies for more information.

**UNDERGRADUATE COURSES**

**THTR 100. Acting for Non-majors (3)**

A course designed to provide the non-majors and undeclared liberal arts majors with a basic understanding of the acting craft and process. Fundamentals in improvisation, analysis, and scene study are stressed. This course fulfills THTR 101 requirements, should the undeclared student select theater as his or her major.

**THTR 101. Beginning Acting I (3)**

The actor and his craft; the development of the actor’s basic tools. Fundamentals of relaxation, concentration, and improvisation.

**THTR 102. Beginning Acting II (3)**

Continuation of THTR 101, with emphasis on action within the structures of improvisation and text.

**THTR 103. First-Year Modern Dance Techniques I (3)**

Comprehensive perspective of theory established, through active participation, to serve individual development of normative movement principles in a broad spectrum of applications including theater movement dance, and sports. Content is directly and fundamentally serviceable to subsequent specialized training applications of the actor, dancer, musician, athlete, physiotherapist, and educator.

**THTR 104. First-Year Modern Dance Techniques II (3)**

Continuation of THTR 103.

**THTR 105. Introduction to Stagecraft (3)**

An introduction to scenic construction and painting, hands-on oriented to workshop skills.

**THTR 122. Dance in Culture (3)**

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.

THTR 123. Theater in Culture I (3)
Introduction to theater forms. Genesis and function of theatrical events, presented in formal lectures, augmented by slide and film presentations. Contemporary theatrical practices are analyzed and roles of production participants and audiences are discussed.

THTR 124. Theater in Culture II (3)
Continuation of THTR 123. Introduction to the historical foundations of theater. Survey of the materials and artifacts of theaters from ancient Greece to the contemporary world.

THTR 160. Introduction to Ballet Technique I (3)
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.

THTR 161. Introduction to Ballet Technique II (3)
Continuation of THTR 160. Prerequisite: THTR 160 or consent of department.

THTR 189. Improvisation I (1)
Movement and dance structures designed to engage responsibility in group dynamics applied to challenge specific technical components which include time, effort, shape and kinetic awareness. Prerequisite: THTR 103.

THTR 190. Improvisation II (1)
Continuation of THTR 189. Prerequisite: THTR 189.

THTR 201. Movement for the Actor I (3)
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. Prerequisite: THTR 101 or THTR 102 or consent of department.

THTR 202. Movement for the Actor II (3)
Continuation of THTR 201. Course focuses on advanced problems for the physical actor. Part of the class incorporates physical characterization through the use of physical acting techniques, and, utilizing dramatic material, the student will put these techniques into practice. Stage combat techniques will round out the semester. Prerequisite: THTR 201 or consent of department.

THTR 203. Second-Year Modern Dance Techniques I (3)
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. Prerequisites: THTR 103 and THTR 104.

THTR 204. Second-Year Modern Dance Techniques II (3)
Continuation of THTR 203. Prerequisites: THTR 103 and THTR 104.

THTR 223. Introduction to Scenic Design (3)
An introduction to visual design for the stage 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 224. Introduction to Lighting Design (3)
A “grounds up” guide to theatrical lighting for the stage. Focus made upon instrumentation, choices made in the design process, aesthetics of presentation. Combines theory with practical application.

THTR 227. Visual Culture and Cultural Criticism in Modern America (3)
This course introduces the often diverging strategies and views expressed as visual art and performance on the one hand, and as critical thought, often in reaction to art, on the other. The historical framework spans the second half of the nineteenth and all of the twentieth century and is constituted by issues raised in American transcendentalism, pragmatism, and modernism/post modernism. Students will study examples of artistic expression side by side with critical thought. Cross-listed as AMST 217.

THTR 229. Theater History II (3)
Modern periods in Western theater history, from the sixteenth century to the turn of the twentieth. The course investigates materials, texts, and artifacts of theaters from the Renaissance to the Modern era. Prerequisites: THTR 123 and THTR 124. Cross-listed as CMPL 229.

THTR 231. Acting Technique I (3)
Basic improvisation skills with emphasis on the individual actor’s expression and creativity. The actor’s approach to a role will be explored through the use of improv and structured exercise. Prerequisite: THTR 102 or consent of department.

THTR 232. Acting Technique II (3)
The actor’s approach to a role; text and character analysis of various dramatic genres with emphasis on plays by Shakespeare. Performance of scenes from plays. Prerequisite: THTR 231 or consent of department.

THTR 303. Third-Year Modern Dance Techniques I (3)
For the dance major and advanced non-major. Durational formalities of dance technique as a contemporary American art form structure the aesthetic and technical challenges of development. Prerequisite: THTR 204.

THTR 304. Third-Year Modern Dance Techniques II (3)
Continuation of THTR 303.

THTR 306. Advanced Acting I (3)
An exploration of the teachings of Michael Chekhov. Emphasis is placed on exercises and the exploration of psychological gesture. Prerequisites: THTR 231 and THTR 232 or consent of department.

THTR 311. Audition Laboratory (1)
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. Prerequisite: Senior Theater major or consent of department.

THTR 312. Playwriting (3)
Theory and practice of dramatic writing, in the context of examples, classic and contemporary. Cross-listed as ENGL 305.

THTR 314. Advanced Playwriting (3)
Theory and practice of dramatic writing with special focus on the craft of writing a full-length play. Prerequisite: THTR 312 or consent of department.

THTR 316. Screenwriting (3)
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. Prerequisite: THTR 312.

THTR 327. American Theater and Playwrights (3)
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. Cross-listed as AMST 327.

**THTR 329. Dramatic Literature (3)**
Dramatic text analyzed in the context of theatrical production. Major analytical tools introduced. Prerequisites: THTR 123 and THTR 124.

**THTR 331. Play Directing I (3)**
Fundamentals of directing. Theory and practice. Prerequisites: THTR 101, THTR 102, and upperclass status or consent of department.

**THTR 334. Shakespeare: Histories and Tragedies (3)**
Cross-listed as ENGL 324.

**THTR 335. Shakespeare: Comedies and Romances (3)**
Cross-listed as ENGL 325.

**THTR 338. Women in Theater (3)**
Primarily an investigation of theater historical phenomena. The course is an interpretive venture using a topic not ordinarily in place in standard histories, in order to test a number of theoretical approaches. The course is organized based on the assumption that the students are willing to tackle difficult and diverse scholarly arguments in history and especially in theater history.

**THTR 342. Seminar: American Playwrights (3)**
An intensive study of the work of a leading American playwright. The focus is on the unique contribution to American theater, drama and literature of the playwright selected for study in a particular semester. Texts, as well as films, videotapes, recordings, and live performances (when available) will be critically studied. The evaluations of theater and literary critics will also be discussed. Cross-listed as AMST 342.

**THTR 352. Costume Design and Construction (3)**
Design and ornamentation of stage costumes and accessories. Laboratory. Prerequisites: THTR 123 and THTR 124 or consent of department.

**THTR 375. Voice for the Stage I (3)**
Development of the actor's vocal instrument. Work in articulation, range, and flexibility. Prerequisite: Theater major or consent of department.

**THTR 376. Voice for the Stage II (3)**
Continuation of THTR 375. Prerequisite: THTR 375 or consent of department.

**THTR 380. Stage Management (3)**
Designed to acquaint student with the numerous aspects of stage management.

**THTR 385. Rehearsal and Production (1-3)**
Practicum for students participating in production work in the Department of Theater Arts. 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 or 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.

**THTR 386. Rehearsal and Performance (1)**
Practicum for students participating in performance in the Department of Theater Arts, relating to the mainstage productions at Eldred Theater or Mather Dance Center. This course may be repeated, for a maximum total of 2 credits.

**THTR 387. Honors Studies I (3)**
Individual projects in acting, design, dance, and directing. Prerequisite: Consent of department.

**THTR 388. Honors Studies II (3)**
Individual projects in acting, design, dance, and directing. Prerequisite: Consent of department.

**THTR 399. Independent Study in Theater Arts (1-3)**
Independent research and project work in areas of acting, design, voice, dance, theater history, playwriting, directing, theater pedagogy, or theater management.

**GRADUATE COURSES**

**THTR 401. Advanced Stage Movement I (3)**
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 (articulation, inclinations and design work) will be developed with Decroux, as well as LeCoq based exercise. This work will be accompanied by Tai Chi and Aikido based chi energy work to develop the actor's concentration. Prerequisite: Must be candidate in M.F.A. acting program.

**THTR 402. Advanced Stage Movement II (3)**
Continuation of THTR 401. The course focuses on simplifying and empowering motor activity 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. Prerequisite: THTR 401 or consent of department.

**THTR 403. Advanced Stage Movement III (3)**
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, the Expressive Mask. Following this work, the students will experience the mask work of the commedia dell'arte and create and perform a commedia scenario. Stage combat work continues. Prerequisite: THTR 402 or consent of department.

**THTR 404. Advanced Stage Movement IV (3)**
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. Prerequisite: THTR 403 or consent of department.

**THTR 405. Improvisation I (1)**
Movement and dance structures designed to engage responsivity in group dynamics applied to challenge specific technical components which include time and effort, shape, and kinetic awareness.
THTR 406. Improvisation II (1)
Continuation of THTR 405.

THTR 407. Fourth-Year Modern Dance Techniques I (1-3)
A logical progression of advanced technique. Performing skills assessed and developmentally stressed. Sections from repertory works learned. Prerequisite: THTR 303.

THTR 408. Fourth-Year Modern Dance Techniques II (1-3)
Continuation of THTR 407.

THTR 412. Playwriting (3)
(See THTR 312.)

THTR 413. Choreography I (1-3)
Principles governing the dynamics of concrete and imagistic space applicable to stage values defined, differentiated, and tested through applied studies. Exercising the dual role of choreographer/performer, the sequencing is designed to enlarge active perception of space values, spatial dynamics, and relationships with spatial determinants. Introduced are the psychological principles involved in the development of one’s own creative process; involvement of these principles integrates the subsequent work in the choreography and production sequences.

THTR 414. Choreography II (3)
A perspective of choreographic craft elements through lecture and practical involvement with specified studies. Emphasized are the craft components of time structures. Prerequisite: THTR 413.

THTR 415. Choreography III (3)
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. Prerequisite: THTR 414.

THTR 416. Choreography IV (3)
Use of properties, costumes, and scenic elements in both first and second function. (Northop) applications challenge the functional and aesthetic appropriateness of conjoined choices. Dance structures fully developed under supervision. Prerequisite: THTR 415.

THTR 417. Fifth-Year Modern Dance Techniques I (1-3)
Performing skills enlarged to include rehearsal and performance of full repertory works. Adaptability, versatility, and fidelity to choreographic intention stressed. Prerequisite: THTR 408.

THTR 418. Fifth-Year Modern Dance Techniques II (1-3)
Continuation of THTR 417.

THTR 424. Stage Lighting (3)
Elements of stage lighting design and technology. Lighting, instruments, and operating procedures. Laboratory lighting experience with main stage productions. Laboratory requirement.

THTR 426. Scene Painting (3)
Standard techniques used in the production of scenery painting.

THTR 427. American Theater and Playwrights (3)
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. Cross-listed as AMST 427.

THTR 428. Theater History Seminar I (3)
A study of classical, medieval, and Renaissance theatrical forms, through primary and secondary source examination.

THTR 429. Theater History Seminar II (3)
Modern periods in Western theater history, from the eighteenth century to the turn of the twentieth. The course investigates materials, texts, and artifacts of theaters from the Renaissance to the Modern era.

THTR 430. Theater History Seminar III (3)
Theater historical research methods, literary critical approaches, and case studies.

THTR 431. Play Directing I (3)
Fundamentals of directing. Concept and development.

THTR 435. Scene Design I (3)
Special projects in mainstage design for theatrical settings.

THTR 436. Scene Design II (3)
Advanced projects in design for the stage.

THTR 440. Portfolio Designs (3)
Independent projects involving presentation and criticism of scenic or costume designs for given play, musical, or opera. Culminates in presentation of portfolio.

THTR 442. Seminar: American Playwrights (3)
An intensive study of the work of a leading American playwright. The focus is on the unique contribution to American theater, drama and literature of the playwright selected for study in a particular semester. Texts, as well as films, videotapes, recordings, and live performances (when available) will be critically studied. The evaluations of theater and literary critics will also be discussed.

THTR 443. Beginning Contemporary Dance I (1)
Through active participation, a comprehensive theoretical perspective on normative movement principles for the actor and singer. Prerequisite: Consent of department.

THTR 444. Beginning Contemporary Dance II (1)
Continuation of THTR 443. Prerequisite: THTR 443.

THTR 445. Principles and Philosophies of Normative Movement I (1-3)
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.

THTR 446. Principles and Philosophy of Normative Movement II (1-3)
Continuation of THTR 445. Prerequisite: THTR 445 or consent of department.

THTR 452. Costume and Construction (3)
Special projects in costuming for mainstage productions.

THTR 453. Graduate Voice Technique I (3)
Exploration of the body and voice as it relates to breath, articulation, resonance,
and the healthy exhalation of sound. Prerequisite: Must be candidate in M.F.A. acting program.

THTR 474. Graduate Voice Technique II (3)
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. Prerequisite: THTR 473.

THTR 475. Voice for Stage: Shakespeare (3)
Development of skills needed to address the specific needs of Shakespeare 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 485. Rehearsal, Performance and Production (1-3)
(See THTR 385.)

THTR 486. Creating Visual Text (3)
Roots and current trends of postmodern contemporary theater. Advent of realism and the subsequent significant movements departing from realism. Through extensive use of slides, videotape, and live performance the course examines selected works for production analysis. Geared to the use of visual and aural imagery, rather than plot and structure, as an effective organizing principle for theatrical presentations.

THTR 500. Weekly Professional Seminar (0)
Discussion of topics for professional development in drama and dance. Interaction with members of the professional drama and dance community.

THTR 505. Music Resources for Contemporary Dance (3)
Resources in the various periods and styles of music for the dancer/choreographer. Study of the choreographic use of music.

THTR 509. Seminar: Introduction to Performance Theory (2)
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)
THTR 521. Advanced Problems/Design I (3)
For design graduates in Theater Arts.

THTR 522. Advanced Problems/Design II (3)
For design graduates in Theater Arts.

THTR 530. Ensemble Technique (1-2)
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. Prerequisite: Must be candidate in M.F.A. acting program.

THTR 532. Acting: Research and Performance I (3)
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 533. Acting: Research and Performance II (3)
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 534. Acting: Research and Performance IV (3)
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. Prerequisite: THTR 531 or THTR 532.

THTR 535. Contemporary Dance Pedagogy (3)
The study and investigation of the approaches and methods of teaching contemporary dance. Detailed study is made of kinesthetic, oral, and creative factors in teaching of dance. Opportunity to assist and teach under supervision.

THTR 536. Theater Pedagogy (1-3)
The study and investigation of the approaches and methods of teaching theater. The emphasis of study will be to prepare graduate acting students to teach a program designed for the beginning actor.

THTR 538. Women in Theater (3)
Primarily an investigation of theater historical phenomena. The course is an interpretive venture using a topic not ordinarily in place in standard histories, in order to test a number of theoretical approaches. The course is organized based on the assumption that the students are willing to tackle difficult and diverse scholarly arguments in history and especially in theater history.

THTR 540. The Business of the Business (2)
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 576. Advanced Voice Technique (3)
Vocal instruction individualized to the particular needs of advanced M.F.A. acting students. This may include the exploration of dialect skills, developing the skills for extraordinary uses of the voice, the coaching of vocal performances, or continued exploration of skills necessary for classic and poetic texts. Required of M.F.A. candidates in the acting program. Prerequisites: THTR 473 and THTR 474.

THTR 601. Special Projects (1-3)
(Credit as arranged.)

THTR 610. Professional Internship (1-4)
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)
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 third-year M.F.A. acting students enrolled in THTR 640. Corequisite: THTR 640.
THTR 621. Advanced Role Analysis Preparation II (3)
Continued study and performance of scenes involving methods of approaching various types of plays and the specific problems they present. Prerequisite: THTR 620. Corequisite: THTR 641.

THTR 630. Performance Studio (3)
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. Prerequisite: THTR 534.

THTR 640. M.F.A. Thesis Production I (3)
Preproduction conception in area of specialization researched and documented under appointed advisement, in accord with production syllabus, and subcommittee approval.

THTR 641. M.F.A. Thesis Production II (3)
Production implementation, post production evaluation/defense and advisory assessment.

THTR 642. Thesis Portfolio I (1)
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)
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.

Women’s Studies

Mather House
Room 105
Phone 216-368-1637
Fax 216-368-4681
Alice Bach, Director

PROGRAM FACULTY
Alice Bach, Ph.D. (Union/Columbia University)
Hallinan Associate Professor of Catholic Studies, Religion
Timothy K. Beal, Ph.D. (Emory University)
Harkness Associate Professor of Biblical Literature, Religion
Christa Carvajal, Ph.D. (The University of Texas at Austin)
Professor, Theater Arts
History of theater; dramaturgy; semiotics
Rachel Chapman, Ph.D. (University of California, Los Angeles)
Assistant Professor, Anthropology
Social cultural anthropology, reproductive health, pregnancy and pre-natal care, gender systems, women’s health in Africa; political economy, applied international health, medical pluralism, medical anthropology; Africa, Mozambique.
Margaretmary Daley, Ph.D. (Yale University)
Associate Professor of German and Comparative Literature
Eighteenth- and nineteenth-century German literature; German women writers; women’s studies; feminist literary criticism.
Susan W. Hinze, Ph.D. (Vanderbilt University)
Assistant Professor, Sociology
Medical sociology; social inequality, sex and gender.
Janis H. Jenkins, Ph.D. (University of California, Los Angeles)
Professor, Anthropology; Associate Professor of Psychiatry, School of Medicine
Heather Meakin, Ph.D. (Hertford College, Oxford)
Assistant Professor, English
Jacqueline C. Nanfito, Ph.D. (University of California, Los Angeles)
Assistant Professor, Spanish and Comparative Literature
Colonial and 19th-century Latin American literature; Golden Age Hispanic literature; literary theory; Chicano literature; contemporary Latin American women writers
Jonathan Sadowsky, Ph.D. (The Johns Hopkins University)
Associate Professor, History
African history; comparative history; cultural anthropology; medical history

Renée Sentilles, Ph.D. (College of William and Mary)
Assistant Professor, History
American women’s history; cultural history; American studies
Eleanor P. Stoller, Ph.D. (Washington University)
Selah Chamberlain Professor, Sociology
Social gerontology, medical sociology, and gender
Athena Vrettos, Ph.D. (University of Pennsylvania)
Associate Professor, English
19th-century British literature and culture; literature and the body; feminist criticism and theory; women writers; 19th-century history of medicine and psychology
Rhonda Williams, Ph.D. (University of Pennsylvania)
Assistant Professor, History
African-American history; U.S. social history
Angela Woollacott, Ph.D. (The University of California, Santa Barbara)
Associate Professor, History; Associate Dean, College of Arts and Sciences
Modern British, British Empire and women’s history

UNDERGRADUATE PROGRAM

The goal of the Women’s 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, psychology and religion in the context of women’s experience; and (6) studies of the body as a focal point for theorizing relations among the arts and sciences.

Women’s studies encompass an interdisciplinary program that prepares students to think critically and creatively within a framework employing gender as the primary 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 dimen-
Major

The Women’s Studies Program offers a major leading to the Bachelor of Arts degree. It may be elected as a second major only. As a double major, the program offers a sound course of study, with a disciplinary concentration grounding the interdisciplinary program objective. To declare a women’s studies major, students must have already declared their first major. Up to six hours credits in required or elective courses for the first major may be applied to the women’s studies major, with the exception of two women’s studies core classes.

Required Courses (6 hours)

In the required two courses, students will become fluent in the tools of research and interpretation currently used in women’s studies. WSTD 201 Introduction to Gender Studies (cross listed as HSTY 270/ENGL 270/PHIL 270) and a capstone class in one of the following disciplines: ANTH 365 Seminar in Women and Gender Studies, ENGL 371 Topics in Women’s Studies, or HSTY 400 Seminar in Women’s Studies. Major courses: 24 credit hours in approved women’s studies courses, at least two from each of the three areas listed.

Minor

The program in women’s studies also offers an undergraduate minor. Fulfillment of the minor requires completion of eighteen credit hours according to the following course distribution:

- Introduction to Gender Studies (offered every fall semester)
- Four cross-listed courses (see list below)
- Independent study

To help ensure a comprehensive course of study in a particular area of interest, the specific combination of courses and structure of the independent study must be approved by the program advisor.

Available approved courses:

- ANTH 306 Anthropology of Childhood and the Family
- ANTH 309 Child Abuse and Family Violence
- ANTH 345 Ethnicity, Gender and Mental Health
- ANTH 354 Women and International Health
- ANTH 356 Gender and Sex Difference: Cross Cultural Perspectives
- ANTH 505 Women and Mental Health
- ANTH 508 Maternal and Reproductive Health
- ANTH 542 Human Body: Discourse and Experience
- ARTH 383 Gender Issues in Feminist Art
- ECON 333 Women in the Economy
- ENGL 353 Major Writers (when given on a woman writer)
- ENGL 368J Images of Women in American Cinema
- ENGL 370 Women Writers
- ENGL 371 Topics in Women’s Studies
- ENGL 376 Images of Women in French Literature
- FRCH 376 Images of Women in French Literature
- GRMN 315 Female Self: German Women Authors
- HSTY 240 The Body in History
- HSTY 313 Women in Modern European History
- HSTY 321 Colonialism, Sex, Race and Gender
- HSTY 350 Gender Issues in the History of Technology and Science
- HSTY 353 Women in American History I
- HSTY 354 Women in American History II
- JAPN 341 Japanese Women Writers
- LAWS 356 Feminist Jurisprudence
- NURS 454 Well Woman Health Care
- PHIL 325 Philosophy of Feminism
- PHIL 334 Social and Political Philosophy
- POSC 346 Women and Politics
- PSCL 390 Women and Depression
- RLGN 207 Religion and Feminism
- SOCI 222 Sociology of Gender
- SOCI 326 Women in Societies in the Modern World
- SOCI 372 Women and Family in the United States
- SPAN 342 Latin American Women Authors
- THTR 338 Women in Theater

Women’s Studies
(WSTD)

UNDERGRADUATE COURSES

WSTD 201. Introduction to Gender Studies (3)

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 studies major. Cross-listed as ENGL 270, HSTY 270, PHIL 270 and RLGN 270.

WSTD 312. Women in the Ancient World (3)

Cross-listed as CLSC 312.
Mandel Center for Nonprofit Organizations

The Mandel Center is a university-wide academic center sponsored by the Mandel School of Applied Social Sciences, the Weatherhead School of Management, the School of Law, and the College of Arts and Sciences. The mission of the Mandel Center is to enhance the effectiveness of nonprofit leaders and managers and the organizations they serve through education, research, and community service. The center’s interdisciplinary program faculty is drawn from partnering schools in the University. In addition, the Mandel Center engages faculty and resources of the entire University, as well as scholars, and professional practitioners from the national and local nonprofit communities, in its activities.

The center offers the Master of Nonprofit Organizations degree, the Certificate Program in Nonprofit Management, the National Certificate in Nonprofit Management, and executive education programs, as well as a number of joint degree programs and special curricular options in cooperation with the sponsoring schools. The Mandel Center also collaborated with the Executive Doctor of Management program at the Weatherhead School of Management to offer practice-oriented nonprofit studies at the doctoral level. In addition it addresses policy and research issues in nonprofit management and leadership through its Distinguished Public Lecture Series, research colloquia, symposia, conferences, and publications.

MANDEL CENTER GOVERNING SECRETARIAT

Darlyne Bailey
Dean, Mandel School of Applied Social Sciences

Samuel M. Savin
Interim Dean, College of Arts and Sciences

William Laidlaw
Interim Dean, Weatherhead School of Management

Gerald Korngold
Dean, School of Law

Steve Bullock
Steve D. Bullock Management Consulting Services

Administration

John Palmer Smith
Executive Director and Mandel Professor of Nonprofit Management

Al Abramovitz, Ph.D.
Director of Executive Education

Susan B. Freimark
Director of Career Development and Management

Marie Lehmann
Assistant Director of Career Development and Management

Ann Lucas
Assistant Director of Community Services

Brenda Marshall-Wieffering
Associate Executive Director

Alan Pires
Assistant Director for Research

Denise S. Rowell
Director of Recruitment and Admissions

Linda Serra
Director of Publications and Alumni Affairs

Carol K. Willen
Director of Education and Manager of Center-Wide Initiatives

John Yankey
Director of Community Services

PROGRAM FACULTY

William Thomas Bogart, Ph.D. (Princeton University)
Associate Professor

Weatherhead School of Management

Susan Case, Ph.D. (State University of New York at Buffalo)
Associate Professor

Weatherhead School of Management

Pranab Chatterjee, Ph.D. (University of Chicago)
Professor

Mandel School of Applied Social Sciences

Laura B. Chisolm, J.D. (Case Western Reserve University)
Associate Professor

School of Law

Steven P. Feldman, Ph.D. (University of Pennsylvania)
Associate Professor

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Ronald E. Fry, Ph.D. (Massachusetts Institute of Technology)
Associate Professor

Weatherhead School of Management

David C. Hammack, Ph.D. (Columbia University)

Hiram C. Haydn Professor of History

College of Arts and Sciences

Robert D. Hirshch, Ph.D. (University of Cincinnati)

A. Malachi Mixon III Chair in Entrepreneurial Studies and Professor

Weatherhead School of Management

Alice K. Johnson, Ph.D. (Washington University)
Associate Professor

Mandel School of Applied Social Sciences

Robert P. Lawry, J.D. (University of Pennsylvania)
Professor

School of Law

Art Naparstek, Ph.D. (Brandeis University)
Grace Longwell Coyle Professor of Social Work

Mandel School of Applied Social Sciences

Sue Pearlmutter, Ph.D. (University of Kansas)
Assistant Professor

Mandel School of Applied Social Sciences

Vaughan Radcliffe, Ph.D. (University of Alberta, Canada)
Assistant Professor

Weatherhead School of Management

Paul Salipante, Jr., Ph.D. (University of Chicago)
Professor

Weatherhead School of Management


Professor for the Practice of Public Policy and Management

Weatherhead School of Management

John Palmer Smith, Ph.D. (Columbia University)
Mandel Professor of Nonprofit Management

Mandel School of Applied Social Sciences

John A. Yankey, Ph.D. (University of Pittsburgh)

Leonard W. Mayo Professor of Family and Child Welfare

Mandel School of Applied Social Sciences

Dennis R. Young, Ph.D. (Stanford University)
Professor

Mandel School of Applied Social Sciences

Weatherhead School of Management

ASSOCIATE PROGRAM FACULTY MEMBERS

Albert J. Abramovitz, Ph.D. (Case Western Reserve University)

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Diana Bilimoria, Ph.D. (University of Michigan)

Associate Professor

Weatherhead School of Management

Art Blum, D.S.W. (Western Reserve University)

Professor Emeritus

Mandel School of Applied Social Sciences

Fred Collopy, Ph.D. (University of Pennsylvania)

Associate Professor

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David L. Cooperrider, Ph.D. (Case Western Reserve University)

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Weatherhead School of Management

Paul H. Feinberg, L.L.B. (Harvard University), L.L.M. (New York University)

Adjunct Professor

School of Law

Paula FitzGibbon, M.S. (Miami University)
Instructor

College of Arts and Sciences

Miriam R. Levin, Ph.D. (University of Massachusetts)

Associate Professor

College of Arts and Sciences
also offers continuing education workshops in conjunction with its sponsoring schools.

Research
Research studies, projects and colloquia designed to expand current knowledge of nonprofit organizations, particularly their management, leadership and governance.

Distinguished Public Lectures
Distinguished Public Lectures bring nationally recognized leaders and scholars to the local community, thus providing a forum for discussion and debate about the issues of most concern to nonprofit organizations.

Conferences
Bring together scholars and professionals to discuss current issues of nonprofit research and practice.

Publications Program
Includes Nonprofit Notes, a newsletter that spotlights Mandel Center activities, people and programs including the lecture series, research and management colloquia, research projects, students, faculty, and the local nonprofit community. A Working Paper Series that offers articles written by faculty, other scholars and practitioners of nonprofit management, and graduate students. A peer-reviewed quarterly journal, Nonprofit Management & Leadership for managers, executives and scholars of the nonprofit sector.

Career Development and Management
The Career Development and Management office offers a number of services to enhance career exploration in the nonprofit sector. Assistance is available with resume writing, interview preparation and other search skills. Highlights include the Mentor Program, Externships and job placement assistance. Career seminars are offered throughout the year and a job kiosk provides up-to-the-minute postings.

THE MASTER OF NONPROFIT ORGANIZATIONS (M.N.O.)

The Master of Nonprofit Organizations is a rigorous professional degree. It is designed to produce leaders and managers in human services, cultural, educational, community development, religious, and other nonprofit organizations. The curriculum recognizes the special concerns of nonprofit organizations in such areas as:

- Management of volunteers and professionals
- Resource development and fund raising
- Governance by volunteer boards of trustees and directors
- Management of multiple sources and types of funding
- A unique legal and regulatory framework
- Special values of service, community, and charity
- The entrepreneurial character of nonprofit leadership
- Special ethical and moral issues
- Measurement of performance without a profit criterion

The M.N.O. degree is a 60-credit-hour program, including 33 hours of required course work, 12 hours from a menu of 10 “choice” courses, and an additional 15 hours of elective courses. Electives may be selected from either the “choice” courses or from an array of relevant courses offered by CWRU professional schools and the College of Arts and Sciences. One course (MAND 425) requires an all-day, four-day session of intensive study in January. Students may pursue the M.N.O. on a full- or part-time basis. The revised M.N.O. curriculum described in this bulletin will be inaugurated in the Fall 2000 semester. For further information, contact the Mandel Center Director of Education at (216) 368-8565.

The M.N.O. curriculum covers many of the same areas as curricula for business and governmental managers and leaders. Financial management, human resources management, marketing management, entrepreneurship, and research and analysis methods are emphasized, but the application and focus are within a nonprofit organizational context. In addition, the M.N.O. includes special areas of analysis such as nonprofit law, ethics, and the historical and social science basis of the nonprofit sector.
M.N.O. Program Structure

- 60 credit hours
- 21 month full-time and varying sequences for part-time study
- Classes offered during the evening and an occasional intensive session to accommodate working students and those seeking employment while in the program.

M.N.O. Curriculum (60 credit total)

Core Curriculum (33 credits)
MAND 401. Introduction to the Nonprofit Sector (3)
MAND 409A. Strategic Planning for Nonprofit Organizations: Practicum I (3)
MAND 409B. Strategic Planning for Nonprofit Organizations: Practicum II (3)
MAND 410. Quantitative Analysis for Nonprofit Leaders (3)
MAND 411. Nonprofit Leadership Dialogs: Major Trends and Issues (1)
MAND 416. Economics for Nonprofit Organizations (1.5) (Seven-week module)
MAND 420. Nonprofit Organization and Management (3)
MAND 425. Financial Accounting and Reporting for Nonprofit Organizations (2)
MAND 426. Financial Management for Nonprofit Organizations (3)
MAND 430. Managing Human Resources in Nonprofit Organizations (3)
MAND 436. Marketing for Nonprofit Organizations (1.5) (Seven-week module)
MAND 450. Law of Nonprofit Organizations (3)
MAND 495A. Decision Making for Nonprofit Leaders (3)

Choice Courses (12 hours)
MAND 405. Ethics and Professionalism for Nonprofit Leaders (3)
MAND 406. Nonprofit Public Policy and Advocacy (3)
MAND 407. Earned Income for Nonprofit Organizations (3)
MAND 408. Philanthropic Fundraising for Nonprofit Organizations (3)
MAND 440. Management Information Systems for Nonprofit Organizations (3)
MAND 489. Trusteeship: The Governance of Nonprofit Organizations (3)

Elective Courses (15 hours)
Elective courses offer the opportunity to gain depth in a particular technical competency or in a given professional discipline or endeavor. Approved courses may be selected from the University’s general bulletin. Current electives offered by the Mandel Center include:
MAND 434 Business and Nonprofit Entrepreneurship (3)
MAND 486 Leading and Managing Nonprofit Arts and Cultural Organizations (3)

The Practica
The curriculum includes two practica. They stress experiential learning and teamwork under the supervision of faculty and in cooperation with participating nonprofit organizations in a variety of fields. This approach is designed to produce useful results for the participating organization as well as critical knowledge and experience for the student.

Part-Time Study
Those interested in part-time study should contact the Mandel Center for details.

Advanced Standing for Certificate Holders
Students who have completed the Certificate in Nonprofit Management (CNM) program with a high level of overall performance, hold an undergraduate degree from an accredited institution, and demonstrate the leadership potential required of master’s candidates may apply to the M.N.O. program and, if accepted, may be eligible for advanced standing, based on certificate course work completed with a grade of B or better. Entry into the M.N.O. program from the certificate program is not automatic.

DUAL DEGREE PROGRAMS
The Mandel Center currently offers dual degree programs with the Mandel School of Applied Social Sciences, the School of Law at Case Western Reserve University and the Department of Music in the School of Graduate Studies. Students must apply and be accepted for each degree program to qualify.

M.N.O./M.S.S.A.
This program combines the Master of Nonprofit Organizations (M.N.O.) with the Master of Science in Social Administration (M.S.S.A.). It provides career preparation for a student with interests in nonprofit management, social service, and the social work profession.
Students beginning their studies in the M.S.S.A. program must apply to the M.N.O. program prior to completing 17 credits of M.S.S.A. courses. Students must finish one complete year of study in both the M.N.O. and M.S.S.A. programs (in either order) before they can mix courses in their final year of study.
- Dual degree students must receive the M.N.O. and M.S.S.A. degrees simultaneously to be granted credit for specific courses taken in the other program.
- M.N.O./M.S.S.A. students continue to register at their initial school of enrollment throughout the dual program.
For more information, contact the individual program directors:
Carol K. Willen, Ph.D., Director of Education
Mandel Center for Nonprofit Organizations
Cleveland Hearing & Speech Center
Case Western Reserve University
10900 Euclid Avenue
Cleveland, Ohio 44106-7167
(216) 368-8565
ckw3@po.cwru.edu

M.S.S.A./M.N.O. Advisor
Mandel School of Applied Social Sciences
Case Western Reserve University
10900 Euclid Avenue
Cleveland, Ohio 44106-7164
(216) 368-2280

M.N.O./J.D.
This program combines the Master of Nonprofit Organizations (M.N.O.) with the Doctor of Jurisprudence (J.D.). It provides preparation for students who desire to practice law within a nonprofit organizational context or serve as managers in nonprofit organizations.
Students in either program must be admitted to the other degree program to be granted dual degree status and receive credit for specific courses taken in the
other program. New students can apply to both programs simultaneously. Several program study options are available. For more detailed information, contact the individual program directors:

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(216) 368-3600

M.N.O./M.A.
This program combines the Master of Nonprofit Organizations (M.N.O.) with the Master of Arts in Music History (M.A.). It provides preparation for students who desire to blend a strong background in music and the arts with management in nonprofit organizations.

Students in either program must be admitted within the first year of study to the other in order to be admitted to dual degree status. New students may apply to both programs simultaneously. Several program study sequence options are available.

For more detailed information, contact the individual program directors:

Carol K. Willen, Ph.D., Director of Education
Mandel Center for Nonprofit Organizations
Cleveland Hearing & Speech Center
Case Western Reserve University
10900 Euclid Avenue
Cleveland, Ohio 44106-7167
(216) 368-8565
ckw3@po.cwru.edu

M.A./M.N.O. Advisor
Department of Music
Case Western Reserve University
Cleveland, Ohio 44106-7105
216-368-2400

General Provisions
In addition to the considerations indicated above, the following provisions apply to all dual degree programs:

1. Students must meet the admission requirements and standards of both programs and be accepted into each program. This may be done at the time of application, or within the first year of study in the M.N.O., M.A., M.S.S.A., or J.D. programs.

2. A specified amount of transfer credit will be granted for academic course work taken in the other programs.

3. Students must adhere to the specific requirements outlined for each degree program consistent with the dual degree agreement.

4. Degrees are conferred simultaneously. Contact the Mandel Center or the appropriate professional school for specific curriculum, sequence options, and complete information about dual degree programs.

CERTIFICATE IN NONPROFIT MANAGEMENT (CNM)
The Certificate Program in Nonprofit Management (CNM) is designed for practicing leaders and managers in human service, fine and performing arts, cultural, educational, civic, religious, and other nonprofit organizations, who hold or aspire to senior-level executive positions.

The program provides knowledge in critical areas of management methodology and the operational environment of the nonprofit sector. The courses address the special concerns of the nonprofit sector in such areas as:

- Management of volunteers and professionals
- Resource development and fund raising
- Governance by volunteer boards of trustees and directors
- Management of multiple sources and types of funding
- A unique legal and regulatory framework
- Special values of service, community, and charity
- The entrepreneurial character of nonprofit leadership

CNM students must satisfactorily com-
consecutive years, with supervised, self-directed study taking place during the intervening months.

FACILITIES AND SERVICES
The Mandel Center for Nonprofit Organizations, Office of Educational Programs, is located in the Cleveland Hearing and Speech Center. Mandel Center classes are generally scheduled at the Weatherhead School of Management, the Mandel School of Applied Social Sciences, and the School of Law (Gund Hall). However, other campus facilities are also utilized.

Mandel Center students are entitled to full use of University facilities and services, including libraries, computer labs, career planning, and housing services. See the appropriate sections of this bulletin for details.

Admission

MASTER OF NONPROFIT ORGANIZATIONS

Requirements
Applicants with academic records from accredited institutions of higher education who submit a complete application, will be considered for admission to the program. No previous academic work in business, management, or nonprofit studies is required.

Admission criteria include:
- Completion of a baccalaureate degree
- Evidence of potential for leadership and executive-level management of nonprofit organizations
- Experience and/or familiarity with nonprofit organizations
- Submission of official scores from the Graduate Management Admission Test (GMAT)

Detailed information about GMAT dates, registration, and score reporting is available by contacting:
Graduate Management Admission Test
Educational Testing Service
Box 966
Princeton, New Jersey 08540
1-800-462-8669 or at http://www.gmat.org

Foreign Applicants
Foreign applicants whose previous college work was completed in non-English speaking countries are required to submit an official Test of English as a Foreign Language (TOEFL) and score 550 or better. For details, see “Students from Other Countries” in the front section of this Bulletin.

Application Procedure
Applications for the M.N.O. program are available from the Mandel Center for Nonprofit Organizations at Case Western Reserve University: (mailing address - 10900 Euclid Avenue, Cleveland, Ohio 44106-7167) (visitors’ address - Cleveland Hearing and Speech Center, 11206 Euclid Avenue). Applicants should arrange to have the following items on file at the Mandel Center for admission consideration:
- Completed application
- Non-refundable $25 application fee, made payable to the Mandel Center for Nonprofit Organizations
- Official transcript of all academic work
- Two letters of recommendation or evaluation forms
- Personal essay as outlined in application materials
- Official GMAT Test Scores

Applicants to the M.N.O. Program should submit the items listed above to:
Denise S. Rowell, Director of Recruitment and Admissions
Mandel Center for Nonprofit Organizations
Case Western Reserve University
10900 Euclid Avenue
Cleveland, Ohio 44106-7167

Only completed applications will be processed.

The deadline for applications to the M.N.O. program is June 1 for admission for the Fall semester. Early admission and scholarship decisions are made in March and April. Those requesting scholarship funding are encouraged to apply early. Applications for admission and financial assistance received after April 1 will be reviewed and considered monthly on the basis of space and fund availability.

Students accepted for admission begin the M.N.O. program with an orientation week in August, one week prior to the start of the fall semester.

January admissions to the program are permitted. The deadline for applications for the Spring semester is November 1.

Potential M.N.O. applicants who have not completed the full M.N.O. admissions process may apply for admission as a non-degree student through the Weatherhead School of Management and if admitted be eligible to take up to two courses (6 credits) in the M.N.O. curriculum, on a space-available basis. Contact the Director of Admissions, Weatherhead School of Management, for further information concerning the non-degree process. If a student applies and is accepted into the M.N.O. program, and has previously completed M.N.O. courses in a satisfactory manner, such courses may be credited toward the M.N.O. program requirements.

Advance Tuition Deposit
Students who are accepted for admission to the M.N.O. program must make a non-refundable tuition deposit of $150 at the time of acceptance to reserve a place in the entering class.

Waiver Policy
A total of six credit hours are eligible for waiver, subject to the following requirements:

Courses to be waived must have been taken from an accredited institution within five years of the date of application to the M.N.O degree program. A grade of at least a “B” must have been earned. Written approval of the waived course must be made by a Mandel Center faculty member. Courses will not be waived based upon work experience. The final decision to waive a course rests with the instructor of the course in question. A student must register for and complete at least 54 credits toward the M.N.O. degree in residence at CWRU in addition to courses waived. A waived course will reduce degree requirements.

Transfer Credit
Courses granted transfer credit must be approved as applicable to the M.N.O. program. They must be taken at an accredited institution, and a grade of at
least B must be earned (not counted in the GPA). Transfer credit is limited to six credits.

**Substitution**

An additional nine credits may be approved for substitute credit. Substitute courses replace required M.N.O. 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/needs and the M.N.O. program mission.

**CERTIFICATE PROGRAM**

Applications for the CNM program are available from the Mandel Center for Nonprofit Organizations at Case Western Reserve University: (mailing address - 10900 Euclid Avenue, Cleveland, Ohio 44106-7167) (visitors’ address - Cleveland Hearing and Speech Center, 11206 Euclid Avenue). Applicants should arrange to have the following items on file at the Mandel Center for admission consideration:

- Completed application
- Non-refundable $25 application fee, made payable to the Mandel Center for Nonprofit Organizations
- Official transcript of all academic work
- Two letters of recommendation. One should be from someone qualified to comment on the applicant’s nonprofit sector experience and career potential in nonprofit management.
- Personal essay as outlined in application materials
- Experience working with a nonprofit organization in a paid staff position, or in a responsible and substantial volunteer capacity.
- A record of academic achievement and the ability to do advanced academic work.

Applicants to the Certificate Program should submit the items listed above to:

Denise S. Rowell, Director of Recruitment and Admissions
Mandel Center for Nonprofit Organizations
Case Western Reserve University
10900 Euclid Avenue

Cleveland, Ohio 44106-7167

Only completed applications will be processed.

**FINANCIAL INFORMATION**

**TUITION**

2000-2001 tuition charges for the M.N.O. degree and CNM program are $838 per credit or $10,500 per semester for full-time M.N.O. students taking 12 or more credits. The cost for the CNM program depends upon the number of credit hours taken. Tuition covers instructional costs and computer usage. Books and living expenses are separate student expenses. Tuition is due and payable according to CWRU tuition payment policy for each semester in which course work is undertaken.

**FINANCIAL AID**

Applications for scholarship financial aid or assistance are available from the Mandel Center. Additional information about federal or other assistance may be obtained by contacting:

Financial Aid Manager
Weatherhead School of Management
310 Enterprise Hall
Case Western Reserve University
10900 Euclid Avenue
Cleveland, Ohio 44106-7235
216-368-4809

Please Note: Initial scholarship and financial aid decisions are made in March and April for the following fall, so early application to the M.N.O. program is encouraged. Requests for financial assistance received after April 1 will be reviewed and considered monthly based on availability of funds.

**ACADEMIC REGULATIONS**

**REGISTRATION**

Registration for the M.N.O. and CNM programs is through the Weatherhead School of Management. All schedules must be approved by the Director of Education prior to registration.

Refer to the Weatherhead School section of this Bulletin for information about course changes and withdrawals. For additional information about registration, contact the Weatherhead School of Management Registrar.

**COURSE LOADS**

Full-time graduate students normally register for no more than 15 or less than 9 credits per semester, and student enrollment is usually consistent with one of several recommended courses of full or part-time study.

**NON-DEGREE STUDENTS**

A maximum of two courses (6 credits) from the M.N.O. curriculum may be taken (subject to space available) by students admitted to non-degree status through the Weatherhead School of Management, providing that course prerequisites requirements are met. Contact the Director of Admissions at the Weatherhead School for further information. (Note: non-degree students are not eligible for any financial aid.)

**RETENTION AND GRADUATION REQUIREMENTS**

**M.N.O. Program**

The retention requirements for continued study in the M.N.O. program are:

- Minimum GPA after 15 credit hours of study: 2.5
- Minimum GPA after 23 credit hours of study: 2.7
- Minimum GPA after 30 credit hours of study: 3.0
- Minimum GPA for graduation: 3.0

A student will be placed on academic probation after any semester in which the minimum GPA is not attained. A student who has not attained the minimum GPA in a particular semester will be allowed one additional semester to attain the minimum GPA in order to continue in the M.N.O. program.

A candidate for the M.N.O. degree must file an application to graduate not later than two months before the commencement at which the degree is expected. The filing of this application is the responsibility of the M.N.O. candidate. Contact the Registrar of the Weatherhead School of Management for complete information. Eligibility of the candidate to graduate at the time requested will be verified upon receipt of the application.
TIME LIMITATION
All requirements for the M.N.O. degree must be completed within five years from the day of the student’s initial registration.

CERTIFICATE PROGRAM
Satisfactory completion of an approved set of five courses (15 credits), 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 Non-profit Management.

TRANSCRIPTS
Official transcripts for course work completed may be obtained from the University Registrar’s Office, 110 Yost Hall.
Mandel School of Applied Social Sciences
Mandel School of Applied Social Sciences (MSASS)

11235 Bellflower Road
Phone 216-368-2290; Fax 216-368-8670
Darlyne Bailey, Ph.D., Dean and Professor

MISSION STATEMENT

MSASS provides and integrates professional social work education, research, and service to promote social justice and empowerment in communities through social work practice locally, nationally, and internationally.

A TRADITION OF SOCIAL WORK

Consistently ranked among the nation’s foremost graduate schools of social work, MSASS counts among its alumni many prominent educators, government officials, accomplished practitioners, researchers, 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. MSASS believes that advanced practitioners are strategists of change, working in partnership with others to enhance the caring capacity of communities. We are committed to preparing advanced practitioners able to understand the dynamics of problematic social situations and to identify the strengths and resources in individuals, families, and communities that offer the best hope of solutions. Our school is dedicated to developing leadership in the empowerment at all systems levels and in the ongoing struggle against discrimination and oppression. MSASS supports innovation and excellence in the service of building healthy communities. MSASS offers a course of study leading to the Master of Science in Social Administration degree (M.S.S.A.), an advanced program for the Doctor of Philosophy in social welfare, several joint programs, and continuing education for professionals. The Master of Science in Social Administration (M.S.S.A.) is a social work master’s degree, accredited by the Council on Social Work Education. Master’s students pursue their degree through a variety of study options, including full-time study, individualized part-time programs, and specialized study options for employed social workers.

Since its founding in 1916 as one of the nation’s first university-affiliated schools of social work, MSASS has been an innovator in professional education. The school’s long-standing dedication to community action has brought more than 300 organizations into a field education program of unusual scope. In every type of local and regional organization, students develop skills in direct practice, research, management, fund raising and community development. Continuing interests in international social work, policy analysis and occupational social work add breadth to a curriculum designed to offer students every opportunity for individualized and interdisciplinary study. The Mandel Center for Nonprofit Organizations offers advanced education in management and governance for leaders from every type of service organization throughout the United States. Its programs combine the perspectives of social science, law, and management for master’s students and Ph.D. fellows wishing to pursue careers in the nonprofit sector. An MSASS 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 United States.

ADMINISTRATION

Darlyne Bailey, Ph.D., ACSW, LISW (Case Western University) 
Dean
Paul Adams, Ph.D., (University of California-Berkeley) 
Associate Dean for Academic Affairs
Victor K. Groza, Ph.D., LISW (University of Oklahoma) 
Associate Dean for Research and Training
Karen M. Kaye, Ph.D., (Bowling Green State University) 
Assistant Dean for Student Administration and Academic Support

David E. Biegel, Ph.D., (University of Maryland) 
Chairperson, Doctoral Program
Mark I. Singer, Ph.D., (Case Western Reserve University) 
Director, Mandel Fellows Program
Deborah Jacobson, Ph.D., (Tulane University,) 
Director, Intensive Weekend Program
Sarah Andrews, M.S.S.A. (Case Western Reserve University) 
Director, Twelve-Month Advanced Standing Program
David Schrader, M.S.S.A., (Case Western Reserve University) 
Director, Development for Major Gifts, Foundations and Corporations
Pamela R. Carson, B.S., (Kent State University) 
Director, Development for Alumni and Allied Constituencies
Arthur S. Biagianti, M.S.S.A., M.S.L.S., (Case Western Reserve University) 
Director, Library
Nancy L. Graf, M.S.W., LISW (Boston College) 
Director, Continuing Education
Gerald A. Strom, M.S.W., LISW (Howard University) 
Director, Field Education
Sherry Jones, M.B.A.(Case Western Reserve University) 
Director of Budgets and Administration
Todd Lloyd, B.S.F.S., (Georgetown University) 
Director of Communications and Marketing
Kathleen Bates, B.A. (Cleveland State University) 
Director, Financial Aid
Susan Freimark, M.A., L.P.C., (John Carroll University) 
Director of Career Development and Management
Debra Fields 
Registrar
Soad Mansour, ACSW, LISW 
Director of International Affairs for Social Welfare and Non-Governmental Organizations

FACULTY

Sarah Andrews, M.S.S.A. (Case Western Reserve University) 
Instructor
Darlyne Bailey, Ph.D. (Case Western Reserve University) 
Professor
David E. Biegel, Ph.D. (University of Maryland) 
Henry L. Zucker Professor of Social Work Practice
Craig Boitel, M.S.S.A.(Case Western Reserve University) 
Instructor
Pranab Chatterjee, Ph.D. (University of Chicago) 
Professor
Claudia J. Coulton, Ph.D. (Case Western Reserve University) 
Lillian F. Harris Professor of Urban Research and Social Change
Academic Programs

MASTER’S DEGREE PROGRAMS

Master of Science in Social Administration

The Master of Science in Social Administration (M.S.S.A.) 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. MSASS 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 (25 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. Students with a bachelor’s degree in social work may be eligible for advanced standing and may have up to 15 credit hours of the foundation course requirements waived. The advanced curriculum (35 credit hours) builds on the professional foundation and provides for advanced knowledge and practice skills in the concentration selected by the student. Concentrations include: aging; alcohol and other drug abuse; children, youth and families; health; mental health; management; and community development. Also available are special focus areas in school social work and international social work.

Field Education

The faculty at MSASS place a high priority on the integration of theory with practice. To facilitate this integration, all 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 300 agencies in the Greater Cleveland area, creating a vast network of field education as well as employment opportunities. Students are required to complete 972 (B.S.W.) or 1,100 (non-B.S.W.) 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.

Direct Practice Concentrations:
- Aging
- Alcohol and Other Drug Abuse
- Children, Youth and Families
- Health
- Mental Health
- Health; Alcohol and Other Drug Abuse; and the Aging concentrations are offered only in the Full-Time format.

Macro Practice Concentrations:
- Management
- Community Development

Electives in the Macro Concentrations are offered only in the Intensive Weekend format.

PLAN OF INSTRUCTION FOR THE M.S.S.A. DEGREE

Full-time Programs

The traditional full-time program is a four-semester program. Students with a bachelor’s degree in social work who are granted advanced standing may complete the program in three semesters.

Twelve Month Advanced Standing Program

Program Description

The Twelve-Month Advanced Standing Program enables qualified B.S.W. graduates to earn a master’s degree in one year. Students begin the program in the fall semester and complete it the following summer. Students may also select a traditional fall, spring, fall pattern instead of attending classes in the summer.
Program Structure and Requirements

During the fall and spring semesters, students attend advanced courses in their area of concentration (Children, Youth, and Families; Aging; Adult Mental Health; Alcohol and Other Drug Abuse; Health; Management; and Community Development) and complete advanced field education requirements.

The typical spring and fall course load includes four courses (12 credit hours) and the field education assignment of three days per week at the field site (4 credit hours). Courses include advanced socio-behavioral theory, advanced research, advanced methods, and advanced policy. During the final summer semester, students carry 13 credit hours: three courses in addition to the final registration for field education. The summer course load includes a capstone course (3 credits) which is a final seminar designed to assist students in integrating their learning from the program, including knowledge and skills assessment, formulating a comprehensive statement of their philosophy of practice, and career planning. In addition, students take Theories of Groups, Organizations, and Communities (SSBT 540), an advanced Practice Methods course, and the final Field Education (SASS 504). The total credit hours required for this program is 45.

Field Education

During the fall and spring semesters, Twelve-Month students participate in an advanced field education experience related to their area of concentration. The first two field education semesters (SASS 402 and 503) follow the standard format for full-time enrollment with students reporting to field education sites for three days per week for 15 weeks. Over the course of the final (summer) semester, students continue at the same placement site, completing field requirements while attending accelerated formatted classes.

Admission Criteria The Twelve-Month Program is open to admitted students who have a bachelor’s degree in social work (B.S.W.) from an accredited program completed within the past seven years. Grades of B or better must have been attained in all core social work courses. These include: policy, research, methods/practice, human behavior, and field practicum. Students granted less than the full 15 credit hours of advanced standing may enter the standard, full-time program and complete degree requirements in three to four traditional semesters.

Additional Information

Because of the short time frame for completing the twelve-month advanced standing program, dual degrees, individualized curricula, and the school and international social work emphases are not available in this program.

Senior Year in Professional Studies Program Undergraduate students of superior ability and achievement may be admitted to the Mandel School of Applied Social Sciences at the end of their junior year. A student in the Senior Year in Professional Studies Program is permitted to substitute the first year (31 semester hours) at the Mandel School of Applied Social Sciences 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 of Applied Social Sciences. 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. Requirements for admission to the Senior Year in Professional Studies Program are as follows: attainment of a cumulative grade point average of at least 3.25 in all courses in the student’s undergraduate program; completion of three-quarters of the major and minor concentration requirements in the undergraduate program. Final 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, guaranteeing that the student will receive the baccalaureate degree from that college upon satisfactory completion of 31 semester hours at the Mandel School of Applied Social Sciences of Case Western Reserve University.

Intensive Weekend Program

The school offers a format of concentrated weekend learning for social workers with career experience who are employed full-time. Based on adequate enrollment, the four foundation courses may be offered off-site in Toledo, Erie, Dayton, Columbus, and Akron/Canton area. Classes meet one weekend per month (including one Friday per course) throughout the calendar year. Five courses are offered each year (six during the first year) and one course is taken at a time. This program allows students to complete their field education requirement at their place of employment. A student can expect to earn the degree in three years. If granted advanced standing, a student may be able to complete the program in two years.

Extended Degree Program Students may opt to complete their degree work on a part-time basis during their first year. During the second and third years, the student will complete field education requirements and carry a full-time or nearly full-time load.

Extended degree program (EDP) students select classes from the full-time weekday schedule. Employed social workers may participate in this program providing they can arrange a flexible work schedule. Field education requirements may be fulfilled at the student’s place of employment. Such placements must be approved by the Director of Field Education.

The EDP program may be completed in three years. Students granted advanced standing may complete the program in fewer semesters. EDP 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.
DUAL AND INTERDISCIPLINARY DEGREE PROGRAMS

(available to full-time students only)

Dual Social Work and Social Welfare (M.S.S.A./Ph.D.) Program

The dual degree program has been structured for students who seek the traditional goals of the Ph.D. program—contributing to the advancement of the knowledge base of social welfare through research and theory development—and a desire to become professional social workers at the master’s level.

The dual M.S.S.A./Ph.D. degree program requires 57 credit hours of course work (normally 19 three-hour courses), 15 credit hours of field practicum, and 18 credit hours of dissertation. The M.S.S.A. degree will be awarded after successful completion of 45 credit hours of course work and 15 credit hours of field education. The Ph.D. degree will be awarded following acceptance of the student’s dissertation.

Course requirements for the dual degree may be completed in two and a half academic years plus two summers. The first academic year consists of M.S.S.A. courses and field practicum. The two summers and the second academic year include primarily Ph.D. level courses. A second field practicum is also required. With the additional time required for dissertation research, the two degrees can be earned in a minimum of four years compared to five years for completion of each degree separately. Dual degree students must meet the admissions standards of the M.S.S.A. and the Ph.D. programs and complete applications for both programs simultaneously.

Dual Social Work and Law (M.S.S.A./J.D.) Program

A 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 and receive the M.S.S.A. and J.D. degrees. This program allows completion of both 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.

Dual Social Work and Master of Nonprofit Organizations (M.S.S.A./M.N.O.)

The dual M.S.S.A./M.N.O. (master’s degree in nonprofit organizations) is designed for individuals without previous graduate training in social work or management who have set their sights on becoming managers of social service agencies. The program is designed to bring the student to a level of professional competence in both the management of nonprofit organizations and the practice of social work. Students may pursue a direct practice, management, or community development concentration in their M.S.S.A. degree.

The Mandel Center also offers a one-year certificate program in nonprofit management. This program consists of five courses that meet throughout the year on evenings and/or weekends.

Students interested in this degree option should contact:
Carol Willen, Ph.D., Director of Education, Mandel Center for Nonprofit Organizations

Admission Procedures

The Mandel School bulletin and application materials 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 or by calling 1-800-863-6772.

Students are admitted primarily for the fall semester, although special requests for admission during the spring semester may be considered. Applications are accepted on a rolling admissions basis, though prospective students are strongly encouraged to apply early (December/ January) for admission. A $30 non-refundable application fee must be submitted at the time of application.

Advanced Standing

Advanced standing (up to 15 credit hours) 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 course for which advanced standing credit hours are given. Students granted advanced standing may not be required to complete selected social work foundation courses and the first semester of field education.

Proficiency Examinations

Students who do not hold a bachelor’s degree in social work may waive the foundation courses in policy, socio-behavioral theory, and research by passing a proficiency examination. Such waivers do not reduce the credit hour requirements for the degree, but enable students to take advanced, open elective courses in place of the foundation courses. There is no fee for examinations, or penalty, if the student does not pass the examination.

Transfer

Transfer credit may be given for related course work completed within the past three years. Credit hours must not have been applied toward a previous graduate degree. Up to 6 hours of credits may be transferred from a non-social work master’s level program. Students who are transferring to MSASS from another 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 evaluation(s) and official transcripts. Students must have received a grade of B or better in any course for which transfer credit is sought.

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, Princeton, New Jersey, U.S.A. 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. All international students must pay the health service fee and purchase the medical insurance policy. No exceptions are allowed. All international applicants must submit to the CWRU Office of International Students evidence of funding sources to fully finance the cost of education, housing, and transportation.

Students holding a B.S.W. from their countries may be eligible for advanced standing. Applicants should contact the Council on Social Work Education (CSWE) directly and ask to have their program reviewed. Please write to CSWE, 1725 Duke Street, Suite 500, Alexandria, VA 22314-3457.

FINANCIAL INFORMATION

Tuition

In the 2000-2001 academic year, tuition for the Mandel School of Applied Social Sciences in the Full-Time master’s degree program is a flat rate of $20,100, and $670 per credit hour for other programs.

A non-refundable 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 Academic Policies, Procedures and Financial Aid Information are available by contacting MSASS.

DOCTORAL PROGRAMS

Doctor of Philosophy

Students selected for study in the Ph.D. in Social Welfare program share a goal with distinguished faculty: the development of knowledge that will enhance the effectiveness of institutions and professions created to serve human need. The purpose of the program is the preparation of scholars, teachers, and practice 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. We prepare students to be knowledgeable in:

• relevant areas of the social and behavioral sciences;
• research, design, statistics, and the philosophy of science;
• theory-building and theories of social welfare; and
• 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 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 practica can be arranged. Students can pursue special interests through individual reading and tutorial courses. In addition, regular course offerings in other departments of the University are available to students, and joint offerings have and continue to be developed. To the extent possible, 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 the program core, 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.

**Formats of the Ph.D. Program**

In response to the differential needs and interests of potential Ph.D. students, MSASS 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:

**The Full-Time 14-Month Program**

Under this format, full-time students can complete course requirements in a minimum of 14 calendar months. This intensive study plan requires total commitment to Ph.D. study during this period of time.

**Full-time Ph.D. Program**

**First Summer**

- SASS 608 Philosophy of Science and Theory Building (required)
- SASS 610 Social and Behavioral Science Approaches (required)
- SASS 613 Advanced Research Design (required)

**Fall Semester**

- SASS 615 Social Statistics and Data Analysis (required)
- SASS 614 Models of Qualitative Research (required)
- SASS 609 Theories of Social Welfare and Social Justice (required)

**January Term**

- SASS 624 Models of Social Work Practice or
- SASS 695 Social Welfare Policy and Planning Models (one required)

**Spring Semester**

- SASS 616 Multiple Regression and Analysis of Variance (required)
- SASS 635 Methodological Issues in Qualitative Research (elective)
- SASS 637 Independent Study

**June Qualifying Examination**

**Second Summer**

- SASS 625 Social Work Practice Applications or
- SASS 694 Models of Service Delivery (one required)
- SASS 618 Measurement Issues in Quantitative Research (required)
- SASS 617 Specialization Seminar (elective)
- SASS 630 Seminar in Social Work Education (elective)
- SASS 650 Leadership: Essence & Praxis (elective)
- SASS 637 Independent Study

**Dissertation (SASS 701/18 credit hrs.)**

**The Summer Study Program**

Course work and residency requirements for the Summer Program can be completed during three summers and two January interim periods. This format is designed to accommodate social work educators and professionals who must maintain their employment commitments, but wish to pursue Ph.D. study during the summer residence. Under both formats, all students will begin the program the first Monday in June with an intensive six-week period of study. During this time they will take three core courses. Students must devote full time to study during this six-week period. Summer program students will have a one-week period of study in January, a second six-week period of study the following summer, a second one-week period in January, and finally a third six-week summer period. During the fall and spring semesters of the first year, Summer Study Students take two graduate level statistic courses at a university in their own community.

Full-time students will normally complete the qualifying examination in the spring following completion of core courses. Summer-study students will complete the qualifying examination prior to their third summer of residence. It is expected that the third summer will be devoted to preparation of the dissertation prospectus, as well as completion of course requirements.

**First Summer**

- SASS 608 Philosophy of Science and Theory Building (required)
- SASS 610 Social and Behavioral Science Approaches (required)
- SASS 613 Advanced Research Design (required)

**Fall-Spring**

- SASS 609 Theories of Social Welfare and Social Justice (required)
- SASS 616 Multiple Regression and Analysis of Variance (required)
- SASS 635 Methodological Issues in Qualitative Research (elective)
- SASS 637 Independent Study

**January Term**

- SASS 624 Models of Social Work Practice or
- SASS 695 Social Welfare Policy and Planning Models (one required)

**Second Summer**

- SASS 625 Social Work Practice Applications or
- SASS 694 Models of Service Delivery (one required)
- SASS 618 Measurement Issues in Quantitative Research (required)
- SASS 617 Specialization Seminar (elective)
- SASS 630 Seminar in Social Work Education (elective)
- SASS 650 Leadership: Essence & Praxis (elective)
- SASS 637 Independent Study

*Summer-study students may take two graduate level statistic courses at a university in their own community. The courses must include the range of tests taught in courses SASS 615 and SASS 616. Six credit hours (two courses) are transferable.*
SASS 650 Leadership: Essence and Praxis (elective)
SASS 637 Independent Study

January Term
SASS 609 Theories of Social Welfare and Social Justice (required)
June Qualifying Examination

Third Summer
SASS 625 Social Work Practice Applications OR
SASS 694 Models of Service Delivery
SASS 617 Specialization Seminar (elective)
SASS 630 Seminar in Social Work Education (elective)
SASS 635 Methodological Issues in Qualitative Research (elective)
SASS 657 Independent Study
Dissertation (SASS 701/18 credit hrs.)

Admission to Doctoral Program

Through the School of Graduate Studies of Case Western Reserve University, the Mandel School of Applied Social Sciences offers a Ph.D. in social welfare. To be admitted to the Ph.D. program, a candidate should have a master’s degree from an accredited school of social work or a master’s degree in a related field and demonstrate a superior record in undergraduate and graduate studies. Practical experience in social welfare is required. Application to the Ph.D. program will be considered from persons with master’s degrees in allied fields with the recognition that their program will include equivalency requirements related to knowledge of social welfare. Students without a master’s in social work may be interested in the dual degree M.S.S.A./Ph.D. program. The Miller Analogies Test or Graduate Record Examination is required for application to the Ph.D. program. Applicants should have a score of at least 1100 on the combined Verbal and Quantitative section of the Graduate Record Examination or 60 on the Miller Analogies Test. A minimum grade point average of 3.0 for baccalaureate and master’s degree study is expected.

Additional materials considered in reviewing applications include the completed application form and a written statement, with the non-refundable application fee (waived for students from other countries); official transcripts of all previous undergraduate and graduate courses taken for credit; and letters of recommendation. In addition, students from other countries must submit results of the Test of English as a Foreign Language (TOEFL) or its equivalent. General inquiries about the advanced programs and requests for application forms should be directed to:

Doctoral Program Office
Mandel School of Applied Social Sciences
Case Western Reserve University
10900 Euclid Avenue
Cleveland, Ohio 44106-7164
1-800-944-2290 ext. 2284

Completed applications should be sent to the address above.

Academic Policies for Ph.D. in Social Welfare

RESIDENCE REQUIREMENT
To meet the official residence requirement, students must be registered for at least three courses in the Ph.D. program either in each of two consecutive semesters or two consecutive summers. A minimum of one year following successful completion of the qualifying examination and course work is generally necessary to complete the doctoral dissertation.

FACULTY ADVISORS
Each doctoral student is assigned a faculty adviser 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 foundation courses. 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 Ph.D. degree upon the successful completion of the qualifying examination. To be admitted to candidacy, the candidate also must have maintained an 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.

DISCERNMENT REQUIREMENTS
Each candidate for the Ph.D. 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. Before a candidate leaves the school as a full-time student, he or she should have formulated the topic, been assigned a dissertation adviser, and had the dissertation prospectus approved by a faculty committee constituted for this purpose.

Once a student registers for SASS 701, Dissertation, 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. The minimum acceptable registration is three semester hours per semester, until 18 hours are completed.

All requirements for the Ph.D. 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. For students whose leaves of absence are for duty in the armed services, the time limitation will be extended by their period of service.

DOCTORAL PROGRAM FINANCIAL AID
Financial aid is available to admitted students in the form of tuition assistance and research and training assistantships. Policies of the doctoral program regarding international students and registration are the same as those of the master’s degree program described in the MSASS bulletin. Grading policy is the same as that for the master’s degree program.
Continuing Education Program Opportunities to increase practical knowledge and skills are offered to human services practitioners in a variety of workshops, institutes, and cosponsored events. Every effort is made to provide practitioners with information that addresses (1) current social issues and practical problems; (2) basic principles and concepts applicable to a wide range of services; and (3) innovative approaches to direct services, staff development, management, and planning.

Over 130 courses are offered throughout the year on campus and at selected off-campus sites. New offerings are developed in response to the demands of practice and to the needs of public and voluntary agencies at all levels. Social Work Licensure Examination Review Courses are offered three times per year.

MSASS is approved by the Ohio Counselor and Social Worker Board to provide continuing professional education to social workers and counselors. Courses offered in the MSASS Continuing Education Program usually meet license renewal requirements for these and other professionals: i.e., psychologists, nurses, nursing home administrators and chemical dependency counselors.

General inquiries should be sent to the Director, Continuing Education, Mandel School of Applied Social Sciences, Case Western Reserve University, 10900 Euclid Avenue, Cleveland, Ohio 44106-7164. Brochures describing these programs are issued regularly, and individuals are placed on a mailing list on request.

SASS 504. Field Education IV (4)
SASS 574. Legal Issues in Social Work (3)
This course surveys the legal system as it affects social work, either direct service practice or in the development of human service policies and programs. Students are exposed to the basic trial court procedures and have the opportunity to develop necessary skills to testify. A paper is required in which the student analyzes and integrates the legal and social work issues on a proposed topic of interest.

SASS 575. Travel and Study Seminar (3)
This course will acquaint the student with the socio-political factors which influenced the development of social welfare systems in a selected country and the impact of this system on the development and functioning of individuals, families, groups or communities. The role of the emerging social work profession in social charge will be explored via the social welfare system. Topics could focus on the health care, mental health, aging, child and/or educational systems and be oriented towards direct practice, management or community development.

SASS 586. Ethical Issues in Social Work Practice (3)
The main focus of the seminar is to relate ethical principles to direct practice. Through lecture, discussion, group projects, and case examples, students gain a deeper understanding of ethical issues related to confidentiality, justice, client autonomy, whistle blowing, right to life, and other areas of great importance to social work practice today.

SASS 590. Field Practice (1-12)
SASS 594. Independent Study Abroad (1-12)
SASS 598. Individual Reading (1-12)
Prerequisite: Special written permission needed. See MSASS registrar.

SASS 608. Philosophy of Science and Theory Building (3)
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)
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. Social and Behavioral Science Approaches (3)
This required course provides a survey of behavioral and social science theories which support social work practice, social welfare programs and social policy. It includes an examination of material from systems theory, field theory, conflict theory, structural function and other theory.

SASS 613. Advanced Research Design (3)
This foundation course in research methods is required of all students. It is a prerequisite to the quantitative and qualitative courses. Research designs and methods relevant to social welfare planning, policy development, practice and administration are examined.

SASS 614. Introduction to Qualitative Research Methods (3)
This course introduces the social scientific paradigms for qualitative research and then explores varying qualitative research strategies, methods of data collection and analysis, and standards for evaluation. Political and ethical issues raised by qualitative research are also considered. Prerequisites: SASS 608 and SASS 613. SASS 618 recommended.

SASS 615. Social Statistics and Data Analysis (3)
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.

SASS 616. Multiple Regression and Analysis of Variance (3)
This course builds on SASS 615, and either it or its equivalent is required of all students. Content focuses on using analysis of variance and multiple regression.

SASS 617. Specialization Seminar (3)
This course focuses on problem definitions and research issues related to specialized populations, fields of service and practice roles. The issues selected as the focus are based on faculty and student interests. Prerequisite: SASS 614 or SASS 618.

SASS 618. Measurement Issues in Survey, Experimental, and Quantitative Research (3)
This course covers the operationalization of social science concepts and develop-
ment of methods for their measurement. Issues covered include index and scale construction, validity, reliability, generalizability theory, multi-dimensionality, questionnaire design, interviewing, and experimental control. Students are required to take either this course or SASS 614.

**SASS 624. Models of Social Work Practice (3)**
This is the first of two required courses for students specializing in direct practice. It critically analyzes major models of current practice, including the traditional, unitary, and radical approaches. The course is designed to examine the development of practice theory, to develop a framework for the analysis of theory, and to study the content, structure applications, and implications of the three models.

**SASS 625. Social Work Practice Applications (3)**
This is the second of two courses aimed at the analysis and development of models of direct practice. Student works on the construction of an approach to practice related to his or her interests. Prerequisite: SASS 624.

**SASS 630. Seminar: Social Work Education (3)**
The first of two courses preparing students for careers in academe. Examination of the structure and content of American higher education. Emphasis is placed on program design and curriculum and course development.

**SASS 632. Research Project (3)**
This course provides students with the opportunity to work with specific faculty engaged in research studies either on an individual or group basis. Prerequisite: SASS 614.

**SASS 637. Individual Reading (1-18)**
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.)

**SASS 640. Advanced Field Practice I (1-3)**
**SASS 642. Teaching Practicum (1-6)**
Students interested in experiential learning within social work education can arrange a teaching assistantship within the M.S.S.A. curriculum.

**SASS 646. International Social Welfare (3)**
This elective course focuses on social welfare programs and services in selected industrialized countries, with particular attention given to comparison of income maintenance and social service programs. Frameworks for cross-national analysis are examined and various national programs are evaluated in the context of these frameworks.

**SASS 650. Leadership Essence and Praxis (3)**
This course explores organizational leadership as both a subject of scholarly study and a potential of human development. Through a mix of didactic and experiential methods, the course will focus on the application of leadership theory and practice in human service settings. This is an advanced doctoral course that assumes students have familiarity with organizational systems and leadership.

**SASS 694. Models of Service Delivery (3)**
This course is required of all planning and policy development students. Content includes specific social science content relevant to social welfare planning.

**SASS 695. Welfare Policy and Planning Models (3)**
This seminar focuses on the analysis of social welfare policy. Tools of policy analysis and frameworks for policy analysis are examined and critiqued. Policy alternatives are considered from an analytical and comparative perspective. Attention also is given to policy development and implementation with emphasis on program planning and evaluation.

**SASS 701. Dissertation Ph.D. (1-18)**
This course is intended for students who have passed the qualifying examination and are actively working on their dissertation.

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**Problem, Policy, Program (SPPP)**

**SPPP 470. Social Policy (3)**
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.

**SPPP 500. Special Topics in Social Work Policy (3)**
This seminar course is intended 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. Prerequisite: SPPP 470.

**SPPP 510. Mental Health Policy and Service Delivery (3)**
This course is designed to acquaint 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 develop 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. Prerequisite: SPPP 470.

**SPPP 511. Issues in Health Policy and Service Delivery (3)**
This course will provide knowledge for understanding health care policy issues and options. It will highlight the development of health care policy in the United States, the influence of health policy development, and the role of social work. Similarly, it is an examination of 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 directed toward students in the health concentration but also welcomes students from other areas of the School school and the University. Prerequisite: SPPP 470.

**SPPP 512. Legislative and Political Process (3)**
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. Prerequisite: SPPP 470.
SPPP 513. Aging Policy and Service Delivery (3)
This course critically 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. Prerequisite: SPPP 470.

SPPP 520. Homelessness (3)
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. Prerequisite: SPPP 470.

SPPP 525. AIDS Seminar (3)
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, is 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. Prerequisite: SPPP 470.

SPPP 529. Child and Family Policy and Service Delivery (3)
This course focuses on major federal legislation impacting children, youth, and families, especially those affecting poor and vulnerable groups, including people of color, women, and individuals and groups with special needs. The course is taught using a policy-practice approach. Students learn how to provide policy-informed services and to participate in policy implementation and change. Students work in groups to plan, implement, and evaluate an Advocacy Project aimed at promoting change at the agency and/or community level. The course is designed to integrate policy content with mezzo-practice skills for direct practice.

Research (SRCH)

SRCH 426. Introduction to Social Research (3)
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 practicum setting. Students are alerted to the risks of cultural bias in research throughout the course through examples and scientific readings.

SRCH 530. Practice Evaluation (3)
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 determine 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. Prerequisites: SRCH 426, SSWM 400, and SASS 401.

SRCH 532. Needs Assessment and Program Evaluation (3)
Macro practice students prepare skills for assessing population needs and determining achievement of program objectives, outcomes, process, and cost-effectiveness. Research results are applied to policy information, planning, and program development. Students are asked to propose a project involving needs assessment of a population and/or a program evaluation using appropriate design and method. Completion of SASS 401 required. Prerequisites: SRCH 426, SSBT 534, and SASS 401.

SRCH 536. Individual Research Practicum (3)
With instructor and research sequence chair approval, an individual program of supervised research experience may be undertaken. This course allows the students to tailor a program of applied research to a specific practice issue or program. Prerequisite: SRCH 426.

Socio-Behavioral Theory (SSBT)

SSBT 440. Human Development over the Life Span (3)
An overview of normal individual development throughout the life cycle. Psychosocial, learning, and social role theories constitute the theoretical basis for the course. Developmentally determined objectives and tasks for every life stage are examined in the context of physical, psychological, familial, and sociocultural factors. Special emphasis is placed on the impact of gender, health, and minority status upon human development.

SSBT 500. Special Topics in Sociobehavioral Theory (1-3)
This seminar is intended for students who are interested in exploring advanced topics of current interest in sociobehavioral theory.

SSBT 501. Advanced Child and Adolescent Development and Dysfunction (3)
Traces the development and dysfunction of individuals from conception through adolescence. It stresses transactions between the individual and his/her environment including schools, peers, community, and family. Special attention is given to the influences of poverty, gender, and ethnicity on development and dysfunction. A variety of etiologic perspectives are addressed in explaining the major maladaptive conditions of children and adolescents. Prerequisite: SSBT 440.

SSBT 508. Advanced Adult Development and Dysfunction (3)
An examination of broad perspectives on adult development and specific dysfunctions in adulthood. Several developmental theories are reviewed. The prevalent and serious emotional problems experi-
enced by adults in our society are presented, with particular attention given to the social contexts in which these problems occur. Examples of such problems include marital dysfunction, family violence, maladaptive approaches to parenting, alcoholism and other addictions, depression, and suicide. The effects of poverty, gender, and minority status on development and dysfunction are addressed. Prerequisite: SSBT 440.

SSBT 520. Family System Theories (3) Development of the family over the life span, with an emphasis on normal family stages and tasks. Life cycle stages include marriage, parenting young children, families with adolescents, launching children and moving on, and families in later life. Divorce, remarriage, and forming a step-family are considered. The course covers a range of family forms based on culture and socioeconomics as well as changes in the family life cycle over time. Families coping with various life stressors, such as alcoholism or drug addiction, children with chronic illness or developmental disabilities, care of elderly family members, and living in impoverished conditions also are discussed. Prerequisite: SSBT 440.

SSBT 534. Organizational Theory (3) Enables students to understand the organizational conditions, processes and structures, and the nature of human service organizations. The course covers various theoretical perspectives on organizations, including the issues of goals, power, leadership, effectiveness, efficiency, performance, clients, and staffing. Special attention is given to the ways in which nonprofit human service organizations are similar to and different from other types of organizations. Prerequisite: SSBT 440.

SSBT 535. Human Sexuality (3) 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. Concludes with practical applications for social work, including an overview of assessment and treatment of sexual dysfunction. Prerequisite: SSBT 440.

SSBT 540. Theories of Groups, Organizations, Communities, and Social Class (3) A foundation about the theory, development, and behavior of groups, organizations, and communities and examination of the influence of these meso- and macro-systems upon individuals and families. The course emphasizes the application and integration of theoretical perspectives on social behavior in relation to empowerment-oriented group work, administration, and community organizing. Prerequisite: SSBT 440.

SSBT 542. Child and Adolescent Psychopathology (3) This course focuses on the dynamics, etiology, and description of diagnosable mental disorders in children and adolescents including disorders of behavior, conduct, effect, and thought. The physical, psychological, environmental, and social factors that contribute to mental disorders in children and adolescents are emphasized, along with treatment possibilities and social implications. Prerequisites: SSBT 440 and SSBT 501.

SSBT 546. Welfare Reform and Poverty (3) This course identifies and critically analyzes major theories of urban poverty and their implications for social policy in contemporary American society. Economic, sociocultural, cultural, and integrative theories of poverty are examined. Case studies of poverty theories for social policy and the elimination of poverty are addressed. Prerequisite: SSBT 440.

SSBT 548. Adult Psychopathology (3) Introduction to the etiology and dynamics of anxiety disorders, mood disorders, personality disorders and psychoses of adults. The etiology of pathology will be examined in the context of theories on personality development, biological and sociocultural domains. Attention is given to treatment possibilities and the social implications of these disorders. Prerequisites: SSBT 440 and SSBT 508.

SSBT 555. Women’s Issues (3) This course examines various theories that are relevant to the development and socialization of women in this society, 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 the women with whom they work. Prerequisite: SSBT 440.

SSBT 584. Diversity, Discrimination, and Oppression (3) Students form 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.

SSWM 400. Social Work Methods (3) This foundation methods course is based on a generalist social work practice perspective incorporating a problem-solving methodology applicable to client systems including individuals, families, small groups, organizations, and communities. Emphasis is placed on developing skills with respect to relationship formation and engagement; data collection and assessment; goal setting and contracting; designing and implementing appropriate interventions; assuming appropriate practice roles; evaluation; and termination. Explicit attention is given to issues of human diversity and their impact on work with clients at all points in the social work process. The course is undergirded by relevant socio-behavioral and practice theories that emphasize the reciprocal nature of person-environment interaction.

SSWM 500. Special Topics in Social Work Methods (1-3) This seminar course is intended for students who are interested in exploring advanced topics of current interest in methods. Prerequisite: SSWM 400.
SSWM 517. Family System Interventions (3)
This course will cover the knowledge, concepts, and skills associated with working with 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 to intervention with families. Considerations of family issues at different developmental stages will be presented. The issue of ethically competent social work practice with families will be stressed throughout the course for each content area. Prerequisites: SSWM 400 and SSBT 520.

SSWM 518. Death and Dying (3)
This course focuses on the concept of death and related topics from a social work perspective. Such topics include the role of death in the 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. Prerequisite: SSWM 400.

SSWM 519. School Social Work Seminar (3)
This course prepares students to work effectively in educational settings as certified school social workers. 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. Will cover student and family problems and areas of need to which school social workers typically respond, e.g., disability, truancy, divorce, teen pregnancy, youth depression and suicide, substance abuse, violence, dropping out of school. Emphasis will be placed on practical application to programs and practices in schools. This course is required for those students participating in a planned program of study leading to state certification as a school social worker. Prerequisite: SSWM 400.

SSWM 530. Managing Organizational Change (3)
This course is designed to provide a conceptual and practical understanding of planned change in human service agencies from an organizational behaviorist perspective. Necessary skills and strategies for identifying the need for change, preparing the organization and managing the process, and institutionalizing the change are critically examined and explored. Prerequisites: SSWM 400 and SSBT 540.

SSWM 531. Strategic Alliances (3)
The goal of this course is to provide organizational leaders with the concepts and practices critical to the development of inter-organizational collaboration. Various strategies are examined, and existing community-based and international linkages are explored. Prerequisites: SSWM 400 and SSBT 540.

SSWM 533. Volunteer Management (3)
Nonprofit organizations need an ongoing supply of dedicated volunteers to effectively survive the challenges of the 1990s and beyond. The major emphasis of this course is mastering theories and practices of motivation as they relate to effective recruitment and development of volunteer staff. Prerequisite: SSWM 400.

SSWM 540. Attracting Government, Foundation, and Corporate Support (3)
This course features for government, foundation, and corporation funding sources the trends, types of support available, sources of information, processes for accessing, criteria for decision-making, and the politics of grant, contract, in-kind, or other types of support. Preparation of winning proposals constitutes a special focus. Nonprofit organizations' accountability, stewardship, and recognition responsibilities or activities are explored. Prerequisite: SSWM 400.

SSWM 542. Conducting Annual, Federated, and Membership Campaigns (3)
This course gives in-depth attention to the planning, implementation, and evaluation of annual funds, federated campaigns, and membership campaigns. Special attention is paid to direct mail fundraising, direct mail fundraising, phoning, and special events fundraising. Computer software options and the selection and use of consultants are highlighted. Prerequisite: SSWM 400.

SSWM 543. Major Gift, Planned Giving, and Capital Campaign Fund Raising (3)
This course gives in-depth attention to the planning, implementation, and evaluation of major gift, planned giving, and capital campaign fundraising. Prospect identification, rating, cultivation, solicitation, and recognition are featured. Special attention is given to developing case statements, face-to-face solicitation techniques, computer software options, selection and use of consultants, and donor stewardship programs. Prerequisite: SSWM 400.

SSWM 544. Budgeting and Finance (3)
This course presents budgeting systems and financial management processes that are commonly used in social service agencies. Students develop and analyze budgets, become familiar with financial reporting, and understand basic accounting practices. Financial analyses used in budgeting and reporting are considered. Prerequisite: SSWM 400.

SSWM 545. Social Program Design (3)
Students will develop skills and techniques for forming social agencies and designing social service programs. The course addresses the demands of multiple constituencies (clients, other agencies, legislators, the legal system, etc.) and competing values (the ability to be flexible versus the need for control and to work both inside the organization and outside its boundaries). It presents an approach that focuses on establishing outcome-based goals and interventions. Prerequisite: SSWM 400.

SSWM 546. International Social Work (3)
This is an advanced seminar designed for students interested in the international dimension 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. Prerequisite: SSWM 400.

SSWM 547. Interventions in Alcohol Abuse and Chemical Dependency (3)
This course provides a basic orientation to alcohol and other drug abuses (AODA) as problems requiring the various interventions that constitute the social work profession. The historical background of AODA treatment interventions, self-help groups, and conceptual models of addiction are presented. Emphasis is placed on current assessment techniques and treatment of the following populations: women, minorities, physically challenged, adolescents, and multi-problem individuals. Students will explore their own attitudes and values toward AODA problems and how these affect treatment outcomes and program development. Prerequisite: SSWM 400.
SSWM 565. Community Based Practice with Children and Families (3)
This course covers the knowledge, concepts, and tools needed in contemporary child welfare practice. Practice methods reflect a family-centered approach in which the welfare of children is considered in the context of family systems of which they are a part. The continuum of child welfare services is covered, including culturally relevant social work roles, activities, and intervention strategies. Topics include risk assessment, case planning, intervention approaches, work with families, supportive services, placement intervention, foster care, group care, adoptions, legal issues, and reunification. Prerequisite: SSWM 400.

SSWM 567. Community Organization and Development Strategies (3)
The purpose of this course is to demonstrate the application of social science theory to the issues of economic and neighborhood development and how social workers can refine their roles, skills, and understanding of techniques in community organization and strategies for economic and housing development. Prerequisite: SSWM 400. Cross-listed as MAND 467.

SSWM 569. Management of Community Based Development (3)
This course examines the fundamentals of building and managing an effective community development organization. Students will develop an understanding of community development with a focus on housing, economic development, and community building. Community building integrates family development, education and health, housing, and economic development. Prerequisite: SSWM 567. Cross-listed as MAND 469.

SSWM 571. Case Management (3)
This course addresses case management as an interdisciplinary human service intervention and examines the social, policy, programmatic, and practice factors that shape the delivery of case management services. A variety of models of case management are covered, along with their respective implications for social work practice. Multiple perspectives of consumers of case management services are addressed. Prerequisite: SSWM 400.

SSWM 573. Home Based Family Intervention (3)
This course will provide students with an in-depth, comprehensive understanding of family preservation services and practice. It will encompass the values, attitudes, beliefs, knowledge base, and skills necessary for the beginning home-based worker. The course will review the theories that guide family-based services, examine models of family preservation services across various service systems, and teach skills or competencies necessary for home-based family work. Prerequisites: SSWM 400 and SSWM 517.

SSWM 574. Integrative Seminar in Alcohol and Other Drug Abuse (3)
This is an advanced methods course in alcohol and other drug abuse treatment which builds upon the material presented in the methods course (SSWM 564) in alcohol and other drug abuse. The course is intended as an elective course for students who are interested in developing their clinical skills in AODA and in enhancing their abilities to conduct an empirically-based practice with AODA clients. Course objectives include integrating clinical and research knowledge about AODA; strengthening the student’s clinical skills in AODA practice; focusing on the complexity of comorbidity issues of AODA practice including, but not limited to, mental health problems, sexual victimization, and domestic and family violence; and recognizing policies and practices relevant to cultural diversity, gender differences and discrimination in social work practice with AODA problems. Prerequisites: SPPP 502 and SSWM 564.

SSWM 575. Social Work with People Who Have Chronic Mental Illnesses (3)
This advanced course will focus on treatment and intervention with people who have chronic mental illnesses. It is intended to teach students (1) interviewing and assessment techniques particular to this population, and (2) community-based treatment and rehabilitative approaches, services and programs. Specific types of community-based programs which have been shown empirically to be effective in reducing relapse and increasing client functioning will be reviewed, including medication management, continuous treatment teams, and family psycho-education programs. As such, the course will cover the skills and knowledge necessary for social work with individuals. Prerequisite: SSWM 400.

SSWM 579. Cognitive Behavioral Interventions (3)
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. Prerequisite: SSWM 400.

SSWM 580. Mental Health Practice with Children and Adolescents (3)
This course will focus on developing specialized knowledge and social work techniques related to professional social work in such settings as hospitals, child guidance agencies, family service agencies, mental health centers, and residential treatment centers. Concentration will be on assessment of normal and pathological social functioning as related to age-appropriate development, adaptations of psychotherapeutic principles to social work interventions, maximizing individual, family and environmental strengths in each situation as guidelines for offering help. Prerequisites: SSWM 400 and SSBT 501.

SSWM 581. Social Work with Older Populations (3)
This course focuses on various intervention strategies particularly appropriate for social work with the elderly. Social work in institutional, community, and home-based care is considered. Attention is given to work with special populations of the elderly, including women and minorities of color. Prerequisite: SSWM 400.

SSWM 582. Social Work in Child Abuse and Family Violence (3)
This course addresses the etiology 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. Prerequisites: SSWM 400 and SSBT 501.

SSWM 583. Mental Health Practice with Adults (3)
This course will explore the contributions of currently prevailing theoretical perspectives to mental health practice with adults: cognitive theory, behavior theory, crisis theory, and structural theory. Specific focus of attention will be on the newly evolving object relations theories. A broad range of treatment approaches will be addressed to provide the student with a diverse array of practice approaches, specifically supportive therapy.
Diverse social work treatment approaches will be related to major diagnostic classifications for adults with mental health problems. Prerequisites: SSWM 400 and SSBT 508.

SSWM 584. Social Work with Couples (3)
This course provides an overview of assessment and intervention methods for working with couples around issues of marriage, divorce, and remarriage. Alternative 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 is given to problems of chemical dependency, its effects on the family, and appropriate treatment approaches. Prerequisite: SSWM 400.

SSWM 585. Social Work with Groups (3)
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 interventions in the group process and structure, and his/her use of various program media. Attention is given to the significance of goals, agency environment, and policy for direct work with groups. Prerequisite: SSWM 400.

SSWM 586. Race and Class: Implications for Social Work Practice (3)
This course provides students with the opportunity to integrate concentration content within a perspective focusing on social work practice within the context of race and class. Specific attention will be focused on the development of a practice model that takes into account the impact of race and class on social functioning. Students will explore the effects of race and class on critical life areas such as education, housing, health care, and involvement with the justice system. Prerequisite: SSWM 400.

SSWM 589. Social Work Intervention in Chronic Illness (3)
This course focuses on direct social work practice on behalf of individuals and their families in all age groups who suffer from chronic illness. Particular emphasis is placed on the psychosocial consequences of chronic illness, its inherent stresses, and concomitant problem areas. The course offers substantive content related to social attitudes, stereotypes, and environmental conditions with reference to their effect on social functioning, interpersonal relationships, and physical mobility. Prerequisite: SSWM 400.
School of Dentistry
The School of Dentistry is a professional school offering a curriculum leading to the Doctor of Dental Surgery degree (D.D.S.). Graduate programs in the dental specialties are also available. The School of Dentistry also offers a program of continuing education courses for dental practitioners and auxiliaries including dental laboratory technicians.

The School of Dentistry 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 Dentistry became an integral part of the University and now occupies a building adjacent to the schools of medicine and nursing and University Hospitals of Cleveland.

The School of Dentistry is a member of the American Association of Dental Schools and all of the programs of the School of Dentistry are accredited by the Commission of Dental Accreditation. Since its organization, it has conferred degrees on approximately 4,500 graduates.

**ADMINISTRATION**

Jerold S. Goldberg, D.D.S. (Case Western Reserve University)

Dean of the School of Dentistry; Professor of Oral and Maxillofacial Surgery

Ronald L. Occhionero, D.D.S. (Case Western Reserve University)

Associate Dean for Clinical Affairs; Professor of General Practice Dentistry and Chair of the Department

Tim S. Whittingham, Ph.D. (University of Wisconsin), M.B.A. (Case Western Reserve University)

Associate Dean for Academic Affairs; Associate Professor of Oral Diagnosis and Radiology

Stanley A. Hirsch, D.D.S. (Case Western Reserve University), M.S. (Indiana University)

Associate Dean for Graduate Studies; Associate Professor of Oral Pathology and Acting Chair of the Department

Christine H. Williams, M.B.A. (Case Western Reserve University)

Assistant Dean and Director of Development and Alumni Affairs

Philip C. Aftoora, B.S. (University of Dayton), M.A. (Case Western Reserve University)

Director of Student Services

David A. Dalsky, B.A., M.Ed. (Kent State University)

Director of Admissions

Timothy R. Martin, B.B.A. (Kent State University), M.B.A. (University of Akron)

Administrative Manager

**FACULTY**

Thomas C. Abrahamsen, D.D.S. (University of Illinois), M.S. (University of Texas)

Associate Professor of General Practice Dentistry

Yasser Armanazi, D.D.S. (Al-Baath University, Syria)

Assistant Professor of Pediatric Dentistry

Hussein M. Assaf, D.D.S. (The Ohio State University)

Assistant Professor of Restorative Dentistry

Nabil F. Bissada, B.D.S. (University of Cairo, Egypt), D.D.S. (Case Western Reserve University), M.S.D. (University of Minnesota)

Professor of Periodontics and Chair of the Department

Seth B. Canion, D.D.S. (Howard University)

Associate Professor of Pediatric Dentistry and Chair of the Department

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Associate Professor of Restorative Dentistry and Chair of the Department

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Assistant Professor of General Practice Dentistry

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James A. Lalumandier, D.D.S. (Georgetown University), M.P.H. (University of North Carolina)

Assistant Professor of Community Dentistry and Executive Officer of the Department

Michael D. Marshall, D.D.S. (State University of New York), M.D. (Mt. Sinai School of Medicine)

Assistant Professor of Oral & Maxillofacial Surgery

André K. Mickel, D.D.S., M.S.D. (Case Western Reserve University)

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Assistant Professor of Orthodontics

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Associate Professor of Restorative Dentistry

Aaron Weinberg, D.M.D., Ph.D. (The Hebrew University, Israel)

Associate Professor of Periodontics

Tim S. Whittingham, Ph.D. (University of Wisconsin), M.B.A. (Case Western Reserve University)

Associate Professor of Oral Diagnosis and Radiology; Associate Dean for Academic Affairs

Stephen Wotman, D.D.S. (University of Pennsylvania)

Professor of Community Dentistry
Facilities

PHYSICAL RESOURCES

The entire Health Sciences Center has been designed so that students can travel from the School of Dentistry to the School of Medicine, the School of Nursing, the Health Sciences Library, the Health Sciences Dining Room, and any component of University Hospitals without having to go outside.

The Dental School building was designed to provide a modern teaching facility. The Multi-discipline Laboratories are designed and equipped so that the basic sciences (except for anatomy), technique, and pre-clinical laboratory work and study 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 a 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. The total collection currently numbers 351,004 volumes. More than 2,841 journals are received.

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 dentistry, medicine, and nursing and the Department of Biology. The audiovisual collection and services are provided at the Health Center Library.

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 library patrons in the use of the library and its bibliographic resources. Items not available on campus may be obtained through interlibrary loan. Other services provided are quick telephone reference, citation verification, and computerized or manual bibliographic searches. The library staff can provide on-line searching of more than 100 data bases.

HOSPITAL AFFILIATIONS

The School of Dentistry has working relationships with many hospitals and health clinics in the Greater Cleveland community. Third and fourth-year 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 Dentistry. Graduate departments in Oral & Maxillofacial Surgery and Pediatric Dentistry are based at this facility. A variety of educational and research opportunities exist in relation to this affiliation.

The Veterans Administration Hospital is a modern 780-bed hospital in the University Circle area. The hospital provides dental services for both outpatient and inpatient veterans.

THE FREE CLINIC

The Free Medical Clinic of Greater Cleveland, at 12201 Euclid Avenue, is a nonprofit community service organization that presently offers medical, dental, pediatric, 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.

Dental students may volunteer their services to any of the programs at the clinic. However, most participate in delivering dental care to the indigent; this also increases students’ skills in emergency and comprehensive patient care.

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 Case Western Reserve University School of Dentistry is to provide contemporary programs that educate and train students to become competent dentists and dental specialists, and to provide programs of postgraduate and continuing education that improve the abilities, knowledge, and skills of members of the dental profession. The school will accomplish its mission through curricula that integrate knowledge of the behavioral, biomedical, and clinical sciences. Through opportunities for...
scholarship and research, the school will encourage individual development and provide leadership to the profession. Through service, the school will improve the oral health and the health care of the community.

**Dental Education Program**

The students who enter the School of Dentistry are very carefully selected and already have 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 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.

The Committee on Dental Education studies, reviews, and evaluates the school's educational goals and objectives, subject matter, grading systems, and clinical and laboratory experiences.

For a complete description of the programs leading to the Doctor of Dental Surgery degree or Master of Science degree in dentistry, see the appropriate pages of this Bulletin.

**Continuing Education**

The School of Dentistry, in conjunction with the Greater Cleveland Dental Society, offers an expanding program of continuing dental education to practicing dentists and auxiliary personnel.

Guest lecturers, including faculty, who have distinguished themselves in one of the many specialty areas of dentistry present courses on an annual basis.

The continuing education courses encompass the expanding horizons of dentistry in the future, covering such subjects as endosseous implants, periodontics, oral medicine, endodontics, dental materials, esthetic dentistry, restorative and prosthetic dentistry, occlusion, practice management, and orthodontics, as well as expanded functions for dental auxiliaries.

These courses are designed to keep the practitioner abreast of current procedures and enrich the participant’s knowledge of the newest and most accepted advances in all subjects of dentistry. Courses may include subject matter of an experimental and/or controversial nature. This material is offered to the profession for educational and informational purposes in a spirit of academic freedom.

Participants are given the opportunity to weigh the validity and usefulness of this material according to their own professional experience and judgment.

All CWRU Dental School continuing education courses are eligible for fellowship and mastership credit through the Academy of General Dentistry (AGD).

**Continuing Education Recognition Provider**

The CWRU Dental School continuing education program is an ADA-recognized provider (Continuing Education Recognition Program.)

**LICENSE TO PRACTICE DENTISTRY IN OHIO**

Currently the license to practice dentistry is granted by the Ohio State Dental Board after successful examinations.

The candidate must be 21 years of age, show evidence of good moral character, and affirm that he or she understands the Ohio Dental Law.

Specific information for the various states should be obtained from individual state boards of dentistry.

**Admission**

**ADMISSION TO THE D.D.S. PROGRAM**

The Case Western Reserve University School of Dentistry is a participant in the American Association of Dental Schools Application Service (AADSAS). An application request card may be secured from either AADSAS, 1625 Massachusetts Avenue, N.W., Suite 101, Washington, D.C. 20036, or from the School of Dentistry.

All applicants are required to take the Dental Admissions Test, which is conducted by the Council on Dental Education of the American Dental Association, in electronic format at Sylvan Learning Centers. The School of Dentistry recommends that the test be taken no later than April of the year before the expected date of application. The scoring of the Dental Admissions Test is on a range of 1 to 30, with the mean score being 16; each integer represents one half of one standard deviation.

**Personal Interviews**

All accepted applicants to the School of Dentistry are interviewed by the Admissions Committee before acceptance. Since it is physically impossible for the committee to interview every applicant, interviews are held only at the invitation of the committee.

**Academic Requirements**

Matriculation at the School of Dentistry requires a minimum of 60 semester hours or its equivalent of collegiate courses exclusive of physical education and military training. Most applicants have completed three or more years of work toward a bachelor’s degree by the time they enter dental school.

Primary consideration is given to applicants with a superior grade point average in both overall course work and prerequisite pre-dental courses. All applicants are expected to have demonstrated compe-
tence in the basic prerequisite courses. Students likely to be given first priority are those who have achieved superior grades in the basic sciences and who have taken an adequate sampling of courses in the social sciences and humanities to give them a broad background. Candidates with major areas of concentration in fields other than the basic sciences are given equal consideration with those who have majored in the basic sciences.

In order to permit maximum flexibility in the selection of candidates, the school has established a limited number of specific prerequisite courses. These include a minimum of 12 semester hours of chemistry (of which 6 semester hours should be in organic chemistry), 6 semester hours in biology, 6 semester hours in physics, and 6 semester hours in English. All prerequisite science courses must include laboratory instruction. These minimal requirements permit superior applicants to pursue a variety of subjects in their areas of academic interest. Students who have difficulty in the prerequisite science courses are encouraged to pursue additional work in the sciences.

Pre-dental electives suggested by the Admissions Committee include comparative anatomy, cell biology, genetics, biochemistry, microbiology, and physiology. These courses are helpful in providing a foundation for the basic science courses to be taken in dental school. However, advanced science courses should not be taken to the exclusion of courses in the humanities and social sciences, which are likely to enhance the applicant’s social and verbal skills and facilitate effective dealings with patients.

Advanced science courses most commonly taken during the undergraduate years by CWRU dental students include anatomy, biochemistry, calculus, cell biology, genetics, microbiology, and physiology.

Letters of Recommendation
The applicant should arrange to have letters of recommendation sent to AADSAS at the time the completed application is forwarded to AADSAS. These should be from the Pre-Dental Advisory Committee at the applicant’s college. If no Pre-Dental Advisory Committee exists, letters from two instructors in the basic sciences are acceptable. Additional letters may be requested by the Admissions Committee.

Deposit of Acceptance
In accordance with the guidelines of the American Association of Dental Schools, applicants will not be advised of acceptance before December 1 of the year preceding their enrollment. Acceptances on or after that date are provisional and are contingent on the applicant’s maintenance of an acceptable level of achievement throughout the remainder of the college program. Upon notification of acceptance, the applicant is required to make a deposit of $1,000, due 45 days from the date of acceptance. All deposits apply toward tuition and are non-refundable and nontransferable.

After January 1, the payment of the deposit is required no later than 30 days after notification of acceptance. By July 15, the balance of tuition for the first semester of the first year must be paid.

Advanced Standing
A student in good standing at another dental school or a graduate of a foreign dental school may be considered for advanced standing at this school. Acceptance is based on the review of credentials, personal interview, and bench testing where applicable. Transfers for students attending other dental schools can be arranged only if schedules and course content at the other school are similar to those of the Case Western Reserve University School of Dentistry.

The transferring student or foreign-trained dentist must submit a written request to the Committee on Admissions of the School of Dentistry indicating a desire for transfer or be considered for advanced standing. Upon receipt, an application will be sent. In addition to the completed application form, the applicant must submit all undergraduate and dental school transcripts, Dental Admissions Test scores, Dental National Board scores, a letter from the dean of the school of current attendance stating that the applicant is in good standing, or in the case of a foreign graduate, a letter from the dean of the school attended stating that the student was graduated and at what rank, and other information deemed appropriate by the committee. The fee for application to advanced standing is $55 and must accompany the submitted application.

If the committee decides that a transfer or advanced placement is feasible, the applicant will be required to pass a laboratory “bench test” examination in the clinical sciences. All travel and lodging costs are borne by the applicant. An additional fee of $150 is charged for those who are required to take a “bench test” and is due at the time of the test.

ADMISSION TO GRADUATE OR RESIDENCY PROGRAMS

PROGRAMS OFFERED
The School of Dentistry, in cooperation with other institutions, offers programs of study in advanced education in general dentistry, endodontics, pediatric dentistry, periodontics, orthodontics, and oral and maxillofacial surgery. Entry requirements vary and are determined by the program director and faculty of each program who selects applicants for admission. Program length, stipends offered and program requirements vary by program. Requests for application materials should be directed to the Office of Graduate Studies of the School of Dentistry or printed from the internet at http://www.cwru.edu/dental/casewebsite/.

All graduate and residency programs are accredited by the Commission of Dental Accreditation of the American Dental Association and are board-eligible programs for the respective specialty boards. The programs in endodontics, orthodontics, and periodontics are master’s degree programs with a certificate granted upon completion of the degree requirements. The residency programs in advanced education in general dentistry and pediatric dentistry are certificate-only programs. The residency program in oral surgery is a joint program with the School of Medicine leading to the M.D. degree and certificate in oral surgery. A certificate-only program in
oral surgery may be available at the discretion of the department.

**Entry Requirements**

The School of Dentistry offers several accredited programs of postdoctoral study leading to a certificate of training, master’s degree, or both. For master’s degree programs, the student must complete all requirements for both the certificate and the master’s degree in order to receive either. The School of Dentistry admits qualified students without regard to race, religion, age, sex, color, sexual orientation, national or ethnic origin. All programs are highly structured and require a commitment to full-time study. Time for employment is limited; enrolled students are not permitted to engage in outside dental practice without the approval of their program director.

In order to be considered for admission, the applicant must submit several items; a completed application form (PASS or MATCH applications are accepted for some programs), all requested supporting documents such as transcripts, letter of recommendation, etc., and an application fee by the deadline published for each program. Incomplete or late applications will not be considered unless all other qualified applicants have been offered admission and a vacancy remains.

The selection of individuals for entry into a program of study is made by the program director (faculty) from the pool of applicants. The general criteria of the most qualified applicants for admission are as follows:

The applicant must be a graduate of dental school accredited by the American or Canadian Dental Association or have been graduated from an institution considered by the School of Dentistry as one of acceptable academic caliber. (Applicants who are currently enrolled as dental students must submit a final transcript and verification of graduation from a dental school prior to entry if selected.)

The applicant must have earned a 3.0 (B) average or its equivalent and/or been graduated in the highest one-third of their graduating dental class.

The applicant must have passed Part I of the National Dental Board and should have an average score of at least 85 and have taken or applied for Part II (to be completed with a score of 85 or higher prior to entry if selected). If the applicant is a graduate of a foreign dental school and has not taken the National Dental Board, recent GRE examination results may be substituted (general test and one subject test in biochemistry, biology or chemistry). GRE scores should be at the fiftieth percentile or higher.

The applicant should have a documented interest in their field of study and must meet additional criteria set by the department to which they are applying.

Applicants graduated from a non-English speaking dental school, and for whom English is not their first language, must take the TOEFL test with a minimum score of 550 (paper-based score) or 213 (computer-based score).

These criteria are considered minimums and a higher level of performance (where applicable) enhances the likelihood of acceptance. Applicants who paid an application fee but were not accepted, can be considered, at no additional fee, for entry the following year. In order for the application to be considered for the following year, a request for reactivation of the application must be made in writing and received by the deadline for applications for the following year. Those not selected for the second year must submit a new application and pay the applicable fee for further consideration.

Applicants selected for residency programs in advanced education in general dentistry, oral surgery, or pediatric dentistry must be eligible for licensure or intern certificate issued by the State of Ohio, and must be a graduate of a dental school accredited by the Commission on Dental Accreditation of the American Dental Association. Foreign applicants are accepted into the programs offered by the Departments of Endodontics, Orthodontics, and Periodontics.

**Admission of Students from Other Countries**

See “Students from Other Countries” section of the General Bulletin.
must be completed no later than the end of the next regular semester or summer clinic session, whichever is sooner. Students cannot be graduated with any failing or incomplete grades and must have a minimum overall cumulative 2.0 grade point average. Each student’s academic performance is reviewed by the Committee on Academic Standing and Promotion as soon as possible after the conclusion of each semester and summer clinic session. Additional review may occur after each eight week period or when grade reports are submitted. The committee sets standards of academic performance for promotion and standing, probationary requirements and remedial actions, and recommends candidates for graduation. The committee, at its option, may place a student on academic review, academic probation, clinical warning, clinical review, clinical probation, require repeat of an academic period, or require a student to withdraw.

The committee will notify each student in writing of their status at least twice each academic year; following the end of each semester and more frequently if necessary. The committee takes reasonable care to accurately evaluate each student and inform them of their status by letter in a timely manner. If a letter cannot be hand delivered, it will be mailed to the student’s official address. The committee reserves the right to reissue letters of standing or promotion at any time it deems necessary. It is the responsibility of the student to fulfill all academic, pre-clinical, and clinical requirements, and to abide by all official policies and protocols outlined in the student services and clinical policy manuals of the Dental School.

For each semester of enrollment, the student is expected to achieve a grade point average of at least 2.0 for didactic courses and 2.0 for pre-clinical technique and/or clinical courses. Students who fail to meet these general guidelines may be placed on:

1. **Academic review:** The student has failed to achieve an acceptable level of performance in a limited number of courses and/or has not achieved a grade point average of at least 2.0. Academic review serves to warn the student that some improvement is required and future promotion may be withheld in the absence of demonstrated improvement. Academic review may, but not necessarily, precede academic probation or dismissal.

2. **Academic probation:** The student has failed to achieve an acceptable level of performance in a number of courses and/or has earned a grade point average deemed unacceptable by the committee. In being placed on academic probation, the student may continue in the program for the next semester, during which time the student must demonstrate an acceptable level of performance or be required to withdraw or repeat an academic period or year. In unusual circumstances, students may be continued on academic probation for one or more succeeding semesters. A student with two or more semesters of probation may become ineligible for federally-sponsored financial aid.

3. **Clinical review:** The student falls short of the minimum expectations for clinical performance, including demonstration of clinical skills and knowledge, patient management, conformity with infection control policies and procedures, attendance and clinical productivity. Clinical review serves to warn the student that some improvement is required and future promotion may be withheld in the absence of demonstrated improvement. Clinical review may, but not necessarily, precede clinical probation or dismissal.

4. **Clinical probation:** The student has failed notably to achieve an acceptable level of clinical performance in one or more of the following areas: clinical skills, clinical knowledge and appropriate application of that knowledge, patient management, conformity with infection control policies and procedures, attendance and clinical productivity. In being placed on clinical probation, the student may continue in the program for the next semester, during which time the student must demonstrate an acceptable level of clinical performance or be required to withdraw or repeat an academic period or year. In unusual circumstances, students may be continued on clinical probation for one succeeding semester.

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**Grades not Averaged**

<table>
<thead>
<tr>
<th>Grade</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>IN</td>
<td>Incomplete and not averaged when received.</td>
</tr>
<tr>
<td>P</td>
<td>Passed and not averaged for pass/fail course.</td>
</tr>
<tr>
<td>NP</td>
<td>Failed and not averaged for pass/fail course; Must be removed through remediation.</td>
</tr>
</tbody>
</table>

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 during a given semester by the sum of the credit hours for all courses in which the student received letter grades of A, A-, B+, B... or F taken during that same semester. The cumulative grade point average is computed by dividing the total grade points earned by the sum of the credit hours for all courses included in the grade point calculation. Grade points earned when an IN grade is replaced by the appropriate course grade are credited to the semester in which the incomplete or course in progress grade was received, but action taken regarding student standing or promotion at the time of the incomplete is not affected.

**Promotion**

The general guidelines used by the Committee on Student Standing and Promotion are that each student must attain a grade point average of at least 2.0 for didactic courses and for pre-clinical technique/clinical courses by the end of the first semester, and each semester thereafter. Students may not be promoted with one or more failing or incomplete grades unless they have entered a remedial program to remove those grades by a deadline set by the course director or committee. In the usual case, the remediation
A student may appeal an action of the Committee on Student Standing and Promotion. The appeal must be in writing, state the basis of the appeal, and be filed within 14 days of the issuance of the notification letter sent to the student informing them of committee action. The written appeal should be directed to the chairperson of the committee. The student may request or be invited to appear before the committee at the hearing of the appeal. The committee will inform the student in writing of the results of the hearing of the appeal. The student is advised to consult with the chairperson, the director of student services, or the associate dean for academic affairs for further information prior to filing the appeal so that the process can be fully explained and the student’s rights protected.

The school reserves the right to require a student to withdraw from the school for any reason it deems sufficient. Academic or clinical failure, moral delinquency, gross misconduct, or failure to meet the specific conditions of probation or review is sufficient reason for requiring withdrawal from the school.

Terms and Course Length

The school year consists of 34 weeks of five days each, exclusive of vacations, and is divided into two semesters of two terms each. The final week of each semester is reserved for examinations. There are mandatory summer clinic and class sessions for all students at the end of the second and third years. A fee is charged for these summer sessions.

Attendance

Students enrolled at the School of Dentistry are expected to pursue their course of study according to a systematic plan as determined by the Faculty. It is the policy of the School that student attendance for clinical and clinic duty assignments is mandatory. Attendance requirements for lectures, laboratories and seminars are at the discretion of the course director. The course director is free to determine the extent to which absences affect the final grade. The student should realize that lack of regular attendance is extremely disruptive of academic progress and every attempt to attend all classes is strongly encouraged. The student should also be aware that the Committee on Student Standing and Promotion will consider faculty notation of poor attendance in its deliberations.

The Office of Student Services serves as a clearinghouse to notify faculty and staff of a student’s absence. Students who are not able to attend classes, laboratories or clinic are to call 216-368-6136 and advise the office of the period and expected duration of an absence and the reason that you will not be able to attend classes. The office will notify appropriate faculty and staff.

Note that the above action does not represent an approved absence. The clearinghouse function provided by the Student Service Office is a notification service. Individual faculty may express their own policy concerning absence as stated in the course outline.

There are situations where an approved absence that excuses the individual from classes et. al. are appropriate. An approved absence requires the approval and signature of the Director of Student Services.

Absence from Examinations

The student is expected to be present at all examinations or provide, when possible, advance notice to the Office of Student Services when absence from an examination is anticipated. If a student fails to provide advanced notice, the student must provide an appropriate excuse. Failing to provide an acceptable excuse, the student will meet with the Director of Student Services and the course director to discuss the absence. Following such consultation, the student will be informed of the consequences. The course director may permit the student to be re-tested (with or without penalty), be assigned a grade of zero for the examination, or receive a failing grade for the course.

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. Such request must be submitted in writing to the Director of Student Services who will forward the request to the Committee on Student Standing and Promotion. The request must be submitted by letter and state the reason for the request, the length of leave requested and the date of return. The Committee will ordinarily grant such requests if the student is currently enrolled and has been in regular attendance prior to the time or circumstances that necessitated the request. The request may be submitted by a parent, spouse or authorized agent of the student if the student is unable to file the request. The maximum length of leave is one year. Students must resume registration at the expiration of the leave unless formally granted an extension. Re-entry into the dental program is determined by the Committee on Student Standing and Promotion and may not necessarily be at the same level attained at the time the leave was granted. The Committee also reserves the right to place a student on Leave of Absence when it has determined that the circumstances warrant that action, even in the absence of a formal request.

M.S.D. Degree and Residency Programs

Registration

Postdoctoral programs operate on a 12 month basis, from July 1st of one year to June 30th of the next. The year is divided into two six-month semesters (Fall, July 1 to December 31; Spring, 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 simplified registration form provided by the Office of Graduate Studies. Each semester, registration must be completed as scheduled by all graduate students and residents. Registration for each semester is handled through the Dental School’s Office of the Registrar. 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 Dentistry, gradu-
Graduate students who are not registered are not considered students of record by the university and subsequently 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.

Under unusual circumstances, special arrangements for registration may be made with permission of the department chairperson and the associate dean for graduate studies. Social Security numbers are used for all records and documents and must be provided at the time of registration. Foreign students will be issued a number for this purpose if they have not obtained a Social Security number prior to registration. New students and new residents who do not register as specified and who have failed to provide satisfactory reasons for the delay in advance, forfeit their right to admission. Vacancies which arise from such circumstances are filled from a list of alternate candidates at the discretion of the department.

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 Office of Graduate Studies for recording by the departmental chairperson. The Office of Graduate Studies maintains the student’s academic record and transmits the grades to other appropriate offices and authorities.

Grades of complete or conditional grades can be awarded only by the course director (see grading policies of the School of Dentistry). Course grades are reported to the Office of Graduate Studies at the beginning of the course. 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. Under unusual circumstances, special arrangements for registration may be made with permission of the department chairperson and the associate dean for graduate studies. Social Security numbers are used for all records and documents and must be provided at the time of registration. Foreign students will be issued a number for this purpose if they have not obtained a Social Security number prior to registration. New students and new residents who do not register as specified and who have failed to provide satisfactory reasons for the delay in advance, forfeit their right to admission. Vacancies which arise from such circumstances are filled from a list of alternate candidates at the discretion of the department.

The following grading system is used at the School of Dentistry for graduate courses:

<table>
<thead>
<tr>
<th>Grade</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>4.00</td>
</tr>
<tr>
<td>A-</td>
<td>3.66</td>
</tr>
<tr>
<td>B+</td>
<td>3.33</td>
</tr>
<tr>
<td>B</td>
<td>3.00</td>
</tr>
<tr>
<td>B-</td>
<td>2.66</td>
</tr>
<tr>
<td>C+</td>
<td>2.33</td>
</tr>
<tr>
<td>C</td>
<td>2.00</td>
</tr>
<tr>
<td>C-</td>
<td>1.66</td>
</tr>
<tr>
<td>D+</td>
<td>1.33</td>
</tr>
<tr>
<td>D</td>
<td>1.00</td>
</tr>
</tbody>
</table>

Grading policies of the School of Dentistry. 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 Dentistry. 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.

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 departmental chairperson, 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 thesis may be transferred from another university.

Graduate credit is not awarded for 100 or 200 level courses or their equivalents.

The Office of Graduate Studies of the School of Dentistry. 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 a graduate 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 chairperson, with a copy filed in the Office of Graduate Studies of the School of Dentistry.

Time Limits

For master’s degree programs, each student is expected to maintain continuous registration and all requirements must be completed within five consecutive calendar years immediately following matriculation as a graduate 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 graduate program is no guarantee of readmission and should not be assumed.

Leaves 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 direc-
tor and to the Associate Dean for Graduate Studies of the School of Dentistry. 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 Dentistry 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 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. Failure to do so will result in separation from the University. 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 chairperson.

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 adviser and chairperson 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 Dentistry may suspend or separate a student from the university for failure to maintain appropriate standards of conduct and integrity in discharging their responsibilities.

Academic failure, moral delinquency, gross misconduct, or failure to meet the specific conditions of probation or academic review is sufficient reason for requiring withdrawal from the school.

Graduation

The minimum requirements for the master’s degree in the School of Dentistry are 54 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 48 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 Dentistry no later than two months before commencement at which the degree is expected.

Candidates must meet all deadlines for completion of degree requirements set forth in the calendar issued by the Office of Graduate Studies for the School of Dentistry. All thesis students must be registered during the semester in which the degree is awarded (also see “Delayed Graduation”).

The awarding of the degree is dependent upon the satisfactory completion of all requirements, and the recommendations of department chairperson, Committee on Graduate Studies, and Faculty of the School of Dentistry. 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 thirty 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.

DEGREES CONFERRED

The degree Doctor of Dental Surgery (D.D.S.) is awarded to students successfully completing the four-year professional program offered by the school. The Master of Science in Dentistry (M.S.D.) degree is awarded to graduate students who successfully complete a graduate program of advanced study.
Degrees are granted by the university on the recommendation of the faculty subject to the satisfactory completion of all curricular requirements and the discharge of all financial obligations to the university. The recommendation for a degree is discretionary with the faculty, and there is no contract stated or implied, between the university and the student that a degree will be conferred at any stated time, or at all.

Withdrawals and Refunds
To officially withdraw from the School of Dentistry, a written notice must be submitted to the dean for approval. Failure to attend class or merely giving notice to an instructor will not be regarded as an official notice of withdrawal.

A student who withdraws after the start of a semester must pay a portion of the usual tuition. The student is charged at the rate of 10% per week, or portion thereof, that classes have been in session to the time of withdrawal. No portion of the tuition is refunded after the ninth week of class or if a student withdraws at any time during the first semester in a program of study. If the withdrawal occurs during the time that the student is enrolled in summer clinic, the student is charged at a rate of 12.5% per week of usual fee for summer clinic.

The university will refund any tuition paid for a semester by any student in good standing who is inducted, or called to active duty, by the Armed Forces of the United States prior to completing that semester, and who does not receive credit for the work completed during that semester.

Appropriate Attire
All students are expected to dress appropriately. The dental student is obliged to follow the dress code developed by the Dental Student Council and approved by the faculty. Graduate students and residents are expected to dress in a manner acceptable to their department.

Student Services

STUDENT ACTIVITIES
The School of Dentistry encourages its students to avail themselves of cultural opportunities within the university and the community.

Each class has its own student organization which is governed by the students, with advice from the dental school’s Office of Student Services and other teaching staff when such advice is requested.

The Student Council is an organization representing the entire student body whose purpose is to advance the interests of the students of the School of Dentistry and the university.

Students of the School of Dentistry share in university athletics, participating in interclass, interdepartmental, and intercollegiate contests in various activities.

The School of Dentistry has chapters of three of the national dental student fraternities: Alpha Omega, Delta Sigma Delta, and Psi Omega. Students of all classes are eligible for student membership in the American Dental Association.

American Student Dental Association
The American Student Dental Association (ASDA) is a student organization of approximately 20,000 individual predoctoral and postdoctoral members organized into chapters, one at each of the U.S. dental schools. The ASDA is committed to the following:
1. Developing and training future leaders of the dental profession
2. Improving the quality of dental education
3. Disseminating information of value to dental students
4. Promoting the social, moral, and ethical obligations of the profession
5. Ensuring due process for all dental students
6. Representing dental students before legislative bodies and organizations
7. Providing opportunities for students and recent graduates to deliver health care to people in areas of need

The local chapter at Case Western Reserve University, representing more than 90 percent of the dental students, provides benefits that include:
1. Five professional publications
2. Reprints of national dental board examinations
3. Insurance at low group rates (disability/major medical, equipment, professional liability, term life insurance)
4. Reduced ADA dues upon graduation.

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.

The dental school’s Office of Student Services acts as a resource for individual dental students, and for classes as a whole, providing services and administering programs that supplement the regular curriculum and enrich the quality of student life. Programs under the direction of this office include:

Freshman Orientation
Incoming students are introduced to the school, the university, and the Cleveland area in a three-day program presented by the Office of Student Services, faculty members, and upperclass students.

Faculty Advisers
All students are assigned to faculty advisers during freshman orientation. The advisers are volunteers from the faculty who offer the students guidance and fellowship during their educational program.

Student Monitoring
The Office of Student Services monitors student grades on a regular basis and works individually with students. Students are assisted in defining problems, identifying available resources, and choosing specific steps to be taken toward improvement.
Tutoring
The Office of Student Services provides tutoring for students who need to improve their academic performance. The tutors are usually upperclassmen or graduate students. Students may seek tutoring on their own or be recommended for tutoring by course instructors. Tutors emphasize study techniques, time allotment, problem solving, and communication in addition to comprehension of content.

Senior Options
Junior and senior students are given the opportunity to participate in elective courses. More than 30 courses are offered in such areas as specialty education, research, and business management training.

Honors, Prizes, and Awards
Recognition, both honorary and monetary, is given to students who achieve excellence in different facets of their dental education. A complete description of each award is available in the Office of the Dean.

Scholastic Achievement
Alpha Omega Fraternity Award for Scholarship
Omicron Kappa Upsilon
Callahan Prize
American Academy of Oral Medicine
American Association of Women Dentists Award

General Dentistry
American College of Dentists, Ohio Section
International College of Dentists
Pierre Fauchard Academy Award
Community Dentistry Robert Dean Feder Award

Comprehensive Dental Care
Ohio Academy of General Dentistry

Endodontics
American Association of Endodontists
Doctor Paul P. Sherwood/Hrutkay Award

Operative Dentistry
Academy of Operative Dentistry
Oral Diagnosis, Radiology, and Treatment Planning
American Academy of Radiology
American Academy of Oral Medicine

Oral Pathology
American Academy of Oral Pathology
Oral and Maxillofacial Surgery
American Association of Oral and Maxillofacial Surgeons
American Dental Society of Anesthesiology, Incorporated

Orthodontics
American Society of Orthodontists

Pediatric Dentistry
American Society of Dentistry for Children
Academy of Dentistry for the Handicapped

Periodontics
American Academy of Periodontology

Prosthodontics
Dentsply International Merit Award in Prosthodontics

Practice Management
Richard A. Collier Prize

Research and Scientific Papers
Alpha Omega Prize
Block Drug Award

Academic Programs

DOCTOR OF DENTAL SURGERY DEGREE CURRICULUM
The Doctor of Dental Surgery curriculum is a sequence of learning experiences designed to prepare the student to serve as an effective general dental practitioner. The present curriculum is a “diagonal” structure designed to give the student a broad foundation through initial instruction in the basic sciences and an introduction of limited clinical experiences during the early period of education. As the student progresses through the educational program, clinical experience increases to facilitate integration of basic science information with clinical science training.

Methods of Instruction
The traditional methodology of lecture, seminars, laboratory, and clinical teaching is augmented by the use of teaching aids developed at the School of Dentistry and elsewhere. Among these aids are:

1. Television monitors for live and taped presentations
2. Slides with accompanying text (audio and visual)
3. Programmed texts and exercises
4. Sequential models

Instructional techniques utilized are intended to encourage students to be active participants in their education wherever possible, and are facilitated by small group conferences, seminars, and demonstrations. These small group settings promote personal and informal communication between students and instructors. In addition, the resources of the libraries offer the opportunity to satisfy personal interests and professional aspirations.

Combined Degree Programs
By arrangement with the College of Arts and Sciences of Case Western Reserve University and other cooperating institutions of higher education, an in absentia privilege is accorded undergraduates in their senior year whereby the first year of professional study may be substituted for the last year of liberal arts education. The student may be granted a baccalaureate degree by the liberal arts college upon completion of the first year in the School of Dentistry. Arrangements for this in absentia privilege must be made by the student with the liberal arts college before entering the School of Dentistry. This option must be exercised at completion of the first year of study in the School of Dentistry unless permission is granted by the undergraduate college and dental school by prior arrangement.

Joint Degree Programs
Students enrolled full time in the School of Dentistry desiring to enter a joint degree program must apply and be admitted to a non-dental degree program of another school of the university through the usual process followed for admission at that school. If accepted, the student must notify the associate dean for academic affairs in writing at least four weeks prior to the start of the semester they wish to initiate non-dental course work in the joint degree program. A dental student must be in the top one-half of the class to be eligible to enter a joint degree program and may not begin earlier than the second semester of the first year.
If the student appears eligible for the initiation of a joint degree program, a dental faculty member will be assigned as an adviser to the student. The faculty adviser will be responsible for routine matters such as assisting in registration (e.g., add slips) in addition to the advisory function. Students should be assigned, or request, an adviser on the faculty of the second school in which non-dental course work is taken.

Eligible students must meet with the advisers and program coordinators of both schools. Following this meeting, the student will be provided with a written agreement and guidelines specifying the program which will have priority in all future considerations, a curriculum plan and projected timetable for the completion of course work, and other conditions or stipulations in effect that will govern the student’s tenure in both programs.

The student will acknowledge the agreement with their signature.

First year students are limited to one course (3 credit hours) in the first semester (spring) of a joint program. Upper level students (years two through four) in good standing (defined as top one-half for this purpose) may enroll for up to two courses (six credit hours) in each of the fall or spring semesters. Course work undertaken in the non-dental program should not ordinarily be scheduled during the regular school hours at the School of Dentistry unless approval is granted by the associate dean for academic affairs. Course work taken as a part of the non-dental program cannot be used to meet the requirements of the dental program.

Tuition charges for course work taken in the non-dental program are the responsibility of the School of Dentistry to the extent outlined in the agreement and to a maximum of six credit hours per semester (fall and spring semesters only) if the student fulfills all eligibility requirements, is enrolled full time and in good standing at the School of Dentistry, and is current in the payment of tuition to the School of Dentistry. Tuition charges for non-dental courses taken during the summer semester are the responsibility of the student. Enrollment in a joint degree program does not constitute a guarantee that a degree will be granted for either program at any given time or at all.

Permission to continue in the joint program may be withdrawn by either school for a variety of reasons including, but not limited to, poor or failing grades or grade point averages, incompleteness or tardiness in completing program requirements, delinquency in payment of tuition, nonacademic or academic probation, suspension or dismissal.

Problems that might arise will be resolved on a case-by-case basis by the associate dean for academic affairs and the faculty advisers in consultation with the student. The student may appeal any unfavorable decision to the Committee on Student Standing and Promotion for final resolution.

Special Programs for Undergraduates

The College of Arts and Sciences and the School of Dentistry jointly offer two programs for exceptionally able and well qualified high school seniors who plan to pursue careers in dentistry. Students admitted to these programs will be provided with advisers from both the College of Arts and Sciences and the School of Dentistry. Prior to enrollment in the School of Dentistry, all students are required to achieve an acceptable performance on the Dental Admission Test given by the American Dental Association. Students in the Six-Year Dental Program should take the test no later than April of the second year and must achieve an average of 15 or higher on both “Academic” and “PAT” portions of the test.

Six-Year Dental Program

The Six-Year Dental Program is designed to enable the especially mature student who is determined to pursue a career in dentistry to accelerate his or her undergraduate and professional education.

The first two years of the program are spent in the College of Arts and Sciences. Students are required to follow a specific curriculum. In order to secure the place reserved for them in the first class year at the School of Dentistry, students must earn a cumulative average of 3.0 or higher for all course work attempted and must achieve grades of “B” or higher in the required courses in biology, chemistry, and physics.

After successful performance in the pre-dental part of the program and on the Dental Admission Test, students in the Six-Year program move into the first year of dental school. The D.D.S. is awarded upon completion of the six-year program.

Up to 10 students can be admitted to the Six-Year Dental Program each year.

Pre-Professional Scholars Program in Dentistry

The Pre-Professional Scholars Program in Dentistry is designed for those who desire careers in dentistry but wish to broaden and enrich themselves with a full undergraduate program before embarking on study in a professional school. Such students matriculate in the College of Arts and Sciences with a conditional commitment for admission to the School of Dentistry to be honored upon completion of the bachelor’s degree.

Students are free to develop and follow a course of study that reflects their educational interests and needs rather than concentrating solely on activities that enhance their chances for admission to professional study. Participants will be expected to take the courses required of pre-dental students and to maintain a grade point average of 3.0 or higher both for their work in the sciences and overall.

Expanded Function Dental Auxiliary Program

The School of Dentistry offers a non-degree certificate course in expanded dental functions to dental auxiliaries with requisite training and experience. The program prepares the student to take an examination administered by the Ohio Commission on Dental Testing for Advanced Qualified Personnel.

The Expanded Function Dental Auxiliary course is a 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.
Basic Science Programs

The most direct route toward a career in research is through the Doctor of Philosophy degree programs offered by the departments that are basic to health education: anatomy, biochemistry, microbiology, pathology, pharmacology, and physiology. Inquiries about these non-dental school programs should be addressed to the Dean of Graduate Studies, whose catalogue provides specific information about these programs. Fellowships may be available to qualified students to assist them during their period of study and research leading to an advanced degree.

The curricula of the School of Dentistry are designed to provide general education in dentistry or in areas of clinical specialization. However, recognizing the need within dentistry for individuals qualified for teaching and research, the School of Dentistry may provide the use of its facilities and faculty as part of a cooperative program in the training of such individuals.

Dentistry (DENC, DEND, DENT)

PROFESSIONAL COURSES
(D.D.S.)

DENC 122. Preventive Periodontics (1)
Companion clinical component to DEND 121. Clinical application of methods for the prevention and maintenance of periodontal health on patients. The importance of patient education, motivation, and cooperation in present methods of prevention and plaque control.

DENC 162. Dental Anatomy (1)
Companion preclinical component to DEND 162. Laboratory exercises and assignments include drawings, waxups, tooth identification, use of semi-adjustable articulator.

DENC 163. Masticatory Dynamics (1.5)
(See DENC 162.)

DENC 168. Prosthodontic Technology (2)
Companion preclinical component to DEND 168. Each student constructs a complete set of dentures using laboratory manikin as patient. Although DENC 168 was conceived as a technique course, one of its principal objectives is to prepare the student for the clinical aspect of dental education.

DENC 222. Periodontics (1.5)
Companion clinical component for DEND 222. 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.

DENC 227. Oral Diagnosis and Treatment Planning (.5)
Companion clinical component for DEND 227. Clinical experiences consisting 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 where the students diagnose and treat a variety of acute oral complaints; and clinical conference with a staff member where the student carries out diagnosis and treatment.

DENC 248. Endodontics (.5)
Companion laboratory component to DEND 248. Complete endodontic treatment performed by each student on extracted teeth using gutta percha.

DENC 267. Partial Denture Design Lab (1.5)
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.

DENC 271. Basic Procedures of Restorative Dentistry (2.5)
Companion laboratory component to DEND 272. Exercises in restorative dentistry in the preclinical laboratory including tooth preparation and restoration, related techniques, biomechanics, and clinical application. Single-tooth and fixed partial prosthesis on a typodont according to modern principles of design, occlusion, and esthetics.

DENC 272. Basic Procedures of Restorative Dentistry (3)
(See DENC 271.)

DENC 282. Orthodontics (1)
Companion laboratory component to DEND 282. Application and fabrication of various orthodontic appliances.

DENC 322. Periodontics Clinic (1.5)
Companion clinical component to DEND 321. Clinical treatment in conjunction with residents and faculty.

DENC 328. Oral Diagnosis and Treatment Planning (1)
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.

DENC 348. Endodontics Clinic (1.5)
Companion clinical component to DEND 348. Clinical application of all these principles.

DENC 364. Operative Dentistry Clinic (1.5)
Companion clinical component to DEND 364. Clinical application of the basic principles of operative and cosmetic dentistry.

DENC 368. Removable Prosthodontics Clinic (1.5)
Companion clinical component to DEND 368. Clinical experiences in removable prosthodontics.

DENC 374. Fixed Prosthodontics Clinic (1.5)
Companion clinical component to DEND 374. Clinical experiences in fixed prosthodontics.

DENC 378. Pediatric Dentistry and Applied Nutrition (1.5)
Companion clinical component to DEND 378.

DENC 389. General Practice Dentistry (3)
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, student cases, techniques, and journal articles are discussed.
ENCE in the provision of emergency den-
various specialties as required. Experi-
diagnosis, treatment planning, and actual
dentist. The preceptor guides students in
ceptor group led by a practicing general
is assigned for clinical training to a pre-
Comprehensive dental care. Each student
DENC 489. General Practice Dentistry (5)
(See DENC 489.)

**DEND COURSES**

**DEND 101. Gross Anatomy (5)**
Anatomy of the human body in three parts: musculoskeletal, visceral, and head and neck. Special emphasis on the develop-
mental origins and biomechanics of the components of the face and masticatory apparatus.

**DEND 102. Dental Histology (3)**
Ultrastructure cytology, general histology, and organology. Histophysiological correlations.

**DEND 104. Neurobiology (3)**
An integrated approach to the anatomy and physiology of the human nervous system. Analyzes neuronal phenomena at
both cellular and systems levels. Focus on
the principles of organization of those
components related to the neurology of
the jaws.

**DEND 106. Oral Histology (2)**
Development of teeth and supporting tis-
ues. Histology and ultrastructure cytology
of the oral region with emphasis on the
calciﬁed tissues.

**DEND 107. Biochemistry (4.5)**
Structure and metabolism of carbohydrates, lipids, proteins, and nucleic acids and their functions in the life processes of the

cell.

**DEND 108. Physiology (5)**
This course investigates the functions of human organ systems in the healthy state and leads to an understanding of the
workings of the human body. Muscle, bone, gastrointestinal, cardiovascular, re-

**DEND 110. Special Topics in Dentistry (5-4)**
Directed study under faculty supervision and with special permission of the associ-
ate dean for academic affairs.

**DEND 111. Introduction to Doctoral
Studies (5)**
This eight hour seminar at the very be-

ing of the ﬁrst year is designed to in-
troduce dental students to aspects of den-
tal education that may differ signiﬁcantly
from their previous experience in school.

Various inventories on critical thinking, learning styles, and behavior types, will
be distributed, scored, and discussed in
light of the interaction of personal style
and the structured sequential system of
the curriculum and faculty. In addition,
patient expectations and their own expec-
tations of professional life and behavior
will be discussed.

**DEND 115. Dental Health Ecology (1)**
Nontechnical aspects of dental practice,
including dental organization, community
dentistry, methods of delivery and pur-
chase of dental care. Dental practice
modes are observed and discussed.

**DEND 116. Introduction to Microbiology
and Infection Control (2.5)**
Introduction to the basic concepts, char-
acteristics and techniques used in the
study of the clinically and orally signiﬁ-
cant microbial groups: viruses, bacteria
and fungi. The structure, metabolism, ge-
netics and control of each microbial group
will be described. Also, the introduction
of the molecular, cellular and organis-
mal mechanisms responsible for the human
immune response system. Basic concepts
of infection control in the clinical setting
will be reviewed.

**DEND 119. Biostatistics and Skill
Development (1)**
Students initiate evaluation of experi-
mental design and apply analytical statis-
tics to the critical reading of dental litera-
ture.

**DEND 121. Preventive Periodontics (1)**
A laboratory lecture and clinical course
in basic procedures including scaling, pol-
ishing, instruction in home care, and a
system of instrumentation for thorough
prophylaxis in preparation for clinical
treatment. An understanding of the for-
mation, composition, and relation of den-
tal plaque to the occurrence and preven-
tion of periodontal disease. Emphasis on
periodontal health and recognition of
early disease condition.

**DEND 162. Dental Anatomy (3)**
Descriptive anatomy of masticatory
structures with emphasis on deciduous
and permanent teeth and the tempo-
mandibular-mandibular movements, and
the fundamental concepts of the func-
tional relationships between the dentition
and the temporomandibular joint. Lec-
tures on comparative anatomy and vari-
tions in tooth morphology.

**DEND 163. Masticatory Dynamics (2)**
(See DEND 162.)
DEND 168. Prosthodontic Technology (4)
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.

DEND 182. Facial Growth and Development (1)
Introduction to the normal and abnormal growth and development of the human face.

DEND 191. Dental Ergonomics (1)
Instruction and demonstration in the objectives of four-handed dentistry. Causes and treatment of fatigue and stress in the treatment room, criteria for the selection of functionally designed dental equipment, chair/positioning for the doctor, patient, and auxiliary, aspiration and retraction, instrument and material transfer, and various delivery systems. Clinic assignments.

DEND 211. General Pathology (4)
General principles of pathology; etiology; retrograde changes; inflammation and repair; bacterial, viral, and mycotic infections; and disturbances of growth presented as an introduction to a more detailed consideration of oral pathology. The pathology of the organ systems.

DEND 214. Oral Pathology (4)
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 systemic disease.

DEND 215. Immunology and Medical Microbiology (4.5)
Fundamental concepts of bacteriology, virology, and immunology, and their interrelationships in systemic and oral disease processes.

DEND 222. Periodontics (1)
A comprehensive course in periodontology including etiology, diagnosis, radiographic interpretations, and prognosis.

DEND 225. Physical Evaluation (1.5)
Involves the exploration of patient database building. The scope and methods for data collection, physical examination appropriate to dental care, data recording, and data interpretation are discussed in order to be able to assess the patient’s ability to receive dental care safely. The recognition of signs and symptoms of medical and dental disease and the implications for patient well-being are discussed. Systematic evaluation of the patient’s physical examination, medical history, and dental history are integrated so that differential diagnoses may be developed.

DEND 227. Oral Diagnosis and Treatment Planning (2)
This course presents a comprehensive and systematic approach to oral diagnosis and treatment. To accomplish this the student is presented with: 1) the pertinent steps and modalities to follow in the examination of the patient; 2) a diagnostic sequence which can be followed in a dental practice; 3) a method of differential diagnosis of oral lesions based on a classification of lesions as grouped according to their similar clinical and/or radiographic appearances; and 4) a working knowledge of the common oral lesions that are thus classified.

DEND 228. Diagnosis and Treatment Planning (1)
Initial course teaching the second-year dental student the basic principle of taking an intraoral radiographic series. Also discussed are the physics involved in x-ray generation, the parts and function of the x-ray unit, head and neck anatomy and pathology in regards to radiographic interpretation.

DEND 229. Principles of Radiography (1.5)
Initial course teaching the second-year dental student the basic principle of taking an intraoral radiographic series. Also discussed are the physics involved in x-ray generation and the parts and function of the x-ray unit. Head and neck anatomy and pathology in regards to radiographic interpretation.

DEND 230. Advanced Principles of Radiography (1)
This is a continuation of DEND 229. This course will explore alternative intraoral radiographic techniques, extraoral radiography techniques, their uses and limitations. Also, discussion of radiation safety in the dental office and film processing. An opportunity to gain “hands-on” experience in learning to align a patient for a panoramic radiograph, expanding diagnostic skills, and thoroughly reviewing radiographic anatomy and pathology.

DEND 243. Pharmacology (4)

DEND 248. Endodontics (1)
Introduction to methods and materials necessary for successful root canal therapy.

DEND 251. Oral Surgery I-A (.5)
Review of head and neck anatomy with clinical correlations.

DEND 252. Oral Surgery I (1)
Anatomy pertaining to local anesthesia. Drugs used in local anesthesia and technique of administration. Management of complications. Slides and clinical demonstrations.

DEND 267. Partial Denture Design (4)
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.

DEND 271. Basic Procedures of Restorative Dentistry (2.5)
Lectures, demonstrations, and instruction in restorative dentistry related to techniques, biomechanics, and clinical application. Single-tooth and fixed partial prosthesis according to modern principles of design, occlusion, and aesthetics.

DEND 272. Basic Procedures of Restorative Dentistry (2.5)
(See DEND 271.)

DEND 282. Orthodontics (1)
Presents principles of orthodontics including relevant areas of applied growth and development, diagnosis methods, biomechanics, and techniques. Histologic and physiological changes due to orthodontic tooth movement, and biomechanics and laboratory techniques related to the fabrication and use of suitable orthodontic appliances. Biomechanical principles and the materials science and biologic background necessary for proper clinical management of these appliances.

DEND 284. Dentofacial Morphology (1)
Study of the direct association between the static dentition and the dynamics of facial growth and development studied from the onset of calcification of the deciduous teeth through the mixed-dentition stages to the final eruption of the third molars in functional occlusion.
DEND 291. Dental Patient Management (.5)
Lectures in the principles of auxiliary management. Overview of organization management, communication skills, duty delegation, and organization of work. Information is provided about the dental allied health fields, duties, responsibilities, training, and testing.

DEND 307. Biochemistry (4)
(See DEND 107.)

DEND 312. Oral Cancer Diagnosis (1)

DEND 315. Practice Management I (2)
Basic concepts of accounting and business management are presented in order to allow students to interpret financial reports, with particular emphasis on dental-related documents. Students are also exposed to different types of practice arrangements available in a dental career, as well as contracts they may need to analyze.

DEND 320. Issues and Trends (1)
Major issues and trends that affect oral health and the mission of dentistry in the United States. Critical analysis and discussion of journal articles in the dental literature.

DEND 321. Periodontics (1)
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.

DEND 327. Diagnosis and Treatment Planning II (1)

DEND 332. Geriatric Dentistry (1)
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.

DEND 333. Management of Medical Emergencies (1)
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.

DEND 340. Physiopharmacological Basis of Oral Medicine (2)
Lectures and case studies designed to review the normal physiology of organ systems, and to discuss the pathophysiology of disease states of special interest, the principles of current and accepted medical and/or pharmacological management of these conditions, and the basis for modification of dental therapy. The student will (1) acquire essential knowledge to assess the functional state of various organ systems based on the recorded medical and drug history and the correlation of significant clinical, laboratory, and radiographic findings; (2) be prepared to prescribe for maximum benefit and recognize the clinical ramifications of concomitant drug therapy; and (3) initiate appropriate medical consultations or referrals for suspected problems and modify dental therapy as dictated by the presence of a particular disease.

DEND 348. Endodontics (1)
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. Prerequisite: DEND 248.

DEND 351. Oral Surgery II (1)

DEND 352. Oral Surgery III (1)
Hospital procedures and protocol and the management of surgical complications and emergencies. General principles of surgery as applied to selected topics.

DEND 354. Oral Surgery IV (1)

DEND 355. Introduction to Conscious Sedation (.5)
Physiopharmacology of nitrous oxide use. Indications, contraindications, and complications.

DEND 360. Implant Dentistry (1)
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.

DEND 363. Operative Dentistry (1)
Expands beyond the basic concepts learned in BPRD to include new advances in materials and techniques, plus the indications and contraindications for their use as supported by recent research and literature. Problem-solving in clinical practice will be emphasized.

DEND 364. Aesthetic Dentistry (1)
Lectures and demonstrations. The indications, contraindications, limitations, and use of modern techniques and materials in operative and cosmetic surgery.

DEND 368. Prosthodontics (2)
Develops basic principles previously taught for clinical application. Instruction to immediate denture, partial denture, and over denture prostheses. Lectures and audio-visual demonstrations relating to cleft palate, TMJ disturbances, and cosmetic prostheses of the face.

DEND 371. Occlusion Seminar (2)
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.

DEND 374. Fixed Prosthodontics (1)
Diagnosis and treatment planning in fixed prosthodontics 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.
DENT 378. Pediatric Dentistry and Applied Nutrition (2)

DENT 382. Orthodontics (1)
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.

DENT 394. Dental Patient Management/ Risk Management (1)
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.

DENT 411. Clinical Oral Pathology (1)
Clinical features of oral lesions as a basis for differential diagnosis. Clinical slides representing a variety of diseases. Students are encouraged to participate in classroom discussions.

DENT 415. Practice Management II (2)
Students deal with particular 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.

DENT 416. Practice Administration III (3)
(See DENT 415.)

DENT 420. Jurisprudence and Professional Ethical Responsibility (.5)
Ethical and legal issues, civil and criminal law, contracts, malpractice, and current ethical and legal dilemmas encountered in practice.

DENT 421. Periodontics Lecture (1)
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.

DEND 424. Occupational Safety in Dentistry (.5)
Preparation for protection against infectious organisms. Serves to identify and provide protection against other hazardous agents and activities associated with dental practice.

DEND 426. Oral Diagnosis Seminar (1)
Case-based review of oral diagnosis, radiology, and medicine.

DEND 427. National Boards Part II Preparation (1)
Multidisciplinary approach designed to prepare students for the National Dental Board Examination, Part II.

DEND 445. Clinical Pharmacology (1)
Drugs useful in dentistry with special emphasis on their clinical application.

DEND 455. Oral Surgery IV-A (.5)

DEND 488. Case Presentations (2)
Selected cases presented by students and instructors emphasizing diagnosis, treatment planning, and complete patient care. Topics of special interest covering the concepts of total patient care and recent advances in dental treatment presented by guest lecturers and faculty.

DENT COURSES

DENT 310. Summer Clinic (0-5)
Attendance is mandatory in the dental clinic between the spring semester of the second year and the fall semester of the third year. Students begin performing restorative preparations on patients and become acquainted with all aspects of clinical practice and operation.

DENT 501. Biological Aspects of the Development (2)
Emphasis on the qualitative, quantitative, and interactive changes during postnatal craniofacial growth and development.

DENT 504. Advanced Facial Growth (1)
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.

DEND 506. Concepts of Occlusion (Orthodontics) (1)
Course given in a continuing education format dealing with the spectrum of gnathology. Subjects include the physiology of occlusion, record-taking and mounting of cases, laboratory and clinical exercises in occlusal equilibration, splint construction, set-ups, positioner construction, and the examination, diagnosis, and treatment of various TMJ disorders. In-struction is carried out by the use of lectures and laboratory and clinical exercises.

DENT 509. Advanced Dental Studies (1-10)
A course for non-degree-seeking students who wish to pursue special post-doctoral studies in the School of Dentistry. Arrangement made through the department and the associate dean for graduate studies.

DENT 510. Epidemiology and Biostatistics (3)
A detailed presentation of modern research methodology designed to acquaint the student with a broad spectrum of scientific approaches and to prepare for a research project.

DENT 512. Advanced Oral Pathology (3)
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. Each participant is required to study a set of microscopic slides. Participation is expected for in-class discussion of the clinical and histopathologic material presented.
DENT 513. Anatomy of the Head and Neck (3)
Rigorous detailed study of structures fundamental to dental specialty training, principally through prostate section, dissection, and self-study. Emphasis on functional relationships as they relate to growth, development, and clinical treatment. Lectures in osteology, cutaneous innervation and blood supply of the face, muscles of facial expression and mastication, cranial fossa, autonomic nervous system, parotid region, temporal and infratemporal fossae, major nerves of the face, and arteries and lymphatics of the oral cavity.

DENT 515. Interdisciplinary Seminar (1)
A weekly seminar in which faculty and student research is presented and discussed. Each candidate is required to present a portion of his or her thesis research to the seminar group. The course is designed to inform students of the research interests and areas of expertise of the faculty, and to give some indication of the types of thesis research projects acceptable. Minimum of two semesters of registration and a presentation is required for all degree-seeking students.

DENT 516. Microbiology, Immunology and Immune Systems (1)
Advanced course in general and oral microbiology and immunology.

DENT 522. Orthodontic Diagnosis Seminar (1)
Registration in each of 6 semesters is required for students in the orthodontics program. Series of weekly lectures and seminars covering the science of orthodontic diagnosis. Initial 2 courses consist of lectures on the techniques of diagnosis, various diagnostic aids, and case planning. The following 3 courses consist of seminars where the students perform diagnosis, plan treatment, and critique cases from the department. The final semester is used for long-term follow-up clinic.

DENT 523. Clinical Specialty Seminar I - Orthodontics (2)
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)
Second in a series of four courses. (See DENT 523)

DENT 527. Clinical Specialty Seminar III - Orthodontics (2)
Third in a series of four courses. (See DENT 523)

DENT 528. Clinical Specialty Seminar IV - Orthodontics (2)
Fourth in a series of four courses. (See DENT 523)

DENT 529. Endodontology I (3)
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. Endodontology II (3)
Second in a series of four courses. (See DENT 529)

DENT 531. Endodontology III (3)
Third in a series of four courses. (See DENT 529)

DENT 532. Endodontology IV (3)
Fourth in a series of four courses. (See DENT 529)

DENT 539. Endodontic Literature Review I (3)
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)
Second in a series of four courses. (See DENT 539)

DENT 541. Endodontic Literature Review III (3)
Third in a series of four courses. (See DENT 539)

DENT 542. Endodontic Literature Review IV (3)
Fourth in a series of four courses. (See DENT 539)

DENT 549. Clinical Pharmacology I (1)
Lectures presenting the pharmacology of all major drug groups with particular reference to clinical dentistry. Objectives are to prepare the resident to obtain the maximum benefit with the minimum risk from drug therapy and to recognize the dental ramifications of medically-prescribed drugs. Clinically oriented lectures on the use of drugs in dental practice and the effect of medically-prescribed drugs on dental patients.

DENT 550. Clinical Pharmacology II (1)
(See DENT 549.)

DENT 551. Clinical Endodontic Specialty I (3)
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)
Second in a series of four courses. (See DENT 551)

DENT 553. Clinical Endodontic Specialty III (3)
Third in a series of four courses. (See DENT 551)

DENT 554. Clinical Endodontic Specialty IV (3)
Fourth in a series of four courses. (See DENT 551)

DENT 555. Management of Medical Emergencies (1)
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 certifications in basic CPR.

DENT 557. Periodontal Conference I (1)
Presentation of treated patients with advanced periodontal disease. Discussion of the 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)
Second in a series of four courses. (See DENT 557)
DENT 559. Periodontal Conference III (1)
Third in a series of four courses. (See DENT 557)

DENT 560. Periodontal Conference IV (1)
Fourth in a series of four courses. (See DENT 557)

DENT 564. Advanced Principles of Occlusion (1)
Structure and function of all anatomic components involved in occlusion: mechanics of articulation and mastication, recording of mastication patterns, diagnosis of occlusal dysfunction, relationship to neuromuscular and temporomandibular joint anatomy and pathology, and treatment techniques used in gnathology.

DENT 565. Practice Management I (Orthodontics) (1)
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 departmental clinic, private practice management, office visitations, and the business community and ethics. Includes use of guest speakers on jurisprudence, personal and professional insurance, accounting, estate planning, banking, office design, organized dentistry, and investments. First in a series of four courses.

DENT 566. Practice Management II (Orthodontics) (1)
Second in a series of four courses. (See DENT 565)

DENT 567. Practice Management III (Orthodontics) (1)
Third in a series of four courses. (See DENT 565)

DENT 568. Practice Management IV (Orthodontics) (1)
Fourth in a series of four courses. (See DENT 565)

DENT 569. Orthodontic Literature Review I (1)
Seminar course. Familiarizes students with classical and contemporary orthodontic literature. Provides students with broad knowledge of orthodontics. Students develop a more scientific attitude which enables them to think and to question, rather than to blindly accept words in print. Students introduced to contemporaneous areas of interest. Possibilities for further research discussed. First in a series of two courses.

DENT 570. Orthodontic Literature Review II (1)
Second in a series of two courses. (See DENT 569)

DENT 572. Advanced Special Principles: Preclinical I (1)
Initial topics provide instruction and laboratory exercises including band formation, impressions, study model construction, wire bending, and soldering. Tweed tip-edge straight-wire techniques performed on typodonts. Topics dealing with materials and mechanics used in orthodontics. Laboratory projects designed to prepare the student for clinical procedures. Later topics place emphasis on record gathering, diagnosis, case planning, treatment, retention, and periodic review of case progress. A comprehensive clinical examination in preparation for board examination is given in the third course.

DENT 573. Advanced Special Principles: Clinical I (2)
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)
Second in a series of four courses. (See DENT 573)

DENT 575. Advanced Specialty Principles: Clinical III (2)
Third in a series of four courses. (See DENT 573)

DENT 576. Advanced Specialty Principles: Clinical IV (1)
Fourth in a series of four courses. (See DENT 573)

DENT 577. Clinical Periodontics I (3)
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)
Second in a series of four courses. (See DENT 577)

DENT 580. Orthodontics-Oral Surgery Conference (1)
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 orthodontic 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)
Third in a series of four courses. (See DENT 577)

DENT 582. Clinical Periodontics IV (3)
Fourth in a series of four courses. (See DENT 577)

DENT 583. Orthodontic Diagnostic Seminar I (1)
Series of lectures and seminars covering the science of orthodontic diagnosis. Course consists of lectures on techniques of diagnosis, treatment planning, and critiques 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)
Second in a series of three courses. (See DENT 583)

DENT 585. Orthodontic Diagnostic Seminar III (1)
Third in a series of three courses. (See DENT 583)

DENT 586. Limited Tooth Movement for the Dental Specialist (1)
A review of the rationale for orthodontic treatment in periodontally diseased 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)
A survey of the interrelationships of periodontal and restorative treatment approaches. Stresses selection of appropriate fixed and removable prosthesis for the periodontal patient. Integration of the periodontal and restorative phases of treatment discussed through documentation of appropriate clinical cases.
DENT 588. Hospital Rotation (2)
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 595. Advanced Periodontal Seminar I (1.5)
Series of seminars covering clinical, pathological 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)
Second in a series of four courses. (See DENT 595)

DENT 597. Advanced Periodontal Seminar III (1.5)
Third in a series of four courses. (See DENT 595)

DENT 598. Advanced Periodontal Seminar IV (1.5)
Fourth in a series of four courses. (See DENT 595)

DENT 651. Thesis M.S.D. (1-9)
Subsections for each program area of study: endodontics, oral medicine, orthodontics, pediatric dentistry, or periodontics.

DENT 661. Conscious IV Sedation I (2)
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)
Supervised clinical experience in conscious IV sedation. (See DENT 661)

DENT 663. Implant Dentistry I
Periodontics (1)
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)
Clinical demonstration, participation, and case presentation in implant dentistry.
(See DENT 663)

DENT 682. Cephalometrics (1)
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 684. Radiology and Cephalometrics (1)
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)
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)
(See DENT 685.)

DENT 690. Pediatric Dental Residency (1-10)
Allows registration for non-degree-seeking students in graduate level courses at the direction of the department.

DENT 695. Oral Surgery Residency (1-10)
Allows registration for non-degree-seeking students in graduate level courses at the direction of the department.
School of Law

11075 East Boulevard
Phone 216-368-3280; Fax 216-368-6144

Gerald Korngold, Dean

Founded in 1892, the School of Law 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 faculty of about 45. 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 (though Ohio still has a large representation), and more of them leave Ohio than stay. There are CWRU law graduates in virtually every state 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.

ADMINISTRATION

Gerald Korngold, J.D. (University of Pennsylvania)

Dean

Andrew P. Morriss, J.D., M.Pub.Aff. (University of Texas), Ph.D. (Massachusetts Institute of Technology)

Associate Dean for Academic Affairs

Sonia Winner, J.D. (Dayton)

Associate Dean for Development and Public Affairs

Bryan L. Adamson, M.A. (Purdue University), J.D. (Case Western Reserve University)

Assistant Dean for Student Services

Barbara F. Andelman, J.D. (Ohio State University)

Assistant Dean for Admissions, Financial Aid, and Special Projects

Susan Renee Seliga, J.D. (Cleveland State University)

Assistant Dean for Career Services

Keith Barton, J.D. (Case Western Reserve University)

Information and Technology Director

Kathleen M. Carrick, M.L.S. (University of Pittsburgh), J.D. (Cleveland State University)

Director of the Law Library

Michelle Frygier, M.A. (Case Western Reserve University)

Director of Publications and Communications

Leon Gabinet, J.D. (University of Chicago)

Executive Director of the Graduate Tax Program

Thomas I. Hausman, J.D. (Ohio State University), L.L.M. (New York University)

Administrative Director of the Graduate Tax Program

Lewis R. Katz, J.D. (Indiana University)

Director of the Graduate Program for Foreign Students in U.S. Legal Studies

Henry T. King, Jr., LL.B. (Yale University)

U.S. Director of the Canada-United States Law Institute

Judith P. Lipton, M.S.S.W. (University of Wisconsin), J.D. (University of Connecticut)

Co-Director, Milton A. Kramer Law Clinic Center

Kenneth R. Margolis, J.D. (Case Western Reserve University)

Co-Director, Milton A. Kramer Law Clinic Center

Maxwell J. Mehlman, J.D. (Yale University)

Director of the Law-Medicine Center

Megan Allen, M.L.L.S. (Kent State University)

Electronic Services and Training Librarian

Cheryl Smith Cheatham, M.S.S.W. (Case Western Reserve University)

Educational Media/Reference Librarian

Deborah S. Dennison, M.L.S. (Kent State University)

Head of Bibliographic Access

Andrew Dorchak, M.L.S. (Kent State University)

Head of Reference

Betty J. Harris

Registrar

Mary Hudson, M.L.S. (Indiana University, Indianapolis)

Associate Director for Technical Services

D.R. Jones, J.D. (Mercer University), M.L.S. (University of Washington)

Associate Director for Public Services

Judith A. Kaul, M.S.L.S. (Case Western Reserve University)

Technology and Reference Librarian

Kathleen Kobylynec, J.D. (Cleveland State University), M.L.S. (Kent State University)

Serials Librarian

Pat Kost, M.B.A. (Cleveland State University)

Director of Finance and Administration

Lisa Peters, J.D. (Georgetown University), M.L.S. (Rutgers University)

Access Services Librarian

Jay A. Ruffner, B.S. (Case Western Reserve University)

Student Finances Administrator

Adria J. Sankovic, M.A. (Case Western Reserve University)

Assistant Director, L.L.M. U.S. Legal Studies

Piper von Gal, M.A. (Ohio State University)

Director of Career Services

Anne-Marie E. Wolanin, M.A. (Saint Louis University)

Director of Admissions

FACULTY

Gerald Korngold, J.D. (University of Pennsylvania)

Dean and Everet D. and Eugenia S. McCurdy Professor of Law

Bryan L. Adamson, M.A. (Purdue University), J.D. (Case Western Reserve University)

Associate Professor of Law, Milton A. Kramer Law Clinic Center, and Assistant Dean for Student Services

Arthur D. Austin II, L.L.B. (Tulane University)

Edgar A. Hahn Professor of Law

Jessica W. Berg, J.D. (Cornell University)

Assistant Professor of Law and Bioethics

David J. Carney, J.D. (University of Michigan)

Instructor in Law, Research, Analysis, and Writing Program

Kathleen M. Carrick, M.L.S. (University of Pittsburgh), J.D. (Cleveland State University)

Associate Professor of Law and Director of the Law Library

Laura Brown Chisolm, J.D. (Case Western Reserve University)

Professor of Law

Hiram E. Chodosh, J.D. (Yale University)

Professor of Law

Ronald J. Coffey, L.L.B. (University of Cincinnati), L.L.M. (Harvard University)

Professor of Law

George W. Dent, Jr., J.D. (Columbia University), L.L.M. (New York University)

Schott-van den Eynden Professor of Law

Melvyn R. Dutschke, J.D. (Northwestern University)

Professor of Law

Jonathan L. Entin, J.D. (Northwestern University)

Professor of Law and Political Science

Peter B. Friedman, J.D. (University of Michigan)

Instructor in Law, Research, Analysis, and Writing Program

Leon Gabinet, J.D. (University of Chicago)

Executive Director of the Graduate Tax Program

Peter M. Gerhart, J.D. (Columbia University)

Professor of Law

Paul C. Giannelli, J.D. (University of Virginia), M.S.F.S. (George Washington University), L.L.M. (University of Virginia)

Albert J. Weatherhead III and Richard W. Weatherhead Professor of Law

Jonathan Gordon, J.D. (Columbia University)

Instructor in Law, Research, Analysis, and Writing Program

Michael Heise, J.D. (University of Chicago), Ph.D. (Northwestern University)

Professor of Law

Katherine Hessler, J.D.(College of William & Mary: Marshall-Wythe School of Law), L.L.M. (Georgetown University Law Center)

Associate Professor, Milton A. Kramer Law Clinic Center

Sharona Hoffman, J.D. (Harvard University), L.L.M. (University of Houston)

Assistant Professor of Law

Erik M. Jensen, M.A. (University of Chicago), J.D. (Cornell University)

David L. Brennan Professor of Law

D.R. Jones, J.D. (Mercer University), M.L.S.
SECONDARY FACULTY
Kenneth F. Ledford, J.D. (University of North Carolina), M.A., Ph.D. (The Johns Hopkins University)
Associate Professor of History and Law
Theodore L. Steinberg, Ph.D. (Brandeis University)
Associate Professor of History and Law

ADJUNCT FACULTY
Thomas I. Hausman, J.D. (Ohio State University), LL.M. (New York University)
Adjunct Professor of Law and Administrative Director of the Graduate Tax Program
Henry T. King, Jr., LL.B. (Yale University)
Adjunct Professor of Law and U.S. Director of the Canada-United States Law Institute

Admission
This section relates to the J.D. programs; see below for information regarding admission to LL.M. programs. For complete information about admission policies and procedures, and about the law program generally, see the law school's current admissions bulletin, which the school's Office of Admissions will mail on request.

Admission Policy
Since the School of Law receives many more applications than there are places in the first-year class, the admissions process must be selective. The objective is to enroll a class that 1) is diverse and 2) will more than likely do very well in a rigorous law program. The admissions committee looks carefully at such indicators as undergraduate grade point average and Law School Admission Test (LSAT) score, but it weighs other, non-quantitative factors into the decision.

The school particularly encourages applications from people of color and others underrepresented in the legal profession, as well as from older students. The admissions committee will consider with sensitivity any information about a candidate's special circumstances.

The school receives applications as early as September for admission in the following fall. The earlier the application, the greater the chance of a scholarship. Beginning in January, the admissions office takes action on the applications that clearly meet or clearly fail to meet the selection criteria. As decisions are made, applicants are notified. Most decisions are made between January 1 and May 1. At that point the class is filled, and the office starts a waiting list of candidates with acceptable credentials. As vacancies occur up to the date of registration, the best qualified candidates are drawn from the list.

ADMISSION REQUIREMENTS

Admission to Regular Standing
In order to enroll as a candidate for the Juris Doctor (J.D.) degree, a student must have a bachelor's degree from an accredited institution. Every applicant must have taken the Law School Admission Test (LSAT) and must have registered with the Law School Data Assembly Service (LSDAS) before the application deadline.

Admission to Advanced Standing
Students currently enrolled in accredited law schools may apply for admission with advanced standing. They must complete four semesters in residence at Case Western Reserve to receive the J.D. degree.

Admission as a Visitor
We accept students enrolled at other law schools who wish to take courses at Case Western Reserve for credit toward their own school's degree requirements. Such students must submit a letter from their dean indicating that they are in good standing and that the other law school will accept the academic credits from Case Western Reserve.

Financial Information
See “Financial Information” section of this bulletin.

ACADEMIC PROGRAMS

Juris Doctor (J.D.) Degree
The School of Law offers the Juris Doctor (J.D.) degree as well as dual degree programs (see below). The J.D. degree requires successful completion of 88 credit hours.

The first-year program for the J.D. degree consists mainly of the required basic courses. In addition, in the spring semester students select a 3-credit elective
course; the menu of first-year “perspectives” courses varies from year to year.

**Fall Semester Required Courses**

- LAWS 123, Contracts (5)
- LAWS 131, Criminal Law (3)
- LAWS 132, Torts (4)
- LAWS 151, Research, Analysis, and Writing I*

**Spring Semester Required Courses**

- LAWS 103, Constitutional Law I (4)
- LAWS 104, Civil Procedure (4)
- LAWS 144, Property (4)
- LAWS 152, Research, Analysis, and Writing II*

In the second year every student must take LAWS 375, Professional Responsibility (3). Otherwise, the curriculum is elective after the first year. As a requirement for graduation, every student must complete a substantial research paper.

**INTERDISCIPLINARY PROGRAMS**

For complete information about dual degree programs, consult the law school’s Student Handbook (available from the registrar).

**J.D./M.B.A.**

A dual degree program between the School of Law and the Weatherhead School of Management allows students to earn two degrees in four years. Students spend the first year in one school and the second year in the other. Once the required courses are behind them, they spend the third and fourth years taking electives at both schools. Five areas of law-management specialization have been approved by the two schools: international business, health systems management, corporate finance, banking and investment, and labor and industrial relations.

**J.D./M.S.S.A.**

Together, the School of Law and the Mandel School of Applied Social Sciences offer a four-year program in law and social work. Students take the basic required courses in both schools and then have considerable flexibility in pursuing their particular interests and preparing themselves for different careers. Besides their time in the classroom, students gain practical experience in internships.

**J.D./M.N.O.**

A 4-year program combining the J.D. with a master’s degree in nonprofit organizations is offered in cooperation with the university’s Mandel Center for Nonprofit Organizations. Housed in the Mandel School of Applied Social Sciences, which has long been noted as a training ground for administrators of nonprofits, the center is cosponsored by MSASS, the School of Law, and the Weatherhead School of Management.

**J.D./M.D.**

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.

**J.D./M.A. (Bioethics)**

The School of Law and the Center for Biomedical Ethics make it possible for a student to earn two degrees in seven semesters, or in six semesters plus two summer sessions. Typically a student begins with a year of law study.

**J.D./M.A. (Legal History)**

Enrolling in both the law school and the School of Graduate Studies, a student can study law and legal history and earn the two degrees in seven regular semesters or six semesters plus two summers.

**Graduate School Option**

Students in the School of Law may take up to nine hours of courses in the other graduate and professional schools of Case Western Reserve University and have such courses counted for credit toward the J.D. degree.

**LL.M. in United States Legal Studies**

The LL.M. in U.S. legal studies is designed for graduates of foreign law schools who wish to spend an intensive year immersed in American legal education. LL.M. candidates take most courses with American J.D. candidates and have seminars with American lawyers. Degree requirements include 24 course credits (including LAWS 570, Foreign Graduate Seminar) and satisfactory completion of a major research paper. Students from civil law countries must take LAWS 595, American Contract Law, and students whose command of English is deficient will be required to take an English language course. LAWS 263, Doing Business in the U.S., is an elective available only to LL.M. students.

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 Professor Lewis R. Katz, Director of the LL.M. in U.S. Legal Studies.

**LL.M. in Taxation**

The School of Law offers the LL.M. degree in taxation to qualified candidates who hold the J.D. degree. Candidates for the LL.M. must complete 24 credit hours at the 600 level; the selection of courses will depend on the candidate’s prior legal education and experience. Students may complete the LL.M. in one academic year or may enroll part time; the schedule of courses accommodates persons regularly employed. Classes are also open to qualified persons (such as accountants) who do not hold the J.D. degree and thus cannot be candidates for the LL.M. Further information and admission materials may be requested from Professor Thomas I. Hausman, Administrative Director of the LL.M. in Taxation.

**THE LIBRARY**

The library’s holdings include more than 350,000 books and volume-equivalents, complete collections of federal and state law, law reviews, current law services, an extensive Britich and Commonwealth collection, and special collections in taxation, labor law, foreign investments, international law, and environmental law. The library is building strong collections in law and medicine and in the law of the European Union. It is a selective depository for both U.S. and Cana-
The library offers its users an ever-expanding list of electronic research databases. As of January 1998, they include Lexis/Nexis, Westlaw, Dialog, QL, RLIN, GPO Access, over 30 OhioLINK databases (including Index to Legal Periodicals, CIS Congressional Compass, Bioethics Line, and Hannah Online Capitol Connection) and more than 100 CD-ROM databases via the CWRU network (including LegalTrac, Westlaw Federal Taxation Library, Justis European References, Shepard’s Ohio Citations, Ageline, Westlaw Federal Taxation Library, West’s Ohio Practice Library, Hein’s U.S. Treaty Index, Matthew Bender Law Libraries, ALR LawDesk, BNA’s Environmental Law Reporter, Health Care Financing Administration Regulations, and UCCSearch). Housed within the library are two computer laboratories and a computer training classroom.

**SPECIAL PROGRAMS**

**Professional Skills Programs**

**Milton A. Kramer Law Clinic**

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 receive academic credit. The supervising attorneys are full-time members of the law faculty. In addition to the general courses in civil practice and criminal practice, the clinic offers specialized courses in family law and health law.

**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 397 Trial Tactics (4), and in the co-curricular moot court and mock trial programs.

**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 law school relationships, it seeks to attract foreign students to the law school and provide opportunities for CWRU law students to study abroad; it also provides opportunities for faculty to study and teach abroad.

**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.

**Law-Medicine Center**

The Law-Medicine Center at Case Western Reserve University has been in operation for more than 40 years. It began with a focus on forensic medicine, but that 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 it 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 and the Cleveland Clinic.

**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* began as a joint undertaking of all six of CWRU’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 yearlong 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 in 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). CWRU 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 published annually in a Student Handbook that is distributed to every student. Copies are available on request from the school’s registrar.

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 published in the Student Handbook.

Law (LAWS)

LAWS 001. Comparative Law and Religion Seminar (3)

LAWS 002. Education Law Seminar (3)
This seminar will build upon the foundation established by the first-year curriculum and focus on selected legal topics relating to education law and policy with a particular emphasis on constitutional (federal and state) issues. Such legal topics will include (but are not limited to) the regulation of educational institutions; student, teacher, and parental rights; equal educational opportunity; school finance; and the federal role in education. Enrollment is limited to 12. Grade is based on a presentation and a paper.

LAWS 003. Reproductive Law and Ethics Seminar (3)

LAWS 004. Settlement Law Seminar (2-3)
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 lawsuits. Grade is based on a presentation and a paper. Enrollment is limited to 12.

LAWS 005. Federalism Seminar (3)
Explores the constitutional relationships between the federal government and the states. Through additional exposure to pertinent case law and concentrated study of early historical materials in addition to scholarly writings, the seminar builds on the basic Constitutional Law course and is designed to give students a deeper understanding of the dimension and complexity of our federal system. Topics will include the role of a federal rather than a unitary or centralized governmental system, and how a system of divided political authority imposes restraints on federal and state legislative and judicial authorities. By way of contrast, the seminar may also explore how other countries administer federal systems and, in this country, the difference between federal/state federalism and state/local federalism.

LAWS 006. Legal History of European Union Seminar (3)
Introduction 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. “Constitutional” structures and institutions of the European Union, including the emergence of a binding jurisprudence from the European Court of Justice. General interpretative principles emanating from the European civil law tradition, such as the doctrines of subsidiarity and proportionality. The public law of the European Union, the “four freedoms,” human rights, and equal treatment of women and men. Private law rights emerging 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 007. Regulation of the Political Process Seminar (3)
Laws that regulate elections, campaigns, and other aspects of the democratic process. Specific topics include campaign finance reform, political parties, the right to vote, and direct democracy. Prerequisites: LAWS 103 and LAWS 202.

LAWS 009. Business Law Research Seminar (2)

LAWS 103. Constitutional Law I (4)
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 104. Civil Procedure (4)
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 123. Contracts (5)
The formation of a contract; problems of offer and acceptance; consideration; the question of contract breach; damages and remedies for a breach. Required.

LAWS 131. Criminal Law (3)
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 132. Torts (4)
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 144. Property (4)
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 151. Research, Analysis, and Writing (2)
Both semesters must be completed before credit is given. Students are introduced to the methods and formats of written legal analysis and to both manual and computerized legal research. Writing assignments include objective memoranda of law, pleadings, motions, and persuasive briefs. Required.
LAWS 152. Research, Analysis, and Writing (1)
Continuation of LAWS 151. Both semesters must be completed before credit is given. Required.

LAWS 202. Constitutional Law II (3)
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 203. Business Associations I (3)
This course first deals at some length with the policies and dimensions of the doctrines of vicarious liability (liability for the wrongs of another) and authority (being bound by the assent or representation of another). The discussion then moves to questions of an intermediary’s or employee’s duties of obedience, due care, and loyalty. Against this background, the statutory approaches of the Uniform Partnership Act and the Uniform Limited Partnership Act are developed and analyzed.

LAWS 204. Business Associations II (4)
This course is an elaboration of “corporateness” as a mode of business asset ownership and management. The functions and relationships of corporate enterprise participants, primarily promoters, shareholders, creditors, and managers, are fully investigated. The course first covers preorganizational problems and fundamental concepts of corporate financing. It then canvasses the roles of ownership and management, with emphasis on the special duties (fiduciary and other) imposed on certain participants. Careful attention is paid to the allocation of prerogatives among those most intimately involved in corporate life. The discussion examines and tests the traditional view of directors as the repositories of everyday management power and shareholders as the possessors of a theoretical franchise to select management, shareholders as the possessors of a theoretical underpinnings of corporate management responsibilities. Maintenance of the capital structure for the protection of creditors and shareholders is treated in connection with problems of recapitalization and distribution. State statutory themes are taken in the context of the ALI-ABA Model Business Corporation Act. Threads of the federal corporate regime being developed under the aegis of the securities laws are woven throughout the course fabric. Throughout the discussion, distinctions are drawn between the requirements and policies applicable to close and to publicly held corporations.

LAWS 206. Corporate Tax Problems (3)
This is an advanced income tax course limited primarily to study and analysis of Subchapter C of the Internal Revenue Code. The course is intended to provide the student with a comprehensive background in taxation of corporations and shareholders, including the tax treatment of dividends, redemptions, corporate reorganizations, and liquidations. Prerequisite: LAWS 211.

LAWS 207. Evidence (3)
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 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 210. Family Law (3)
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.

LAWS 211. Federal Income Tax (4)
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 212. Evidence (4)
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 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 214. Scientific Evidence Seminar (3)
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. May satisfy the writing requirement.

LAWS 215. International Law (3)
Examines the basic international legal processes (including the fundamental principles, international dispute resolution processes, the sources of international law, the subjects of the international legal system, nationality and jurisdiction) as well as the role and status of international law within the United States legal system. Throughout the course, use is made of contemporary international problems.

LAWS 217. Juvenile Law (2)
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 219. Workers’ Compensation (2)
Workers’ compensation law has a statutory basis which continues to evolve through judicial decisions. The statutes deal with benefits for work-connected injury and disability. Course material is national in scope with an emphasis on recent Ohio cases. The course also touches on related areas of law, such as torts.

LAWS 220. Civil Law and Psychiatry (2)
The interaction between law and psychiatry.
try and its effects on patient rights, institutional care, guardianship, psychiatric malpractice, suicide, psychic damages, 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 222. The Health Care Professions (2)
Offered pass/no credit. Recommended for students interested in health law who do not have a medical background. The history of medicine, the scientific method, techniques for researching medical and scientific questions, basic human anatomy and physiology, and an overview of medical training and practice. Prerequisite or co-requisite: LAWS 227.

LAWS 224. Global Perspectives (3)
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 225. Criminal Law and Psychiatry (2)
The interaction between criminal law and psychiatry: psychiatric diagnosis and treatment, competence to stand trial, the insanity defense, malingered mental illness, infanticide, sexual psychopath 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 227. Health Law (3)
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. Cross-listed as HSMC 427.

LAWS 229. Patent Law (2)
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 232. Wills, Trusts, and Future Interests (4)
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 234. Nonprofit Organizations (3)
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 236. Natural Resources (3)
An introduction to the law of natural resources with emphasis on private rights rather than resources in the public domain. Major themes will include: how the common law deals with rights in another’s land; problems of common pool resources, their ownership, and regulation; different legal treatment of renewable and nonrenewable resources; legal structures available for the exploitation of natural resources. Primary focus will be on water, oil, and gas, but the legal issues of other extractive industries will also be considered.

LAWS 238. Mergers and Acquisitions (3)
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. Prerequisite: LAWS 204.

LAWS 240. Computing and the Law (3)
Deals primarily with intellectual property issues: the patentability and copyrightability of software and the protection of interests in software by contract or by treating it as a trade secret. Issues relating to the risks of distributing computer software (i.e., the risks of products’ liability for computer software) will also receive considerable attention. Some time will be spent on the legal issues that arise when computers are interconnected by networks. Since many of the legal issues relating to computers arise because courts and lawyers do not understand how computers work and what they can and cannot do, the course begins with basic instruction in such matters as registers, central processing units, logic gates, and computer languages; this portion of the course includes ungraded homework assignments.

LAWS 244. Poverty, Social Inequality, and the Law (3)
An overview of the way the law impacts on disadvantaged people, and the law that supports advocacy on behalf of them. 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, legislative 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.

LAWS 245. Complex Litigation (2)
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 247. International Human Rights (3)
The course considers the role of human rights in a period of transition to a democratic system. This issue has been absolutely critical in newly democratic nations throughout the world. We will look at such subjects as access to secret police files, the role of criminal punishment, the eligibility of candidates for public office, and the role of “truth commissions.” Countries under examination will include Argentina, the Czech Republic, Germany, Poland, and South Africa.

LAWS 248. Criminal Procedure II (2)
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. Prerequisite: LAWS 327.
LAWS 249. Comparative Constitutional Law Seminar (3)
The seminar deals with constitutional law and adjudication in a comparative context. It offers an analysis of judicial review and its position in the modern world. It explores certain structural and functional differences among national systems of judicial review and discusses the relatively recent phenomenon of judicial review at the supranational level, particularly as it has emerged in Europe. May satisfy the writing requirement.

LAWS 250. Trends and Tensions in Legal Education (3)
Focuses on critical legal studies; analyzes CLS impact or influence on critical race theory and feminist jurisprudence; covers deconstruction and its use as a method of criticism. May satisfy the writing requirement.

LAWS 251. Employment Law (3)
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).

LAWS 253. European Community Law (3)
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 257. English for Foreign Graduate Law Students (3)
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 258. Business Torts (3)
This course builds on the foundation provided by Torts and focuses on the application of torts doctrines in the business context. Emphasis is placed on such topics as interference with economic relations, marketplace falsehoods, intangible assets, appropriation, and false light. Grade is based on a final examination.

LAWS 261. Business Associations (5)
LAWS 262. Appellate Advocacy (2)
The goal of the course is to teach students how to handle an appellate case. It examines appellate practice and procedure through reading materials, lectures, discussions, and simulations. Students are assigned to small groups to develop their advocacy skills through simulation exercises and critique. Credit will be awarded only to students who also participate in the Dunmore Moot Court Competition in the spring semester.

LAWS 264. International Organizations (3)
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 265. Health Care and the Constitution (3)
The seminar will examine a variety of health care issues that raise constitutional law questions. The course will focus on the following questions: (1) whether a constitutional right to health care exists, (2) what constitutional principles justify the state’s involvement in health care, and (3) how conflicts between individual liberty and state interests should be resolved. In analyzing these questions the class will address several contemporary issues including the right to parents to refuse medical treatment for a child on religious grounds, mandatory HIV and drug or alcohol testing, reproductive rights, maternal-fetal conflicts, assisted suicide, national DNA data banking, and others. Grade is based on a presentation and paper. Enrollment is limited to 12.

LAWS 266. Sales and Secured Financing (4)
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 267. Products Liability (2)
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 268. Death Penalty Law and Process (2)
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. Prerequisite: LAWS 327.
LAWS 274. Community Development Law (2)
An examination of the law of economic and land development in underserved and deteriorated areas. Legal issues related to business organization, financing, real estate development, governmental programs, and regulation and taxation (among other areas) will be covered. Topics include background of urban deterioration, governmental and private sources of assistance, organizing the developing entity, financing the project, governmental programs, tax policy and programs, land assemble, and administration of developments.

LAWS 275. Fundamentals of Law Practice Management (2)
An overview of the components of a successful practice. Applicable to practices of any type and size, the course integrates contemporary business theories and practices with the values of the legal profession and the realities of a law practice. Topics covered include assessing and responding to the market for legal services, client development, pricing, systems to insure quality, use of technology, firm structure and governance, and financial considerations. Class sessions include lectures, discussions, analysis of business cases developed in legal settings, and guest lectures. Students work in small teams to develop a hypothetical business plan for a firm or practice group.

LAWS 277. Immigration Law (2)
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.

LAWS 278. Regulatory Law and Policy (3)
Covers the substance of regulatory law, rather than the procedure aspects covered in Administrative Law (LAWS 301). We will examine the theories used to regulate a variety of areas including telecommunications, utilities, agriculture, and pesticides. The course also includes a substantial comparative law aspect, examining how each area is handled in other countries. Materials from the political science and economic literatures are used in addition to legal materials.

LAWS 279. Advanced Real Estate Development: Shopping Centers (2)
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 281. Environmental Anatomy of a Business Transaction (2)
Students will explore how issues of environmental law affect the structure and progress of a business transaction. A case study will start with a letter of intent and will proceed through environmental due diligence; the drafting of environmental representations, warranties, indemnities and schedules; the closing of the transactions; the making of environmental claims under the contract; and mediation of those claims to resolution. Ethical issues of new information about violations discovered in due diligence that must be reported to government agencies will be examined. Students will divide class time among the following activities: (a) the presentation of short research memoranda on the issues in the transaction, (b) the critiquing of drafts of transaction and mediation documents, and (c) role playing as sellers, buyers, bankers, environmental consultants, government agency personnel and their lawyers at different stages of the transaction. The course is designed to allow students to integrate concepts from first- and second-year courses in contracts, business associations, property, and environmental law in a series of problem solving exercises. Prerequisite: LAWS 331.

LAWS 283. Medical Malpractice (2)
The course will involve liability and quality of care issues in the health care field, with an emphasis on the liability of physicians, hospitals, and to a lesser extent insurers. Topics will include defining the standard of care, theories of liability, defenses to medical malpractice, tort reform, and quality control.

LAWS 285. Social Science and the Law (3)
Examines the social impact of law and the 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. Cross-listed as POSC 429.

LAWS 286. Litigation Practice (4)
This course will examine the lawyer’s role in resolving disputes. The course will take the students through a case from the initial client through litigation in a trial court up to summary judgment and then on appeal from a grant of summary judgment. We will examine (1) issues pertaining to resolution of the dispute, including negotiation, alternative dispute resolution mechanisms, and the costs and benefits of litigating in court; (2) issues pertaining to the development and use of facts, including exploration of the lawyer’s role as investigator, the use of formal discovery mechanisms, and the different burdens posed by the different levels of scrutiny applied by a court at different stages, and (3) issues pertaining to the role of the lawyer, including his or her role as counselor to the client, negotiator with and warrior against the adversary, and advocate to the court. The course will consist primarily of simulations and class lectures, and will also involve substantial written assignments, including the drafting of pleadings, discovery materials, and briefs. Enrollment for both terms (LAWS 286 and LAWS 287) is required. Students who have taken or are enrolled in Alternative Dispute Resolution (LAWS 351); Appellate Advocacy (LAWS 262); Lawyering Process (LAWS 401); or Pretrial Practice (LAWS 399) may not enroll in this course. Students who take this course are free to take either Trial Tactics (LAWS 397) or Trial Practice (LAWS 395). The course satisfies the Lawyering Process requirement that is a prerequisite for Clinic courses. Students who complete the course in their second year may— but are not required— to compete in the Dunmore Moot Court Competition in their third year. Limited to 12.

LAWS 287. Litigation Practice (3)
(See LAWS 286.) This course is the second semester of LAWS 286. Enrollment in both semesters is required.

LAWS 288. Environmental Law Practicum (2)
This practicum will focus on facilitating public participation in and enforcement of federal and state environmental laws.
Most if not all of the projects will address existing community needs and concerns in the Cleveland metropolitan area (e.g., wetlands developments, Clean Air violations, water quality concerns, and open space issues). Students will spend most of their two credits designing and writing a variety of handbooks, brochures, and other educational materials (including developing a Web Site) in order to provide local citizens with the tools necessary to participate more meaningfully on specific environmental problems. Students may also conduct one or more town meetings or short courses to further educate communities or nonprofit members about specific environmental laws. The clinic will serve a greatly needed (and possibly unprecedented) role in enhancing the public's understanding of the environmental laws. Students participating in the clinic will also find their writing and research skills are strengthened, particularly their ability to communicate complex legal requirements clearly. Prerequisite or corequisite: LAWS 331.

**LAWS 290. Federal Judicial Externship Academic Year Program (3)**

Externship opportunities are available to a limited number of second- and third-year students who have not participated in the summer judicial externship program. Participants are selected by the instructor from a pool of interested students following preregistration. Students chosen will be placed by the instructor with a selected federal judge or magistrate in the Cleveland, Akron, Medina, or Youngstown areas. Throughout the semester, students will attend seminar classes at the law school for a total of 17.5 hours and will work in the judge’s chambers for a minimum of 15 hours per week. Students must keep and submit to the instructor weekly, contemporaneous time records of their work in chambers. Topics to be covered in the seminar classes will include the role of law clerks, advanced legal research techniques, the process of judicial decision making and opinion writing, learning from observation and supervision, ethics in the judicial process, reflective lawyering, what makes effective advocacy, and other topics. Students will work in chambers under the supervision of the judge and his or her law clerks where their primary role will be to perform legal research and assist in the development of judicial opinions. Copies of the students’ written work will be provided to the instructor for review. Grade is based on classroom participation and work done in the judge’s chambers. Enrollment is limited to 12. Students will be notified of acceptance into the program by August 1.

**LAWS 292. Health Care Legislation (2)**

The course will introduce students to legislative processes, interpretation, and drafting, focusing on health care legislation. The course will examine one major legislative proposal in depth and follow its progress through the Ohio General Assembly. Initial proposal documents, as well as the actual statute (including all versions), will be studied. The views of all constituents will be examined. One class meeting will be a mock legislative session. Some of the meetings may take place in Columbus and the class may attend a committee hearing. Prerequisite: LAWS 227.

**LAWS 295. Law of Health Care Organization and Finance (2)**

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. Prerequisite: LAWS 227.

**LAWS 298. Health Care Transactions (2)**

This course will examine a variety of typical transactions among health care providers and payers. 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. Prerequisite: LAWS 295.

**LAWS 300. Advanced Environmental Law: Issues in Industry Compliance (3)**

In-depth analysis of key issues encountered in environmental law practice from the perspectives of the regulator and the regulated entity. Introduction to environmental research and the role of agency interpretive materials. Exploration of environmental audits, ethics, and issues arising in environmental enforcement. Issues will be presented in a series of problem sets, which will form the basis for both written analysis and in-class discussion. Prerequisite: LAWS 331 or permission of the instructor.

**LAWS 301. Administrative Law (3)**

This course examines legal issues surrounding the actions of state and federal administrative agencies. Areas of emphasis include statutory interpretation; the availability, timing, and scope of judicial review of agency action; and control of agency discretion. The course emphasizes written work, including advanced legal research training.

**LAWS 303. Admiralty Law (2)**

The general principles of admiralty law including jurisdiction, practice, maritime liens, collisions, salvage, limitation of liability, and the rights of injured maritime workers.

**LAWS 304. American Legal History (3)**

This course surveys the American legal past from the Revolutionary era to the present. It examines the development of a distinct American legal culture by exploring the interrelationships among legal institutions, thought, practice, and education in various historical periods.

**LAWS 307. Securities Regulation (3)**

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 bro-
LAWS 203. LAWS 204, and LAWS 205. LAWS 203. LAWS 204, and LAWS 205. LAWS 315. Commercial Paper (3)
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 317. Comparisons of Law (3)
This course concentrates on the comparative study of distinguishing features of the legal systems of foreign societies in order (1) to understand, by reverse projection, the unique characteristics of U.S. analogs; (2) to cultivate a cross-cultural jurisprudential understanding of law through the development of the comparative method; (3) to develop a basis for evaluating the fairness, efficiency, and integrity of legal systems currently engaged in reform efforts; and (4) to appreciate obstacles to the development of international law from a comparative perspective, including distinctive problems of transnational practice.

LAWS 319. American Indian Law (3)
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. May satisfy the writing requirement.

LAWS 320. Conflict of Laws (3)
Competing approaches to choice of law in cases having multi-state and/or multinational 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 323. Debtor-Creditor Law (3)
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 inappropiately 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 324. Bankruptcy (3)
A study of bankruptcy, with emphasis on the current Federal Bankruptcy Act. Includes Chapter 7 (liquidation bankruptcy proceedings), Chapter 11 (business reorganization), and Chapter 13 (debt adjustment by individuals). Also noted and investigated are the quite different policies and legal rules that we apply to bankruptcies because they no longer are capable of conforming to the usual legal standards. Students should take UCC and debtor-creditor courses before taking Bankruptcy.

LAWS 325. Corporate Reorganizations—Tax Aspects (3)
This course deals with the federal income tax treatment of corporate reorganizations at both the shareholder and corporate levels. It will concentrate primarily on acquisitive reorganizations described in Section 368, IRC (mergers and consolidations, de facto mergers and recapitalizations, and triangular mergers). The operative provisions of Sections 354 and 356 will be examined in detail. The latter part of the course will deal with the taxation of divisive reorganization under Section 355, i.e., spin-offs and split-offs. Prerequisite: LAWS 206.

LAWS 327. Criminal Procedure I (3)
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 328. Discrimination in Employment (3)
The federal laws and regulations concerning discrimination in employment. 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, and federal executive orders requiring affirmative action in employment. Regulation of discrimination based on race, sex, religion, national origin, age, and disability will be studied, with a focus on practical considerations in prosecuting and defending employment-based civil rights actions.
LAWS 331. Environmental Law (3)
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.

LAWS 332. Civil Rights (3)
The course focuses on race, discrimination, and segregation in American law. It includes historical material on the Civil War amendments to the Constitution, equal protection cases, and statutory remedies under the current civil rights legislation. The substantive areas examined include segregation and discrimination in education, housing, public facilities, and voting rights. Employment discrimination is not covered in this course, but in Discrimination in Employment (LAWS 328).

LAWS 335. Equity and Equitable Remedies (3)
The course provides a short introduction to the equitable jurisdiction and in particular to the concept that “equity acts in personam.” The major emphasis of the course is on the specific performance of contracts and on injunctions against continuing torts. A major concern is the doctrine that equity affords a remedy only when the remedy at law is inadequate. The course also gives some attention to the law of restitution, since restitutional remedies, even those granted by law courts, are traditionally considered to be equitable. Equitable liens, constructive trusts, equitable enforcement of “restrictive covenants,” and the doctrine of “equitable conversion” are considered. The defenses that apply to equitable remedies, such as laches, “unclean hands,” and the doctrine that “he who seeks equity must do equity” are also considered. If time permits, some consideration is given to injunctions against governmental officers and to other extraordinary remedies that form the common law basis for administrative law and judicial review of governmental actions.

LAWS 336. Ethics in the Professions (3)
Theories of professional ethics, as applied to the professions of law, medicine, nursing, social work, and management. A major portion of the course will be devoted to issues common to these professions, such as confidentiality, truth-telling, client or patient autonomy, decision making, and conflict of interest, comparing professional norms and practices in the light of the dominant ethical theories first developed. Open to students of law, medicine, nursing, applied social sciences, and management. May satisfy the writing requirement.

LAWS 340. Federal Courts (3)
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.

LAWS 341. Estate Planning and Taxation (3)
This course covers disposition of individual wealth from both the property law and tax law viewpoints. Grade is based on class participation and major written project. Students may elect either to complete a research paper or to prepare an estate planning memorandum and documents for a hypothetical client. Prerequisites: LAWS 232 and LAWS 211.

LAWS 343. Federal Taxation of Partnerships and S Corporations (3)
A study of Sub-chapters K and S of the Internal Revenue Code, with emphasis on the problems of determining the tax liability of (1) partners for contributions to partnerships, distributions from partnerships, and transfers of partnership interests; and (2) shareholders for the equivalent transactions involving S corporations. Prerequisite: LAWS 211.

LAWS 346. Insurance (3)
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 348. International Negotiations and Agreements (3)
Introduces students to the role of the lawyer in the dispute avoidance (rather than dispute resolution) process in relation to international agreements. The course is taught from the simulation approach. Students take active part in a mock negotiation and drafting of the international agreement between the United States and another country to be selected (either Canada or Russia). In the mock negotiation students are divided into two six-person teams, one team representing the U.S. and the other team representing the other designated country. Prerequisite: LAWS 215.

LAWS 349. International Trade and Development (3)
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 aid and are also explored, as well as U.S. legislation affecting the transfer of resources to less developed countries.

LAWS 350. International Arbitration (2)
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 351. Alternative Dispute Resolution (2)**

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. Cross-listed as LHRP 451.

**LAWS 353. Philosophy of Law (3)**

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 right affect particular court cases and the course and development of law generally. Topics will include abortion, obscenity and sin, civil disobedience, affirmative action, surrogacy, 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. Cross-listed as PHIL 335.

**LAWS 354. International Business Transactions (3)**

The private law of international trade and investment. (International Trade and Development, LAWS 349, deals with the public law of international trade and investment.) The emphasis of the course is on the legal aspects of foreign market penetration by U.S. firms, including exporting, licensing, and investing. The laws studied will be host country regulations, foreign and U.S. tax, antitrust law, and export and import laws. In addition, basic issues faced by multinationals, such as co-determination, employee participation, transfer pricing, and technology transfer will be studied.

**LAWS 356. Jurisprudence (3)**

The main themes in the history of Western jurisprudential thought. Ideas such as the nature of justice, the definition of law, the power of the state, legal and moral obligation, and the nature of the judicial process are explored through the works of such writers as Aristotle, Aquinas, Austin, Dworkin, Holmes, Hart, and Finnis, together with selected works of literature.

**LAWS 359. Labor Law (3)**

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 representative 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 court and by arbitrators, and the legal regulation of industrial warfare, the strike and lockout.

**LAWS 360. Labor Arbitration and Collective Bargaining Workshop (3)**

Students participate in a collective bargaining project involving contract drafting and negotiation, with settlement required prior to a predetermined strike deadline. They also arbitrate a grievance arising under their executed agreements. The course materials deal with bargaining strategy and game theory, arbitration process and procedure, and the subject matter of collective bargaining agreements: seniority, management rights, union security, wages, vacations, holidays, discharge, and discipline. In addition, students will make use of tools of labor law research in drafting an arbitration brief. Prerequisite: LAWS 359 or equivalent.

**LAWS 363. Land Use Control (3)**

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 365. Legislation (2-3)**

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 370. Intellectual Property (2-3)**

The course will survey federal and state intellectual property rights, including getting, keeping, and protecting trademarks, copyrights, patents, and trade secrets. Unfair competition doctrines will also be examined. The course will emphasize a wide range of practical applications, including artistic expression, industrial espionage, corporate counseling, and employment agreements.

**LAWS 373. Bioethics and Law (3)**

How the legal and policy systems reconcile competing values and interests in controversies surrounding the practice of medicine. Case law, legislation, advisory policies, and institutional policies will be examined, as well as selected commentary from the legal, medical, and philosophical perspectives. Substantive topics to be addressed include definitions of death, competent patients’ right to refuse treatment, decisions on life-sustaining treatment for incompetent patients (including children), active euthanasia and assisted suicide, hospital ethics consultants and committees, organ transplantation, and selected issues raised by genetics and by managed care.

**LAWS 374. State and Local Government (3)**

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 375. Professional Responsibility (3)
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 377. Property Security (3)
The use of property as security for repayment of a debt is growing in all sectors of our economy. This course deals with the underlying social policies and the fundamental legal and equitable rules governing these secured transactions. In particular, we study the fundamentals of the law of security interests (historically and still commonly known as mortgages) in both real estate and personal property (the latter now codified in Article 9 of the Uniform Commercial Code), and we identify the common principles underpinning these seemingly separate bodies of law. The posing of actual problems assures that students develop strong practical capacity as well as theoretical understanding. Specific topics studied include creation of the security interest (mortgage), the legal rights and obligations of the debtor (mortgager) and the secured party (mortgagee), the priority accorded to a security interest when in competition with competing interests in the same property, the transfer of a security interest, the redemption rights of the debtor (mortgager), and the foreclosure of a security interest. Students may not take both LAWS 377 and LAWS 266 (Sales and Secured Financing).

LAWS 379. Restitution (3)
Studies the remedies by which one recovers specific property, the value of specific property, or a debt. A detailed examination of the remedies and legal theories that govern recovery of benefits conferred without a contract, under a void or voidable contract, or under a contract that is broken by either the plaintiff or the defendant. The major remedies considered are those of replevin, ejectment, debt, quasi-contract, specific restitution in equity, equitable liens, constructive trust, equitable accounting, tracing assets, and subrogation. Substantive areas that are studied include frustration of purpose, fraud, mistake, duress, unjust enrichment, and protection of ideas. Since restitution is often an alternative remedy in cases where damages are also available, the course also considers the normal rules for calculating damages for breach of contract and for tort.

LAWS 381. Sales (3)
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 also investigated. Other specific topics studied are the legal rules applicable to 1) the formation of the sale contract, including the battle of the forms, statute of frauds, and parol evidence rule; 2) performance 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 385. Real Estate Transactions and Finance (2-3)
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 390. Advanced Labor Law (2)
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 of fair representation, union security, federal preemption of state labor legislation, internal union affairs, and labor law reform. Prerequisite: LAWS 359.

LAWS 392. Mass Media Law (3)
Legal regulation of the communications media. The course briefly surveys basic First Amendment principles, then addresses limitations upon publishing (including defamation and privacy), legal problems of news gathering (including reporter’s privilege and access to information), and the regulation of broadcasting and cable television. Completion of Constitutional Law II (LAWS 202) is advised but is not a prerequisite.

LAWS 395. Trial Practice (2)
This course provides practical training in jury and nonjury courtroom trial procedure. Students are assigned as lawyers in criminal and civil cases to conduct jury selection, examine and cross-examine witnesses, make objections, and argue motions in a simulated courtroom environment. Students may not take both Trial Practice and Trial Tactics (LAWS 397). Prerequisite: LAWS 207 or LAWS 212.

LAWS 397. Trial Tactics (4)
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). Prerequisite: LAWS 207 or LAWS 212, which cannot be taken concurrently.

LAWS 399. Pretrial Practice (2)
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
LAWS 401. The Lawyering Process (2)
Certain legal skills basic to the practice of law, including interviewing, counseling, and negotiating, are discussed, and students have the opportunity to practice those skills in simulated interviews and negotiations under the supervision of the instructor. Videotapes of lawyers and/or students are shown and reading materials assigned. Class discussions of reading materials and videotapes and experience in simulations enable students to confront basic problems of interpersonal communication, role conflicts, and decision-making posed by law practice.

LAWS 403. Criminal Defense Clinic (4)
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. Prerequisites: LAWS 401 and LAWS 327.

LAWS 411. Civil Clinic I (2)
Students must be enrolled in and complete both semesters to receive credit. Students represent plaintiffs or defendants in a variety of matters, including landlord-tenant disputes, domestic relations cases, small business ventures, contract preparation, and administrative proceedings. A major part of the student’s responsibility is to determine whether a legal problem actually exists and, if so, to resolve it as expeditiously as possible. The seminar sessions are devoted to discussions of matters being handled by the students and to the ethical and practical problems encountered in civil law practice. Emphasis is on the use of such tools as negotiation, litigation, and settlement procedures to accomplish specific objectives. Prerequisite: LAWS 401. Prerequisite or co-requisite: LAWS 207 or LAWS 212.

LAWS 412. Civil Clinic II (2)
Continuation of LAWS 411. Both semesters must be completed before credit is given.

LAWS 415. Family Law Clinic I (2)
Students must be enrolled in and complete both semesters to receive credit. Students represent parties in a variety of family law matters, including contested and uncontested divorces, domestic violence petitions, custody, support, and property division. A major part of the student’s responsibility 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 cases handled by the students. The ethical and practical problems encountered in family practice are emphasized, as well as case theory. Prerequisite: LAWS 401. Prerequisites or co-requisites: LAWS 207 or LAWS 212, and LAWS 210.

LAWS 416. Family Law Clinic II (2)
Continuation of LAWS 415. Both semesters must be completed before credit is given.

LAWS 418. Health Law Clinic I (2)
Students must be enrolled in and complete both semesters to receive credit. Students represent parties in a variety of health law matters, including premature discharge or inappropriate transfer from medical facilities; informed consent and substituted consent; entitlement to public or private insurance coverage, health services, and income benefits; and mental health issues such as guardianships and involuntary hospitalization. A major part of the student’s responsibility 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. Prerequisite: LAWS 401. Prerequisites or co-requisites: LAWS 207 or LAWS 212; LAWS 227 or LAWS 220.

LAWS 419. Health Law Clinic II (2)
Continuation of LAWS 418. Both semesters must be completed before credit is given.

LAWS 430. Community Development Clinic I (2)
Students must be enrolled in and complete both semesters to receive credit. Students represent individuals and entities in a variety of community development matters which may include first-time home buyer real estate purchases, construction and rehabilitation; business and nonprofit entity formation; individual and entity representation in neighborhood rehabilitation projects; and group representation in other contexts. 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. Prerequisite: LAWS 401 or LAWS 286/LAWS 287. LAWS 203 or LAWS 204 may be taken concurrently.

LAWS 431. Community Development Clinic II (2)
Continuation of LAWS 430. Both semesters must be completed before credit is given.

(See LAWS 430.)

LAWS 500. Supervised Research Seminar (1-2)
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 511. Supreme Court Seminar (3)
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 512. Tax Policy Seminar (2)
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. Prerequisites: LAWS 211 and LAWS 206.
LAWS 524. Health Care Advanced Research Seminar (2)
Students will undertake significant research in health law, participating in group discussions to help refine each other’s topics, identify research materials, and critique rough drafts. May satisfy the writing requirement. Prerequisites: LAWS 227 and permission of the instructor.

LAWS 537. Health Care Controversies (3)
The course is open to students in the schools of law, medicine, and management. Students will confront current controversies in law, bioethics, and health care policy, such as active euthanasia, discrimination in access to health care resources, social control of new genetic technologies, the relationship between patients and physicians in managed care, and policies on donation and allocation of transplant organs. Students often will work in interdisciplinary teams, and will have an opportunity to discuss the issues with outside experts, health care practitioners, and patients. Prerequisite: LAWS 227.

LAWS 548. Federal Criminal Law Seminar (3)
This surveys a variety of topics in substantive federal criminal law, such as mail fraud, political corruption, federal drug laws, currency reporting, money laundering, RICO, asset forfeiture, and the federal sentencing guidelines. May satisfy the writing requirement.

LAWS 551. Consumer Protection Seminar (3)
This is a study of federal and state statutory and decisional law in the areas of consumer credit, consumer sales, and advertising. Considerable attention is given to the Federal Consumer Credit Protection Act, the Uniform Consumer Sales Practices Act, and the activities of the Federal Trade Commission in the consumer protection area. There are no prerequisites, but it is recommended that a student have completed one commercial law course. May satisfy the writing requirement.

LAWS 554. Theories of Equality Seminar (3)
Explores fundamental concepts of equality and how those concepts have been applied by the courts in race, gender, and other status-based areas. Since familiarity with the case law will be assumed, most of the discussion will focus on writings of legal scholars and legal philosophers. May satisfy the writing requirement.

LAWS 556. Judicial Externship Seminar (4)
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. Prerequisite: Permission of the instructors.

LAWS 557. Genetics and Law (3)
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 561. International Issues in Intellectual Property Seminar (3)
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. Prerequisite or corequisite: LAWS 370.

LAWS 562. European Legal History (3)
From the “Well-Ordered Police State” to the modern welfare state, law has helped to shape the history of European states and societies. This course will use law as a means to explore such larger questions as the tension between communitarianism and individualism, the origin and functioning of capitalism, the rise of the bureaucratic state, and the future of liberalism. We will examine the history of law in Europe since the “reception” of Roman law around 1500, through the rise of the absolutist state, the emergence of the Rechtsstaat (state ruled by law), the great codification, to the growth in power of the European Union. Focus will be on how law was shaped by, and in turn shapes, the material foundations of economy and society and the modes of discourse of culture. Along the way, students will learn about the foundations of the substantive and procedural law of European civil law systems. May satisfy the writing requirement.

LAWS 563. Biomedical Research Law and Policy (3)
The 20th-century biomedical research revolution has generated many conflicts demanding legislative, judicial, and administrative action. This seminar will address some of the most pressing issues. Topics include: experimentation on human beings (ethical principles and regulatory system); issues raised by “rescue” research (e.g., artificial heart); random clinical trials; research on children, elderly, and mentally disabled; research involving human fetuses and embryos; research on “neomorts;” gender and racial bias in research; HIV research issues; use of Nazi and other “tainted” research data; experimentation on animals; scientific fraud and misconduct, and commercialization of biomedical research. May satisfy the writing requirement.

LAWS 564. Science and the Law Seminar (3)
In this seminar we will examine problems encountered by decision-makers when scientific information is required for the resolution of a legal issue. Science-law discords arising in the courts, in administrative agencies, and in Congress will be considered in turn, with attention focused on why these institutions have difficulty processing scientific information and how these processes can be improved. Readings will be selected from political science, sociology, philosophy, the natural sciences, and law. May satisfy the writing requirement.

LAWS 568. Financial Markets: Law, Theory, and Practice (2)
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 569. Constitutional Law Clinical Seminar (2)***

Some students enrolled in Constitutional Law II (LAWS 202) may enroll in this clinical or practicum seminar designed to expose them to many of the issues discussed in class as those issues arise in the context of legislative proposals and specific “client” complaints. The source of these issues will be the Ohio ACLU. Students will work in pairs and will be required to research and evaluate specific First Amendment issues, writing write opinion letters, assisting in the preparation of briefs and pleadings in pending litigation, and evaluating the First Amendment consequences and implications of legislation introduced or proposed to be introduced in the Ohio General Assembly. Students need not be certified by the Ohio Supreme Court to practice as law students; second-year students may enroll. Corequisite: LAWS 202.

**LAWS 570. Foreign Graduate Seminar (2)***

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 571. Jurisprudence Seminar: Justice and Religion in the Liberal State (3)***

The liberal theory of justice emphasizes “fairness” and a “thin theory of the Good.” Religious believers often favor substantive results across a range of law and public policy issues. How are the dilemmas posed by these seemingly contradictory visions of legal and political life to be resolved? Issues to be discussed include homosexual marriage, abortion, physician-assisted suicide, religion and education, affirmative action, and pornography. Both the religious clauses of the Constitution and the ideas of modern liberal (Dworkin, Rawls, Richards) and nonliberal (George, Carter, Finnis) thinkers will be the context for a discussion of these issues. May satisfy the writing requirement.

**LAWS 572. International Law: Selected Problems in Theory and Application (3)***

This applied international legal theory seminar raises foundational questions about the nature and scope of international law in the context of contemporary international legal problems. It also introduces students to the fundamentals of international legal research. Each student is expected to select a contemporary international law topic, research the relevant legal issues, conduct a classroom session on that topic; and write a substantial paper. No prerequisite, but a prior course in international or comparative law is recommended. May satisfy the writing requirement.

**LAWS 573. Vietnam War and the Law Seminar (3)***

This seminar explores the Vietnam War as a legal event. After an introduction to the history of the Vietnam War and U.S. involvement in Southeast Asia, we will examine several of the legal issues and events related to the war. Topics may include: the Vietnam War and international law; the Tonkin Gulf Resolutions and the constitutionality of the war; extension of the war to Cambodia; selective service, draft evasion and resistance, desertion, and amnesty; GI rights, GI dissent, and the military justice system; My Lai, the rules of engagement, and America’s conduct of the war; legal strategies of the anti-war movement; the Pentagon Papers case; and the legal legacies of the Vietnam War. May satisfy the writing requirement.

**LAWS 574. The American Legal Profession (3)***

This seminar explores selected issues relating to the social organization and ideologies of American lawyers. Topics may include the attributes of professions, the demographics of the profession, the concept of professionalism, justifications and critiques of self-regulation, the distribution of legal services, the role of lawyers in social change movements, recent changes in the organization of legal practice, and legal education. May satisfy the writing requirement.

**LAWS 575. International Organizations Seminar (3)***

Deals primarily with constitutional and procedural legal issues surrounding some common characteristics of both governmental and nongovernmental international organizations. The growth of international law through intergovernmental organizations is also addressed. May satisfy the writing requirement.

**LAWS 577. European Legal Professions Seminar (3)***

Introduction to the origins, histories, developments, and contemporary shapes of the legal professions in western and central continental Europe from 1500 to the present. The course will examine the development of legal education in Europe, the principal legal occupations into which graduates move (private practice, the notariate, the judiciary and state prosecutor’s office, state service, and business) and conclude with an examination of the role of lawyers in politics and in society. Concentration will be on France and Germany, with additional examples drawn from Italy, Russia, Switzerland, and elsewhere. May satisfy the writing requirement.

**LAWS 579. Environmental History and Law Seminar (3)***

This seminar is designed to introduce students to the relatively new and exciting field of environmental history and explain how it can help us better understand the law. Our concern in this course is not so much with black letter law, but with the larger ecological and historical context in which the law is formed. We will concern ourselves especially with the ways in which the law was used to transform the natural world, focusing exclusively on this story as it unfolded in the United States. Our goal is to see not just how law shaped nature, but also how the complexities of the natural world have affected legal doctrine. May satisfy the writing requirement.

**LAWS 586. Death Penalty Seminar (3)***

**LAWS 587. Research Seminar in Taxation (2)***

An opportunity to undertake significant research and writing in taxation, with each student expected to complete a major paper and present that paper to the class. Grade is based on the paper and class participation. Prerequisite: LAWS 211.

**LAWS 588. Jurisprudence Seminar: Natural Law, Natural Rights (3)***

Examines the legal philosophy of John Finnis through a careful reading of his book, *Natural Law, Natural Rights*. Finnis is an analytic philosopher and is consciously in the Aristotelian-Thomist tradition. The subjects to be studied include
rights, obligation, justice, authority, and law. May satisfy the writing requirement.

**LAWS 589. Law of the Workplace Seminar (2)**

This research seminar affords the student and opportunity to write a substantial original research paper on a topic relating to Labor, Employment, or Employment Discrimination Law. In addition to the paper, students are required to present their topic early in the semester, and make an oral presentation of their research toward semester’s end. Prerequisites: LAWS 359 and LAWS 328.

**LAWS 590. The Religion Clauses of the First Amendment Seminar (3)**

This course addresses the major issues in the constitutional relationship between church and state. Specific topics include religion in the public schools, aid to parochial education, public acknowledgments of religion, and mandatory accommodation of religious practice. May satisfy the writing requirement.

**LAWS 592. International Economic Integration (3)**

As countries open their economies to the world economy, new strains are placed on their legal systems. This course explores how legal systems adapt to open markets and free trade. Topics covered may include intellectual property, environmental, and labor laws. We will also examine specific countries' experiences (New Zealand, Chile, Mexico), the mechanisms for growing international trade agreements (expansion of NAFTA, for example), and methods of legal reform. May satisfy the writing requirement.

**LAWS 595. American Contract Law (3)**

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 596. Social History of Crime Seminar (3)**

The meaning of law in the largest sense—how it works as a system of power to advance certain interests in society at the expense of less powerful groups. What is a crime? How have certain customary rights been criminalized and why? What are the ideological underpinnings of the law? Exploration of crime and the law in the lives of ordinary men and women in Britain and the U.S. from the eighteenth century to the present.

**LAWS 598. Comparative and International Dispute Resolution Seminar (3)**

Students will explore a wide range of domestic, foreign, and international dispute resolution processes. The seminar will develop and apply a methodology for comparing, assessing, and reforming such processes, with significant attention to the institutional context in which the processes operate. Students will write substantial research papers on topics that they select from a menu of options, including (but not limited to) informal mediation, formal adjudication, and international dispute settlement, and they will make a presentation in class. May satisfy the writing requirement.

**LAWS 599. Doing Business in the United States (3)**

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 740. Journal of International Law and U.S. Legal Studies.**

This course builds on the concepts developed in International Aspects of U.S. Income Tax I (LLM 619) and focuses on

**LLM Tax Program (LLM)**

**LLM 601. Basic Federal Income Tax (2)**

The fundamental concepts of the current U.S. system. Gross income, deductions (personal and business), the computation of gains and losses, adjusted basis, basic tax accounting principles, time value of money considerations, and certain restrictions on loss deductions.

**LLM 611. Corporate Tax I (2)**

The tax consequences of the formation of the corporation, distributions of cash or property to shareholders, stock dividends, redemptions, and liquidations.

**LLM 612. Corporate Tax II (2)**

Corporate reorganizations, including acquisitive and divisive reorganizations; more details on the rules of Subchapter S. Prerequisite: LLM 611.
the U.S. taxation of the foreign activities of U.S. corporations and individuals. Topics include the foreign tax credit, subpart F and other "anti-deferral rules," the taxation of transfers to foreign corporations, transfer pricing, and the individual foreign-earned income exclusions. No prerequisite, but students with no experience in international tax who plan to take both I and II should take International Aspects of U.S. Income Tax I (LLM 619) first.

LLM 621. Basic Estate Planning (2)
The basic Internal Revenue Code provisions of the federal wealth transfer tax law. Topics include the gross estate, the marital deduction and other deductions, the taxable estate, and gift taxes.

LLM 622. Advanced Estate Planning (2)
Estate planning techniques, including marital deduction planning; generation-skipping trusts; life insurance; estate planning regarding qualified retirement plans; estate freezes (Chapter 14 of the Internal Revenue Code); other planning opportunities. No prerequisite, but the student should have a basic understanding of federal wealth transfer taxes before taking this course.

LLM 623. State and Local Taxation (2)
In addition to constitutional issues, specific topics include income and franchise taxes, property taxes, sales and use taxes, and value-added and single business tax issues. Research on state and local tax problems will be discussed.

LLM 628. Partnership Tax (2)
The tax consequences of the formation of the partnership; the adjusted basis of a partner’s interest; capital accounts; the receipt of a partnership interest in exchange for services; the allocation of profits and losses; partnership distributions; transfers of partnership assets and partnership interests; special rules pertaining to the death of a partner; special basis adjustments; the liquidation of a partner’s interest; the liquidation of the partnership. The substantive law and the tax aspects of limited liability companies will be analyzed and discussed.

LLM 629. Advanced Partnership Tax (1-2)
Advanced study of profit and loss allocations under Code sections 704(b) and (c); a detailed analysis of the liability sharing rules under Code section 752; the tax consequences of the contribution and distribution of appreciated or depreciated property to and from the partnership; and more detailed study of limited liability companies.

LLM 630. Income Taxation of Estates and Trusts (2)
An examination of the different types of trusts including grantor trusts, simple trusts and complex trusts; consideration of the tax treatment of estates; analysis of the concept of Distributable Net Income and its effect on trusts and their beneficiaries; analysis of the tax treatment of split-interest charitable trusts.

LLM 632. Tax Procedure and Research Methods (2)
The procedural provisions of the Internal Revenue Code, including the provisions governing the assessment and collection of taxes; the statute of limitations; petitions to the U.S. Tax Court; the mitigation provisions governing inconsistent positions; refunds; other similar matters. Instruction on research methods, including computer research. All participants are required to perform some legal research outside class.

LLM 633. Taxation of Natural Resources (2)
The federal income tax consequences of the ownership and exploitation of natural resources. The concept of an “economic interest;” the deduction for depletion; production payments; the deduction of exploration expenditures; the deduction of development expenditures; certain recapture provisions; sales and exchanges of natural resource properties; certain special rules regarding the foreign tax credit.

LLM 634. Consolidated Tax Returns (2)
Topics include the affiliated group; the election to file and discontinue filing consolidated returns; taxable years, income included in returns, and methods of accounting; consolidated taxable income; intercompany transactions, special limitations on deductions; net operating losses; excess loss accounts; intercompany distributions; the disposition of stock of a subsidiary.

LLM 638. Advanced Corporate Tax Problems (2)
A more detailed examination of corporate reorganizations (including original issue discount problems in recapitalizations), distributions, redemptions, liquidations, and S corporation taxation; personal holding companies; accumulated earnings tax; collapsible corporations; the carryover of net operating losses and other tax attributes.

LLM 640. Executive Compensation (Nonqualified Plans) (2)
Incentive stock options; nonqualified stock options; restricted stock plans; constructive receipt problems; “Rabbi” trusts; stock appreciation rights plans; other nonqualified deferred compensation methods; golden parachutes; other compensation methods and techniques.

LLM 645. Criminal Tax and Procedure (2)
The course covers the various tax and tax-related crimes under the Internal Revenue Code and Titles 18 and 31 of the United States Code. These include tax evasion and false return charges, money laundering, and currency transaction crimes. In addition, students analyze the stages of a criminal tax investigation and prosecution in both non-grand jury and grand jury settings.

LLM 648. Federal Taxation of Exempt Organizations (2)
This course will cover the basics of the taxation of tax-exempt organizations, including the following topics: the requirements for tax-exempt status (the organizational and operational requirements); an analysis of the application for exemption process; unrelated business taxable income, private inurement, public and private foundation status, intermediate sanctions, and various other topics.
Weatherhead School of Management
Weatherhead School of Management

Administrative Office
Enterprise Hall
Phone 216-368-2030
William K. Laidlaw, Jr., Interim Dean

Since awarding the region’s first business degree in 1930, the Weatherhead School of Management’s spirit of innovation has been the driving force that has elevated the University’s management programs to national prominence. Among these innovations are the nation’s first Ph.D. program in operations research, one of the first academic divisions of management information systems, and the first integrated network of IBM personal computers for M.B.A. instruction.

The School of Management at Case Western Reserve University was created in 1967 through the federation of Western Reserve University and Case Institute of Technology. In 1980, in recognition of the support and achievements of Cleveland’s entrepreneurial Weatherhead family, the school was named the Weatherhead School of Management.

Today, the Weatherhead School offers academic programs leading to bachelor’s, master’s and doctoral degrees, as well as certificate and executive education programs. Our students are an outstanding and diverse group, selected for their superb academic records, work experience and intellectual and personal attributes. This combination of excellence and diversity assures that the Weatherhead School will produce effective leaders for the regional, national and international business communities.

The Weatherhead School of Management has been fully accredited by the American Assembly of Collegiate Schools of Business since 1958.

Mission

The Weatherhead School is an international center of management scholarship committed to preparing and enhancing organizational leadership. The School is dedicated to making discoveries of enduring consequence, to developing innovative educational programs, to fostering strategic partnerships with students and organizations, and to providing services to multiple communities. The School delivers measurable value to its constituencies through its scholarly commitment to discovery, learning, and service:

- Through the scholarship of discovery, we develop, integrate, and apply new ideas through traditional research and pioneering approaches that transcend conventional boundaries;
- Through the scholarship of learning, we create an environment in which students develop the knowledge and skills to be effective leaders in their professions and communities; and
- Through the scholarship of service, our faculty and students share their knowledge to achieve significant outcomes with partner organizations, our alumni, our community, and our world society.

Vision

The Weatherhead School of Management aspires to be the worldwide leader in developing an outcome orientation in its missions of discovery, learning and service, in achieving a consistent record of innovation, and in creating a learner-centered environment, emphasizing an active learning partnership among students, faculty and organizations. Because of its distinctive record of achievement in these three areas, the school will be recognized by students and key external stakeholders academic colleagues, organizational leaders, and the larger community as one of the top management schools in the United States and in the world.

Core Values

Five core values unite the faculty and staff of the Weatherhead School as management educators, scholars, and colleagues within the University community. These core values express the ethos of our School as well as our aspirations for its future. They guide us in our missions of discovery, learning and service, and will be reflected in all of our efforts:

- We have an overriding scholarly commitment to create and share knowledge for the common good.
- We aspire to make contributions of enduring consequence. We continually strive for outcomes that influence and ultimately change the way people think and act.
- We believe management should be a noble profession, committed to the enhancement of human life, to innovation, to leadership and to the creation of healthy organizations.
- We value a diverse community, characterized by open dialogue and mutual respect among individuals with different specializations, backgrounds, cultures and perspectives.
- We are a learning organization, valuing the abilities to reflect upon and alter assumptions and to pioneer in unexplored territory. We are committed to increasing individual creative capacities, nurturing new and expansive patterns of thought, achieving collective aspirations, and encouraging lifelong learning.

Academic Degree Programs

Professional Programs

Degrees granted by the Weatherhead School of Management)
- Master of Accountancy
- Master of Business Administration (M.B.A.)
- Executive M.B.A.
- Master of Science in Management – Information Systems
- Master of Science in Management - Operations Research
- Master of Science in Management - Supply Chain
- Executive Doctor of Management (E.D.M.)
- Master of Nonprofit Organizations (M.N.O.) (granted jointly by the Weatherhead School of Management and the Mandel School of Applied Social Sciences)

Joint Degree Programs:

(Degrees granted by the Weatherhead School and other schools of CWRU)
- B.S. in Mathematics/M.S. in Management
- J.D./M.B.A.
Undergraduate Programs

Degrees granted by the Weatherhead School of Management

- B.S. in Accounting
- B.S. in Management
- B.A. in Economics (Degree granted by the CWRU College of Arts and Sciences)

Graduate Programs

Degrees granted by the CWRU School of Graduate Studies

- M.S. in Organization Development and Analysis
- Ph.D. in Management
- Ph.D. in Operations Research
- Ph.D. in Organizational Behavior

Non-Degree Certificate Programs

- Certificate in Health Systems Management
- Certificate in Management Information Systems
- Certificate in Nonprofit Management
- Certificate in Public Policy
- Professional Fellows Program

ADMINISTRATION

William K. Laidlaw, Jr.
Interim Dean of the Weatherhead School of Management

Melissa Amos-Landgraf
Director, Career Planning and Student Life

John Aram
Director, Executive Doctorate of Management

Michael Barnes
Assistant Dean for Action Learning and Corporate Liaison

Richard Bennett
Senior Associate to the Dean - Peter B. Lewis Campus

Deborah L. Bibb
Director, Placement Administration

Barbara J. Bolek
Director, Health Systems Management Center

Kevin Carduff
Interim Director, Undergraduate Services

Bo A. Carlsson
Associate Dean for Research and Graduate Programs

Odell Coleman
Assistant Director, Annual Giving

Frances B. Cort
Assistant Dean for Professional Programs

Ronald Fountain
Director, Professional Fellows Program

Ronald Fry
Director, Executive M.B.A. Program

Julia Grant
Associate Dean for Professional and International Programs

Larry Goodpaster
Director, Financial Planning and Analysis

Christin Gill
Director, Marketing and Admissions

Richard Headley
Associate Dean for Executive Education

Marian J. Hogue
Assistant Dean for Academic Affairs

Sarah Jaquay
Director, Corporate Relations

Todd Lloyd
Associate Director, Admissions and International Programs

Ellen M. Machan
Director, Communications

Gary J. Previs
Associate Dean for Undergraduate Programs

Diann Rucki
President, EDI

Richard Shatten
Director, REI

Peggy Sobul
Director, Alumni Affairs

Ellen Brooks Van Oosten
Director, Corporate Education

Weatherhead Degree Programs

The M.B.A. Program

In 1990, the Weatherhead School of Management introduced an innovative M.B.A. program, based on the underlying philosophy that our graduates must create value for organizations and society. The Weatherhead M.B.A. curriculum emphasizes the assessment and development of management skills along with knowledge of the functional areas of business, and offers a liberating experience through exploration of the diverse contexts of management.

In 1997, the Weatherhead School introduced a new, integrated core curriculum, which will enhance the potential of each student to create value by:

- drawing from different perspectives to identify, analyze and resolve complex problems;
- being creative and agile in designing systems and adapting to change;
- developing and enhancing organizational leadership;
- making a personal commitment to life-long learning;
- adding value in a special area of expertise;
- contributing to the betterment and communities and society.

M.B.A. Program Structure

The full-time M.B.A. is delivered as a 63-hour program for candidates with diverse academic backgrounds, and as a 47-hour program for students with undergraduate business degrees from U.S. universities. Part-time instruction is available as a 51-hour program for candidates with diverse academic backgrounds, and as a 42-hour program for students with undergraduate business degrees from US. Both programs involve the same required courses. The part-time curriculum has fewer elective options. The M.B.A. program is divided into management assessment and development, the core curriculum, the perspectives courses and the elective sequence. See the Departmental Course Offerings section for detailed course descriptions.

Full-time M.B.A. Program

63-hour curriculum Core Courses: 33 hours—

Because of the integrative nature of the full-time core, no courses may be waived, regardless of undergraduate equivalent courses.

MBAC 410: Management Assessment and Development I (2)

MBAC 411: Strategic Issues and Applications I (2)

MBAC 412: Management and Career Skills I (1)

MBAC 413: Human Value in Organizations (3)

MBAC 414: Statistics and Decision Models (3)

MBAC 415: Financial Reporting and Control (3)

MBAC 416: Financial Management (3)
47-hour curriculum

Core Courses: 17 hours – Because of the integrative nature of the full-time core, no courses may be waived, regardless of undergraduate equivalent courses.

- MBAC 410: Management Assessment and Development I (2)
- MBAC 410L: Team Skills Lab (1)
- MBAC 411: Strategic Issues and Applications (3)
- MBAC 412: Management and Career Skills (1)
- MBAC 413: Human Value in Organizations (1)
- MBAC 413L: Negotiations Lab (1)
- MBAC 414: Statistics and Decision Models (1)
- MBAC 415: Financial Reporting and Control (1)
- MBAC 416: Financial Management (1)
- MBAC 423: Information Design and Management (1)
- MBAC 424: Marketing (1)
- MBAC 425: Operations Management (1)
- MBAC 426: Economics (1)
- MBAC 440: Management Assessment and Development II (1)

Thematic Electives: 6 hours

Students choose from a group of 30 courses that approach management decision making from a broad, non-functional perspective, selecting no more than one course from the following themes:
- the Global Manager
- Technology Issues and the Manager
- Leadership and Ethics in Management
- the Manager and Society

Advanced Electives: 24 credits

There are no requirements to achieve a concentration to complete degree requirements, however, some students may wish to pursue one (or more) of the concentrations below.

Note that a maximum of 12 hours of Accounting (ACCT) elective credit (beyond ACCT 401) can be counted toward degree requirements, although all coursework necessary to meet Certified Public Accountant (CPA) examination requirements is offered through the Weatherhead School.

Concentrations will be designated on the academic transcript at the time of graduation. Courses can not be double-counted for more than one concentration.

Functional Concentrations

Concentrations in the functional areas below are defined as a minimum of nine hours of electives completed under a single course area designation (i.e., BAFI, MKMR, etc.).

- BAFI Banking and Finance
- ECON Economics
- ENTP Entrepreneurship
- HSMG Health Systems Management
- LHRP Labor and Human Resource Policy
- MIDS Management Information Systems
- MAND Nonprofit Management
- PLCY Management Policy
- MKMR Marketing
- OPMT Operations Management
- OPRE Operations Research
- ORBH Organizational Behavior

International Management Concentration

Completion of three of the following courses meets the requirement for a concentration in International Management:

- ACCT 416: International Accounting for Management
- BAFI 480: International Financial Management
- ECON 472: The World’s Regions and Strategic Advantage
- ECON 473: International Economics for Management
- ECON 474: International Trade
- ECON 475: International Finance
- ECON 476: Fundamentals of International Business
- LHRP 435: International Human Resource Management
- MKMR 405: Industrial and New Technologies Marketing
- MKMR 425: Multinational Marketing
- OPMT 435: International Operations Management
- ORBH 488: Leadership and the Global Agenda
- PLCY 450: Challenges to U.S. Management from East Asia
- PLCY 451: Developing and Implementing Global Strategies

In addition, all courses completed while on international exchange are eligible for international management concentration credit.

Management of Technology Concentration

Completion of three of the following courses meets the requirement for a concentration in Management of Technology:

- ACCT 406: Computer Based Accounting Systems
- ECON 462: Industrial Economics
- ECON 482: High-Tech Regions and Business Strategy
- MIDS 411: Advanced Information Systems
- MIDS 433: Managing Electronic Teams in Global Economy
- MIDS 442: Management of Information Systems
- MKMR 405: Industrial and New Technologies Marketing
- OPMT 480: Operations Strategy and Technology
- ORBH 418: The Management of Work: Socio-technical Systems (offered alternate years with limited availability)
- PLCY 471: Introduction and Development of Management Innovation
- PLCY 472: Strategic and Organizational Issues in Management of Technology

The existence of the above concentrations is not intended to discourage students from pursuing elective course work that would not represent a concentration or pursuing elective course work that would represent a particular area of applied study, such as management control or financial reporting. Faculty advisors in the appropriate departments will be available to develop individual elective sequences as well as counsel students regarding all elective course work. Other course sequences may be organized as specialization (i.e., construction management, nonprofit management, etc.) but will not appear as a concentration on the transcript.
Entrepreneurship Concentration
Completion of three (nine credits) of the following courses meets the requirement for a concentration in entrepreneurship.

Required course(s):
ENTP 429 New Venture Creation or
ENTP 427 Entrepreneurial Behavior and
ENTP 440 – Entrepreneurial Finance
Remaining course(s) from the following list:
ENTP 418 New Enterprise Development
ENTP 419 Entrepreneurship
ENTP 420 Managing the Family Firm
ENTP 422 Managing the Emerging Growth Enterprise
ENTP 424 Advanced Principles of Entrepreneurship
ENTP 426 International Entrepreneurship
ENTP 428 Small Enterprise Consulting
ENTP 434 Business & Nonprofit Entrepreneurship

Supply Chain Management Concentration
Completion of the required course and two additional courses from either Operations or Marketing tracks meet the requirement for a concentration in Supply Chain Management.

Required course:
MKMR/OPMT 407 Supply Chain Management
Remaining Courses in Operations Track:
OPMT/MKMR 475 Logistics/Physical Distribution Management or OPMT/MKMR 476 Purchasing/Materials Management
OPMT 477 Enterprise Resource Planning
Additional courses in Operations Management or Operations Research Remaining courses in Marketing Track:
MKMR/OPMT 475 Logistics/Physical Distribution Management or MKMR/OPMT 476 Purchasing/Materials Management
MKMR 421 Product and Brand Management
Additional courses in Marketing such as MKMR 405, MKMR 425, MKMR 440

e-Business Concentration
Completion of the required course and two additional courses (for a total of 9 credits) meet the requirement for a concentration in e-Business.

Required course:
The Technology of e-Business
Remaining courses (total of 6 credits):
MKMR 412 e-Marketing
MIDS 411 Advances in Information Systems Technology
MIDS 433 Managing Electronic Teams in a Global Economy
MIDS 415 Multimedia Systems
MKMR 407 Supply Chain Management
OPMT 477 Enterprise Resource Planning
ENTP 440 Entrepreneurial Finance
MKMR 450B Entrepreneurial Marketing
PLCY 429 New Venture Creation
ECON 436 Economics of Organizations Internet Business Law (offered by the Law School for MBA credit – available during 2000/2001 academic year)
e-Business Strategy (available during 2000/2001 academic year)
Electronic Payment Systems (available during 2000/2001 academic year)
M.B.A. students are limited to six hours of elective credit as independent study. Any hours greater than six will be subject to petition and approval by the Associate Dean for Professional Programs.

The following CWRU courses have been approved for M.B.A. elective credit:
MAND 401: Introduction to the Nonprofit Sector (3)
MAND 405: Ethics, Professionalism and Leadership (2)
MAND 450: Law of Nonprofit Organizations (3)
Other CWRU courses may be eligible for M.B.A. elective credit. Contact the registrar for additional information.

Non-Credit Supplemental Instruction in computer familiarity.
The Weatherhead School offers non-credit supplemental instruction to M.B.A. students in computer familiarization.

Statistics Preparation Workshop
All admitted students in the 63-hour curriculum must demonstrate proficiency in quantitative skills in order to enroll in the M.B.A. program. They can satisfy this requirement by having completed a college-level statistics course. Students who have not completed a statistics course must take the Statistics Preparation Workshop, offered one week before the start of the first semester.

PART-TIME M.B.A. PROGRAM

The part-time M.B.A. program is designed for qualified students who wish to pursue their graduate management education by taking evening courses. The majority of these students work full-time for organizations in the Cleveland area. The same full-time faculty teach both evening and daytime classes. The full-time and part-time programs have the same admission standards and course requirements, and both are accredited by the AACSB.

Part-time instruction is available as a 51-hour program for candidates with diverse academic backgrounds, and as a 42-hour program for students with undergraduate business degrees from U.S. Residency Requirement. With one or two “overload” semesters, the 51-credit hour program can be completed in three years, and the 42-hour program can be completed in two years.

Part-time 51-hour curriculum Core Courses: 33 hours –
Students who have completed undergraduate equivalent coursework may substitute
MGMT 400: Management Assessment and Development I (2)
MGMT 402: Strategic Issues and Applications I (1)
MGMT 418: Management and Career Skills (3)*
MGMT 413: Human Value in Organizations (3)
QUMM 414: Statistics and Decision Models (3)
ACCT 401: Financial Reporting and Control (3)
BAFI 402: Financial Management (3)
MIDS 409: Information Design and Management (3)
MKMR 403: Marketing (3)
OPMT 405: Operations Management (3)
ECON 403: Economics (3)
MGMT 429: Management Assessment and Development II (1)
MGMT 431: Strategic Issues and Applications II (2)

*Students who have completed executive skills seminars outside of the M.B.A. program may exempt from this course and reduce total core credits to 30.
Part-time 42-hour curriculum Core Courses: 24 hours —

Students with undergraduate business degrees may waive or replace four or more courses from the list below as long as their total core curriculum totals no less than 24 hours.

- MGMT 403, Management Assessment and Development (3)
- MGMT 413, Human Value in Organizations (3)
- MGMT 418, Management and Career Skills (3)
- QUMM 414, Statistics and Decision Models (3)
- ACCT 401, Financial Reporting and Control (3)
- BAFI 402, Financial Management (3)
- MKMR 409, Information Design and Management (3)
- MIDS 409, Information Design and Management (3)
- MGMT 499, Strategic Issues and Applications (3)

Part-time Thematic Elective: 3 hours

Students choose one course from a group of 30 courses that approach management decision making from a broad, non-functional perspective, selecting no more than one course from the following themes:

- The Global Manager
- Technology Issues and the Manager
- Leadership and Ethics in Management
- The Manager and Society

Part-time Advanced Electives: 15 hours

There are no requirements to achieve a concentration to complete degree requirements. For more information about choosing a concentration please refer to the section describing concentrations in the full-time program description.

International Management Center (IMC) International M.B.A. Program

The program with IMC, which began in 1996, is being phased out and no new students are being accepted into the program.

Contact Fran Cort, Assistant Dean for Professional and International Programs (phone: 216-368-3315, email: fxc@po.cwru.edu)

EXECUTIVE DOCTOR OF MANAGEMENT

The Executive Doctor of Management (EDM) Program is an interdisciplinary, doctoral degree program designed specifically for experienced, practicing executives. The E.D.M. program focuses on the broad economic, political, social, and technological forces shaping contemporary institutions including business.

Qualifications for the E.D.M. Program include an M.B.A. or equivalent graduate degree, at least 15 years of experience, including a minimum of 10 years in management positions, and a personal commitment to seeking a broader and deeper understanding of the global context of management today. For further details, a program brochure and information on applying to the E.D.M. Program contact Sue Nartker, Program Manager, at 216-368-2042.

EXECUTIVE MASTER OF BUSINESS ADMINISTRATION

The Executive Master of Business Administration (E.M.B.A.) program, a two-year, five-semester program, is specifically designed to prepare experienced managers with the knowledge, skills and perspective required for expanded general manager and executive responsibility. An applicant to the program must have 10 years of experience, 5 of those in a management capacity, company sponsorship, and an in-person interview. The program is conducted in all-day sessions on alternating Fridays and Saturdays, plus three, 3-4 day off-site residencies. Request a program brochure by calling the Dively Management Center at 216-368-2042.

MASTER OF ACCOUNTANCY

The Master of Accountancy is an integrative program, which builds directly upon the student’s undergraduate education. Entering students must have an undergraduate degree in accountancy from an accredited U.S. program, or the equivalent. Students who do not have an accountancy degree may still be admitted, but will need to take courses to provide an appropriate foundation in business and accountancy. The program is normally 36 semester hours for those who have an undergraduate accountancy degree. Entering students without an accountancy degree will usually require an extended period of study in the program to meet prerequisites in the following areas:

- General Business. Business law, corporate finance, marketing, micro and macro economics, organizational behavior, operations management and statistics
- Accountancy. Principles, intermediate financial accounting, advanced financial accounting, managerial accountancy, U.S. taxation and auditing

The program is primarily designed for students interested in full-time study. Part-time students are also admitted, contingent upon their commitment to complete the program on a timely basis. Students may be admitted for study at the beginning of the Fall, Spring or Summer terms, but it is generally advantageous to begin study in the Fall term. Some scholarships are available to exceptional applicants for the full-time program.

Undergraduate accountancy students at Case Western Reserve University are strongly advised to enter and complete the Master of Accountancy program in their fifth year. University policies permit such students an opportunity to complete the Master of Accountancy in 30 hours, rather than 36, if course selection is properly planned. Certain highly qualified undergraduate students in Accountancy may be eligible to accelerate their completion of the B.S. in Accountancy and the Master of Accountancy through the integrated studies 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 plan-

*Students who have completed executive skills seminars outside of the M.B.A. program may exempt from this course and reduce total core credits to 30.
The goal of the M.S.M.-IS program is to educate a new standard of systems professionals to meet the needs of evolving technological and organizational challenges. Beyond a strong, state-of-the-art technical ability, the M.S.M.-IS program will provide graduates with:

- Thorough knowledge of organizational analysis techniques for creatively designing business processes that improve performance and learning in work groups.
- Communication skills to effectively lead teams, collaborate with other managers in defining needs and opportunities, and coach their colleagues.
- Practical techniques to successfully manage complex change processes, and integrate emerging technologies into organizational practices.

The M.S.M.-IS is for those who desire a strong, specialist program in organizational consulting and information technology. Because of its specialization and focus, the M.S.M.-IS differs significantly from an M.B.A. program, which is for those who desire a more general management background.

The M.S.M.-IS program is expressly intended for a diverse community of students, in the belief that creative and effective use of information technology requires a wide variety of expertise - from computer science, engineering, and management to history, humanities and sociology. The critical admission requirements are a strong analytic and communication potential, a demonstrated interest in information technology and a commitment to furthering its effective use in the world.

**Curriculum**

Three integrative courses extend over the Fall and Spring semesters (1.5 credit hour per term) and serve to supplement and unify consulting skills from the regular semester courses. They are:

- Communication and Negotiation
- Change Management
- Technology and Society

A three course “Models of Management” sequence enables students to diagnose organizational problems with a holistic perspective, and to employ the principal conceptual models used by managers in the major functional areas of the firm. These three courses are taught jointly by multi-disciplinary faculty teams. The material is true to the complexities and nuances of the full breadth of management thinking, yet focused on the needs of information technology deployment. The models of management courses are:

- Business Processes
- The Firm and its Environment
- Dynamics of the Firm

Four technology courses present a compressed and intensive training in developing information systems. These courses emphasize both hands-on experience and strong conceptual understanding of current and emerging information technologies.

- Design of Object-Oriented Systems
- System Development and Data Management
- Information Technology Architectures
- Intelligent Systems

The three-course system management sequence ensures that the deployment of information technology provides economic and human value to the firm. The courses are:

- System Analysis and Organizational Design
- Advances in Information Systems Technology
- Management of Information Systems

M.S.M.-IS Students must also choose one elective course from the Information Systems (MIDS) department. The following elective courses are currently offered:

- Technologies of E-Business
- Multimedia Systems
- Managing Electronic Teams
Full-Time Study:

Summer
- Business Processes (3)
- The Firm and its Environment (3)
- Object-Oriented Programming (3)

Fall
- Communication and Negotiation (1.5)
- Change Management (1.5)
- Technology and Society (1.5)
- Dynamics of the Firm (3)
- Information Technology Architectures (3)
- System Analysis and Organizational Design (3)
- MIDS Elective (3)

Spring
- Communication and Negotiation (1.5)
- Change Management (1.5)
- Technology and Society (1.5)
- Advances in Information Systems Technology (3)
- Intelligent Systems (3)
- Management of Information Systems (3)
- Systems Development and Data Management (3)

Part-Time Study:

Summer Semester I
- Business Processes (3)
- The Firm and its Environment (3)

Fall Semester I
- Communication and Negotiation (1.5)
- Object-Oriented Programming (3)
- Information Technology Architectures (3)
- Spring Semester I
- Communication and Negotiation (1.5)
- System Analysis and Organizational Design (3)
- System Development and Data Management (3)

Summer Semester II
- Technology and Society (3)
- Advances in Information Systems Technology (3)

Fall Semester II
- Change Management (1.5)
- MIDS Elective (3)
- Dynamics of the Firm (3)

Spring Semester II
- Change Management (1.5)
- Intelligent Support Systems (3)
- Management of Technology (3)

Residency Requirement

M.S.M.-IS students must register for a minimum of 36 credit hours in the Weatherhead School of Management. This obligation is termed the “residency requirement.”

Contact the Department Administrator, MIDS Department at (216) 368-2144 for an application and additional information.

MASTER OF SCIENCE IN
MANAGEMENT IN
OPERATIONS RESEARCH
(M.S.M.-OR)

Operations research (or management science) uses mathematics, statistics and computers to help managers make decisions regarding complex organizational problems. These types of problems arise in manufacturing and service companies as well as many other kinds of organizations. Decision problems may be solved by developing mathematical models of the problem, using a computer to obtain a solution, then validating that the solution can be implemented and performs as predicted by the model.

Purpose of the M.S.M.-OR

The 36-credit-hour M.S.M.-OR Program trains students in the techniques and applications of operations research and provides them with a basic understanding of business fundamentals in order to contribute value to organizations and communicate effectively with managers.

M.S.M.-OR Curriculum

Requirements for the M.S.M.-OR degree are typically completed in 18 months of full-time study, or in one calendar year by taking 6 credit hours in the Summer semester and 15 credit hours in both the Fall and Spring semesters. All students are strongly encouraged to begin the program in the Summer semester; however, some students may begin in the Fall or Spring semesters. The program is also available part-time.

The M.S.M.-OR curriculum comprises three components; the Business Core, the Operations Research Core, and a Specialty Track.

Business Core (6 credit hours total):

- The Business Core provides students with an introduction to the major principles and concepts of business operations. Subject areas addressed in the Business Core include Accounting, Economics, Finance, Information Systems, Marketing and Operations.

Operations Research Core (18 credit hours total):

- The Operations Research Core provides a solid grounding in the techniques of management science. Course requirements include:
  - Prerequisite Mathematics Courses (if needed)

Required Courses (1.5 credit hours each):

- Linear Programming
- Deterministic Models with Applications
- Stochastic Models with Applications
- Probability II
- Statistics
- Regression and Experimental Design
- Simulation Design
- Simulation Models with Applications
- Integrated Problem Solving
- Computer Programming
- Data Structures
- Specialty Track (12 credit hours total):
  - To obtain an in-depth, marketable set of skills in one area of concentration, students take a coherent sequence of courses in one of four tracks. Representative courses include the following:

Operations Research


Operations Management


Finance

- Applied Security analysis, Personal and Institutional Money Management, Options and Futures, Risk Management

**Information Systems**


**MASTER OF SCIENCE IN MANAGEMENT IN SUPPLY CHAIN (M.S.M.-SC)**

Supply chain management deals with the coordination of all activities that impact a product flowing from its sources of raw materials to customers for the purpose of creating time, place, and from values in the end product.

The product may be a physical good, a service, and idea, information or other entity that flows through a defined pipeline or channel.

**Purpose of the M.S.M.-SC**

The 36-credit-hour M.S.M.-SC Program trains students at the masters’ level in supply chain methods and concepts, business fundamentals, and quantitative techniques in order to be effective analysts in manufacturing and service companies.

**M.S.M.-SC Curriculum**

Requirements for the M.S.M.-SC degree may be completed in one calendar year by taking 6 credit hours in the Summer semester and 15 credit hours in both the Fall and Spring semesters. Students wishing to complete the program in 18 months or less must begin the program in the Summer semester. The program is also available part-time.

The M.S.M.-SC curriculum comprises three components: the Business Core, the Supply Chain Core, and Specialty Electives.

**Business Core (6 credit hours total):**

The Business Core provides students with an introduction to the major principles and concepts of business operations. Subject areas addressed in the Business Core include Accounting, Economics, Finance, Information Systems, Marketing and Operations.

**Supply Chain Core (24 credit hours total):**

The Supply Chain Core provides coverage of the techniques of Management Science as well as the fundamentals of Supply Chain Management. Course requirements include:

- Prerequisite Mathematics Courses (if needed)

**Required Courses**

**Quantitative (1.5 credit hours each):**

- Linear Programming
- Deterministic Models with Applications
- Probability Applications
- Statistics
- Regression and Experimental Design
- Simulation Models with Applications
- Simulations Design
- Integrated Problem Solving

**Managerial (3 credit hours each):**

- Supply Chain Management
- Logistics/Physical Distribution Management
- Purchasing/Materials Management
- Enterprise Resource Planning

**Specialty Elective (6 credit hours total):**

With the recommendation of their program advisor, M.S.M.-SC students select courses from Operations Research and/or Operations Management appropriate to their career goals.

**MASTER OF NONPROFIT ORGANIZATIONS (M.N.O.)**

(Weatherhead School of Management and Mandel School of Applied Social Sciences)

The M.N.O. is an advanced professional degree offered through the Mandel Center for Nonprofit Organizations, a University-wide center for education, research and community service. The Mandel Center is co-sponsored by the Mandel School of Applied Social Sciences, the Weatherhead School of Management, the School of Law, and the College of Arts and Sciences.

The M.N.O. degree is a 60-credit-hour program, including 33 hours of required course work, 12 hours from a menu of 10 “choice” courses, and an additional 15 hours of elective courses. Electives may be selected from either the “choice” courses or from an array of relevant courses offered by CWRU professional schools and the College of Arts and Sciences. One course (MAND 425) requires an all-day, four-day session of intensive study in January. Students may pursue the M.N.O. on a full- or part-time basis.

The revised M.N.O. curriculum described in this bulletin will be inaugurated in the Fall 2000 semester. For further information, contact the Mandel Center Director of Education at (216) 368-8565.

**Admission Requirements**

For additional information concerning the M.N.O. Program (including scholarships), contact the Director of Education at (216) 368-8565, by e-mail at ckw3@po.cwru.edu, or by mail at Case Western Reserve University, Cleveland, Ohio 44106-7167.

**Scholarship Aid**

The Mandel Center offers the Mandel/Premier National Scholarship as well as other generous scholarships for the M.N.O. program.

**Advanced Standing for Certificate Holders**

Students who have completed the Certificate in Nonprofit Management (CNM) may be eligible for advanced standing, based on certificate course work completed with a grade of B or better, if admitted to the M.N.O. program.
Waiver Policy
A total of six credit hours are eligible for waiver, subject to the following requirements. Courses to be waived must have been taken within the past five years and prior to admission to the M.N.O. program. A grade of B or above must have been earned from an accredited institution. Courses cannot be waived based upon work experience, and the decision to waive rests with the instructor of the course. A waived course may shorten degree requirements.

Transfer Credit
Courses granted transfer credit must be approved as applicable to the M.N.O. program. Courses must be taken at an AACSB accredited institution and approved prior to enrollment. Satisfactory grades must be achieved (grades not counted in cumulative grade point average). Transfer credit is limited to six credits.

Substitution
An additional nine credits may be approved for substitute credit. Substitute courses replace required M.N.O 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 the student’s interests/needs and the M.N.O. program mission.

Residency Requirement
Students must complete a minimum of 54 hours of coursework in residence, through the Weatherhead School of Management, to be eligible to receive the M.N.O. degree.

Registration
Registration for M.N.O. and certificate programs is through the Weatherhead School of Management. Refer to the section on Registration and Academic Information for information about course changes and withdrawals. For additional information about registration, contact the Weatherhead School of Management Assistant Dean for Academic Affairs (216) 368-8907.

Retention and Graduation Requirements
The retention requirements for continued study in the M.N.O. program are:
- Minimum GPA after 15 credit hours of study: 2.5
- Minimum GPA after 23 credit hours of study: 2.7
- Minimum GPA after 29 credit hours of study: 3.0
- Minimum GPA for graduation: 3.0
A student will be placed on academic probation after any semester in which the minimum GPA is not attained. A student on academic probation must achieve the retention level in the next semester in which they register.

Non-Degree Students
A maximum of two courses (six credits) from Mandel Center offerings may be taken by non-degree students. Non-degree students may be admitted through the Weatherhead School of Management on a space-available basis. Contact the Weatherhead School Admissions Officer at (216) 368-2030 for an application and additional information.

Joint Degree Programs

J.D./M.B.A. JOINT DEGREE PROGRAM
The Weatherhead School of Management at Case Western Reserve University has a formal full-time joint degree program with the CWRU School of Law. Students enrolled in the program who fulfill the requirements set for graduation by both schools will receive both a J.D. and an M.B.A. degree.

Purpose
For those who wish to specialize in the governmental aspects of management, the M.B.A. and J.D. degree programs complement each other. J.D./M.B.A. graduates from CWRU have worked in the areas of labor law, tax law, health law, legal aspects of systems management, etc., for law firms, corporations and government agencies. J.D./M.B.A.s often join entrepreneurial firms that are in special need of business and legal advice during the period of rapid organizational growth.

Program Structure
The Weatherhead School of Management offers two curriculum options for M.B.A. students: the accelerated, 11-month M.B.A. Program (for students with undergraduate business degrees); and the traditional, two-year M.B.A. program (for students with all other undergraduate degrees).

Students enrolled in the traditional M.B.A. Program may complete the three-year J.D. program and the two-year M.B.A. program in four academic years (including a 9-credit overload which can be taken during the academic year or during the summer semester). Students in the accelerated M.B.A. Program may complete the J.D./M.B.A. Program in 3 years, plus one semester. Joint degree candidates may start the J.D./M.B.A. program at either school.

The School of Law allows joint degree students to use 12 credit hours from the M.B.A. to fulfill both J.D. and M.B.A. requirements. The Weatherhead School allows joint degree students to use 12 credit hours from the School of Law to fulfill both M.B.A. and J.D. 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 (if the residence requirement for each school is met).

Students in the joint program are encouraged, but not required, to make use of the summer programs of the two schools in planning their joint programs. (They may also opt for enrolling in additional courses during the fall or spring semesters.). The School of Law is a full-time day school with no evening division. Therefore, J.D./M.B.A. students may enroll only on a full-time basis, except during summer sessions.

Joint degree students must receive both the J.D. and the M.B.A. degrees simultaneously upon completion of degree requirements at both schools in order to receive the 21 hours of cross-credits described above.

Admission to the J.D./M.B.A. Program J.D./M.B.A. applicants must meet all of the admission requirements of both
schools, including taking both the LSAT and the GMAT and completing separate applications to both schools (indicating in the section on both applications that they are applying for the J.D./M.B.A.) and paying both application fees. Students may defer the decision to apply to the J.D./M.B.A. program until after enrolling in either the M.B.A. or J.D. program provided that the application to the second school is received before the beginning of the third semester in either program. Normally, students are expected to take one full year of study in one program followed by one full year of study in the other. During the third and fourth years of the J.D./M.B.A., students combine courses in both schools each semester. Best J.D. contact for joint degree candidates: Andrew Morriss—368-3302. Best M.B.A. contact for joint degree candidates: Linda Gaston—368-2031.

Registration
Throughout the joint degree program, J.D./M.B.A. students continue to register in the first school they attended. After completion of both degree programs, two separate transcripts and diplomas are awarded. Course work for both programs must be completed within six years of the date of initial enrollment in either program.

M.D./M.B.A. JOIN THE DEGREE PROGRAM
The M.D./M.B.A. degree was developed to respond to the growing need in the medical and health care community for doctors who have management skills and knowledge.

Program Structure
In the M.D./M.B.A. Program, students may double count elective courses from the M.D. and reduce hours from the M.B.A., which shorten their M.B.A. degree by 10 credit hours. Students can complete the four-year M.D. degree and two-year M.B.A. degree in five years (including taking a course overload for four semesters).

Admission to the M.D./M.B.A. Program
M.D./M.B.A. applicants must meet all of the admission requirements of both schools, including taking both the MCAT and the GMAT and completing separate applications to both schools (indicating in the section on both applications that they are applying for the M.D./M.B.A.) and paying both application fees. Students may defer the decision to apply to the M.D./M.B.A. program until after enrolling in either the M.B.A. or M.D. program providing that the application to the second school is received before the beginning of the third semester in either program.

Registration
M.D./M.B.A. students register at the medical school for all years except for the year (Year 1 or Year 3) and any summer session in which they take only M.B.A. courses. During these periods, M.D./M.B.A. students register and pay tuition at the WSOM.

Joint degree students must receive both the M.D. and the M.B.A. degrees simultaneously upon completion of degree requirements at both schools in order to receive the 12 hours of cross-credits described above.

If the M.D. is registering through the Medical School, WSOM will not charge for the semesters during which the student is taking only M.B.A. courses. Each course is three credits. Electives in the M.B.A. program.

Structure of the M.B.A. Curriculum in the M.D./M.B.A. Program
Each course is 3 credits. Electives in the M.B.A. program.

(Traditional M.B.A. Core (34 credits)

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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<tbody>
<tr>
<td>Management Assessment and Development</td>
<td>3.0</td>
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<tr>
<td>Human Value in Organizations</td>
<td>3.0</td>
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<tr>
<td>Introduction to Financial Management</td>
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<tr>
<td>Health Care Economics*</td>
<td>3.0</td>
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<tr>
<td>Health Care Marketing*</td>
<td>3.0</td>
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<tr>
<td>Systems Design and Management</td>
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</tbody>
</table>

Plan A: (54 credit M.B.A.)

Year 1 At Weatherhead
Fall Semester: (17 credits)

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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<tbody>
<tr>
<td>Financial Reporting and Control</td>
<td>3.0</td>
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<tr>
<td>Financial Management</td>
<td>3.0</td>
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<tr>
<td>Health Care Economics*</td>
<td>3.0</td>
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<tr>
<td>Health Care Marketing*</td>
<td>3.0</td>
</tr>
<tr>
<td>Operations Management for Service Orgs.*</td>
<td>3.0</td>
</tr>
<tr>
<td>Statistics and Decision Modeling</td>
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Year 2 at WSOM
Spring Semester: (15 credits)

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<tr>
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<tr>
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<tr>
<td>Statistics and Decision Modeling</td>
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Year 3 at WSOM
Fall Semester: (17 credits)

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<tr>
<td>Statistics and Decision Modeling</td>
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Year 4 at WSOM
Spring Semester: (15 credits)

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<tbody>
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<tr>
<td>Health Care Marketing*</td>
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<tr>
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Year 5 at WSOM
Fall Semester: (15 credits)

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<tbody>
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<td>Health Care Economics*</td>
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<td>Health Care Marketing*</td>
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<tr>
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<tr>
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Year 6 at WSOM
Spring Semester: (15 credits)

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<td>3.0</td>
</tr>
<tr>
<td>Statistics and Decision Modeling</td>
<td>3.0</td>
</tr>
</tbody>
</table>
Operations Management for Service Organizations*
Systems Design and Management
Strategic Issues and Applications
Summer Semester (6 credits)
Summer Institute in Europe or Two electives

Year 2 at Medical School
Standard Medical School Curriculum plus
Fall Semester (3 credits)
  Health Systems Finance*
  Spring Semester (4 credits)
  Strategic Issues in Health Care*

Year 3 at Medical School
Standard Medical School Curriculum plus
Fall Semester (6 credits)
  Health Law*
  Elective
  Spring Semester (3 credits)
  Additional Elective

Years 4 and 5 at Medical School
Standard Medical School Curriculum

Plan B (54 credit M.B.A.)

Year 1 at Medical School
Standard Medical School Curriculum plus
Fall Semester (6 credits)
  Management Assessment
  Health Systems Finance*
  Spring Semester (3 credits)
  Strategic Issues in Health Care*

Year 2 at Medical School
Standard Medical School Curriculum plus
Fall Semester (3 credits)
  Health Law* or Health Care Information Systems*
  Spring Semester (3 credits)
  Health Care Marketing*

Year 3 at Weatherhead
Summer Semester (6 credits)
  Summer Institute or Financial Reporting and Control Financial Management
Fall Semester (18 credits)
  Strategic Issues and Applications
  Health Care Economics*
  Communication Skills
  Financial Reporting and Control
  Financial Management
  Statistics and Decision Models
  Human Value in Organizations
  Elective
  Spring Semester: (15 credits)
  Health Care Marketing*
  Health Care Economics*
  Operations Management for Service Organizations*
  Negotiation Skills and Effective Group Management
  Strategic Issues and Applications
  Systems Design and Management

Years 4 and 5 at Medical School
Standard Medical School Curriculum

Plan C
The Health Care Certificate (5 courses, 15 credits; see courses with *) may be taken independent of the M.B.A. during the first two years of Medical School. Students wishing to pursue the M.B.A. later will be credited with 15 hours toward the degree.

If a Medical School student begins as a student in the HSM Certificate Program and wishes to switch to the M.D./M.B.A. Program, all course work will transfer to the M.B.A. degree, as long as the student applies to the M.B.A. program within 6 academic years of enrolling in the certificate program.

THE M.S.S.A./M.B.A. JOINT DEGREE PROGRAM

Program Objective
The M.S.S.A./M.B.A. joint degree program is designed for candidates who wish to prepare for advanced social work practice in a variety of clinical settings, while developing the skills to assume management responsibility in those organizations.

Admission Requirements
Candidates must apply separately to the M.S.S.A. program at the Mandel School of Applied Social Science and the M.B.A. program at the Weatherhead School of Management, and complete all application requirements of both schools, indicating on both applications their intent to join the joint degree program. Admission decisions are made independently by each school. After admission, each school will copy the other school on the admission decision. Candidates to the joint program will be expected to meet admission standards for academic records, test scores, and other criteria set by both schools. In addition, candidates must have completed a minimum of two years of full-time experience in a social service organization.

Program Structure
M.S.S.A./M.B.A. students may begin the joint degree in either school. Students will continue to register in the school at which they began the program, regardless of the school they are attending. When students have completed all degree requirements for both degrees, they will receive separate transcripts and diplomas for each degree.

Students in the joint M.B.A./M.S.S.A. degree program may begin their program at either MSASS or WSOM. Students who prefer to be considered for internship between the first and second years of the program may prefer to begin the curriculum at WSOM.

Part-time Program Structure
Although the following curriculum structure has been designed for the traditional full-time programs at both schools, it can be adjusted for students who wish to complete the M.S.S.A./M.B.A. at a part-time pace.

Credit Requirements
There are 105 credits in the joint M.S.S.A./M.B.A. Program (51 credits at MSASS, 54 credits at WSOM), compared with 125 credits 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, joint degree students may complete the M.S.S.A./M.B.A. in three years, instead of the four years required if both degrees were to be completed separately. Students will be charged the MSASS tuition rate for all M.S.S.A. coursework and the WSOM tuition rate for all M.B.A. coursework.

Joint M.B.A./M.S.M.-IS Degree Program
72 hour M.B.A./M.S.M.-IS Curriculum for Students Admitted to the Four-Semester M.B.A. Program
This 72-hour curriculum structure is designed to allow a joint degree candidate to complete degree requirements within two calendar years. Students who wish to obtain a full-time internship during the summer between the first and second years (or completing the M.S.M.IS/M.B.A. at a slower pace) program should consult with Colleen Gepperth (368-2144/cam4@po.cwru.edu) or Frances Cort (368-3315/fxc@po.cwru.edu) to discuss curriculum options for completing the joint degree at the end of the summer of the second year.

**66-hour M.B.A./M.S.M.IS Curriculum for Students Admitted to the Accelerated M.B.A. Program**

This 66-hour curriculum structure is designed to allow M.S.M.IS/M.B.A. degree candidates with undergraduate business degrees to complete joint degree requirements within fifteen months. Students who wish to complete the joint degree at a less accelerated pace or who wish to obtain a full-time internship during the summer II semester should consult with Colleen Gepperth (368-2144/cam4@po.cwru.edu) or Frances Cort (368-3315/fxc@po.cwru.edu) to discuss curriculum options for extending completion of the joint degree requirements through the Spring 2 semester.

**M.B.A./M.S.M.-OR Degree Program and M.B.A./M.S.M.-SC Degree Program**

Contact the Admissions Officer, Operations Department at (216) 368-3845, for detailed information about the M.S.M. degrees offered through the Department of Operations (Operations Research and Supply Chain).

**Registration Requirements**

Students in the M.S.M./M.B.A. program will register through the Weatherhead School of Management for all joint-degree course work.

**Degree Requirements**

Students may pursue the M.S.M.-OR/M.B.A. or M.S.M.-SC/MBA on a full-time or part-time basis. Students planning to attend part-time should confer with an advisor to determine the appropriate sequence of courses in the program. Full-time and part-time students who already have begun the M.S.M. or M.B.A. program must complete their application to the joint degree program no later than upon completion of 18 credit hours in the M.S.M. program or 30 credit hours in the M.B.A. program (12 credit hours in the accelerated M.B.A. program).

Students in the joint degree program will receive both degrees simultaneously, regardless of whether course work for one of the degrees has been completed. Course work for both programs must be completed within six years of the date of initial enrollment in either program. Students in the joint degree program will be granted an automatic one-year extension to the five-year deadline for completion of the M.S.M. degree.

**Retention Requirements**

GPAs of students in the joint degree program will be calculated separately to determine compliance with retention requirements in each program. Students may have up to six additional credit hours beyond the minimum to meet degree requirements to improve their cumulative GPA in order to attain the graduation GPA requirement for the appropriate program.

Students must also comply with the 36-credit-hour residency requirement of the M.B.A. program and the 36-credit-hour requirement for the M.S.M.

**M.B.A./M.S.M. Program Structure**

Contact Fran Cort, Assistant Dean for Professional and International Programs to discuss curriculum options (phone: 216-368-3315, e-mail: fxc@po.cwru.edu).

**THE JOINT M.B.A./M.I.M. DEGREE**

**Program Description**

The Weatherhead School of Management and the American Graduate School of International Management—better known as the Thunderbird School—in Glendale, Arizona, jointly offer a graduate level program in both management and international studies.

This combined degree program, the Master of Business Administration/Master of International Management, provides the strengths and career planning advantages of both schools for students who wish to build a career in international business by offering:

- a unique management skills assessment and development process and strong functional concentrations in finance, marketing, MIS, operations, human resource management, entrepreneurship and health care management available through the M.B.A. program at the Weatherhead School
- foreign language fluency, with an emphasis on business communications, and a wide range of course offerings in international studies and world business through the M.I.M. program at Thunderbird
- access to all placement services and alumni networks at both schools, both during enrollment in the joint degree program and as a graduate of the joint degree program

**Program Structure**

Because of the interdisciplinary advantages achieved when taking both degrees simultaneously, students in the M.B.A./M.I.M. joint degree program are able to accelerate and streamline coursework in both schools. As a result, most students can complete the joint program in 78 hours (2 years, including summers), as compared to the 102 hours (3 years) required to complete the two programs separately. Students with undergraduate degrees in business may be able to complete the joint program in 66 hours, or 21 months. In order to progress through the joint degree program at the most efficient pace, students should plan to first enroll at the Weatherhead School and complete the program at the Thunderbird School.

Both degrees must be awarded simultaneously at the completion of all joint degree requirements.

The following is a typical curriculum structure for the 78-hour M.B.A./M.I.M. program for a student whose undergraduate degree is not in business administration.

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CWRU GENERAL BULLETIN 2000-2002  WEATHERHEAD SCHOOL OF MANAGEMENT • 463
The 78-Hour Curriculum for Non-Business Undergraduate Degree Holders

At Weatherhead (52 hours)

**Fall Semester I (17 credits)**
- Business Core (17 cr.)

**Spring Semester I (18 credits)**
- Business Core (15 cr.)
- Open elective (3 credits)

**Fall Semester II (17 credits)**
- Thematic elective (non-global) (3 credits)
- Open electives (12 cr.)
- Exit assessment (1 credit)
- Executive dialogues (1 credit)
- The Weatherhead School will accept credit for one perspectives course (3 cr.) and three electives (9 cr.) from Thunderbird coursework.

At Thunderbird (30 hours)

**Winter Session I (3 weeks/3 credits)**
- Foreign language or International Studies (3 cr.)

**Summer Semester II (12 credits)**
- World Business (6 cr.)
- International Studies (6 cr.)

**Spring Semester II (15 credits)**
- World Business (9 cr.)
- International Studies (6 cr.)

**Part-time Enrollment Option**

Both schools offer part-time enrollment options. Students who wish to pursue the joint degree program on a part-time basis should speak with curriculum advisors at each school before applying to either school.

**Application/Admissions Process**

Prospective students who are interested in applying to the joint M.B.A./M.I.M. program offered by the Weatherhead School and the Thunderbird School should apply separately to each school. (Applicants to the Weatherhead School should indicate their interest in the M.B.A./M.I.M. in the appropriate area under “Intended Program” at the top of the first page of the Weatherhead M.B.A. application.) Separate transcripts, GMAT and TOEFL scores, recommendations, essays and other materials required to complete application at each school must be sent individually to each school.

The admissions committees of each institution will maintain independent control over its admissions criteria and procedures. Students must be admitted separately to each of the programs. Admission to one school has no bearing upon admission to the other.

Students who have already been enrolled in the M.B.A. or M.I.M. program before pursuing their interest in the joint M.B.A./M.I.M. degree will be permitted to apply to the joint degree program provided they have completed no more than 27 hours in either program.

Students applying to the joint degree program are also eligible to apply for scholarships, fellowships and loan programs at both schools. Please refer to the application catalog of each school for information regarding tuition, financial aid, etc.

For other information about the joint degree program please contact:

At Weatherhead:
- Frances B. Cort
- Assistant Dean for Professional and International Programs
  (216) 368-3315

At Thunderbird:
- W. Richard Bossert
  Associate Vice President for Academic Affairs
  (602) 978-7251

To request Thunderbird application materials, please contact:

Dean of Admissions
American Graduate School of International Management—Thunderbird
15249 North 59th Street
Glendale, AZ 85306-6003
(602) 978-7210 (800) 848-9084
Fax: (602) 439-5432

**M.S.N./M.B.A. DEGREE PROGRAM**

The Master of Science in Nursing/Master of Business Administration (M.S.N./M.B.A.) joint degree is designed to provide nurses with the managerial and organizational skills needed to manage patient care environments or health programs and, at executive levels, to participate fully in the strategic and operational leadership of hospitals, other health care agencies or corporations. Graduates will have developed the critical and creative thinking skills needed to function fully in a variety of management contexts.

M.S.N./M.B.A. students will participate in a condensed version of both individual degree programs. The core curricula from each school remain intact, but the two degrees can be completed jointly in 75% of the time needed to complete each individually. Candidates entering the program must bring with them a strong clinical background, possess current assessment skills, and have at least two years of clinical nursing experience.

**Program Description**

There are two tracks available to an M.S.N./M.B.A. student: 1) a management track; and 2) a clinical specialty track. At least nine hours of practice in either specialty are included. The managerial practicum will be coordinated with community health care organizations and industries; the clinical specialty with a local hospital.

The 72-hour course of study is designed to integrate nursing and management courses by having students take both concurrently throughout the program. For those who select the management track, a nine-hour practicum must be taken in one semester. For those who select a clinical specialty track, the practice will be arranged according to the varying specialty requirements.

The following course sequence represents a suggested order in which courses may be taken. With the exception of the statistical courses (QUMM 403 and QUMM 405) and the three nursing inquiry courses, which must be taken in sequence, there are few prerequisites for the other courses. This enables the program to be very flexible and allows the students to establish their own schedule according to their specific needs.

The M.S.N. curriculum component consists of scientific inquiry (9-11 hours), professional development (6 hours), clinical specialty (9 hours) and career options (3 hours), for a total of 27 credit hours.

The M.B.A. curriculum component consists of management assessment (3 hours), perspectives (3 hours), M.B.A. core (33 hours) and electives (6 hours), for a total of 45 credit hours.

**Admissions**

M.S.N./M.B.A. students must be admitted to both the Frances Payne Bolton
School of Nursing and the Weatherhead School of Management. Applicants should write to the admissions offices of both schools for application materials and indicate that they are applying to the M.S.N./M.B.A. program. Separate application fees are charged by each school. For additional M.S.N. admissions information, contact:
Office of Admissions
Frances Payne Bolton School of Nursing
Case Western Reserve University
2121 Abington Road
Cleveland, Ohio 44106-4904

The Commonwealth Fund Nurse Executive Fellowship Program

The Commonwealth Fund granted funds to develop this M.S.N./M.B.A. joint degree program and has continued its support by offering a $15,000 one-time grant to full-time candidates enrolled in this program. For further information, contact the School of Nursing.

Academic Information

All M.S.N./M.B.A. students register through the Weatherhead School of Management. Degrees are awarded simultaneously upon completion of requirements for both.

M.S.N./M.B.A. Program structure

Contact Fran Cort, Assistant Dean for Professional and International Programs for full-time and part-time options (phone 216-368-3315; email: fxc@po.cwru.edu).

THE MASTER OF BUSINESS ADMINISTRATION/ CERTIFICATE IN NONPROFIT MANAGEMENT DUAL PROGRAM (M.B.A./CNM)

M.B.A. students with a career focus in the management of nonprofit organizations may obtain a Certificate in Nonprofit Management (CNM) by completing an M.B.A. specialization in nonprofit management (nine credit hours) plus six credit hours of nonprofit management coursework above their M.B.A. requirements. By enrolling in one additional course during each of the last two semesters of the M.B.A. program, full-time students may complete the M.B.A. and the CNM without extending their course of study or incurring additional tuition fees.

Credit Requirements for the M.B.A./CNM

Students in the dual program must fulfill 15 credits toward the CNM certificate and 63 or 47 hours (traditional or accelerated full-time curriculum) toward the M.B.A. degree. These students may double count nine credit hours of Mandel courses that have been approved for credit in both programs.

Courses in the CNM/M.N.O. curriculum currently approved for M.B.A. and CNM credit

There is one required course for the M.B.A./CNM, Introduction to the Nonprofit Sector. The most appropriate sequence of study would generally include Law of Nonprofit Organizations as well. In addition, students choose three courses selected from among the following:

- Nonprofit Public Policy and Advocacy
- International and Comparative Analysis of Non-Governmental Nonprofit Organizations
- Organizational Assessment and Program Evaluation in Nonprofit Organizations
- Earned Income for Nonprofit Organizations
- Government Funding for Nonprofit Organizations
- Philanthropic Fundraising for Non-profit Organizations
- Leadership for Nonprofit Organizations
- Trusteeship: The Governance of Non-profit Organizations
- Ethics and Professionalism for Non-profit Leaders
- Business and Nonprofit Entrepreneurship
- Leading and Managing Nonprofit Arts and Cultural Organizations

Students wishing to propose any modification in the recommended sequence of study on the basis of prior course work, past experience, or professional interest must present a request, in writing, for consideration by the Weatherhead M.B.A./CNM faculty advisor.

Students pursuing the M.B.A./CNM are also expected to attend all meetings of the Mandel Center’s Nonprofit Leadership Dialogs series.

Admission/Enrollment Procedures in the dual M.B.A./CNM Program

Candidates must complete both applications and be admitted to each program separately. M.B.A. students must apply to the dual credential program by no later than the end of the first year in the M.B.A. Program (or at the end of the first semester in the 42-hour M.B.A. curriculum). Candidates who have already completed the M.B.A. degree or the Certificate in Nonprofit Management may not apply for the dual M.B.A./CNM program.

M.S.S.A./CNM

The M.S.S.A./CNM combines the master of Social Science Administration (M.S.S.A.) with the Certificate in Nonprofit Management. It provides excellent preparation for students who have a career focus in the management of economic and community development and nonprofit organizations.

The program is five courses which must include MAND 401 and MAND 475, and SSWM 541/MAND 481. The remaining two courses are chosen in consultation with a faculty advisor.

For more information contact Carol Willen, 216-368-8565.

CERTIFICATE PROGRAMS

Professional Fellows Program

The Professional Fellows Program is an academic one-year program for the executive or accomplished professional seeking an advanced learning environment. The program consists of a business-related seminar series coupled with self-assessment exploration intended to identify and solidify individual goals and learning plans. Upon completion of the program, participants are inducted into the Professional Fellows Society, a group dedicated to lifelong learning. Participants also receive six credits of advance coursework upon completion of the program. Request a program brochure by calling the Executive Education Program at 216-368-2042.

Certificate in Health Systems Management

Admissions qualifications: Bachelor’s degree, professional experience in health
care delivery system or graduate degree in the health sciences: Contact Fran Cort to apply (216-368-3315).

Suggested curriculum and sequence of courses:

Fall Semester
(Pre-semester preparation as pre-requisites to Fall courses: selected readings in accounting and financial management)
- **HSMC 420:** Health Finance and Economics (3 credits)
- **OPMT 420:** Managing Quality in Organizations (3 credits)
- **HSMC 501:** Health Care Executive Education - Student’s choice of three out of four Friday seminars in the Fall Series (partial fulfillment of 3 credits)

Spring Semester
(Pre-semester preparation: selected readings in the marketing concept and marketing dynamics; three-page application of the concepts in a health systems context)
- **HSMC 422:** Health Systems Marketing (3 credits)
- **HSMC 456:** Issues in Health Care Management (3 credits)
- **HSMC 501:** Health Care Executive Education - (continued from Fall semester) Student’s choice of three out of four Friday seminars in the Spring Series, plus completion of paper covering an aspect of the management of health care systems (with HCEE Fall Series, 3 credits)

Alternately, courses may be taken at a slower pace, during a two-year sequence.

Please note: Students who have completed MIDS 409 or the equivalent may substitute MIDS 432, Health Care Information Systems, for HSMC 420, HSMC 422 or OPMT 420.

**Tuition Payment**

Tuition for each 3-credit course will be charged at the current rate for the semester in which the student registers.

**Academic Policy**

Courses in the HSM Certificate Program are documented on an academic transcript from Case Western Reserve University. A Certificate in Health Systems Management will be awarded after the student completes five courses with passing grades and completes a graduation application through the Professional Degree Programs Administrative Office. All HSM Certificate participants who matriculate into the M.B.A. Program within five years of completion of the Certificate may transfer the five courses toward completion of M.B.A. degree requirement.

**Certificate in Nonprofit Management (CNM)**

The Certificate Program in Nonprofit Management is designed for practicing managers and leaders in human service, fine and performing arts, cultural, educational, community development, religious and other nonprofit organizations who aspire to top-level executive positions.

CNM students must satisfactorily complete five approved courses (13-15 hours). Admission criteria include satisfactory undergraduate work, the ability to master graduate-level course work, experience and familiarity with nonprofit organizations, and leadership potential for executive-level management.

For additional information concerning the CNM program (including scholarship information), contact: Carol Willen Director, Graduate Programs and Center Initiatives

Mandel Center
Case Western Reserve University
11206 Euclid Avenue
Cleveland, Ohio 44106-7167
(216) 368-8566

**Certificate in Public Policy**

In a continuing effort to liberalize M.B.A. students’ perspectives on management issues, the faculty of the Weatherhead School has developed a Certificate in Public Policy, which may be completed within the time scope and tuition coverage of the full-time M.B.A. curriculum.

Requirements for the Certificate in Public Policy:
- Students must take five courses (15 credits) which have been approved for the Certificate in Public Policy.
- Three of these courses (9 credits) may be double-counted for both M.B.A. degree credit and certificate credit.

Courses Approved for Credit in the Public Policy Certificate Program

**Law School Courses**
- LAWS 227: Health Law (also listed as HSMC 227)
- LAWS 244: Poverty, Social Inequality and the Law
- LAWS 278: Regulatory Law and Policy
- LAWS 285: Social Science and the Law
- LAWS 292: Health Care Legislation
- LAWS 301: Administrative Law
- LAWS 309: Antitrust Law
- LAWS 331: Environmental Law
- LAWS 332: Civil Rights
- LAWS 363: Land Use Control
- LAWS 365: Legislation
- LAWS 374: State and Local Government
- LAWS 392: Mass Media Law
- LAWS 512: Tax Policy Seminar
- LAWS 537: Health Care Controversies
- LAWS 563: Biomedical Research: Law and Policy

**Mandel School of Applied Social Sciences Courses**
- SPPP 470: Social Policy
- SPPP 502: Alcohol and Drug Abuse Policy and Service Delivery
- SPPP 510: Mental Health Policy and Service Delivery
- SPPP 511: Issues in Health Policy and Service Delivery
- SPPP 512: Legislative and Political Process
- SPPP 513: Aging Policy and Service Delivery
- SPPP 525: AIDS Seminar
Graduate Programs

Master of Science—Organization Development and Analysis
The Department of Organizational Behavior offers a 24-month master’s program for students who are employed full-time. The M.S.ODA program combines academic and work experience in the theory and techniques of analysis and intervention for constructive change in organizations. Students combine intensive academic learning with program-related activity in the organizations in which they are employed. The program stresses the development of applied skills in support of planned change processes in organizations. Classes are held in modular format, approximately 3 days a month, in addition to four workshops distributed throughout the two-year program. The following is the general design:

Year 1:

Semester I (10 credit hours)
• Opening Off-Site Workshop: Overview & Team Community Building (4 work days, one Saturday—early September)
• Three, 3-day classes, September, October, & November—Class Content: Leadership Skills; Organizational Analysis; Projects & Exercises for Understanding Human Systems

Semester II (10 credit hours)
• Three, 3-day classes, January, February, & March—Class Content: Management of Work; Managing Organizational Change; Practicum in Organization Development

Year 2

Semester I (10 credit hours)
• Third Off-Site Workshop: Training Design & Presentation Skills Workshop; Competency-Based Learning Activities (three work days, one Saturday)
• Three, 3-day classes, September, October & November—Class Content:

Design of Organization Development and Analysis Projects; two electives, i.e., Labor & Human Resource Policy, Diversity in the Workplace, Global Leadership, Overseas Study Experience, etc.

Semester II (10 credit hours)
• Three, 3-day classes, January, February, March—Class Content: Organization & the Environment; Individual Field Project Presentations; Two Year Workshop credit

Fourth Off-Site Workshop: Evaluation of Academic Experience and Future Career Planning and Professional Development Choices (two workdays, one Saturday)

For additional information contact:
Richard E. Boyatzis, Chair
Department of Organizational Behavior
Weatherhead School of Management
Case Western Reserve University
Cleveland, Ohio 44106-7235
(216) 368-2055

Ph.D. in Management

The Ph.D. in Management program is designed for individuals whose career goals are to conduct research and teach in academic, policymaking or research institutions. The program provides both a general background in management and strong specialization in the individual’s choice of major field (accountancy, health care management, labor and human resource policy, management information systems, marketing and policy). A program of study is tailored to each student’s needs and career goals. Students are encouraged to engage in publishable research before receiving their doctorates. They also are given the opportunity to teach courses after admission to candidacy.

An integral strength of the Ph.D. in Management program at the Weatherhead School of Management is its attention to the individual. A successful doctoral experience requires more than coursework. Frequent one-to-one interaction with faculty in the area of one’s specialization is necessary for developing conceptual and methodological skills. Only a few students are admitted to the doctoral program each year, guaranteeing direct communication with faculty in

Medical/Nursing School Courses
EPBI 440: Seminar in Health Policy
EPBI 468: Continuing Improvement in Health Care
EPBI 490: Epidemiology
NURS 483: Health Care Planning and Policy and Information Management Systems

Weatherhead School Courses
BAFI 420: Health Care Finance and Economics (also listed as HSMC 420)
ECON 421: Health Care Economics
ECON 462: Industrial Economics
ECON 472: Regional Advantage for Business
ECON 473: International Economics for Management
ECON 474: International Trade
ECON 482: High-tech Regions and Business Strategy
ECON 483: Economics of Cooperation
LHRP 409: Unions and Management Policy
HSMC 456: Issues in Health Care Management
MAND 431: Business and Nonprofit Entrepreneurship
MGMT 455: Public Policy Analysis (required course for all students in the Certificate Program)
ORBH 450: Executive Leadership
ORBH 488: Leadership and Global Agenda

Questions? Contact Paul Gottlieb at 216-368-5110 (email: pgd2@po.cwru.edu) or Fran Cort at 216-368-3315 (email fxc@po.cwru.edu).
research, teaching and advanced independent study courses.

The Ph.D. in Management program has been designed so that the student, in cooperation with an advisor, can develop the plan of study that best meets his or her career objectives. Students are encouraged to be eclectic and take coursework outside of the Weatherhead School.

Specific requirements for completion of the program are detailed in its rules and regulations; fundamentally, the requirements are:

- A full-time commitment to the program.
- Completion of prerequisite courses deemed essential to the student’s area of specialization.
- Involvement in classroom activities to develop teaching skills.
- A minimum of 12 courses covering the student’s major and minor fields and foundations courses supporting the major field. The foundations courses include a three-course, required sequence in research methods. Some of this work might be fulfilled through courses in the Departments of Economics, Operations Research or Organizational Behavior, or outside of the Weatherhead School of Management in areas such as sociology and computer science.
- Successful completion of written and oral general examinations, typically within two years of admission.
- Completion of a satisfactory dissertation.

Because only a small number of applicants can be admitted each year, selection is limited to those whose credentials are strong and whose interests match well with the faculty’s. Each applicant is required to furnish an official copy of his or her GMAT score, official transcripts, at least three letters of recommendation, and a statement of his or her area of interest. Financial aid is available on a competitive basis, ranging from graduate assistantships to fellowships and lectureships.

Requests for information should be addressed to:
Richard E. Boyatzis, Chair
Department of Organizational Behavior
Weatherhead School of Management
Case Western Reserve University
Cleveland, Ohio 44106-7235
(216) 368-2055

Ph.D. in Operations Research

For the Ph.D. degree in operations research, a number of required courses in specific areas must be taken. Required and elective courses form a coherent program of study that provides a depth of knowledge of the field as well as a comprehensive understanding of related subjects. The student also must demonstrate the ability to perform research in an independent manner.

Ph.D. students may elect to specialize in either operations research or operations management.

Refer to the Operations Research Bulletin of Graduate Programs, available from the Department of Operations, for more detailed information (216-368-4141).

Ph.D. in Organizational Behavior

The doctoral program offered by the Department of Organizational Behavior focuses on the development of competence in creative inquiry and the understanding and management of planned change activities in social systems. Conceptual and empirical analysis and understanding at various levels (e.g., individual, group, organizational, societal) are stressed. Students also are encouraged to develop the skills necessary to use their knowledge to promote constructive change.

Requests for information should be addressed to:
Richard E. Boyatzis, Chair
Department of Organizational Behavior
Weatherhead School of Management
Case Western Reserve University
Cleveland, Ohio 44106-7235
(216) 368-2055

Undergraduate Programs

BACHELOR OF SCIENCE IN ACCOUNTING

The importance of accountancy to business, government and society is well recognized. Like the professions of architecture, law, engineering and medicine, accountancy demands of its students both a high degree of technical training, 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 health care sectors. The undergraduate program in accountancy is designed to prepare students for entrance into these careers and to provide a foundation for the examination to become a Certified Public Accountant (CPA) or to achieve other professional certifications.

As part of the sequence of courses leading to the Bachelor of Science degree in Accounting offered through the Weatherhead School of Management, the student takes required and elective courses in related fields of banking and finance, economics, marketing, organizational behavior, management information decision systems, management policy, operations management, and operations research. Twelve semester hours of accountancy taken at another accredited institution may be considered in transfer toward the Bachelor of Science degree in Accounting. Transfer credit for courses beyond introductory accountancy (six semester hours) must be approved by the Department of Accountancy.

- An accountancy major cannot take accountancy and management courses on a pass/no pass basis.
- Introductory Accounting may be taken the first year
- Accounting majors may not take Weatherhead classes on a pass/no-pass basis

Of the 9 credit hours in Weatherhead electives, no more than 6 hours can be in Accounting.

BACHELOR OF ARTS IN ECONOMICS (COLLEGE OF ARTS AND SCIENCES)

Economics is concerned with the problems of allocating scarce resources to meet human needs. Students who study economics gain an understanding of how consumers (households), producers (firms) and governments make decisions affecting the allocation of resources and, therefore, a society’s economic performance. Economics also involves an examination of how the interaction of these decisions in markets and in the political process produces certain outcomes, and how legal and institutional arrangements can influence these outcomes. Finally, the study of economics leads to a better ap-
### BACHELOR OF SCIENCE IN ACCOUNTING

#### Fall Semester

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<td>MATH125 Calculus-I</td>
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<tr>
<td>ENGL150 Expo Writing</td>
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</tr>
<tr>
<td>Natural Science</td>
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</tr>
<tr>
<td>PSYC101 Intro. to Psychology or SOCI 112 Intro. to Sociology</td>
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</tr>
<tr>
<td>History, Philosophy, Religion</td>
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**First Semester Credits** 16

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<td>ACCT101 Intro. to Financial Accounting</td>
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<td>STAT207 Statistics for Business</td>
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<td>COSI100 Communications or COSI 236 Public Speaking</td>
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<td>Non-Weatherhead Elective</td>
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**Second Semester Credits** 16

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**Third Semester Credits** 15

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<td>ACCT302 Managing Costs</td>
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<td>MIDS308 Intro to Mgmt Information Systems</td>
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<td>BAFI355 Corporate Finance</td>
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<td>ECON341 Money &amp; Banking</td>
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**Fourth Semester Credits** 15

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<td>OPMT350 Operations Management</td>
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<td>MIDS309 Mgmt &amp; Development of Info Systems</td>
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<td>ACCT314 Attestation and Assurance Services</td>
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<td>PLCY399 Business Policy</td>
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<td>BLAW330 Law and Mngt. II</td>
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**Seventh Semester Credits** 15

<table>
<thead>
<tr>
<th>Course</th>
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<tbody>
<tr>
<td>Non-Weatherhead Elective</td>
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<td>Weatherhead Elective</td>
<td>3</td>
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</tbody>
</table>

**Eighth Semester Credits** 15

**Total Minimum Degree Credit Hours** 122

#### Notes about the Accountancy Curriculum:
- Introductory Accounting may be taken the first year.
- Accounting majors may not take Weatherhead classes on a pass/no-pass basis.
- Of the 9 credit hours in WEATHERHEAD electives, no more than 6 hours can be in Accounting.
- Major (for B.A. degree)
  - A major in economics consists of 30 hours, with a minimum of 24 hours of economics courses. It leads to the Bachelor of Arts degree.
- Required courses (15 hours):
  - ECON 102, 103, 307, and either 308 or 309 (12 hours)
  - STAT 201 or 207 (3 hours)
  - Elective (15 hours): Minimum four economics elective (12 or more hours)
  - One course may be in a related field (such as ACCT, HSTY, MATH, PHIL) approved by the departmental adviser (3 hours maximum).
- Minor (for B.A. or B.S. degree)
  - A minor in economics consists of 15 hours, as follows:
    - ECON 102, ECON 103, and three additional economics courses (9 hours) selected in consultation with the minor adviser.

#### Social Science (B.S.)
- Notes about the Accountancy Curriculum:
- Social Science Sequence (for B.S. based upon Engineering Core Curriculum)
  - The sequence requirement is satisfied by taking ECON 102, ECON 103, and one other 200- or 300-level ECON course.
- Social Sciences/Social Institutions Requirement (for B.A. or B.S. degree based on Arts and Sciences General Education Requirements)
  - The three-credit minimum may be satisfied by taking any one of the courses below. The six-credit sequence may be satisfied by taking any two of the courses listed below:
    - ECON 102, ECON 103, or ECON 205.

### BACHELOR OF SCIENCE IN MANAGEMENT

A graduate of the Bachelor of Science in Management program obtains a broad education within a scientific framework that enables him or her to bring an unusual degree of analytical capability to the problems of management and business. To respond to students’ diverse interests and goals, four elective sequences are offered, leading to careers in operations management, accountancy, information systems, and economics and finance. Each student consults with an adviser in the Office of Undergraduate Services at the Weatherhead School.

#### Management Elective Sequences (B.S.)

**Requirement:**
- Three approved electives for sequence (9 hours)
- Weatherhead elective (3 hours)
- Total 12 hours
- Three approved electives are required in the area of the sequence, and one additional elective may be selected from any management division or department.
- Special sequences may be arranged in Marketing or in Human Resources. Consult the Weatherhead Office of Undergraduate Services for appropriate forms and information about the approval process.

**Notes about the Weatherhead Curriculum:**
- Introductory Accounting may be
taken the first year
- Management majors may not take Weatherhead classes on a pass/no-pass basis

**Minor Areas of Concentration for the Bachelor of Arts Degree**

**Accounting Minor**
ACCT 101, 102, 300
At least two additional courses approved by the Department of Accountancy
Total hours required: 15

**Information Systems Minor**
Total hours required: 15
Requirements:
1. One of either ENGR 131 or MIDS 307.
2. MIDS 308, 309, and two additional MIDS or other courses as approved by the Minor adviser.

**Entrepreneurial Studies Minor**
Total hours required: 15
Requirements:
One of either ACCT 102 or ACCT 303
MKMR 301
ENTP 295, 310, and 311

**Other Minors**
Consult Weatherhead Office of Undergraduate Services in the Weatherhead School of Management.

**INTEGRATED STUDY PROGRAMS**

Highly qualified students who are candidates for either the B.S. in Accounting or the B.S. in Management may be eligible to accelerate their programs toward completion of one of two graduate degree programs, the Master of Accountancy (M.Acc.) and the Master of Business Administration (M.B.A.). Because of this acceleration opportunity, successful candidates are able to complete their graduate programs of study in two semesters after completing their undergraduate requirements.

**Integrated Study Program Options in Accountancy**

There are two programs, which 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).

**MANAGEMENT ELECTIVE SEQUENCES (B.S.)**

**Sequence I: Finance**
BAFI 341 – Money and Banking
BAFI 356 – Investments
BAFI 359 – Intermediate Corporate Finance
ECON/BAFI 372 – International Finance

**Sequence II: Information Systems**
MIDS 310 – Technology of Information Systems
MIDS 326 – System Design & Analysis
MIDS 327 – Database Management
MIDS 329 – Design of Object Oriented Systems

**Requirement:**
Three approved electives for sequence (9 hours)
Weatherhead elective (3 hours)
Total 12 hours
Three approved electives are required in the area of the sequence, and one additional elective may be selected from any management division or department.
Special sequences may be arranged in Marketing or in Human Resources. Consult the Weatherhead Office of Undergraduate Services for appropriate forms and information about the approval process.

**BACHELOR OF SCIENCE IN MANAGEMENT**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Fall Semester Credits</th>
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<td>ECON102</td>
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<td>STAT207</td>
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<td>MIDS308</td>
<td>Intro to Mgmt Information Systems</td>
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<td>BAFI355</td>
<td>Corporate Finance</td>
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<td>MIDS309</td>
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<td>BAFI355</td>
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<td><strong>Seventh Semester Credits</strong></td>
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<td><strong>Eighth Semester Credits</strong></td>
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**Notes about the Weatherhead Curriculum:**
Introductory Accounting may be taken the first year.
Management majors may not take Weatherhead classes on a pass/no-pass basis.
Beginning in the year 2000, CPA candidates must have completed 150 semester hours of study at the university level in order to qualify to sit for the professional Certified Public Accountant examination. The B.S./Master of Accountancy (M.Acc.) program enables the individual to earn efficiently both the undergraduate and the graduate degrees within the required hours of study. (Those individuals pursuing other non-accounting career alternatives need to complete only the 122 hours of study required by the B.S. in Accounting degree program. However, the M.Acc. is still highly desirable and strongly encouraged.) Highly qualified students who are candidates for the B.S. in Accounting may be eligible to accelerate their programs toward completion of the Master of Accountancy (M.Acc.). Because of this acceleration opportunity, successful candidates are able to complete their graduate programs of study in two semesters after completing their undergraduate requirements.

**Joint B.S./Master of Accountancy (M.Acc.)**

This program allows students to begin graduate coursework while studying for the award of their undergraduate accounting degree. Undergraduate accounting majors accepted for this opportunity will be permitted to enroll for 6 credit hours of Weatherhead School graduate courses during the senior year. These hours will also be part of the undergraduate business elective requirements. These hours of credit will count toward the satisfaction of the M.Acc. degree program requirements, reducing the graduate program requirements from 36 to 30 hours. Before taking graduate coursework, the student must have completed all prerequisites for the course on the undergraduate level and have a “B” average in those prerequisites. Students will complete and be awarded their Bachelor of Science in Accounting prior to their Master’s program.

**Accelerated B.S./Master of Accountancy (M.Acc.)**

This program allows motivated students to accelerate their pursuit of both the B.S. and M.Acc. degrees. In addition to applying six credit hours of Weatherhead graduate coursework towards their undergraduate degree program, students in this program may begin taking more graduate coursework before completing all of their undergraduate degree requirements. To enroll in this program, students must have:

- Completed 90 hours of undergraduate coursework
- Completed all of the undergraduate Weatherhead General Education Requirements
- Completed 36 hours of the Weatherhead Management requirements (including 18 hours of the required Accountancy coursework)
- Achieved at least a 3.0 overall GPA

Students in this program will receive both the B.S. and the Master’s degree at the end of the program. For the first eight semesters of study, the student will register as undergraduates in Case Western Reserve University; thereafter, students will register in the graduate professional degree program in the Weatherhead School of Management.

Application to either Integrated Study program in Accountancy should be made in the junior year to the Director of the Master of Accountancy Program. Also, the GMAT (Graduate Management Admission Test) should be completed during the junior year. In addition, students in the Accelerated Program should design a comprehensive study plan of coursework with the Coordinator for Integrated Studies.

**PROFESSIONAL PRACTICUM**

The primary goal of this active learning experience is the intellectual, personal and professional growth of the student in an area related to their academic course of study. The Practicum should provide the students with new skills, insights and experiences that are transferable to the academic setting.

The Practicum is an experiential learning agreement between the Student, the Employer and the Practicum Advisor in conjunction with the office of Career Planning and Placement.

Employers provide appropriate supervision and work related learning objectives.

Practicum Advisors guide and evaluate the student’s Practicum experience.

All practica developed through CP&P must be taken by the student for transcript notation and 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, they will not have the benefits of a full-time student status nor do they represent the Practicum Program in any official capacity. A Practicum is a planned, structured supervised workplace learning experience at an approved “site” organization.

**WEATHERHEAD UNDERGRADUATE STUDENT ORGANIZATIONS**

**Alpha Kappa Psi**

Alpha Kappa Psi is a national professional business fraternity whose objective is to help develop well-trained, ethical, and skilled leaders. Members interact with speakers from the business community, attend conferences with other Alpha Kappa Psi chapters, and organize social events on and off campus.

**Beta Alpha Psi**

Beta Alpha Psi is the honorary accounting fraternity. CWRU is home to one of the oldest chapters in the country, founded in 1930. Professionals from all major accounting and consulting firms come to campus to talk about career opportunities in the management profession. The fraternity also sponsors field trips to accounting firms and corporations. Membership to this fraternity is restricted to accounting, finance and information systems majors; however, all students can attend meetings and attend the presentations of the guest speakers.

**Omicron Delta Epsilon**

Omicron Delta Epsilon is the international honor society in economics. Students who maintain a high academic record are invited to join the organization. Meetings and activities are held throughout the year and highlighted by the McMyler Memorial Lecture at the end of the school year.

**WEATHERHEAD CENTERS**

The Weatherhead School of Management’s George S. Dively Building provides an ideal setting for executive
programs as well as special events of the Weatherhead School. The Weatherhead Executive Education Center creates and maintains educational linkages between the Weatherhead School and regional organizations and executives. Program offerings include The Corporate University, The Weatherhead Affiliate Program and the Family Business Program for organizations; two degree programs – The Executive MBA and Executive Doctorate of Management, and one certificate program – Professional Fellows Program for advanced professionals. Richard Headley, Interim Associate Dean for Executive Education (phone 216-368-2042).

Center for Regional Economic Issues (REI) improves the quality of information about the regional economy and makes this information available for public and private sector decision making. REI staff monitor economic conditions throughout the Great Lakes region, conduct research on issues of long-term significance to the region, provide policy analyses for organizations and maintain an extensive communications program. (Richard Shatten, Director: 368-5534)

Enterprise Development, Inc. (EDI) was created through the merger of Cleveland Tomorrow’s Center for Venture Development and the Entrepreneurial Programs at the Weatherhead School of Management. EDI promotes economic development through entrepreneurship in northeast Ohio by identifying opportunities and mobilizing the necessary resources to create new businesses and facilitating the translation of research into the entrepreneurial process. (Diann Rucki, President: 229-9445)

The Health Systems Management Center (HSMC) is an interdisciplinary education and research center jointly sponsored by the Weatherhead School and the CWRU School of Medicine. HSMC focuses its programming on issues involving three key groups in the health care delivery system: medical providers, institutional providers and purchasers of health care services. (Barbara Bolek, Director: 368-2143)

The Mandel Center for Nonprofit Organizations is a cooperative venture of the Weatherhead School, the CWRU School of Law and the Mandel School of Applied Social Sciences. Among its diverse programs in the education, research and consulting fields, the Mandel Center administers the Master of Nonprofit Organizations degree program and the Certificate Program in Nonprofit Management. (John Palmer Smith, Director 368-2275)

The Arts Management Program, a joint venture with the Mandel Center for Nonprofit Organizations, aims to enhance the management of arts organizations through database decision making and improved management systems and practices. The Program staff conduct applied research with a range of arts organizations in the northeast Ohio area and are planning an executive education program for arts managers. (Margaret Wyszomirski, Director: 368-6135)

Weatherhead Student Organizations

Graduate Business Student Association (GBSA)

The GBSA was formed by Weatherhead graduate students to serve as a liaison with WSOM faculty and staff on issues pertaining to student life. The organization’s primary focus is to enhance each student’s experience in and out of the classroom in the areas of professional development, academic achievement and community involvement. GBSA acts as an umbrella group for all student organizations by facilitating communication with the Advisory Council of Club Presidents, allocating resources to student organizations, organizing social activities and operating the WSOM Coffee Bar.

Graduate Business Student Association

Community Service Committee, Dean’s Receptions, the Social Committee, and the Student Learning Management Committee (SLMC).

Black M.B.A. Student Association (BMBASA)

The Black M.B.A. Student Association provides business, academic, and social support for students at WSOM through sponsored seminars, forums, and social activities.

Business Technology Association (BTA)

The BTA provides supplemental learning and exposure to new technology and innovation across functional business disciplines by sponsoring extracurricular activities related to technology in the workplace, and offering opportunities to network with local professionals.

Career Day Committee and the Career Management Center Task Force

These committees offer students an opportunity to work with the Career Management Center to design programs and seminars to prepare students for their career search.

Entrepreneurs Club

This club introduces students to opportunities to create new businesses utilizing the resources available in the Case Western Reserve community. In addition to Weatherhead, Case Western Reserve has nationally recognized capabilities in Medicine, Computer Science, MEMS, and Engineering. By linking novel technologies to energetic, capable Weatherhead students, we are working to create opportunities for new businesses with unlimited possibilities.

Finance and Investment Club

This club offers seminars and lectures to introduce students to career opportunities in banking and finance, and to innovative concepts in both corporate and personal financial planning.

Health Systems Management Association (HSMA)

The HSMA helps students interested in careers in health care to learn about the many career opportunities in the field through seminars and meetings with faculty from the Health Systems Management Center.

Human Resource and Organizational Behavior Group

Affiliated with the Society for Human Resource Management (SHRM), this club provides excellent opportunities to meet human resource professional on both an educational and social basis, and
to broaden members’ exposure the human resource issued and problems at the practical and academic levels.

**Insight-2-Excel**
Insight-2-Excel provides high school students the opportunity to participate in a yearlong program with Insight volunteers. Through interactive, experiential exercises the students are offered mentoring, business and life skill development, and career/life action planning. In addition to being in a formal classroom setting, the students partake in events outside the classroom. For instance, the students participate in and lead several community service events throughout the year.

**International Business Group (IBG)**
This group provides a forum for the informal exchange of international business ideas and the promotion of cross-cultural awareness. Among other things, activities include topical forums, speakers, parties and field trips. The IBG also serves as a source of information for students about international career opportunities in the U.S.A. and abroad.

**J.D./M.B.A. Student Association**
Founded in 1995, the J.D./M.B.A.S.A. is a student organization of the Weatherhead School of Management and the School of Law of Case Western Reserve University. Its purpose is to assist J.D./M.B.A. students in their educational and professional development. The organization serves as a source of information and guidance to students from the time that they manifest interest in becoming a J.D./M.B.A. joint-degree student, through the completion of their program and into their respective careers.

**Operations Management Organization (OPMT)**
The OPMT organization is comprised of students who have an interest in planning, control, procurement, production and distribution functions.

**Multicultural Task Force**
The Multicultural Task Force coordinates the International Fest and the Workforce 2000 Conference on Diversity. This task force also offers a forum to discuss and address issues of diversity at WSOM and in our world.

**Speaker’s Corner**
Speaker’s Corner offers students opportunities to hone their public speaking skills through special extemporaneous sessions.

**Student for Responsible Business**
Students for Responsible Business at the Weatherhead School of Management at Case Western Reserve University is a local chapter of the national Students for Responsible Business organization, a national association of graduate students interested in socially-responsible business practices.

**Weatherhead Coffee Bar**
A great place to get a snack or some coffee. (Not to mention a great place to work!)

Open during the fall and spring semesters, the Coffee Bar is a student run business. The proceeds are directed to the GBSA to help fund student activities.

**Weatherhead Consulting Group (WCG)**
The WCG provides an educational link between the consulting industry and WSOM students and offers actual consulting experiences to students interested in exploring consulting as a career.

**Weatherhead Marketing Association**
The Marketing Association brings members of the business community to campus to speak about a wide variety of marketing issues and career paths available to marketing students.

**Weatherhead Women in Business**
This organization provides professional and social development opportunities for women at the Weatherhead School of Management and opportunities to share the diversity of women’s experiences and perspectives with the WSOM community. The association represents women’s issues to the WSOM administration and facilitates an exchange of ideas and information with the student community and with other women’s organizations and business groups in Cleveland.

**Weathervane (student newspaper)**
http://universe.som.cwru.edu/Weathervane/

This on-line student newspaper provides students with the opportunity to gain publishing, management and sales experience while delivering a responsible, high-quality, thought provoking, and timely newspaper.

**ORSA/TIMS Student Chapter (Operations Research Society of America/The Institute of Management Sciences)**
The professional chapter of this organization at the Weatherhead School of Management offers students a variety of academic and social activities and provides a direct link to individuals with careers in the profession. The chapter serves to provide information to students on the professional characteristics and practice of operations research as a field of applied science in management.

**Alumni Association**
Members of the Weatherhead School of Management Alumni Association include all alumni of the Weatherhead School’s graduate and professional programs. The Association works to promote the welfare and advance the objectives of the school and sponsors a range of activities and services for alumni and students that encourage professional development, provide for the exchange of ideas and stimulate social interaction. Each year, the Association selects a graduating student to receive the Student Leadership Award and an incoming M.B.A. student to receive the WSOM Alumni Association scholarship. In addition to a very active Weatherhead School Alumni Association, numerous Case Western Reserve University alumni chapters throughout the country are open to all CW RU graduates.

**Honorary Societies**
Beta Gamma Sigma is a national scholar- ship honorary society in the field of business administration and commerce. M.B.A. candidates whose academic performance is outstanding (usually in the top 20% of the graduating class) may be
elected to membership in the Eta Chapter of Ohio, which was established at Case Western Reserve University in 1958.

Beta Alpha Psi is a national professional honorary accountancy fraternity. The Weatherhead School of Management is home to the Pi Chapter, which was chartered in 1930. The organization’s primary purpose is to encourage higher standards in accountancy education and to develop a closer relationship among professional accountants, faculty and students.

Omega Rho is an international honor society founded in 1975 to honor academic excellence in operations research and closely allied intellectual disciplines. As a founding chapter of Omega Rho, the Case Western Reserve University unit recommends membership for students who have achieved high honors in the graduate program in operations research. The Department of Operations Research and Operations Management initiates chapter members annually.

Teaching Excellence Award Program

Each May, an award for teaching excellence is presented at the Weatherhead School of Management graduation ceremony. The Teaching Excellence Award Committee is composed of student representatives from the undergraduate and graduate accounting, management, operations research and organizational behavior programs, the previous year’s winner (who is ineligible to receive the award the following year) and the Assistant Dean for Academic Affairs. This committee administers the voting procedure, and determines the winner, and, presents the award at the graduation ceremony. All students registered in Weatherhead School courses are encouraged to nominate instructors for the Teaching Excellence Award.

Student Leadership Award

The Student Leadership Award is presented each year at commencement to a graduating student who has demonstrated leadership characteristics by providing a model for other students, enhancing student life and atmosphere, promoting the Weatherhead image in a positive way and contributing to the total community. The recipient of this award is chosen by a selection committee comprising alumni representatives of all Weatherhead programs. Nominations may be made by students, alumni, faculty, staff and friends of the Weatherhead School.

Registration and Academic Information

Course Loads

Full-time graduate students must register for at least nine credit hours per semester to maintain full-time status. A typical full-time course load, however, is 15-17 credit hours per semester.

Part-time students who are employed full-time generally register for a maximum of six hours per semester and three hours in the summer, which is considered halftime status. Requests for course overloads are approved by the Weatherhead School Registrar.

Course Registration

The student’s social security number is the identification number for all university documents and records.

A student may enroll during each registration period through the last day of late registration, as set by the official University calendar. Exceptions will be granted only upon the recommendation of the Dean of the Weatherhead School of Management. A fee of $25 is charged during the late registration period.

To register, students must submit a completed student schedule form and payment of half of the semester tuition charges. (Students who wish to obtain information on federal loans should contact the Professional Degrees Program Administrative offices to obtain an information packet.)

Course registrations are processed with a 5-digit course registration number (CRN). CRN numbers are produced as follows:

1st digit = department letter (A=Acct or Blaw, B=Bafi, E=Econ, H=Hsmc, U=Lhrp, W=MBAC, G=Mand or Mgmt, S=Mids, K=Kmkr, P=Pcly, T=Opmt, R=Opre, Z=Orbh, Q=Qumm)

2nd 4th digit = course number;
5th digit = section number.

For Example: Acct 401, section 2 = A4012; Pcly 418, section 1 = P4181.

Independent study courses will have system assigned CRN numbers. Please indicate course, Professor, and number of credit hours (i.e., Pcly 501 Feldman 3 hrs.) on your course schedule form.

During any semester, students may not register in more than one school or college of Case Western Reserve University. Transfer within the University requires the approval of the deans of the schools or colleges involved. Special arrangements are made for students in joint degree programs. (See the appropriate section of this bulletin for details.)

If at any time a student fails to register in two consecutive semesters, excluding the summer session, he or she must reapply for admission to the Weatherhead School of Management unless a prior arrangement has been made.

Course Changes

Requests for changes in courses and sections must be approved by the Weatherhead School Registrar by the last day of the drop/add period.

Withdrawals

To withdraw from all courses in a semester, the student must contact the Professional Degree Programs Administrative Office (PDPAO) in person or by phone, before the University deadline for withdrawal to have an official withdrawal form processed. All withdrawals after the official drop/add periods will result in a transcript entry. 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 may be assigned to each course from which the student has not officially withdrawn.

Tuition charges for withdrawals after the drop/add deadline are prorated based upon the week of withdrawal and according to the schedule published in the semester registration materials.

Note: A student is not entitled to any tuition adjustment for a course dropped after the drop/add deadline (unless student withdraws from all coursework for the semester. If a student must drop a
course for circumstances that are unavoidable and unforeseen, he or she may petition (in writing to Weatherhead School registrar) for a partial tuition refund for the course.

**Grades**

The grading system for Weatherhead School of Management students is:

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<th>Grade</th>
<th>Description</th>
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<tbody>
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<td>A—4</td>
<td>Quality points</td>
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<td>B—3</td>
<td>Quality points</td>
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<tr>
<td>S—0</td>
<td>Quality points (averaged in cumulative grade point average, no degree credit)</td>
</tr>
<tr>
<td>F—0</td>
<td>Quality points (averaged in cumulative grade point average, no degree credit)</td>
</tr>
<tr>
<td>IN</td>
<td>Incomplete (no degree credit)</td>
</tr>
<tr>
<td>AD</td>
<td>Audit (no degree credit)</td>
</tr>
<tr>
<td>NG</td>
<td>Unsatisfactory audit</td>
</tr>
<tr>
<td>W</td>
<td>Withdrew without grade (no degree credit)</td>
</tr>
<tr>
<td>WD</td>
<td>Withdrew from all courses in a semester (no degree credit)</td>
</tr>
</tbody>
</table>

**Incomplete Grade**

The grade of IN is assigned at the discretion of an instructor, provided that two criteria are met:

1. 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 students’ responsibility to notify the instructor of the circumstances which prevent completion of the course.
2. The student has been passing the course and only a small segment of the course remains to be completed, such as a term paper, for which the extenuating circumstances justify a special exception.

In order to receive credit for a course marked IN, 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 IN unless the instructor elects to give the grade of F.

Any student who wishes to petition to extend an IN grade beyond the stated university deadline of the next regular semester must obtain approval from the faculty member who assigned the IN grade. Student requests must be in writing and convey: (a) extenuating circumstances justifying the extension, and (b) the expected date of completion of the work. If approved, the request should be initialed by the faculty member and delivered by the student to the Professional Degrees Program. Administrative offices for inclusion in the student’s file. Failure to complete course requirements by an extended date will result in a permanent IN grade or an F grade, at the discretion of the instructor.

**Withdrawn Grade**

The grade of W will be given if a student officially withdraws from a semester-length course by the deadline specified in the official university calendar. A student withdrawing after this date will receive the grade of F unless, in the judgment of the Associate Dean of the Weatherhead School of Management, there are valid reasons for recording the grade of W.

**Audit Grade**

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 instructor may designate that the student has not completed all requirements for auditing the course and that NG (no grade) be recorded on the students transcript. The designation of NG is not available under any other circumstances.

Students will be permitted to change their registration in a course from credit to audit (AD) only if the change is officially made by the deadline specified in the University calendar. Students may audit only with permission of the instructor and may not audit a required course in the M.B.A. curriculum. Any course that has been audited may not be repeated for credit.

**Satisfactory Grade**

The grade of S indicates passing performance only in designated courses approved by the Professional Degree Programs Committee.

The grade of S is not counted in determining quality average and an S, once entered on the students record, may not be changed. Under no circumstances should some students in a course receive an S while other students receive grades of A, B, C or D.

No student can receive credit for more than six semester hours of grades of S toward the M.B.A. degree.

**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 IN grade to a regular grade or changing one regular grade to another. However, faculty may replace or substitute assignments for individual students in a course, depending on extenuating circumstances.

**Retention Requirements**

For retention in the M.B.A., E.M.B.A., M.S.M. and M.Acc. degree programs of the Weatherhead School, a student must meet the following academic requirements: (1) a quality-point average of 2.25 at the completion of 12 semester hours of graduate study; and (2) a quality-point average of 2.4 or higher at the completion of 21 semester hours or more of graduate study. In calculating the quality-point average, all graduate courses for which quality points are given are counted, including courses that may have been repeated. (Refer to the M.N.O. degree information in this bulletin or the School of Graduate Studies section for retention requirements for other degree programs.)

**Graduation Requirements**

A cumulative quality-point average of 2.50 in all graduate courses taken for credit in the M.B.A., E.M.B.A. M.S.M. or M.Acc. degree programs is required for the award of these degrees. All requirements for each of the professional degree programs must be fulfilled within six years from the date of the student’s initial registration in graduate study in the Weatherhead School of Management.
A candidate for a degree awarded by the Weatherhead School of Management must make an application for the degree in the PDPAO no later than two months before the commencement at which the degree is expected to be awarded. Upon receipt of the student’s application, the PDPAO will verify that the student is eligible to graduate at the time requested. Students are advised to contact the PDPAO if they have any questions regarding the time or the requirements for graduation.

An annual convocation ceremony is held in May. Candidates who are awarded degrees in August or January will be invited to attend the ceremony the following May.

Transcripts
Case Western Reserve University considers grades and other information about students performance at Case Western Reserve University to be a private matter and will release such information to students only upon written request. Transcripts will not be issued to or on behalf of students who have not discharged all financial obligations to the University.

Transcripts of work completed at other institutions will not be released to students or other third parties.

Transfer Credit
Six hours of transfer credit may be granted toward the M.B.A. degree in accordance with the following provisions:

1. The student registers for and completes a minimum of 36 semester hours of coursework in the Weatherhead School of Management toward the M.B.A. degree;
2. The work to be transferred must have been done at another AACSB accredited graduate school of business;
3. Satisfactory grades for the work to be transferred are documented on an official transcript (not counted in the students grade point average); and
4. The courses are applicable to the M.B.A. program at Case Western Reserve University.
5. Coursework to be transferred from a local college or university must not be offered by the Weatherhead School of Management.

The student must contact the Weatherhead School registrar to initiate a request for transfer credit for a course to be taken at another university. The registrar will seek approval from the appropriate department Chair or division head, and the Associate Dean for Professional Programs. The school will not be liable for acceptance of transfer credit unless this approval process is completed prior to a student’s enrollment in courses at another university. Approval of coursework is acknowledged in writing. An official transcript from the other school, mailed directly to the Weatherhead School registrar, must be on file before the transfer of credit can be completed. Graduate courses counted toward another degree are not eligible for transfer credit.

Double-Counting of Courses for Joint Degree Students
Any student wishing to double-count courses for any joint degree program in the Weatherhead School of Management will be subject to the following restrictions:

1. A minimum of 36 hours of coursework will be required for each degree awarded by the Weatherhead School of Management, over and above all courses taken in any other degree program at Case Western Reserve University.
2. In the M.B.A. program, elective courses may be double counted within the limits of Item 1 above, with the further provision that a minimum of three electives must be Weatherhead School of Management elective courses. A grade of C or higher must be received for any elective taken outside the Weatherhead School of Management in order to be counted for M.B.A. credit.

Departmental Course Offerings
Department of Accountancy

621 Enterprise Hall
Timothy J. Fogarty, Chair
Phone 216-368-2073 Fax 216-368-4776

Specified advanced undergraduate major courses, numbered on the 300 level, are open to graduate students. When these courses are taken for graduate credit, the instructor assigns additional work, usually research. Graduate courses are numbered 400 and above. Listed below are all graduate course offerings for the master’s and doctoral degree programs and the certificate programs described earlier in this bulletin.

The Accountancy Department prepares students for professional careers in public accountancy, financial management and academia. The faculty offers coursework leading to the Bachelor of Science in Accounting and the Master of Accountancy. A major field in accountancy in the Ph.D. in Management program is also offered. In addition, the faculty provides service courses to M.B.A. students seeking elective coursework in accounting, taxation, auditing and related subjects in preparation for professional examinations. University-wide general service courses are also provided for students not enrolled in Weatherhead School of Management or the School of Graduate Studies.

FACULTY
Timothy J. Fogarty, Ph.D. (Pennsylvania State University), J.D. (State University of New York at Buffalo)
KPMG Peat Marwick Faculty Fellow; Professor of Accountancy, Chair, Accountancy Department, Undergraduate Accountancy Program
Individual income taxation, business law
Robert J. Bricker, Ph.D. (Case Western Reserve University)
Ernst and Young Faculty Fellow; Associate Professor of Accountancy
Financial accounting
David R. Campbell, Ph.D. (University of Georgia)
Professor of Accountancy
Auditing, financial reporting, financial accounting
Peter C. Koo, Ph.D. (Columbia University), CPA
Assistant Professor of Accounting

Alfred C. Ernst, Ph.D. (Columbia University)
Professor of Information Systems

SECONDARY APPOINTMENTS

Richard J. Boland, Jr., Ph.D. (Case Western Reserve University)
Professor of Information Systems; Professor of Accountancy

Accounting (ACCT)

UNDERGRADUATE COURSES

ACCT 101. Introduction to Financial Accounting (3)
This course covers concepts, software, principles, and practices including the preparation and interpretation of financial reports, recordkeeping procedures, and internal controls.

ACCT 102. Introduction to Managerial Accounting (3)
This course examines the collection, classification and analysis of information for management. It focuses upon how managers coordinate, plan and control operations, and how decisions in business are made. Prerequisite: ACCT 101.

ACCT 300. Corporate Reporting I (3)
This course covers financial theory and reporting practice, including evaluation of current issues and practices related to asset valuation and present value, including receivables, inventory and fixed assets. Software applications and international aspects are considered. Prerequisites: ACCT 101 and ACCT 102.

ACCT 301. Corporate Reporting II (3)
This course covers financial accounting theory, technique and reporting practices. Areas of focus include: liability determination; equity measurement; principles of revenue and expense measurement; earnings per share, inflation and interim reporting; pensions; and lease accounting. Software applications and international aspects are considered. Prerequisite: ACCT 300.

ACCT 302. Managing Costs (3)
This course covers internally-generated reports and information for management decisions. Subjects include standard and product cost systems, cost-volume-profit relationships, budgeting, systems design and relevant cost studies. Prerequisite: ACCT 102 or ACCT 401.

ACCT 303. Survey of Accounting (3)
The course covers the principle of financial and managerial accounting for non-management students, including the framework that underlies financial and manual 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 or accounting majors nor enrolled in the Weatherhead School of Management. This course cannot be substituted for ACCT 101-102 without a waiver from the chairman.

ACCT 304. Advanced Financial Reporting (3)
This course covers partnerships, consolidations, fiduciaries, receivables, estate and trusts and foreign exchange. Computer spreadsheet applications are utilized. Prerequisite: ACCT 301.

ACCT 305. Income Taxation: Concepts, Skills, Planning (3)
This course covers underlying federal income tax and concepts and law applicable to individuals. May not be taken for credit if ACCT 410 is taken for credit. Prerequisite: ACCT 102 or ACCT 401.

ACCT 314. Attestation and Assurance Services (3)
This course covers methods for the examination of financial statements, internal control and internal audit, auditing, inventory analysis, fraud, professional ethics, legal responsibilities, emerging assurance services, and the recent developments in the auditing profession. Prerequisite: ACCT 301.

ACCT 360. Independent Study (1-18)
ACCT 396. Accountancy for Non-profit Entities (3)
This course covers essential techniques of accounting valuation, recording, measurement and reporting process for health care, government and institutional entities. Prerequisite: ACCT 102 or ACCT 401 or MBAC 415.

GRADUATE COURSES

ACCT 401. Finance and Managerial Accountancy (3)
This course examines the framework that underlies financial and managerial accountancy and how reports and 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.

ACCT 402. Advanced Managerial Cost Accounting (3)
This course covers inventory planning and control, budgeting, managerial performance measures, decision models and cost behavior patterns. Computer analysis is utilized. A research project is required. Prerequisite: ACCT 302.

ACCT 403. Survey of Accounting (3)
(See ACCT 303.)

ACCT 405. Advanced Federal Taxes (3)
Corporate income taxes, estate and gift tax, partnerships and hybrid forms of organization are covered. Computer-related analysis and assignments are made. Prerequisite: ACCT 305.

ACCT 406. Computer-based Accounting Systems (3)
This is an integrative case oriented course intended to examine the characteristics and elements of planning and control systems and the requirements for the development and implementation of such systems. Planning control systems in service, nonprofit and multinational organizations are analyzed. The course explores the role accounting plays in the development and support of planning and control systems, and the problems and implications for accounting of developing systems for different types of organizations. Prerequisite: ACCT 401 or MBAC 415.

ACCT 414. Corporate Reporting and Analysis (3)
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. Prerequisite: ACCT 401 or MBAC 415.

ACCT 415. Managerial Accounting - E.M.B.A. (2)
This course examines the framework that underlies financial and managerial accountancy and how reports and 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. This course is open only to students in the Executive M.B.A. program.

ACCT 420. Advanced Accountancy Theory (3)
This course studies contemporary issues in theory. Topics are considered from their historical development to contemporary circumstances. Academic and professional literature are employed to gain a variety of perspectives on current matters. Prerequisite: ACCT 301.

ACCT 430. Taxes and Management Decisions (3)
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 as opposed to accounting or tax. Prerequisites: ACCT 401 or MBAC 415 or MAND 425 and MAND 426.

ACCT 441. Audit and Security of Information Systems (3)
Cross-listed as MIDS 441.

ACCT 501. Special Problems and Topics (1-18)
This course is offered, with permission, to students undertaking reading in a field of special interest.

ACCT 501H. Special Problems and Topics (1-18)

ACCT 530. International Taxation (3)
This course provides a basic understanding of U.S. taxation of foreign-source income of multinational corporations, U.S. citizens and residents, and includes: taxation of foreign subsidiary versus branch operations; Sec. 861 and Sec. 482 income and expense allocation problems; foreign tax credits; tax treaties; tax policy issues of equity and neutrality; and Foreign Sales Corporations. Prerequisites: ACCT 402 and ACCT 405 and ACCT 420.

ACCT 531. Tax Research Methods (3)
This course concentrates on the basic nature of the tax research process, identification of pertinent facts, evaluation of authoritative sources, problem definition, evaluation of alternative courses of action and recommendations of solutions to the problem. Library research materials are used, including tax services, journal articles, analyses of court cases and administrative rulings. Tax research cases are employed as the basic methodology for simulating actual tax research problems. Computer applications for tax research are assigned. Prerequisites: ACCT 402 and ACCT 405 and ACCT 420.

ACCT 532. Advanced Corporation and Shareholder Tax Problems (3)
This course includes federal tax problems of corporations and their shareholders: corporation formation; liquidation; reorganization; reincorporating; dividends, earnings and profits; stock redemption; problems of choice of business organization; thin capitalization; and special designations. There is extensive use of journal articles, treasury regulations and codes, and corporate tax search and planning cases. Computer applications are assigned. Prerequisites: ACCT 402 and ACCT 405 and ACCT 420.

ACCT 533. Partnership Taxation (3)
This course provides in-depth analysis of the federal income taxation of partners and partnerships. Topics covered include partnership formation, transfers of partnership interests, distributions of partnerships’ property, and rules governing the termination of a partnership.

ACCT 534. Estate and Gift Taxation (3)
This course covers code, regulations and case law in the federal estate and gift area. Family financial planning to minimize income and transfer taxes is included. Prerequisites: ACCT 402 and ACCT 405 and ACCT 420.

ACCT 535. Special Topics in Federal Taxation (3)
This course includes tax practice and procedure, tax policy, consolidation, tax returns, international taxation and deferred compensation. Prerequisites: ACCT 402 and ACCT 405 and ACCT 420.

ACCT 539. Regulation of Accountancy (3)
This course examines the role and structure of standard-setting agencies in the private and public sectors, including FASB, AICPA boards and divisions, the Securities and Exchange Commission and other regulatory bodies. The 1933 and 1994 securities acts, the disclosure and independence aspect of securities regulation, and elements of professional behavior, international reporting and measurement requirements are also explored. Extensive use is made of web-based information including company and mutual fund sites and databases. Prerequisites: ACCT 402, ACCT 405 and ACCT 420 or permission.

ACCT 540. Contemporary Accountancy Policy (3)
This course studies subjects of contemporary concern to the profession which are currently being debated and researched by professional bodies and the academic community. These subjects include: independence; scope of services; litigation; relationships with financial and non-financial management; social accounting; and education and competency issues. The seminar provides a participative understanding of the press of various economic and accounting environments. Prerequisites: ACCT 402 and ACCT 405 and ACCT 420.

ACCT 544. Advanced Auditing Theory and Practice (3)
This course examines auditing concepts and issues in depth, including: the philosophy of auditing operational auditing compilation and review; ethics; analytical review procedures; fraud; the computer as an audit tool; and statistical sampling. Student are exposed to judgment making through the use of audit cases. Prerequisites: ACCT 402 and ACCT 405 and ACCT 420.

ACCT 601. Special Problems and Topics (1-18)
This course is offered, with permission, to Ph.D. candidates undertaking reading in a field of special interest.

ACCT 701. Dissertation Ph.D. (1-18)
ACCT 702. Appointed Dissertation Fellow (9)

Department of Banking and Finance

David A. Bowers, Chair
Phone 216-368-2040 Fax 216-368-4776

FACULTY
David A. Bowers, Ph.D. (Southern Methodist University)
Professor of Banking and Finance; Chair, Banking and Finance Department
Business cycles and forecasting
Konan Chan, Ph.D. (University of Illinois at Urbana-Champaign)
Assistant Professor of Banking and Finance
Investments and Corporate Finance
Anurag Gupta, Ph.D. (New York University)
Assistant Professor of Banking and Finance
Derivatives and Financial Markets
Paul A. Laux, Ph.D. (Vanderbilt University)
Associate Professor of Banking and Finance
Financial markets, market microstructure, options and futures.
Bing Liang, Ph.D. (University of Iowa)
Assistant Professor of Banking and Finance
Financial management, capital markets and econometrics
Thomas F. Morrissey, Ph.D. (Syracuse University)
Professor of Banking and Finance;
Financial economics
Ranga Narayan, Ph.D. (New York University)
Assistant Professor of Banking and Finance
Insider trading market microstructure, corporate finance
J. B. Silvers, Ph.D. (Stanford University)
Professor of Banking and Finance;
Economics, options and futures.
Elizabeth M. & William C. Treuhaft Professor of Management:
Financial management, health systems management, health economics
Sam Thomas, Ph.D. (The Wharton School, University of Pennsylvania)
Senior Lecturer of Banking and Finance
Corporate finance and investments
UNDERGRADUATE COURSES

BAFI 341. Money and Banking (3)
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. Prerequisite: ECON 103. Cross-listed as ECON 341.

BAFI 342. Public Finance (3)
Prerequisites: ECON 102 and ECON 103. Cross-listed as ECON 342.

BAFI 355. Corporation Finance (3)
This course emphasizes the identification and solution of the financial problems confronting the business enterprise. Designating the goal of the firm to be maximization of shareholder wealth, topics include financial analysis, valuation, capital budgeting, financial structure, dividend policy, and working capital management. Prerequisite: ACCT 102.

BAFI 356. Investments (3)
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. Prerequisite: BAFI 355.

BAFI 359. Intermediate Corporate Finance (3)
This is the second course in corporate finance. It is a case-based course that will apply and amplify concepts developed in the first course (BAFI 355 Corporate Finance). The cases selected for BAFI 359 will cover, among other topics, cash budgets and working capital management, capital budgeting, capital structure/ dividend policy concepts, IPO process and valuation. The objectives of the course are to develop both conceptual and financial-modeling skills. Prerequisite: BAFI 355.

BAFI 360. Independent Study (1-18)
This course is offered for candidates undertaking reading in a field of special interest. Permission of department chair required. BAFI 372. International Finance (3) Cross-listed as ECON 372.

GRADUATE COURSES

BAFI 402. Financial Management I (3)
In this course, students are introduced to the mathematics of finance, the basis for decision making in the investment of long-term and short-term assets, financial statement analysis and working capital management. Corequisite: MBAC 415 or ACCT 401.

BAFI 403. Financial Management II (3)
This is a continuation of BAFI 402 and serves as a prerequisite for several advanced electives in banking and finance. Its purpose 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. Prerequisites: ACCT 401 or BAFI 402 and QUMM 414 or MBAC 415, MBAC 416 and MBAC 414. Prerequisite or corequisite: ECON 403.

BAFI 404. Financial Modeling (1.5)
Financial Modeling is the practical skill that combines financial theory, business planning, forecasting, and sensitivity and simulation analysis to produce computer models that are useful for a variety of decision-making purposes. Prominent purposes include project and company valuation, strategic planning, cash planning, credit evaluation, and the tactical implementation of business plans. Financial Modeling is a threshold skill for several careers attractive to M.B.A. graduates, including investment banking, equity analysis and management, and corporate treasury. Financial Modeling is a 1.5 credit hour course designed for M.B.A. students who anticipate either internships or careers in the financial services industry or in corporate financial management. The course aims to develop students’ skills in implementing models that operationalize the core tools and concepts developed in other finance and accounting classes. Corequisite: BAFI 403.

BAFI 406H. Financing International Trade (3)
The course is intended to assist the students to gain an understanding of the finance of international trade, techniques of foreign exchange and support services provided for exporters, importers and merchants, further on it will extend to the correspondent relationship among the banks. The course puts the accent to the knowledge necessary mainly for the students who later on want to get employment in banks or in the treasury of large companies and would like to be well accomplished not only in theoretical but in practical aspects of international finance, as well. Due to this criteria, the topics of the course will be based on the previous subjects of Financial Management courses extending them towards the present international financial requirements and practice.

BAFI 407H. Advanced Financial Management (3)
Case studies and readings for decision making in financial management; working capital policy, capital budgeting, financing with debt and equity, dividend policy, and valuation. Prerequisites: BAFI 402 and BAFI 403.

BAFI 415. Economic Analysis for Managers-E.M.B.A. (2)
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.

BAFI 420. Health Finance (3)
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. Prerequisite: ACCT 401 or MBAC 415 or consent of instructor. Cross-listed as HSMC 420.

BAFI 422. Management of Financial Institutions (3)
This course applies the principles of financial management to financial institutions, especially commercial banks. The impact of monetary and fiscal policies and the changing regulatory, legislative, and technological environments are studied. Specific problem-solving techniques and decision-making are emphasized. Prerequisite: MBAC 416, BAFI 402 or consent of instructor.

BAFI 423. Managerial Finance-E.M.B.A. (3)
This course, which is limited to students in the Executive M.B.A. program, analyzes the policies and problems of obtaining and managing funds for operation, expansion and diversification.

BAFI 424. Managerial Finance II-E.M.B.A. (3)
This course emphasizes theoretical and empirical issues pertinent to the fields of investment management, derivative assets, and international finance. The course will span the topics of modern portfolio theory, market efficiency, equity markets, debt markets, derivative assets, financial engineering and risk management, international financial markets, and others.

BAFI 426. Applied Security Analysis (3)
This is a course for those seeking an in-depth examination of equity investment decision. The course is funded by a grant and involves the continuing analysis, review and reinvest-
ment of the funds in an actual portfolio dedicated to this course. There is active involvement with members of The Cleveland Society of Securities Analysts, including attendance at Corporate Investor Relations presentations. The course emphasizes the application of particular analytical models of stock selection. Prerequisite: BAFI 403, ECON 403, MBAC 414 or QUMM 414.

BAFI 428. Problems in Financial Management (3)
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. Prerequisite: BAFI 403.

BAFI 429. Investment Management (3)
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 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. Corequisite: BAFI 403.

BAFI 430. Options and Futures (3)
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. Corequisite: BAFI 403.

BAFI 431. Fixed Income (3)
This course is a sequel to BAFI 430. Extensions of standard option pricing models are considered with emphasis on interest rates. Hedging and risk management of interest rate risk and the use of swaps are covered in depth. Prerequisite: BAFI 430.

BAFI 432. Risk Management and Financial Engineering (3)
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. Prerequisites: BAFI 403 and BAFI 430.

BAFI 440. Advanced Corporate Finance (3)
This course exposes students to recent developments in corporate finance from both theoretical and empirical viewpoints. Topics covered include agency and signaling theories of capital structure policy, mergers and acquisitions, CEO compensation, bankruptcy, investment banking and insider trading, internal control systems and risk management. Prerequisite: BAFI 403.

BAFI 441. Advanced Money and Banking (3)
Participants study the roles of money and monetary institutions in the economy, the creation, liquidation and control of the money supply, and problems of the value of money and policies of the monetary authorities. Prerequisites: ACCT 401, MBAC 416 or BAFI 402, ECON 403 and QUMM 414. Cross-listed as ECON 441.

BAFI 445. Money and Capital Markets (3)
This course provides an examination of the current structure, pricing, competition and financial innovations in money and capital markets. Theory is coupled with contemporary events to study the impact of the secular rise and cyclical variability of interest rates, the proliferation of financial instruments, deregulation and the wider competition in financial markets. Individual segments of the money market such as the commercial paper and acceptances markets are examined, as are capital market segments such as the various bond markets, mortgages and derivative instruments. Prerequisites: ACCT 401 or MBAC 415, MBAC 416 or BAFI 402, ECON 403 or MBAC 426 and QUMM 414 or MBAC 414.

BAFI 450. Corporate Restructuring (3)
This course examines the economic rationale behind and analytical techniques used in decisions to restructure assets and capital. Emphasis is on valuation and corporate control aspects of acquisitions, divestitures and changes in the debt/equity mix. Prerequisite: BAFI 403.

BAFI 450H. Corporate Restructuring (3)
BAFI 460. Investment Banking (3)
This course will conduct a detailed examination of the role of the investment banker in the corporate capital acquisition process. Initial Public Offers and Seasoned Equity Offers, including General Case Offers to the public and Rights Offers to existing stockholders will be reexamined. The nature of the underwriting contracts entered into between the firm and its investment banker will be discussed. Additional topics to be covered will include mergers and acquisitions, joint ventures, equity carve-outs and spin-offs. Prerequisite: BAFI 403.

BAFI 460H. Investment Banking (3)
BAFI 480. International Financial Management (3)
This course introduces students to international finance and foreign exchange risk management by corporations. Topics include foreign exchange markets and international financial institutions; financial contracts; exchange rate risk and corporate risk management; and international aspects of long-term financing. Prerequisite: BAFI 403.

BAFI 501. Special Problems and Topics (1-18)
This course is offered, with permission, to students undertaking reading in a field of special interest.

BAFI 601. Special Problems and Topics (1-18)
This course is offered, with permission, to Ph.D. candidates undertaking reading in a field of special interest.

BAFI 701. Dissertation Ph.D. (1-18)

Business Law (BLAW)

UNDERGRADUATE COURSES

BLAW 329. Law and Management I (3)
This course is an introduction to the American legal system as well as coverage of the legal rules and regulations governing specific areas of law. Emphasis is on legal topics of special interest to business students contracts, agency, property, corporations, sales, and product liability.

BLAW 330. Law and Management II (3)
This course provides further coverage of legal and regulatory topics of business law. These include antitrust, environmental law, employment law and commercial paper. It is designed as a survey course and is offered to address special topics which follow from an understanding of issues developed in BLAW 329. Prerequisite: BLAW 329.

GRADUATE COURSES

BLAW 407H. International Business Law (3)
The course introduces basic legal notions surrounding international business. It is designed to teach M.B.A. candidates how to recognize and understand legal problems arising in the context of a multinational enterprise and transnational business transactions. It is expected that the course will help future managers understand the importance of the role of a lawyer in the stages of business strategy development and contract drafting, and not solely
in the post-dispute stage. The course adopts a comparative approach, with the intention to show both the diversity and the similarity of national laws. Attention is given to major international legal agreements.

**BLAW 417A. Legal Environment for Managers-M.B.A. (2)**

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 their daily decisions. 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 torts, contracts, products liability, employment law, and corporations. Special emphasis is placed on regulatory areas.

**BLAW 417B. Legal Environment for Managers-M.B.A. (3)**

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 their daily decisions. 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 torts, contracts, products liability, employment law, and corporations. Special emphasis is placed on regulatory areas.

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### Department of Economics

400 Wickenden Building
William T. Bogart, Chairman
Phone 216-368-2970 Fax 216-368-5039

**FACULTY**

William T. Bogart, Ph.D. (Princeton University)
  - Associate Professor of Economics; Chairman, Economics Department
  - Urban economics, public finance, real estate markets
Eric Bettinger, Ph.D. (Massachusetts Institute of Technology)
  - Assistant Professor of Economics
Bo A. Carlsson, Ph.D. (Stanford University)
  - E. Mandell deWitt Professor of Industrial Economics; Associate Dean for Research and Graduate Programs
  - Managerial economics, industrial economics
David J. Cooper, Ph.D. (Princeton University)
  - Assistant Professor of Economics
  - Industrial Organization, Microeconomic Theory
Avi Dor, Ph.D. (City University of New York)
  - John R. Mannix Blue Cross & Blue Shield Associate Professor of Health Care Economics

**SECONDARY APPOINTMENTS**

Paul D. Gottlieb, Ph.D. (Princeton University)
  - Associate Director, Center for Regional Economic Issues; Senior Lecturer of Economics
  - Economics of cities and regions, public policy, labor markets and commuting, amenities and economic development
David C. Hammack, Ph.D. (Columbia University)
  - Elbert Jay Benton Professor of History, College of Arts and Sciences; Professor of Economics
  - Nonprofit organizations, urban and social policy history
Andrew P. Morriss, J.D., M.Pub.Aff.
  - (University of Texas at Austin), Ph.D. (Massachusetts Institute Technology)
  - Professor, School of Law; Associate Professor of Economics
  - Labor economics, industrial organization, law and economics

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### Course Requirements

- **One elective may be in a related field (3 hours)**
- **Minimum of four economics electives (12 hours)**
- **Electives (15 hours)**
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  - John R. Mannix Blue Cross & Blue Shield Associate Professor of Health Care Economics

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**Health care economics, industrial economics**

Robin A. Dubin, Ph.D. (The Johns Hopkins University)
  - Associate Professor of Economics
  - Spatial econometrics, urban economics, regional economics
Asim Erdilek, Ph.D. (Harvard University)
  - Professor of Economics
  - International economics, international finance
Michael S. Fogarty, Ph.D. (University of Pittsburgh)
  - Professor of Economics
  - Regional growth and development, science and technology infrastructure, economics of cities
Susan Helper, Ph.D. (Harvard University)
  - Associate Professor of Economics
  - Economic history, technical change, economics of supplier relations
William S. Peirce, Ph.D. (Princeton University)
  - Professor of Economics
  - Public finance, public choice, economics of energy and industrial economics
James B. Rebiter, Ph.D. (University of Massachusetts-Amherst)
  - Frank Tracy Carlton Professor of Economics
  - Economics of organizations, employment relationships and labor markets, human resource management and industrial relations, behavioral economics
Richard A. Shatten, M.B.A. (Harvard University)
  - Professor for the Practice of Public Policy and Management; Director, Center for Regional Economic Issues
  - Public policy, nonprofit leadership and corporate involvement in society
Robert L. Slonim, Ph.D. (Duke University)
  - Assistant Professor of Economics
  - Game theory, learning, behavioral economics, reference theory, auctions, decision theory and experimental economics
Marcus Stanley, M.A. (Syracuse University)
  - Instructor of Economics

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**ADJUNCT FACULTY**

Martine Lussier, Ph.D. (University of Toronto)
  - Instructor of Economics
Ayunah Talu, Ph.D. (Arizona State University)
  - Lecturer

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**BACHELOR OF ARTS DEGREE**

*(College of Arts and Sciences)*

Economics is concerned with the problems of allocating scarce resources to meet human needs. Students who study economics gain an understanding of how consumers (households), producers (firms) and governments make decisions affecting the allocation of resources and, therefore, a society’s economic performance. Economics also involves an examination of how the interaction of these decisions in markets and in the political process produces certain outcomes, and how legal and institutional arrangements can influence these outcomes. Finally, the study of economics leads to a better appreciation of the ways in which trade, investment and the movement of people and information across national boundaries tie the global economy together.

An undergraduate major in economics provides an excellent preparation for a variety of professional careers, such as management, law and government service. A major is essential for those wanting to pursue graduate work in economics.

**Major**

*(for B.A. degree)*

A major in economics consists of 30 hours, with a minimum of 24 hours of economics courses. It leads to the Bachelor of Arts degree.

**Required courses (15 hours)**

- ECON 102, 103, 307, and either 308 or 309 (12 hours)
- STAT 201 or 207 or equivalent (3 hours)
- Electives (15 hours)
  - Minimum of four economics electives (12 or more hours)
  - One elective may be in a related field (such as ACCT, HSTY, MATH, PHIL)
approved by the departmental adviser (3 hours max)

**Minor**

**(for B.A. or B.S. degree)**

A minor in economics consists of 15 hours, as follows:

ECON 102, ECON 103, and three additional economics courses (9 hours) selected in consultation with the minor adviser.

**Social Science Sequence**

**(for B.S. based upon Engineering Core Curriculum)**

The sequence requirement is satisfied by taking ECON 102, ECON 103, and one other 200- or 300-level ECON course.

**Social Sciences/Social Institutions Requirement**

**(for B.A. or B.S. based upon Arts and Sciences General Education Requirements)**

The three-credit minimum may be satisfied by taking any one of the courses listed below. The six-credit sequence may be satisfied by taking any two of the courses listed below ECON 102, ECON 103, ECON 205.

**Economics (ECON)**

**UNDERGRADUATE COURSES**

**ECON 102. Principles of Microeconomics (3)**

This course covers how productive resources are allocated in a market economy, the determination of individual prices and costs of production, consumer behavior, the consequences of governmental controls over prices and wages, and problems related to allocating resources between the private and public sectors.

**ECON 103. Principles of Macroeconomics (3)**

This course covers how incomes, employment, inflation, and the national output of goods and services are determined, as well as the monetary system and its management. Government revenue and expenditure policies and their influence on economic stability and growth are also studied.

**ECON 205. Economic Perspectives (3)**

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 255. The Economic History of the United States (3)**

Cross-listed as HSTY 255 and PLCY 255.

**ECON 306. History of Economic Thought (3)**

In this course you will study first hand the writings of the great economists. The course focuses on such famous thinkers as Adam Smith, David Ricardo, Karl Marx, Leon Walras, John Maynard Keynes, Milton Friedman, and Ronald Coase. For many of these writers, economics went beyond contemporary boundaries and encompassed the study of history, philosophy and sociology. Their original texts are “classics”—books that everybody talks about yet nobody reads. As such they are often misinterpreted. In this course you should develop your own interpretation—hopefully it will surprise you. Prerequisites: ECON 102 and ECON 103.

**ECON 307. Intermediate Macroeconomy (3)**

This course examines the theories of the determination of national income, the unemployment rate, inflation, and the rate of interest, as well as alternative theories of income determination, the theory of capital, monetarists vs. Keynesians, and dynamic analysis. Prerequisite: ECON 103.

**ECON 308. Intermediate Microeconomy (3)**

This course examines pricing and resource allocation, welfare economics, general equilibrium, and relative economic efficiencies of capitalistic and alternative forms of economic organization. Prerequisite: ECON 102.

**ECON 309. Intermediate Microeconomy: Math Based (3)**

Course covers the same topics as ECON 308 but uses calculus. Prerequisites: MATH 121 or MATH 125 and ECON 102.

**ECON 326. Econometrics (3)**

This course covers the techniques used by economists to estimate the parameters of economic relationships such as demand curves and consumption functions. Prerequisites: ECON 102 and ECON 103 and one semester of statistics.

**ECON 328. Experimental Economics (3)**

This course covers the methods of experiments to study economic behavior. This course will examine the role of market institutions, game theory, and individual choice. Specific topics will depend on both the instructor and student interest, but will include market organization, game theory and rational choice and recent modifications to economic thinking on this topics. Prerequisite: ECON 102.

**ECON 329. Game Theory: The Economics of Thinking Strategically (3)**

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. Prerequisite: ECON 102.

**ECON 332. Economic Analysis of Labor Markets (3)**

This course examines the determinants of the demand for and supply of labor, the operation of labor markets under differing degrees of competition, and the relationship between the operation of the labor market and the level of inflation. Prerequisite: ECON 102.

**ECON 335. Comparative Economic Systems (3)**

This course examines the way different institutions affect economic performance. An alternative course title might be “Comparative Institutional Analysis.” In particular, we look at the economic institutions of three capitalist economies (the U.S., Japan and Sweden), one socialist economy (the former Soviet Union), and two economies in transition (Poland and Hungary), together with the unique institutional arrangements in Iran (the “Islamic Model”) and the former Yugoslavia (“worker management”). We combine insights from traditional economic theory, recent developments in “information economics,” and the use of case studies. Prerequisites: ECON 102 and ECON 103.

**ECON 338. Law and Economics (3)**

This course examines legal institutions and rules from an economic perspective. Students will learn when and how legal rules can be efficient. Topics will depend on both the instructor and student interest, but will include commercial law, accident law, property rights, contracts, and polycentric legal systems. Prerequisite: ECON 102.

**ECON 341. Money and Banking (3)**

Prerequisite: ECON 103. Cross-listed as BAFI 341.

**ECON 342. Public Finance (3)**

This course covers economic aspects of government spending and taxing, allocation of scarce resources among competing claims in the public and private sectors, application of equity and efficiency criteria to tax and expenditure systems, and theories of bureaucratic performance. Prerequisites: ECON 102 and ECON 103. Cross-listed as BAFI 342.

**ECON 343. Economics of State and Local Governments (3)**

This course examines economic analysis of the
roles of federal, state, and local government; economic effects of state and local property, sales, and other taxes; effects of intergovernmental grants; public school finance; the urban fiscal crisis. Prerequisite: ECON 102.

ECON 345. Public Choice (3)
This course covers economic theory and empirical analysis of the behavior of politicians, bureaucrats, and voters based on the assumption of rational pursuit of self-interest, comparison with other approaches to the study of political behavior, and implications of alternative collective decision procedure. Prerequisites: ECON 102 and ECON 103.

ECON 361. Managerial Economics (3)
This course explores the economic principles that underlie strategic decisions in firms. Topics include the determination of vertical and horizontal boundaries of firms, strategic positioning and the sources of competitive advantage. Prerequisite: ECON 102.

ECON 364. Competition & Public Policy (3)
This course covers alternative market structures and their performance in terms of profit, prices, and productivity, as well as antitrust laws and regulations and their importance to industrial organization. Prerequisite: ECON 102.

ECON 367. Economics of Energy (3)
The economic aspects of energy are studied. Long term trends in consumption, sources of supply, the theory of nonrenewable resources, interactions with environmental problems, and current questions of energy policy are included. Prerequisite: ECON 102.

ECON 368. Environmental Economics (3)
This course examines the economics of both the causes of pollution and the remedies for it. Among the topics covered will be: citing of environmentally undesirable facilities (such as nuclear waste repositories), tradable air pollution emissions permits, pesticide use in agriculture, and international cooperation in cleaning up the Great Lakes. Prerequisite: ECON 102.

ECON 369. Economics of Technological Innovation (3)
This course looks at the process of technological change. We will explore topics such as: the computer/internet revolution, Japanese manufacturing techniques, the mechanization of housework, the impact of new technology on workers and consumers, and how managers and government policy-makers can affect the nature of technological change. Prerequisite: ECON 102.

ECON 372. International Finance (3)
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. Prerequisites: ECON 102 and ECON 103. Cross-listed as BAFI 372.

ECON 373. International Trade (3)
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. Prerequisites: ECON 102 and ECON 103.

ECON 375. Economics of Developing Countries (3)
This course examines the problems of less developed countries, including theories of economic growth, policies for capital accumulation, criteria for resource allocation, foreign trade problems, inflation, population trends, and development planning. Prerequisites: ECON 102 and ECON 103.

ECON 377. Economics of Nonprofit Organizations (3)
The purpose of this course is to familiarize students with the private nonprofit sector of the U.S. economy, with economic theory contributing to our understanding of this sector, and with economic analysis of policy and management issues affecting nonprofit organizations. Topics include understanding the different types of nonprofit organizations; the size, scope and economic impact of the nonprofit sector; economic theories of why nonprofit organizations exist and how they behave; economic analysis of tax and regulatory policy issues affecting nonprofits. Prerequisite: ECON 102.

ECON 378. Health Care Economics (3)
This course deals with the health care system, the fastest growing sector of the U.S. economy. Because of its complexity and sheer size, the health care system affects virtually every facet of the economy, including labor productivity, income distribution and international competitiveness. The course will foster an understanding of economic analysis of health care markets and related public policy issues by developing a general understanding of the health care system, and then focusing on (1) the behavior of consumers; (2) the supply side (physicians, hospitals and their markets); (3) insurance and regulation with special emphasis on current events. Prerequisite: ECON 102; ECON 103 recommended.

ECON 386. Urban Economics (3)
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 this course, we examine the implications of spatial location for economic analysis. One of the most important implications is that households and firms can find it advantageous to cluster together in cities in order to reduce transportation costs. The course will emphasize applying the theoretical analysis to real world issues, with a special emphasis on important problems facing the Cleveland metropolitan area. Prerequisite: ECON 102.

ECON 397. Honors Research I (3)
ECON 398. Honors Research II (1-3)
Prerequisite: ECON 397.

ECON 399. Individual Readings and Research (1-6)
Intensive examination of a topic selected by the student.

GRADUATE COURSES

ECON 403. Economics of Management (3)
This course surveys of 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 421. Health Care Economics (3)
The health care industry is one of the largest sectors of the economy, yet the usual supply and demand relationships are often violated because of the presence of large third-party-payers (insurers) and the heavy involvement of central governments. We will develop an understanding of the roles of health care consumers, providers, and large purchasers in health care markets, financial incentives contained in various reimbursement schemes, and of principles insurance. The policy intricacies of this sector have sparked a fruitful area of consulting with government agencies, health care systems, pharmaceutical firms, and even hospitals among the typical clients. The course will be taught from the perspective of a policy or economic consultant in health care and is appropriate not only for those with an interest in consulting, but also for prospective business leaders and decision makers who will have to evaluate policies for their organizations, and for corporate officers who need a better understanding of benefits management. Many topics and applications covered in this course may be of interest to decision makers in other sectors of the economy. These include cost-benefit analysis, or principles of insurance, to name but two. Prerequisite: ECON 403 or MBAC 426. Cross-listed as HSMC 421.

ECON 431. Economics of Negotiation and Conflict Resolution (3)
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. Cross-listed as LHRP 413.

ECON 434. Business and Nonprofit Entrepreneurship (3)
This course examines the power of entrepreneurship in the nonprofit sector. It will cover large scale policy initiatives, new services and for-profit activities. Course elements include vision, staffing, leadership, and funding. Cross-listed as MAND 434 and ENTP 434.

This course, which is limited to students in the Executive M.B.A. program, presents the basic elements in the analysis of production and technological change. It explores the uses and limitations of theory in analyzing innovative activity in industry and examines the role of technological progress in the growth of firms and industries.

ECON 436A. Economics of Organizations—E.M.B.A. (2)
Dramatic changes in technology, work force demographics and economic competition are forcing firms to rethink their internal organization. Implementing new internal strategies is remarkably hard for organizations and managers to do. This class is designed to provide the economic tools that managers need to understand why their organizations are the way they are and why change can be as difficult as it is important. This course focuses on two elements of a firm’s internal strategy: structuring incentives and investing in relationships. In the incentives section, we analyze how organizations: allocate decision rights; evaluate performance; and implement motivation strategies. In the relationships section, we analyze how organizations sustain functional, long-term relationships in competitive or conflictual environments. A small number of surprisingly simple economic models, it turns out, offer important insights into incentive design and investments in long-term relationships.

ECON 441. Advanced Money and Banking (3)
Prerequisites: ACCT 401 or MBAC 415 and BAFI 402 or MBAC 416 and ECON 403 or MBAC 426 and QUMM 414 or MBAC 414. Cross-listed as BAFI 441.

ECON 461. Managerial Economics (3)
This course explores the economic principles that underlie strategic decisions in firms. What determines their boundaries - i.e., Which activities do they expand, acquire and divest? What are the sources of competitive advantage, and how do firms position themselves strategically? Prerequisite: ECON 403 or MBAC 426.

ECON 462. Industrial Economics (3)
This course deals with the dynamics of the industrial growth process. Topics include industrial production and productivity, the evolution of industrial structure, technological innovation and choice of technology, the response of firms to competition in an international environment, the characteristics of industrial restructuring processes, and the role of industrial policy. Prerequisite: ECON 403.

ECON 472. The World’s Regions and Strategic Advantage (3)
This course will focus on business decisions in an increasingly complex regional and global economic environment and the significance of place in business success. Every company decision involves location—recruiting, locating headquarters or an R&D lab, choosing where to invest, evaluating a merger, evaluating the investment portfolio of a bank, locating a new facility, and marketing your product. Topics include: high technology development, interpreting business climate indexes, the business location decision, sources of regional advantages, case studies of the world’s important cities, geographic clustering of industries, and business partnerships for improving regional economics. Prerequisite: ECON 403.

ECON 474. International Trade (3)
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. Prerequisite: ECON 403.

ECON 475. International Finance (3)
This course covers the global financial markets that multinational corporations, government agencies, and banks use in conducting business. These financial markets include the market for foreign exchange, the Eurocurrency and related money markets, the Eurobond and global equity markets, the commodity markets, the markets for forward contracts, options, swaps, and other derivatives. Prerequisite: ECON 403.

ECON 476. Fundamentals of International Business—E.M.B.A. (3)
This course deals with the fundamentals of business activities that cross national boundaries. It focuses on not only exports and imports, but all other issues, such as foreign direct investment, international technology transfer, organizational structure, and financial management, that required a corporate strategy in establishing and maintaining global competitiveness. It covers the basic international business activities within an interdisciplinary framework, drawing from economics, finance, accounting, marketing, organizational behavior, political science, and history. Its aim is not only to enable an understanding of such technical issues as how the effects of tariffs and quotas differ or how foreign exchange rates are determined, but also to provide a systemic view of how government policies and corporate strategies interact in changing the environment of international business. The basic premise of the course is that to formulate successful global corporate strategies, we must comprehend and cope with the political, cultural, and economic environment of international business.

ECON 482. High-Tech Regions and Business Strategy (3)
Many regions of the world seek to emulate Silicon Valley’s success as a high-tech center. These include Taiwan, Israel, India, Britain, Cote d’Azur (“Europe’s California”), Pyramid Technology Park of Egypt, and Malaysia. A region’s innovation system serves as both a regional business incubator and a national business. This course will look at what makes Silicon Valley so successful as a high-tech region, and whether it can be used as a model for high-tech development in other countries and regions. We examine alternative systems of innovation in other regions of the world and the U.S., including older industrial regions. Countries and regions will be selected depending on class composition. The class will focus on the critical ingredients that form a regional
innovation system and their effect on the performance of companies and industries. Prerequisite: ECON 403 or MBAC 426 or equivalent.

ECON 501. Special Problems and Topics (1-18)
This course is offered, with permission, to students undertaking reading in a field of special interest.

ECON 501H. Special Problems and Topics (1-36)
ECON 601. Special Problems and Readings (1-18)
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)
ECON 702. Appointed Dissertation Fellow (9)

Department of Marketing and Policy Studies

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Division of Labor and Human Resource Policy

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FACULTY

Paul F. Gerhart, Ph.D. (University of Chicago)
Professor of Labor and Human Resource Policy
Collective bargaining, conflict management and dispute resolution, labor markets, wage and salary administration

Gil A. Preuss, Ph.D. (Massachusetts Institute of Technology)
Assistant Professor of Labor and Human Resource Management
Strategic human resource management, high performance work systems, organizations and information

Paul F. Salipante, Jr., Ph.D. (University of Chicago)
Professor of Labor and Human Resource Policy
Human resource management in private and nonprofit organizations, theories and procedures of employment conflict, including tension between tradition and change

Marc Weinstein, Ph.D. (Massachusetts Institute of Technology)
Visiting Assistant Professor of Labor and Human Resource Policy

ADJUNCT FACULTY

Norman G. Halpern, M.A. (Case Western Reserve University)
Adjunct Professor of Labor and Human Resource Policy

Labor and Human Resource Policy (LHRP)

UNDERGRADUATE COURSES

LHRP 251. Labor and Human Resources Management (3)
The main objective of this course is to discuss four forms of employment relationships (old non-union, old union, new non-union, and new union). The topics include an overview of the legal basis for the employment relationship in the non-union sector (employment standards), a detailed discussion of collective bargaining (the history of the labor movement, the legal basis for unions, the major actors in the employment relationship, the process of collective bargaining, the grievance arbitration process, and the future of the labor movement), the development of human resource management, and the prospects for labor-management co-operation. The course includes a bargaining simulation, which highlights the complex nature of the collective bargaining process. One of the main advantages of the course is the way it relates the dimensions of the employment relationship with appropriate career paths for undergraduate students.

LHRP 311. Labor Problems (3)
This course examines labor/capital/government relations from current and historical perspectives. It reviews sociological, political, psychological, and economic explanations for conflicts and cooperation between labor and management. Selected aspects of law and negotiated institutions, such as individual rights and grievance procedures and a comparison of the U.S. with other countries, are also covered.

LHRP 360. Independent Study (1-18)
This course is offered for candidates undertaking reading or independent research in a field of special interest.

GRADUATE COURSES

LHRP 409. Unions and Management Policy (3)
Why employees join, or do not join unions, the organization and decertification of unions, and union development in industrialized countries outside the U.S., are studied, as are alternative management strategies and public policies for dealing with unions and unionized employees. Collective bargaining strategies and dispute resolution tactics, including grievance resolution, in the U.S. context are explored with the aid of simulations.

LHRP 413. Economics of Negotiation and Conflict Resolution (3)
Cross-listed as ECON 431.

LHRP 421. Human Resource Analysis and Policies (3)
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 424. Developing High Performance Work Systems (3)
This course will focus on understanding the factors shaping high performance work systems (HPWS) in organizations. Overall, an HPWS is based on a philosophy of using people to provide a sustainable competitive advantage; a reorganization of work structures and processes to maximize organizational learning and customer responsiveness; a set of human resource policies that seek to build employees’ motivation, skills, and align individual interests with those of the organization; and new approaches to managing employees that are consistent with these philosophies, work organizations, and policies. The content of the course is divided in three parts: 1) an introduction to HPWS, 2) components of HPWS, and 3) factors beyond the work systems which shape adoption and outcomes. Course work will include a combination of readings from various sources as well as several cases for class discussion. Class grade will be based on participation, individual case analyses, a paper addressing a topic within HPWS, and a final exam. Prerequisite: MBAC 413 or MGMT 413.

LHRP 431. Conflict Management and Dispute Resolution (3)
Seeking to strengthen participants’ negotiating skills, this course addresses the pervasive nature of conflict within and between organizations, as well as between and among individuals. The focus is on enhancing organizational performance and achieving improved outcomes for individuals through development of skills. Models of dispute resolution are drawn from social psychology, economics, labor relations and legal literature. There is heavy reliance on role play and simulation.

LHRP 431H. Conflict Management and Dispute Resolution (3)
(See LHRP 431.)

LHRP 435. International Human Resources Management (3)
This course examines the unique challenges of managing human resources globally. Particular emphasis is on cultural and other contextual differences, and their influence on HR practices such as selection, training, performance...
appraisal, compensation, and union relations. The course establishes a conceptual foundation in cross-cultural cognitive and behavioral differences. Heavy emphasis is on case analysis.

LHRP 435H. International Human Resource Management (3)
International human resource management examines different issues of human resources confronting multinational corporations in today’s turbulent environment. Topics to be explored include internationalization and its impacts on the personnel function the different fields (staffing, pay and benefit, competency model performance management, training and development and industrial relations) of HRM in the international environment, and the debate over the transportability of specific Western HR tools into emerging countries of the world. Prerequisite: LHRP 421 or MBAC 412.

LHRP 440. Human Resources Policy for Executives-E.M.B.A. (2)
This course focuses on managing human resources from the viewpoint of the general or line manager. It considers strategic, practical and legal aspects of hiring, performance appraisal, grievance systems, pay systems, worker participation and unions. Some emphasis is given to the enhancement of negotiating skills to improve outcomes for all organizational participants. This course is limited to students in the Executive M.B.A. program.

LHRP 445. Labor Markets and Compensation Management (3)
Beginning with an analysis of labor markets, this course considers various models of the firm’s employment decisions; the economics of recruitment and training; systems of job evaluation, internal wage structure and pay equity (including the economics of discrimination); union wage effects; methods for relating performance and pay; and the effects of government policies. Prerequisite: ECON 403.

LHRP 451. Alternative Dispute Resolution (2)
Cross-listed as LAWS 351.

LHRP 501. Special Problems and Topics (1-18)
This course is offered, with permission, to students undertaking individual reading or research projects in a field of special interest.

LHRP 510. Contemporary Problems in LHRP (3)
This course considers labor and human resource management problems of current interest, with specific topics varying from semester to semester. The primary focus is on the consideration of public (societal) and private (organizational) policies, especially as they relate to current issues and projected institutional, market and legal trends. The course may include consideration of procedures for evaluating policies and programs and for using evaluations in formulating and modifying policies. (Students are advised to consult with the instructor for specific course content.) Prerequisite: LHRP 421.

LHRP 601. Special Problems and Topics (1-18)
This course is offered, with permission, to Ph.D. candidates undertaking reading in a field of special interest.

LHRP 701. Dissertation Ph.D. (1-18)
LHRP 702. Appointed Dissertation Fellow (9)

Division of Management Policy

513 Enterprise Hall
Robert D. Hisrich, Head
Phone 216-368-5354 Fax 216-368-4785

FACULTY
Robert D. Hisrich, Ph.D. (University of Cincinnati)
Professor of Management Policy; Mixon Chair of Entrepreneurship
Entrepreneurship, venture capital and international business
John D. Aram, Ph.D. (Massachusetts Institute of Technology)
Professor of Management Policy; Director, Executive Doctor of Management Program
Management policy and practices, socio-economic development, institutional analysis
Sayan Chatterjee, Ph.D (University of Michigan)
Associate Professor of Management Policy
Diversification, mode of entry, mergers and acquisitions
David L. Deeds, Ph.D. (University of Washington)
Assistant Professor of Management Policy
Entrepreneurship
Jay Dial, D.B.A. (Harvard University)
Assistant Professor of Management Policy
Steven P. Feldman, Ph.D. (The Wharton School, University of Pennsylvania)
Associate Professor of Management Policy
Business ethics and professional ethics, leadership, business-society relations
Ernesto J. Poza, M.B.A.,M.S. (Massachusetts Institute of Technology)
Professor for the Practice of Management; family business continuity and governance
Richard L. Osborne, M.S. (Case Western Reserve University)
Professor for the Practice of Management
Valuation, capital acquisition, turnarounds and growth strategies are featured, utilizing successful entrepreneurs and their companies to assure a real world learning experience.
Cross-listed as ENTP 418.

PLCY 419. Entrepreneurship (3)
Utilizing active entrepreneurs, class exercises and original case studies, this course will explore the roles of the chief executive in smaller enterprises as negotiator, manager, leader and strategist. Cross-listed as ENTP
PLCY 420. Managing the Family Firm (3)
The vast majority of U.S. firms are family controlled and present special problems in strategic management including the interaction of family and firm objectives, executive succession, management development and motivation, finance, estate planning, etc. This course explores solutions to these problems in the context of guiding the firm’s growth through the threshold between personal and professional management. The course pedagogy is participative and experiential. Cross-listed as ENTP 420.

PLCY 422. Managing an Emerging Growth Enterprise (3)
Students are exposed to what it is like to work in an emerging growth company with sales under $100 million. Prospective students might be individuals who are considering employment with middle market company, entrepreneurs who may start a company, or business persons who may buy a middle market company. The learning experience will stem from participating in an actual semester-long project. In-class discussions include: business planning, selling, managing technology transfer, and creativity/innovation, and guest presentations by CEOs from middle market companies. Prerequisites: ACCT 401 and BAFI 402 and MKMR 403 and MIDS 409 and consent of instructor. Cross-listed as ENTP 422.

PLCY 423. Domestic and International Entrepreneurship (3)
This course investigates various aspects of entrepreneurship and intrapreneurship. Topics of focus include: entrepreneurial characteristics, the entrepreneur and the entrepreneurial process, entrepreneurial self-assessment and creativity, opportunity analysis, creating the business plan, marketing evaluation and strategic positioning, the financial plan and sources of capital, the organizational plan and legal forms of organization, structure, legal issues and patents, and the role of venture capital and public and private offerings. Each topic is explored from a domestic and international perspective. The course also focuses on change as a way of life for organizations and societies of the present and future. Cross-listed as ENTP 423.

PLCY 424. Advanced Principles of Entrepreneurship (3)
This course will provide students with in-depth information on the entrepreneurial process by cross-cutting the stages of venture development with key functional business areas including marketing, operations, strategic planning, finance, and human resources. Each student will complete a practicum with a host company that consists of a weekly time commitment (work schedules will be set and agreed to by the course instructor, the host company and the student). Prerequisite: Approval of Ellen Blahut, EDI. Cross-listed as ENTP 424.

PLCY 425. Chief Executive Officer (3)
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 path to and preparation for the top job, and develop a personal career strategy to increase their chances of becoming a CEO.

PLCY 426. International Entrepreneurship (3)
This course introduces the area of international entrepreneurship by focusing on various aspects of this area. Topics to be covered include: conditions making small, medium-sized, and new ventures increasingly important in international business; information sources relevant to international entrepreneurship; critical steps in deciding on doing international entrepreneurship, strategic planning and methods of conducting international entrepreneurship; and benefits and problems of going international as a new venture. Cross-listed as ENTP 426.

PLCY 426H. International Entrepreneurship (3)

PLCY 427. Entrepreneurial Behavior (3)
This course focuses on the entrepreneurial process from a behavioral perspective by defining and developing the skills and behaviors necessary to be entrepreneurial in both the start-up and in the established firm setting. From the readings, case material and from interviews, you will develop a definition of the skills and competencies of entrepreneurs. You will also focus on developing your own competencies through exercises and a personal assessment of your entrepreneurial strategy. Finally, you will acquire strategies that will promote innovative thinking, idea championing, and change in established firms. Cross-listed as ENTP 427.

PLCY 428. Small Enterprise Consulting (3)
Student teams will apply their expertise and experience to solve a strategic problem for a small enterprise selected by COSE (Council of Small Enterprises). Teams are expected to meet with their client, manage the project workload, and provide a case report with recommendations. Up to two of the teams will be selected to present their case report in the Ohio Graduate Business Student Competition.

PLCY 429. New Venture Creation (3)
This course focuses on all aspects of creating a new venture from both an entrepreneurial as well as an intrapreneurial perspective. The primary focus of the course will be understanding all the aspects of the business plan both at startup as well as growing the venture. This will involve understanding sources of capital, the financial plan, the marketing plan, the organization plan, and the production plan all within the business plan framework. (Fall) Cross-listed as ENTP 429.

PLCY 430. Executive Seminar on Current Issues I-E.M.B.A. (0)
This is the first of a series of seminars in which guest professionals and executives examine social, technical and economic issues as they affect executive and corporate objectives. This course is limited to students in the Executive M.B.A. program.

PLCY 431. Executive Seminar on Current Issues II-E.M.B.A. (1)
This course, a continuation of PLCY 430, is limited to students in the Executive M.B.A. program.

PLCY 432. Executive Seminar on Current Issues III-E.M.B.A. (0)
This course, a continuation of PLCY 430, is limited to students in the Executive M.B.A. program.

PLCY 433. Executive Seminar on Current Issues IV-E.M.B.A. (1)
This course, a continuation of PLCY 430, is limited to students in the Executive M.B.A. program.

PLCY 440. Entrepreneurial Finance (3)
This course explores the financing of entrepreneurial new ventures. The primary focus of the course will be the various financing methods and mechanisms available to entrepreneurs. This will involve understanding: estimation of capital requirements, bootstrap financing, angel investors, venture capitalists, private placements, firm valuation and initial public offerings. Cross-listed as ENTP 440.

PLCY 450. Challenges to U.S. Management from East Asia (3)
Examination of the Japanese, Chinese, and other East Asian business systems. Looks at how the business systems relate to broader social, economic, and political contexts. Compares the different systems with each other and with that of the United States. Inquires into the reasons for the past successes and recent problems of these systems.

PLCY 451. Development and Implementation of Global Strategy (3)
World events have radically altered the business environment as well as the structure and decision making of business throughout the world. Businesses today must increase their awareness of the influence of international events and activities on their future and establish and conduct transactions in other countries. While businesses become international for such reasons as a desire for continued growth, domestic market saturation, the opportunity to exploit some new technological advantage, the dominant reason relates to performance, as there is a correlation between improved performance and the degree of internationalization and the extent that this internationalization is focused through a well-formulated global strategy, the substance of this course.

PLCY 472. Strategic and Organizational Issues in the Management of Technology (3)
This course addresses a wide variety of strategic and organizational issues that confront firms in technology-intensive environments. Although the emphasis is on firms in the private sector, public policy issues will be covered where appropriate. The course covers five broad themes: (1) managing firms in technology-intensive industries, (2) linking technology and business strategies, (3) using technology as a source of competitive advantage, (4) organizing the firm to achieve these goals, and (5) implementive technology in organizations. Case studies and participation in class discussions are stressed. In addition, students analyze actual situations in organizations and summarize their findings and recommendations in an in-depth term paper. Prerequisites: BAFI 402 and ECON 403 and MKMR 403.

PLCY 473. E-Commerce Strategies (3)
This course will develop a basic understanding of how e-commerce firms have developed a strategy for providing value to both consumers and businesses. The course will build on the basic strategy frameworks that the students have learned in their course strategy classes. The pedagogy will involve short lectures and case discussions. Prerequisites: MBAC 411 and MBAC 421.

PLCY 480. Management Policy and Strategic Planning I-E.M.B.A. (2)
This course places the functional areas covered in the first year in the Executive M.B.A. program in a context of corporate objectives and works on problems involving the interaction of functional areas. This course is limited to students in the Executive M.B.A. program.

PLCY 481. Strategic Planning-E.M.B.A. (2)
This course develops an understanding of the long-term strategic view of the firm. The ability to analyze types of business strategies and capabilities is emphasized. Readings and cases examine alternatives, including internal growth, acquisitions, divestitures, and other emerging forms of corporate development. This course is limited to students in the Executive M.B.A. program.

PLCY 488. Applied Problem Analysis-E.M.B.A. (2)
Participants are required to study an organization of corporate problems which reflects individual backgrounds and interests and which is of significance to their futures and to corporate objectives. This analysis is carried out with faculty supervision and may be conducted with a team of full-time M.B.A. students. This course is limited to students in the Executive M.B.A. program.

PLCY 490. Diversification and Merger Strategies (3)
This course explores the determinants of successful diversification strategy and a special case, acquisitions, to sustain growth and profitability. The course develops current frameworks of diversification based around the notion of synergy and/or capabilities transfer at the business strategy level. Using the fundamentals of competitive strategy, the course addresses type of entered markets (related or unrelated) and the mode of entry (direct, joint venture, acquisitions, etc.). The course also develops frameworks of diversification built around the concept of strategic intent, core competencies, leveraging of resources and dominant logic. Finally, the course develops the concepts that are useful in acquisitions. These concepts will address individual acquisitions as well as acquisition programs. The course content will be complemented by guest speakers from industry. Prerequisite or corequisite: PLCY 495 or PLCY 499. Prerequisite: BAFI 403.

PLCY 494. Consultation/Management of Professional Service Firms (3)
The course views consultancy as a role rather than career and conceptualizes consultancy as a process of optimizing an organization’s value creation potential. Students should be able to apply the concepts regardless of career choice. Unique aspects of consultancy to entrepreneurial firms will be emphasized. Exposure to senior practicing consultants is featured. Students will learn to match consulting methodologies with client needs. Projects include student consultancy to actual companies. Prerequisites: BAFI 402 and MKMR 403.

PLCY 495. Industry and Competitive Analysis for Strategic Planning (3)
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)
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 emergent 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 498H. Business, Government, and Society (3)
The economic performance of the firm can be affected in significant ways by the government-business and society-business relations—especially in case of transitional economies. Regulation and public policy, taxation and public finance, lobbying and rent seeking, conflicts and cooperations with social organizations like trade unions, environmentalists, NGOs, and the media, crisis situations represent challenges for the managers with outstanding importance in business. Sometimes these issues present themselves in crisis, that demand effective managerial action. Both in the short and the long run, swift managers can apply means by which their firms make strategic use of the opportunities presented to them in the political/social systems they are embedded in. This course aims at discussing some fundamental elements, theorems, structures, and practical phenomena and cases related to the above situations, as well as drawing the attention to the variety of tools and methods to analyze them and navigate among them.

PLCY 499. Management Policy (3)
This course focuses on the work of top managers in their roles as creator of value in organizations and society. The multiple skill requirements of top managers’ roles are stressed, particularly their leadership ability and their ability to develop and implement strategies for the long term in the face of environmental changes and domestic and global competitive threats and opportunities. The integration of functional areas such as marketing, finance, manufacturing and human resource management into a coherent and comprehensive analysis of the total organization is emphasized. Course requirements vary, but exercises such as computer simulations of whole industries, field projects involving contact with local organizations, and strategic analysis of firms or industries using in-depth library research are frequently used. The course is taught through the case method and, learning by discussion, reading, debate and written analysis of cases is stressed. The course tends to be more varied and open-ended than functional area courses. Prerequisite: Completion of all other required M.B.A. courses.

PLCY 501. Special Problems and Topics (1-18)
This course is offered, with permission, to students undertaking reading in a field of special interest. Prerequisite: Consent of instructor.

PLCY 601. Special Problems and Topics (1-18)
This course is offered, with permission, to Ph.D. candidates undertaking reading in a field of special interest.

PLCY 701. Dissertation Ph.D. (1-18)
Division of Marketing

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Stanton G. Cort, Head
Phone 216-368-2064 Fax 216-368-4785

FACULTY
Stanton G. Cort, D.B.A. (Harvard University)
Associate Professor of Marketing
Market opportunity analysis, channel management, multinational market entry strategy and marketing development
Maria Tereza Alexandre, M.S.B.A. (Pontifical Catholic University, Brazil)
Instructor of Marketing
Ellen Garbino, Ph.D. (Duke University)
Assistant Professor of Marketing
Detelina Marinova, Ph.D. (University of Cincinnati)
Assistant Professor of Marketing
N. Mohan Reddy, Ph.D. (Case Western Reserve University)
Associate Professor of Marketing: Nancy and Joseph Keithley Professor in Technology Management
Management and marketing technology
Jose Antonio Rosa, Ph.D. (University of Michigan)
Assistant Professor of Marketing
Jagdip Singh, Ph.D. (Texas Tech University)
Professor of Marketing
Marketing research, research methodology and measurement, consumer satisfaction/dissatisfaction and issues in boundary spanning roles
Deepak Sirdeshmukh, Ph.D. (Ohio State University)
Assistant Professor
Consumer memory and persuasion processes underlying brand positioning, brand image and consumer satisfaction management
Ellen Garbino, Ph.D. (Duke University)
Assistant Professor of Marketing

ADJUNCT FACULTY
Larry J. B. Robinson, D.B.A. (Harvard University)
Adjunct Professor of Marketing

Marking (MKMR)

GRADUATE COURSES

MKMR 301. Marketing Management (3)
This course covers key concepts and practices of marketing with emphasis on analysis and development of integrated marketing plans and programs that create customer value and competitive advantage in the world-wide marketplace. Prerequisite: ACCT 102.

MKMR 360. Independent Study (1-3)
This course is offered, with permission, to students undertaking reading and research in an area of their special interest.

MKMR 403. Managerial Marketing (3)
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. Prerequisite: ACCT 401.

MKMR 405. Industrial/New Technologies Marketing (3)
This course focuses on concepts and practices of business-to-business marketing of products and services. It also examines how rapid technological change impacts industrial markets. Topics covered include: buyer-seller relationship building, competitive bidding, developing markets for new materials and value-based pricing strategies. Marketing to the government, marketing of intellectual property and marketing-R&D-manufacturing interface issues will also be explored. Prerequisite: MKMR 403 or MBAC 424.

MKMR 406. Sales Force Management (3)
The best laid plans of marketing managers must be implemented in the trenches by the field sales force. This course provides a conceptual framework and analytical tools to profitably manage a firm’s field sales force. It first focuses on assessing key sales force outcomes: productivity of investment in the sales force, performance of individual salespeople, and turnover. Students then examine how to structure, deploy, motivate and compensate the sales force to maximize individual performance, manage turnover and provide a solid return on sales force investment. Specific issues covered include design and management of selling teams and independent agents, national account management, and managing the relationship between the marketing department and the sales force. Prerequisite: MKMR 403 or MBAC 424.

MKMR 407. Supply Chain Management (3)
If you’re not on the shelf, you’re not in business. This course addresses managing the processes of getting products and service to market. It focuses on strategic and tactical management of the supply chain and distribution channels as value-adding networks. Topics include assessing the value creation potential of network members (suppliers, producers, distributors, dealers, and retailers), which of them should make key decisions and how they relate to each other. Emphasis is on communication throughout the marketing network to coordinate activity, to provide appropriate compensation, and to ensure the marketing program is implemented effectively at the customer level. Prerequisite: MKMR 403 or MBAC 424 or MIDS 456. Cross-listed as OPMT 407.

MKMR 410. Marketing Research for Decision Making (3)
This course stresses the generation and use of marketing information for a range of managerial decisions, including identifying and defining marketing performance and improving understanding of marketing as a process. This course discusses contemporary approaches for defining marketing information needs, designing methods for information collection and analysis, and making sense of obtained results. The course utilizes lecture/discussion, case analysis, and a field project to develop skills in defining and solving marketing problems. Prerequisite: QUMM 405 or MBAC 424 or MKMR 403.

MKMR 411. Consumer Behavior (3)
This course addresses micro and macro issues in consumer behavior which are essential for managers seeking to analyze and influence consumer decision making. The course focuses on how consumer behavior analysis can be used to develop effective marketing techniques and strategies. This involves developing an understanding of consumer behavior from a variety of perspectives, identifying the major factors that influence how consumers process and learn, marketing communications, managing consumer satisfaction, and developing an understanding of purchase decision making and its implications for marketing strategy. Emphasis is placed on designing persuasion strategies, enhancing brand memory, consumer profiling, analyzing consumer trends, and customer relationship management. Prerequisite: MKMR 403 or MBAC 424.

MKMR 412. eMarketing (1.5)
The purpose of the course is to provide students with tools to help them negotiate the difficult process of developing internet marketing strategy. The focus of this course is on consumer markets, though some business-to-business examples are included. This course is strategic, not technical, in nature. Examples of successful and unsuccessful firms are discussed to illustrate how to foster customer relationships and build brand equity via the internet. Though topics are likely to change in response to market conditions and technical advances, currently the topics include how the use of technology impacts branding and customer relationships, and how best to manage website content and other marketing functions. The role of the internet in communication and retailing/distribution functions is also discussed. Cases and hands-on exercises are used to reinforce concepts and evaluate student performance. Prerequisite: MKMR 403 or MBAC 424.

MKMR 413. Services Marketing (1.5)
Nearly 70% of U.S. GNP is in the services sector. Managing customer expectations and experience in services encounters is crucial as a consequence. This course provides students with tools to market and evaluate service design and delivery, complementing marketing courses that focus predominantly on tangible

*MKMR 403 or MAND 425 and 435 are prerequisites for all graduate courses in marketing.
products. Prerequisite: MKMR 403 or MBAC 424.

**MKMR 415. Managerial Marketing—E.M.B.A. (3)**
This course focuses on the analysis, planning and implementation of marketing strategies from middle and upper management perspectives. Key concepts and methods for the development of integrated marketing programs are introduced. This course is limited to students in the Executive M.B.A. program.

**MKMR 420. Health Systems Marketing (3)**
This course stresses the practical application of marketing techniques to health care products and services. The major components of the industry and the interrelationships among health care customers, payers, providers and equipment suppliers are examined. Also addressed are ethical issues of health care marketing. Prerequisite: MKMR 403 or MBAC 424. Cross-listed as HSMC 422.

**MKMR 421. Product and Brand Management (3)**
Established products and brands typically provide the majority of firms’ earnings. If carefully managed, these products also are a significant source of growth and future earnings. This course focuses on the role of a Product/Brand Manager in profitably managing a firm’s existing offering. Students identify areas for growth (or decline) within a firm’s mature product lines, devise ideas to capitalize on growth potential or address decline, develop and assess concrete marketing initiatives, and determine the financial impact of alternative plans. The course uses a combination of case analysis, lecture/discussion and guest speakers, allowing students to develop their repertoire of quantitative and qualitative marketing decision skills. Prerequisite: MKMR 403 or MBAC 424.

**MKMR 425. Global Marketing (3)**
This course addresses the process of marketing across political and cultural boundaries, within trade groups like the EC, NAFTA and ASEAN and under global trade systems like the WTO or GATT. Emphasis is on planning, programming and managing profitable marketing strategies for exporting, importing or in-country production. Topics include: comparative opportunity analysis, identification of key points where value is added, market entry strategies, in-country competition after entry, and worldwide strategies for various stages of multinational marketing involvement. Prerequisite: MKMR 403 or MBAC 424.

**MKMR 450A. Entrepreneurial Marketing—E.M.B.A. (2)**
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. Prerequisite: Open to only E.M.B.A. students.

**MKMR 450B. Entrepreneurial Marketing—E.M.B.A. (3)**
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. Prerequisite: MKMR 403 or MBAC 424. Cross-listed as ENTP 450.

**MKMR 460. Marketing Communications Management (3)**
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. Prerequisite: MKMR 403 or MBAC 424.

**MKMR 475. Logistics/Physical Distribution Management (3)**
Prerequisite: OPMT 405. Cross-listed as OPMT 475.

**MKMR 476. Purchasing/Materials Management (3)**
Cross-listed as OPMT 476.

**MKMR 501. Special Problems and Topics (1-18)**
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)**
This course is offered, with permission, to Ph.D. candidates undertaking reading or a project in a field of special interest.

**MKMR 701. Dissertation Ph.D. (1-18)**

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**Department Information Systems**

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**FACULTY**

Richard J. Boland, Jr., Ph.D. (Case Western Reserve University)
Professor of Information Systems and Chair, Department of Information Systems; Professor of Accountancy

Miles Kennedy, Ph.D. (London School of Economics)
Associate Professor of Information Systems

Kai H. Lim, Ph.D. (University of British Columbia)
Assistant Professor of Information Systems

Paul P. Stork, M.B.A. (Case Western Reserve University)
Lecturer in Information Systems

Betty Vandenbosch, Ph.D. (University of Western Ontario)
Associate Professor of Information Systems

Youngjin Yoo, Ph.D. (University of Maryland)
Assistant Professor of Information Systems; Collaborative technology, the role of information technology in learning, virtual team management, information technology and organizational transformation

**ADJUNCT FACULTY**

Alan F. Dowling, Jr., Ph.D. (Massachusetts Institute of Technology)
Adjunct Professor of Information Systems

**Information Systems (IS)**

**UNDERGRADUATE COURSES**

MIDS 307. Computer Programming and Problem Solving (3)
The objective of this course is to help students gain proficiency in computer programming using a procedural language. Emphasis is placed on a modular, structured approach to developing programs; the use of workbench tools (dynamic debuggers, etc.) for increasing productivity in the development and testing of programs; the use of data structures such as lists, trees, hashtables, etc.; the use of a variety of file structures; and the design and analysis of efficient algorithms.

MIDS 308. Development of Information Systems (3)
The purpose of this course is to provide students with a basic understanding of human information exchange within an organizational context and how technology can be used to support various information exchange activities and gain competitive advantage. Topics include shortcomings of human decision making, decision support systems, information technology-enabled new organizational forms, strategic use of information technology, e-commerce, and ethical issues involved in the use of information technology. Through analysis of case studies and group projects, students explore the central management issues concerning the effective use of information technology in today’s globally competitive organizations. Prerequisite: Proficiency in Excel.

MIDS 309. Management of Information Systems (3)
This course is designed to familiarize students with some important issues in the design and development of information systems. Topics include: using information technology as a tool to redesign organizations, managing the information system development process, managing the implementation of new information systems, and designing databases. Students will develop the interpersonal, analytical and technical skills needed to analyze an organization as a system and to design and develop an information system. Working in teams, students deal with real-world organizations to analyze their information requirements and design systems that meet the requirements. Prerequisites: MIDS 308 and proficiency in Access.

MIDS 310. Technology of Information Systems (3)
Reviews present day computing systems and function of modern computer technology. Computer systems architecture, file structures, operating systems, compilers and assemblers, and telecommunications. Prerequisite: MIDS 309.

MIDS 326. Systems Analysis and Design (3)
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. Prerequisite: MIDS 309.

MIDS 327. Database Management (3)
Technical and managerial issues of database management, especially the features of database management systems (D.B.M.S.) and the role of the database administrator (D.B.A.). D.B.M.S. using the three major data models are presented. Techniques for database designs at the logical and physical level are discussed. Students will have hands-on experience in using a D.B.M.S. Prerequisites: MIDS 309 and MIDS 310.

MIDS 329. Design of Object-Oriented Systems (3)
This course provides an opportunity to gain an understanding of the concepts and technology of object-oriented systems and learn system design techniques that take full advantage of this technology. Students also develop competence in programming in an object-oriented language. Prerequisite: Ability to program in Pascal or C, or consent of the instructor.

MIDS 360. Independent Study (1-18)

GRADUATE COURSES

MIDS 403. Management of Information Systems-E.M.B.A. (1)
This course is concerned with information as a resource in organizations. Students develop an appreciation of how information can support management decision making and control; an understanding of the factors influencing the individual and group processes of creating, distorting, communicating and using information; and the skills required to anticipate, recognize and diagnose those factors effectively. This course is limited to students in the Executive M.B.A. program.

MIDS 404. Management Information Systems-E.M.B.A. (2)
This course investigates the strategic and operational use and value of information technology in organizations. Its objectives are to enable students to assess both the opportunities and the challenges resulting from information technology and to become fluent with and comfortable addressing the issues relating to the management of the IT function and its resources. This course is limited to students in the Executive M.B.A. program.

MIDS 407. Computer Programming and Problem Solving (3)
The objective of this course is to help students gain proficiency in computer programming using a procedural language. Emphasis is placed on a modular, structured approach to developing programs; the use of workbench tools (dynamic debuggers, etc.) for increasing productivity in the development and testing of programs; the use of data structures such as lists, trees, hashtables, etc.; the use of a variety of file structures; and the design and analysis of efficient algorithms.

MIDS 409. Introduction to Management Information Systems (3)
This course focuses on the effective, value creating deployment of information technology in organizations. Students develop a strong conceptual foundation as a basis for determining and evaluating information and decision support requirements, and for identifying opportunities to amplify individual and organizational intelligence though information technologies. The examination of actual systems being used in organizations serves to ground the concepts and issues explored in the course and make them as relevant as possible to the needs of modern organizations operating in a global environment.

MIDS 410. Information Technology Architectures (3)
Just as a craftsperson needs an intimate understanding of the tools of a trade, the information professional must understand the architecture of hardware, telecommunication facilities, operating systems, applications and networks. This course covers how prioritization, security, sharing and distribution can be improved by parallelism and how required synchronization can be safely and efficiently implemented across an essentially layered architecture that extends from the chip to the user-friendly application. Prerequisite: MIDS 409 or MBAC 423.

MIDS 411. Advances in Information Systems Technology (3)
This course examines advanced and emerging information technologies, and evaluates their potential uses. Topics include: advanced computer architectures, massively parallel computers, networking, graphics, machine learning, and new programming paradigms. Prerequisite: MIDS 409 or MBAC 423.

MIDS 415. Multimedia Systems (3)
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. Prerequisite: Ability to program in any modern high-level language.

MIDS 418. Intelligent Support Systems (3)
Information systems should be active partners in the work group with responsibility for pattern recognition, task coordination and memory. This course provides students with
an understanding of the factors influencing individual and group processes of creating, communicating, using and distributing information. Through case studies and hands-on use of data analysis, group decision and AI tools, students learn how increased levels of intelligence can be built into both work flow systems and decision support systems. Prerequisite: Instructor approval required if student has already completed MIDS 414 and/or MIDS 422.

**MIDS 426. Systems Analysis and Organizational Design (3)**

This course emphasizes creativity in diagnosing organizational problems and opportunities. Students learn to generate high payoff (strategically significant) models for organizational and information system design. It covers consultation and intervention strategies for moving to a consensus on problem definition, a vision of desired changes and the preparation of functional specifications for the required new organizational vision. Prerequisite: MIDS 409 or enrollment in M.S.M.-IS program. Preference given to M.S.M.-IS candidates.

**MIDS 426H. Systems Analysis and Organizational Design (3)**

This course provides an opportunity to gain an understanding of the concepts and technology of strategic planning; change management; and high performance teams. Students develop competencies in organizational design and strategic decision-making. Preference given to M.S.M.-IS candidates.

**MIDS 427. System Development and Data Management (3)**

This course presents principles of system development using both relational and object-oriented databases. State-of-the-art tools are employed for developing both client and server system components. Object orientation is stressed as a design philosophy. Both prototyping and more conventional life-cycle methodologies are studied. Prerequisite: MIDS 429 or MBAC 423.

**MIDS 428. Human-Computer Interaction (HCI) (3)**

This course deals with human-computer interaction (HCI) for decision making. Students learn the importance of HCI, the impact of good and bad HCI, user and task diversity, design tradeoffs, technology for developing HCI, and HCI for managerial decision making. Students will use HCI generators to develop a system. Prerequisite: MIDS 409 or MBAC 423.

**MIDS 429. Design of Object-Oriented Systems (3)**

This course provides an opportunity to gain an understanding of the concepts and technology of object-oriented systems, and to learn system design techniques that take full advantage of this technology. Students develop competence in programming in an object-oriented language. Prerequisite: Ability to program in a procedural language (such as Pascal, C or Visual Basic), consent of the instructor, or enrollment in the M.S.M.-IS program. Preference is given to M.S.M.-IS candidates.

**MIDS 432. Health Care Information Systems (3)**

This course covers concepts, techniques and technologies for providing information systems to enhance the effectiveness and efficiency of health care organizations. Prerequisite: MIDS 409 or MBAC 423. Cross-listed as HSMC 432.

**MIDS 433. Managing Electronic Teams in Global Economy (3)**

This course covers technical, behavioral, and managerial bases that are necessary to build and manage high-performance global teams whose members are communicating primarily through electronic channels. Students will be working with students at other countries (or other schools) to learn various aspects of cross-functional “electronic” teams via various communication technologies, including electronic mail, groupware, and desktop videoconferencing. Fundamental group processes such as leadership, negotiation, communication, and decision-making will be revisited in the context of electronic teams.

**MIDS 439. Marketing Information Systems (3)**

Prerequisite: MIDS 409.

**MIDS 441. Audit and Security of Information Systems (3)**

Accidental or intentional unauthorized disclosure, modification or destruction of data or software can result in processing delays, errors and financial loss. To minimize such risks, adequate control, audit and risk analysis methodologies are examined. Prerequisites: ACCT 401 or MBAC 415 and MIDS 409 or MBAC 423. Cross-listed as ACCT 441.

**MIDS 442. Management of Information Systems (3)**

Examines information technology issues facing senior information management, including the role of information technology in supporting organization strategy: relationships with other senior managers and with end users; technology and applications architectures; funding information technology; managing in distributed technology environments; managing a global information technology activity; technology forecasting; and operational issues such as staffing and procurement. Prerequisite: MIDS 409 or MBAC 423 or enrollment in M.S.M.-IS program. Preference given to M.S.M.-IS candidates.

**MIDS 444. Managing Scientific and Technical Knowledge as a Corporate Asset (3)**

This course explores the role of technology in the successful enterprise. It examines the intersection of technical knowledge and systems with strategic enterprise management, with emphasis on managing scientific and technical capabilities as a strategic asset. Students will learn to analyze and assess the value of technical capabilities and to improve their written and oral skills for communicating about technology management decisions. Prerequisite: MIDS 409.

**MIDS 445. Technologies of E-Business (3)**

Emerging concepts and principles in the practice of electronic commerce are presented in a hands-on, experience based approach. Topics covered include: the role of e-commerce in the global economy, key underlying technologies, business-to-business and business-to-consumer applications, knowledge management, security, electronic payments and privacy. Strategic and policy-level implications will be emphasized. Students will complete a team-based e-commerce design and development project. This course complements electives in Multimedia Management and E-Marketing. Prerequisite: MIDS 409 or MBAC 423.

**MIDS 445H. Technologies of E-Business (3)**

**MIDS 455. Models of Management: Business Processes (3)**

Case studies are used extensively in this course in order to strengthen a student’s ability to diagnose deficiencies and propose the redesign of core organizational processes. Students develop a working knowledge of process flow models, accounting models and cycle models of the firm, as well as basic principles of quality management and financial analysis. Preference given to M.S.M.-IS candidates.

**MIDS 456. Models of Management: Firm and Its Environment (3)**

Students develop an understanding of the structure and process of the firm and its industrial, national and global markets. Economic and policy models of firms, industries and markets are presented along with models of marketing as a value creating relationship with customers. Focus is on the competitive performance of the firm and its relation to marketing and strategy formulation and execution, including the financial analysis of technology strategy. Preference given to M.S.M.-IS candidates.

**MIDS 457. Models of Management: Dynamics of the Firm (3)**

Mathematical representations add clarity and precision to the analysis of a firm and its information requirements. This course covers the important theory and methods of modeling an enterprise, emphasizing systems dynamics as the principle modeling technique. Practical managerial applications are studied and students develop and use a systems dynamics model to gain insight into the information and control needs of a firm’s business processes and strategies. Preference given to M.S.M.-IS candidates.

**MIDS 460A. Communication and Negotiation (1.5)**

Through a combination of lectures, discussions, simulations and projects, students develop their communication and negotiation skills. Topics include: facilitation, interviewing, report writing and presentation, meeting management, negotiation, making demands and persuasion. This course is taken for one and a half credit hours per semester and is integrated with projects and materials being covered in the other courses.

**MIDS 460B. Communication and Negotiation (1.5)**
Through a combination of lectures, discussions, simulations and projects, students develop their communication and negotiation skills. Topics include: facilitation, interviewing, report writing and presentation, meeting management, negotiation, making demands and persuasion. This course is taken for one and a half credit hours per semester and is integrated with projects and materials being covered in the other courses. Prerequisite: MIDS 460A.

**MIDS 461A. Change Management (1.5)**
The process of managing organizational transformation is studied, including changes in structure and rewards, training, and the planning required for new organizational forms and systems to succeed. Topics that are covered include: risk assessment, anticipation of technology impacts, methods of project management, application portfolio analysis, and implementation strategies and tactics. This course is taken for one and a half credit hours per semester and is integrated with projects and materials being covered in the other courses.

**MIDS 461B. Change Management (1.5)**
The process of managing organizational transformation is studied, including changes in structure and rewards, training, and the planning required for new organizational forms and systems to succeed. Topics that are covered include: risk assessment, anticipation of technology impacts, methods of project management, application portfolio analysis, and implementation strategies and tactics. This course is taken for one and a half credit hours per semester and is integrated with projects and materials being covered in the other courses. Prerequisite: MIDS 461A.

**MIDS 501. Special Problems and Topics (1-18)**
This course is offered, with permission, to students undertaking research in a field of special interest.

**MIDS 501H. Strategic Role of IT Organizations Within the Enterprise (1-18)**
The course will focus on the many aspects that influence the role, mission and position of an IT organization within the enterprise. Various models of existence will be explored with special emphasis on examining the "value added" dimensions of IT to the overall goals of the firm. The implications of Quality Management on IT organizations will be examined, including interactions with customers and suppliers. Organizational models that provide the best fit to the specific enterprise mission will be designed. Attention will be given to the human resources aspect of the IT environment including team structures and reward/recognition mechanisms. Real life situations will be brought into the classroom. Teaching will involve current practitioners of IT management. Team work will be emphasized as a way of creating solutions to business problems.

**MIDS 527. Seminar in MIDS (3)**
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)**
This course is offered, with permission, to Ph.D. candidates undertaking reading in a field of special interest.


**MIDS 701. Dissertation Ph.D. (1-18)**

**MIDS 702. Appointed Dissertation Fellow (9)**

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**Department of Operations**

601 Enterprise Hall
Matthew J. Sobel, Chair
Phone 216-368-4141 Fax 216-368-4776

The Operations Department offers courses in operations research, operations management, and quantitative methods. The Department offers the M.S. in Management in Operations Research and Supply Chain Management, a Ph.D. degree in operations research, and courses pertinent to the M.B.A. and undergraduate programs.

**FACULTY**

Matthew J. Sobel, Ph.D. (Stanford University)
Professor of Operations and Chair, William E. Unstatta Professor
Product design and technology change, coordination of operations, finance and marketing; supply chain management, environmental and energy management; large-scale structured Markov decision processes

Hamilton Emmons, Ph.D. (The Johns Hopkins University)
Professor of Operations Research; Queuing control, workforce and job shop scheduling

Ronald H. Ballou, Ph.D. (Ohio State University)
Professor of Operations Management; Planning, analysis, and control of physical supply and distribution systems.

Apostolos N. Burnetas, Ph.D. (Rutgers University)
Associate Professor of Operations Research and Operations Management; Stochastic modeling and optimization; estimation and control under incomplete information; applications in queuing, reliability, and finance

A. Dale Flowers, D.B.A. (Indiana University)
Associate Professor of Operations Management; Quality management and control, manufacturing planning and control.

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**Operations Management (OPMT)**

**UNDERGRADUATE COURSES**

**OPMT 350. Operations Management (3)**
This course presents an overview of the management of operations in business and service firms. The nature of operations problems through the use of case studies is introduced. Emphasis is placed on problems of production, purchasing, product movement and storage, and the attendant information required to achieve desired levels of consumer satisfaction and company profitability. Not recommended for freshmen and sophomores. Prerequisite: Introductory course in Statistics or consent of instructor.

**OPMT 360. Independent Study (1-18)**

**OPMT 390. Special Problems and Topics in Operations Management (1-18)**
Undergraduate student pursues a special topic or problem, with agreement of operations management instructor. Prerequisite: Consent
GRADUATE COURSES

OPMT 405. Operations Management (3)
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. Prerequisite or corequisite: QUMM 405.

OPMT 407. Supply Chain Management (3)
If you’re not on the shelf, you’re not in business. This course addresses managing the processes of getting products and service to market. It focuses on strategic and tactical management of the supply chain and distribution channels as value-adding networks. Topics include assessing the value creation potential of network members (suppliers, producers, distributors, dealers, and retailers), which of them should make key decisions and how they relate to each other. Emphasis is on communication throughout the marketing network to coordinate activity, to provide appropriate compensation, and to ensure the marketing program is implemented effectively at the customer level. Prerequisite: MKM 405 or MBAC 424 or MIDS 456. Cross-listed as MKM 407.

OPMT 420. Managing Quality in Organizations (3)
This course provides an introduction to managing quality in both manufacturing and service settings. It begins with the development of a customer centered approach through the concepts of quality function deployment. Representative programs which may be covered are: the Juran trilogy, Deming’s approach, Crosby’s approach, Kaizen or continuous process improvement, quality teams and vendor relationships and certification. Broad management considerations in managing quality, such as education and training of organizational personnel, commitment to quality, and administration of the quality function are also covered. Students may work in teams on cases or real world projects in order to apply the concepts introduced in the course. Prerequisite: OPMT 405 or MBAC 425.

OPMT 422. Service Operations Management with E-Commerce (3)
This course concerns the management of operations in e-commerce and other kinds of services. E-commerce absorbs more course time than any other type of service, but we also examine other settings such as financial services, health care, information systems, and transportation. There are modules on the similarities and differences of operations in e-commerce versus other service industries, structures of service industries, design of services, profitably utilizing service capacity, enhancing the quality of services, and managing service projects. Topics in capacity management include revenue management, queuing models, and simulation. A recurring theme is the integration of service operations with marketing, finance, and information systems. Prerequisite: MBAC 425 or OPMT 405 or equivalent.

OPMT 423. Operations Management-E.M.B.A. (2)
Participants study the processes by which goods and services are supplied, produced and distributed in organizations, with emphasis on systems for analyzing design and operational problems in the production/operations functions. This course is limited to students in the Executive M.B.A. program.

OPMT 450. Project Management (3)
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. Each project is usually unique in terms of task structure, risk characteristics and objectives. In this course we study in detail up-to-date concepts, models and techniques useful for the evaluation, analysis and management of projects including topics in project organization and team building, pitfalls in evaluating risky projects, topics in preference theory, multiattribute utility theory, project scheduling, resource management, auctions and bidding, development of projects on internet time, etc.

OPMT 475. Logistics/Physical Distribution Management (3)
Effective management of the distribution of goods and services as they flow from plants/ports/vendors to customers is the focus of this course. Concepts and methods, some computerized, are presented that can lead to improved physical distribution customer service and/or to lower costs in a variety of manufacturing and service company settings. Key topics include transportation, inventories, warehousing, materials handling, order processing, packaging, pricing, customer service standards, and warehouse and retail location. (A companion course to OPMT/MKMR 476.) Prerequisite: OPMT 405 or MBAC 425. Cross-listed as MKM 475.

OPMT 476. Purchasing/Materials Management (3)
Effective management of the physical supply of goods and services to manufacturing and service companies is the focus of this course. The course is designed to provide an overview of the management problems associated with acquiring and maintaining the flow of material supplies to a firm, and to sharpen decision-making skills as related to materials supply within the broader scope of logistics and the firm as a whole. Topics include purchasing, inventory control and supply scheduling. (A companion course to OPMT/MKMR 475.) Prerequisite: OPMT 405 or MBAC 425. Cross-listed as MKM 476.

OPMT 477. Enterprise Resource Planning (3)
Enterprise resource planning (ERP) includes the application of various concepts to plan proper resource utilization for an enterprise. Concepts including forecasting, material requirements planning, operations scheduling (aggregate and detailed), capacity planning, and activity control are central to ERP. Both quantitative modeling and managerial analysis for these subjects are included in this course. The quantitative analysis will be performed on a microcomputer using software available in the Weatherhead Computer Lab. Prerequisite: MBAC 425, OPMT 405, OPMT 423 or consent of instructor.

OPMT 478. Operations Design and Quality Control (3)
The primary thrust of this course is statistical applications in manufacturing. The areas of acceptance sampling, process control, total quality control and an introduction to industrial research are included in the course. Methods engineering is introduced as an important underpinning of the quality control system. Prerequisite: OPMT 405 or MBAC 425 or consent.

OPMT 479. International Operations Management (3)
The main objective of this case-based course is to help prospective operations managers to overcome national and cultural myopia, identify cultural and contextual differences in operations management practice, describe successful operations management approaches in other countries and examine reasons for their success as well as the viability of transferring them to significantly different operating environments, and finally address the impact of the global scope of operations on the usual operating decisions (production planning, quality control, etc.). Topics to be covered include organization of global operations, production strategies in entering foreign markets, development of a global manufacturing strategy, international facilities location, offshore manufacturing, global sourcing and logistics, global transfer of technology, risk management on global operations, cultural and national comparisons of operations management practices, and successful global service operations. Prerequisite: OPMT 405 or MBAC 425.

OPMT 480. Operations Strategy and Technology (3)
This course discusses the process of developing an operations strategy for competitive advantage. A number of strategic issues are studied from a manufacturing perspective, including: product development, introduction of new technologies, managing multiple plant operations, flexibility, and financial control systems.
Prerequisite: OPMT 405 or MBAC 425.

OPMT 490. Independent Study in Operations Management (1-15)
This course is offered, with permission, to students undertaking research in a field of special interest. Prerequisite: Consent of instructor.

OPMT 501. Special Problems and Topics (1-18)
This course is offered, with permission, to students undertaking research in a field of special interest. Prerequisite: Consent of instructor.

OPMT 501H. Special Problems and Topics (1-9)
OPMT 601. Special Problems and Topics (1-18)
This is a course of flexible design in which a student, with the agreement of an instructor in operations management, may pursue a special topic or problem. M.B.A. students should enroll in OPMT 501. Prerequisite: Consent of instructor.

OPMT 602A. Predissertation Research (1.5)
The objective of this course is to study a potential Ph.D. thesis area in detail. Under the guidance of a committee headed by a faculty member in the Department of Operations, students perform a thorough literature review of the chosen area with the objective of summarizing the recent major results obtained in the area and identifying open problems that might be suitable for research. Prerequisite: Consent of instructor.

OPMT 602B. Predissertation Research (1.5)
As a continuation of OPMT 602A, students complete study of a potential Ph.D. thesis area in detail. Under the guidance of a committee headed by a faculty member in the Department of Operations, students finish a thorough literature review of the chosen area and write a 10-page report summarizing the recent major results obtained in the area and identifying open problems that might be suitable for research. Students also make a one-hour presentation to their committee and other interested students and faculty. Prerequisite: Consent of instructor.

OPMT 701. Dissertation Ph.D. (1-18)
This course is open to Ph.D. candidates who are preparing dissertations in some field of operations management. Prerequisite: Consent of instructor.

Operations Research (OPRE)

UNDERGRADUATE COURSES

OPRE 201. Introduction to Operations Research (1) (3)
This course covers philosophy, concepts, methods, and techniques of operations research, several classical problems and some contemporary case studies. Topics include linear programming, the transportation and assignment problems, integer programming, PERT/CPM, inventory models, simulation, and the use of analytical techniques in portfolio management.

OPRE 300. Undergraduate Projects in Operations Research (1-18)
Individual operations research projects are carried out by qualified students. Prerequisite: Consent of instructor.

OPRE 345. Decision Theory (3)
(See OPRE 445.)

OPRE 348. Personal Investment Strategies (3)
This course is an introduction to the world of personal investing. In the framework of personal investment objectives and alternatives, topics included are: stocks, bonds, convertibles, warrants, options and mutual funds. Discussions of contemporary factors driving stock and bond prices such as international currency and interest rate implications are also discussed. Practical money management programs to meet different investment objectives and levels of wealth are explored. Prerequisite: ACCT 102 or consent.

GRADUATE COURSES

OPRE 402. Stochastic Models with Applications (1.5)
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. Prerequisites: OPRE 425A and OPRE 425B.

OPRE 403H. Applied Multivariate Analysis (3)
This course will provide students with an understanding of multivariate statistics and its practical use to a broad variety of business problems. It focuses on methods that can be applied in a variety of fields, such as financial management, operations management, marketing research, human resource management, information systems, data processing, economics and engineering. Emphasis is placed upon the ability to identify, formulate and solve problems where multivariate statistics can have an impact. Prerequisites: MBAC 414.

OPRE 404. Data Analysis (3)
This course presents selected topics in applied data analysis focusing on the fundamentals of time series analysis, categorical data analysis and experimental design. The course emphasizes what the statistical process is all about: how to conduct studies, what the results mean and what can be inferred about the whole from pieces of evidence. Modules include the analysis of data from designed experiments through the analysis of variance and covariance, fundamental models for the analysis of time series data, including smoothing techniques, classical decomposition; and Box-Jenkins ARMA, and the analysis of categorical responses through measures of association, log-linear models, and logistic regression. Prerequisite: OPRE 405 or OPRE 428B or MBAC 414/QUMM 414 or consent of instructor.

OPRE 405. Regression Models in Management (1.5)
This course is for students interested in the problems of business and management. A wide variety of applications, drawn from the spectrum of business disciplines, drive our treatment of regression. The focus is on understanding and forecasting in a variety of data settings. Students will learn how to summarize relationships and measure how well these relationships fit data, and how to make meaningful statistical inferences when the usual assumptions do not hold. Students should achieve a working knowledge of multiple regression, and will be encouraged to become critical consumers of statistical information. OPRE4 28B covers much of the same material, with a higher assumed knowledge of mathematical statistics. Prerequisite: MBAC 414 or consent of instructor.

OPRE 410. Math Foundations for Advanced Studies (1.5)
This course enhances the ability to use mathematics in advanced studies. In addition to learning such elementary ideas as the difference between closed-form and numerical-method solutions, a systematic approach is used to learn how to read, understand, think about, and do proofs. Specifically, it is shown how all proofs, regardless of subject area, can be explained as a sequence of individual proof techniques. The following mathematical skills are also taught: translating visual images to symbolic form using quantifiers; classifying mathematical objects into groups having similar properties; creating and working with mathematical definitions; unification; generalization. Prerequisites: Linear Algebra (equivalent of 1 semester undergrad course) and Calculus (equivalent of 3 semesters of undergrad studies) or consent of instructor.

OPRE 411A. Linear Programming (1.5)
The objective of this course is to enable the student to formulate deterministic (linear, nonlinear, integer and network) models. The simplex algorithm for solving linear programming problems is presented geometrically, algebraically and economically. The role of duality theory is also discussed. Case studies are used to teach the student how to interpret computer output obtained from the simplex algorithm and how to use that output to answer “What happens if...” questions. Prerequisite: One semester of undergraduate linear algebra or consent of instructor.

OPRE 411B. Deterministic Models with Applications (1.5)
Case studies are used to teach the student how to formulate, use computer packages, and prepare managerial reports for solving determin-
istic (linear, nonlinear, integer, network, and goal programming) problems that arise in business operations as well as project management problems (using PERT/CPM techniques). Conceptual and mathematical ideas of the various methods for solving such problems are presented. Prerequisite: OPRE 411A or MBAC 414/QUMM 414 or consent of instructor.

OPRE 412A. Theory of Linear Programming (1.5)
This course presents the theory of linear programming, including the formal development and proofs of (a) the geometry of linear programming problems (convex sets, extreme points and extreme rays), (b) the steps of the simplex algorithm and their relationship to the geometry, and (c) duality theory and its uses in sensitivity and post-optimality analysis. Prerequisites: OPRE 410 and OPRE 411A or consent of instructor.

OPRE 419. Game and Decision Theory (1.5)
Most of this course is an introduction to game theory; the remainder is a brief introduction to Bayesian analysis of decision problems including decision trees and conjugate pairs of distributions. The game theory portion consists of an axiomatic approach to utility theory, non-cooperative solution concepts emphasizing equilibrium points, and cooperative solution concepts. Examples are drawn from economics, marketing, and operations research. Prerequisites: Linear Algebra and Calculus. Corequisite: Linear Programming.

OPRE 424. Scheduling Theory (3)
Combinatorial and implicit search techniques are developed and applied to scheduling problems, including sequencing on a single and parallel processors, scheduling in flow shops, open shops and general job shops, and resource-constrained project scheduling, to satisfy various objectives. Topics in the complexity of algorithms and worst-case analysis of heuristics are discussed. Stochastic extensions, manpower scheduling or other special topics may be considered. Prerequisites: OPRE 425A and OPRE 425B or equivalent or consent.

OPRE 425A. Probability Applications (1.5)
This course introduces the basic tools of probability. Topics include combinatorial analysis, basics of random variables and distributions, and correlation. Emphasis is placed on business applications in production and inventory planning, reliability and maintenance and finance. Prerequisite: A semester of calculus or consent of instructor.

OPRE 425B. Probability II (1.5)
This course introduces the fundamental concepts of probability theory. Topics include probability spaces and events, conditional probability and Bayes theorem, joint distributions of random variables, moment generating functions, laws of large numbers and the central limit theorem. Prerequisite: OPRE 425A or consent of instructor.

OPRE 426. Stochastic Processes (3)
This course develops probability models for systems that evolve dynamically over time and display uncertain behavior. The models studied include discrete and continuous time Markov processes, with several important special cases including the Poisson Process and other birth-and-death processes, branching processes, and Brownian motion. Other models include renewal, regenerative and semi-Markov processes. Applications include production and manufacturing, supply chain management, telecommunications, finance and economics. Prerequisites: OPRE 425A and OPRE 425B.

OPRE 427. Convexity and Optimization (3)
Cross-listed as MATH 427.

OPRE 428A. Statistics (1.5)
This course covers the basic foundations of statistical analysis, with an emphasis on applications of confidence intervals and hypothesis testing for a wide array of experimental designs. Topics include: descriptive statistics, sampling, comparison of means, medians and proportions through interval estimation and hypothesis testing, and an introduction to the design of experiments. Prerequisite: OPRE 425B or MBAC 414/QUMM 414 or consent of instructor.

OPRE 428B. Regression and Experimental Design (1.5)
This course covers the fundamentals of regression analysis and generalized linear models, emphasizing understanding and forecasting relationships between variables in a variety of data settings. Heavy use of case studies is supplemented by more technical material, as students learn to summarize relationships and measure how well these relationships fit data, and how to make meaningful statistical inferences when the usual assumptions do not hold. Prerequisite: OPRE 428A or consent of instructor.

OPRE 432A. Simulation Models with Applications (1.5)
This course covers the modeling and analysis of business systems using computer simulation. The focus of the course is the introduction of simulation as a modeling tool with emphasis on understanding the structure of a simulation model and how to build such models with the help of popular simulation software(s). Some fundamental statistical concepts behind simulation modeling will also be discussed. Corequisite: A course in basic statistics (QUMM 414 or MBAC 414, or OPRE 428A and OPRE 428B) or consent of instructor.

OPRE 432B. Simulation Design (1.5)
This 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. Prerequisite: OPRE 432A. Corequisites: OPRE 428A and OPRE 428B or consent of instructor.

OPRE 435A. Computer Programming (1.5)
The objective of this course is to provide the student with the ability to write object-oriented computer code in C++ for solving problems that do not involve complex data structures. Topics include the use of variables and pointers, built-in functions, input and output, selection statements, loops, functions, and classes.

OPRE 435B. Integrated Problem Solving in OR and OM (1.5)
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. Prerequisite or corequisite: OPRE 411B or consent of instructor.

OPRE 435C. Data Structures (1.5)
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. Prerequisite: OPRE 435A or consent of instructor.

OPRE 445. Decision Theory (3)
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 448. Personal and Institutional Money Management (3)
This course is an introduction to contemporary portfolio management. In addition to introductory material on securities, options and security markets, topics include contemporary equity and debt management models, hedging strategies, program trading, portfolio insurance, arbitrage programs, mergers and acquisitions, international investing and intermarket influences, and other contemporary factors driving stock and bond prices. Prerequisite: BAFI 402 or equivalent or consent.

OPRE 454. Analysis of Algorithms (3)
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 algo-
Problems. Mathematical programming and optimization analysis for control and decision making (MCDM) with single and multiple decision makers are included as are: interactive MCDM methods; multiple objectives for discrete and continuous models; decision making (MCDM) with single and multiple objectives; multi-objective multi-criteria methodology and applications of multiple criteria. Prerequisites: OPRE 411A and OPRE 411B.

OPRE 518. Integer Programming I (3)
This course is an introduction to integer programming with the emphasis divided among applications, techniques and computations. Applications include problems in scheduling, location, sequencing, capital budgeting, loading and frequency management. Algorithms discussed are of the cutting plane, enumerative, partitioning and group theoretic type. Prerequisites: OPRE 411A and OPRE 411B or consent of instructor.

OPRE 521. Queueing Theory (3)
This course covers basic theorems in stochastic processes pertaining to queueing theory; analysis of descriptive models for queues with exponential, Erlang and general distributions for interarrival times and service times; distributions of the queue size and the waiting time; and optimization analysis for control and design of queueing systems. Prerequisite: OPRE 425A or OPRE 425B.

OPRE 523. Multiobjective and Hierarchical Systems (3)
This course covers basic concepts of hierarchical, multi-level systems, Lagrangian decompositions, and coordination principles. Fundamentals and recent advances in theory, methodology and applications of multiple criteria decision making (MCDM) with single and multiple decision makers are included as are: interactive MCDM methods; multiple objectives for discrete and continuous models; multi-objective programming methods; hierarchical overlapping coordination with single and multiple objectives; multi-objective multi-stage impact analysis; and applications to large-scale systems and to decision support systems. Prerequisites: OPRE 411A and OPRE 411B or consent of instructor: OPRE 412A recommended. Cross-listed as ESCI 523.

OPRE 524. Stochastic Optimization in Operations Research (3)
Mathematical models for decision making in a random environment, with emphasis on sequential decision problems, are studied. Theory is developed for stochastic processes endowed with a control mechanism and a cost structure. Applications are drawn from control of queuing systems, reliability and maintenance of equipment, inventory control, finance, etc. Topics include Markovian Decision Processes (MDP) and Semi-Markov Decision Processes (SMDP), as well as special topics such as the multi-armed bandit problem, partial state observations, and adaptive control of MDPs. Prerequisites: OPRE 411A and OPRE 411B and OPRE 426 or consent.

OPRE 601. Advanced Readings in Operations Research (1-18)
Students report on recent literature and review selected topics in the various areas of operations research. Students also perform detailed studies of special topics in operations research under the guidance of a faculty member. M.B.A. students should enroll in OPRE 501. Prerequisite: Consent of instructor.

OPRE 602A. Predissertation Research (1.5)
The objective of this course is to study a potential Ph.D. thesis area in detail. Under the guidance of a committee headed by a faculty member in the Department of Operations, students perform a thorough literature review of the chosen area with the objective of summarizing the recent major results obtained in the area and identifying open problems that might be suitable for research. Prerequisite: Consent of instructor.

OPRE 602B. Predissertation Research (1.5)
As a continuation of OPRE 602A, students complete study of a potential Ph.D. thesis area in detail. Under the guidance of a committee headed by a faculty member in the Department of Operations, students finish a thorough literature review of the chosen area and write a 10-page report summarizing the recent major results obtained in the area and identifying open problems that might be suitable for research. Students also make a one-hour oral presentation to their committee and other interested students and faculty. Prerequisite: Consent of instructor.

OPRE 651. Thesis M.S. (1-18)
This course is limited to candidates for the degree of Master of Science who are preparing theses in some phase of operations research. Prerequisite: Consent of instructor.

OPRE 701. Dissertation Ph.D. (1-18)
This course is limited to candidates for the Ph.D. degree who are preparing dissertations...
in some field of operations research. Prerequisite: Consent of instructor.

**Quantitative Methods in Management (QUMM)**

**GRADUATE COURSES**

**QUMM 414. Statistics and Decision Modeling (3)**
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.

This course examines the use of modern quantitative methods to support the executive decision-making process. Particular models examined include those which assist in describing and analyzing problems and those devoted to suggesting possible managerial actions. This course is limited to students in the Executive M.B.A. program.

**QUMM 501. Special Problems and Topics (1-18)**
This course is offered, with permission, to students undertaking reading in a field of special interest. Prerequisite: Consent of instructor.

**QUMM 601. Special Problems and Topics (1-18)**
This is a course of flexible design in which a student, with the agreement of an instructor in quantitative methods, may pursue a special topic or problem. M.B.A. students should enroll in QUMM 501. Prerequisite: Consent of instructor.

**FACULTY**

Richard E. Boyatzis, Ph.D. (Harvard University)
Chair, Department of Organizational Behavior; Professor of Organizational Behavior
Leadership and developing emotional intelligence, lifelong learning, competency and outcome assessment, values development

Diana Bilimoria, Ph.D. (University of Michigan)
Associate Professor of Organizational Behavior
Corporate governance and leadership, women directors, leaders and entrepreneurs, management education

Susan S. Case, Ph.D. (State University of New York at Buffalo)
Associate Professor of Organizational Behavior
Organizational communication, management of diversity, multicultural work environments and teams, gender and organizations, career assessment and development

David L. Cooperider, Ph.D. (Case Western Reserve University)
Associate Professor of Organizational Behavior
Social innovations corporate governance and policy, management of professional organizations, organization analysis, appreciative inquiry

Vanessa U. Druskat, Ph.D. (Boston University)
Assistant Professor of Organizational Behavior
Effectiveness in self-managed teams; gender and leadership style; group facilitation.

Ronald E. Fry, Ph.D. (Massachusetts Institute of Technology)
Associate Professor of Organizational Behavior, Faculty Director, EMBA Program
Team development, functioning of the executive, design of learning environments, effecting system-wide change, appreciative inquiry

Richard A. Headley, M.A. (Michigan State University)
Lecturer in Organizational Behavior; Interim Associate Dean for Executive Education Program

David A. Kolb, Ph.D. (Harvard University)
Professor of Organizational Behavior; Individual and social change, experiential learning, career development, organization development

William K. Laidlaw, E.D.M. (Case Western Reserve University)
Interim Dean, Professor for the Practice of Management

**SECONDARY APPOINTMENTS**

Darlyne Bailey, Ph.D. (Case Western Reserve University)
Professor and Dean, Mandel School of Applied Social Sciences; Professor of Organizational Behavior

Donna Voelker, Ph.D. (University of Chicago)
Professor of Epidemiology and Biostatistics, School of Medicine; Professor of Organizational Behavior

Peter J. Whitehouse, M.D., Ph.D. (The Johns Hopkins University)
Professor of Neurology, School of Medicine; Professor of Organization Behavior

**UndeGRADUATE COURSES**

**ORBH 250. Introduction to Organizational Behavior and Management (3)**
This course challenges students to analyze and manage organizations as complex systems, and to enhance their individual and interpersonal effectiveness.

**ORBH 303. Leadership and Personal Development (3)**
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 304. Advanced Workshops in Personal Development (3)**
This is an experience-study course offered for groups of interested and qualified individuals. This course concentrates on an affective theme: conflict and power, intimacy, aggression, etc. There is an effort to combine experience-based learning with conceptual understanding. Prerequisite: ORBH 303.

**ORBH 390. Special Topics (1-18)**
This course is offered for candidates undertaking reading in a field of special interest.

**GRADUATE COURSES**

**ORBH 403. Developing Interpersonal Skills for Managers (3)**
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. Organizational Analysis (3)**
This course studies organizational analysis through appreciative inquiry. It explores multiple frame works 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 415. Residency Periods-E.M.B.A. (2)**
The primary objective of the residency periods is to create and maintain relationships among the E.M.B.A. participants and faculty that enable and accelerate learning throughout the program. This includes the formation, maintenance and development of effective Study Groups. Another primary objective is to develop behavioral management skills in leadership, teamwork, conflict negotiation, decision making and problem management that are best studied through sustained periods of experiential learning, simulations and exercises available in a residential setting. This course is limited to students in the Executive M.B.A. Program.

**ORBH 417. Managing Organizational Change (3)**
This course focuses on change as an inescapable fact for organizations and societies of the present and future. Given the existence of such change, how may individuals charged with managing or facilitating an organization’s response to change deal with their task, and what conceptual or technical tools will help them cope with the challenges of the unpredictable? The course examines social and organizational change to provide a base for considering the future and the demands it is likely to pose. Strategies and tactics used in organizational and social developments in the past are critically examined for their relevance to the future.

**ORBH 418. Management of Work: Organizational Systems Design (3)**
This course views behavior in organizations as a result of interaction between the person and the environment. Person-based characteristics such as stress, style, motives, experience, etc., will be studied in concert with contextual factors such as structure, rewards, co-worker relations, leadership, etc. to explore optimum job design, effective performance management and sustainable system structures. Theories and concepts regarding motivation, high performance cultures, sociotechnical systems, and team-based organization design will provide the bases for our inquiry.

**ORBH 425. Developing Emotional Intelligence (3)**
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. Prerequisites: MGMT 403 and MBAC 413.

**ORBH 432. Understanding and Enhancing Human Systems (4)**
This is an introduction to organizational behavior and development. The twin objectives are to increase awareness of the many ways in which behavior in organizations can be explored and to develop basic skills in understanding, diagnosing and intervening in organizational life. Classroom activities combine experiential exercises with homework assignments that focus on participants’ current jobs, leadership responsibilities and career plans. Limited to candidates for the MSODA program.

**ORBH 435. Practice in Intervention Skills (3-4)**
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 maximize collaborative innovation and learning between client and consultant. This course is limited to candidates for the MSODA program.

This course surveys past and present research on the unique contributions of the executive role in organizations and how leadership, decision and problem management, change management, and strategic planning are enacted from the executive perspective. Participants’ historical analysis of leadership in their organizations provides the basis for applying the concepts presented. This course is limited to students in the Executive M.B.A. Program.

**ORBH 438. Design of Organizational Development and Analysis Projects (4)**
This course has two objectives: (1) to learn to design and deliver training workshops; and (2) to plan and execute organizational change and/or analysis projects that are consistent with their current skills, career plans and developmental needs, and with the opportunities, strategic needs and organizational problems of their client organizations. This course is limited to candidates for the MSODA program.

**ORBH 439. Individual Field Project (4)**
Participants design, execute and formally present problem-solving projects in their organizations. Each project is supervised by appropriate faculty and organization members. This course is limited to candidates for the MSODA program.

This course is an introduction to concepts for understanding the organization as a complex social system, with emphasis on the behavioral aspects of strategy and structure, including recruitment, reward systems, staffing and social and technical aspects of special arrangements. This course is limited to students in the Executive M.B.A. degree program.

**ORBH 450. Executive Leadership (3)**
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)**
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 478. Organization and the Environment (3)**

This course focuses on ways of looking at the interface between organizations and their environments that have important implications for organizational development activities and the people who design and implement them. The first part of the course reviews several conceptual approaches to assessing this interface. The second part involves the application of these approaches to a series of organizational/environmental problems that members of the class perceive their organizations as currently experiencing. Limited to MSODA candidates.

**ORBH 488. Leadership and the Global Agenda (3)**

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)**

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. Prerequisite: Consent of instructor.

**ORBH 491. Managing Diverse Workgroups (3)**

From the increasing gender and ethnic diversity in the American workforce, to the globalization of business, from the impact of the American with Disabilities Act, to the worldwide atmosphere of intensified competition which requires a committed and innovative workforce, and to changes in the structure of how work gets done, major trends are making the understanding and effective management of cultural diversity as an extremely important asset. This course will help future managers learn to work with, supervise, and tap the talents of diverse employees within their organizations for more productive working relationships. It will be done by developing abilities that both build bridges between various groups within the workforce and change the organization to attract and retain quality workers of diverse backgrounds. Key areas are: increasing awareness about the positive side of diversity in organizations, providing students with a broad analytic framework, and helping students develop relevant managerial skills.

**ORBH 495. Advanced Seminar on Organizational Change (3)**

The purpose of this course is to provide a forum for the investigation of dynamics associated with fundamental organizational change as it is being experienced by a select group of E.M.B.A. candidates. A small seminar format enables each participant to: use literature and theory on organizational change to think more clearly and critically about a change situation or opportunity in his or her organization; help each other with ideas for alternate ways of approaching these situations; and critically review each other’s situation. This course is limited to students in the Executive M.B.A. program.

**ORBH 496. Leadership, Executive Assessment, and Development-E.M.B.A. (3)**

The purpose of this course is to learn a method for assessing a participant’s knowledge, abilities, values and interests relevant to leadership and executive management so that the person will be able to develop and implement a plan for enhancing leadership and executive capability throughout career and life. The enabling objectives are: (a) to construct a view of 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 is limited to students in the Executive M.B.A. program.

**ORBH 497. Development of Executive Leadership Skills (3)**

The objective of this course is the development of skills in effective human interaction, with emphasis on the pragmatics of working with people in organizations. The focus is on learning by doing through the use of applied behavioral science methods of simulation, role plays and structured exercise. Leadership topics covered include decision management, problem management, motivation, planned change, teamwork, and the language of leaders. Designed for MSODA students. M.B.A. students admitted upon consent of instructor.

**ORBH 501. Special Problems and Topics (1-18)**

This course is offered, with permission, to students undertaking reading in a field of special interest.

**ORBH 510. Foundations of Organizational Thought (3)**

Learning some of the foundations of organizational thought can stimulate a vision for creating organizations for the twenty-first century. This course is intended to prepare future scholars for understanding, creating and intervening in future organizational life. Preparation will include study of the classics in organizational literature, contemporary writings and historical analyses of seminal thought in organizational behavior. Preparation will include the process of historical and appreciative inquiry, roots in organizational thought, contemporary roots of organizational thought and some organizing principles. Prerequisite: Consent of instructor.

**ORBH 511. Personality Theory and Development Processes (3)**

In this course, the problem areas of personality theory are integrated with the formulations of leading personality theorists. Problems center on heredity-environment, developmental epochs, stability and change, rationality and irrationality, and social forces. The systematic positions of Lewin, Allport, Kelly, Freud, the neo-Freudians and the social theorists are woven into the treatment of problems. Prerequisite: Consent of instructor.

**ORBH 520. Group and Interpersonal Analysis (3)**

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. Prerequisite: Consent of instructor.

**ORBH 525. Developing Emotional Intelligence (3)**

This course will examine the process 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 or she changes. The efficacy and ethics of various approaches to individual change as part of human resource and organization development efforts will be discussed.

**ORBH 530. Social Analysis (3)**

This course is an introduction to major themes and concepts in sociology that influence the field and to sociological analysis as it relates to the careers of behavioral science practitioners. Students are exposed to major theoretical orientations as well as to summaries of current thinking in several major topic areas in sociology. The studies of sociology, sociologists and the self are combined to help students develop a sociological perspective of their own potential roles in the applied behavioral sciences.
Prerequisite: Consent of instructor.

**ORBH 541. Organizational Systems (3)**
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. Prerequisite: Consent of instructor.

**ORBH 560. Research Methods I (3)**
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. Prerequisite: Consent of instructor.

**ORBH 561. Research Methods II: Theory Building (3)**
This course is designed as a methodological practicum in theory building through qualitative methods. The process of good theory construction is portrayed as the discovery of theory from data, resulting in the co-construction of knowledge of consequence. The course asserts, in Lewinian fashion, that "there is nothing so practical as good theory." It then focuses on the methods, personal disciplines, and perspectives needed to bring this dictum alive. Individual research proposals are developed throughout the semester.

**ORBH 570. Learning and Development (3)**
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 these ideas to current issues in human resource development such as adult learning in higher education, advanced professional development, and large system learning and development. Prerequisite: Consent of instructor.

**ORBH 572. Thematic Analysis (3)**
This course will help students develop the abilities to sense themes or patterns, to apply coding systems in a reliable manner, to develop a coding system, and to design research studies for developing or using codes. Participants will develop and practice three abilities on four types of data: 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 of material provided, developing preliminary code from materials selected, and completing a research project in which the development and/or use of a code is required. This course is appropriate for doctoral students in the behavioral or social sciences. Prerequisite: Consent of instructor.

**ORBH 601. Special Problems and Topics (1-18)**
This course is offered, with permission, to candidates undertaking reading in a field of special interest.

**ORBH 600. Methods of Applied Behavioral Science (3)**
This course includes laboratory methods of learning, techniques of design and operation in human relations training, and trainer behavior in group settings. The course is aimed at conceptualizing learning and influence processes in training laboratory settings as well as providing opportunities for the practice of design and operating skills. Prerequisite: Consent of instructor.

**ORBH 701. Dissertation Ph.D. (1-18)**
**ORBH 702. Appointed Dissertation Fellow (9)**
**ORBH 706. Advanced Behavioral Science Theory I: Integrative Seminar (3)**
These seminars are advanced courses which various faculty offer depending on current research interests. Content topics and convening faculty change from semester to semester. These advanced seminars may lead into new intervention activities and/or dissertation research.

**ORBH 707. Advanced Behavioral Science Theory II: Integrative Seminar (3)**
(See ORBH 706.)

### Other Course Offerings

#### M.B.A. Core Courses (MBAC)

**MBAC 404. Executive Dialogues (1)**
Credit/pass/fail option only. Students will engage in dialogues with leaders of regional organizations on issues related to leadership, organizational development and success, and community activism/social responsibility. Each class will begin with remarks from the invited guest on a topic related to the course, and the remainder of the class time will consist of a dialogue among the students and the speaker. Students are expected to prepare for each session by reading materials about the speaker’s organization and articles related to the topic to be discussed in class. The pass/fail grade will be based on individual class attendance and participation, as well as on the performance of each team in preparing for its assigned speaker.

**MBAC 410. Management Assessment and Development (2)**
The Management Assessment and Development course is the cornerstone of the Weatherhead M.B.A. program that offers students an opportunity to take an active role in shaping their learning experience in the program. The objective of the course is to have students learn a method for assessing and developing the knowledge and abilities relevant to management throughout their careers. This is accomplished through helping students develop an individualized learning plan to enhance their abilities and knowledge areas as well as to help achieve their career objectives. Students engage in a number of assessment activities, then receive feedback, and interpret it. These activities take place in the context of an Executive Action Team where students collaboratively help each other assess their current capability and future development needs.

**MBAC 410A. Management Assessment and Development (2)**
Each student will complete an assessment of individual abilities in critical management areas, with the assistance of an instructor/facilitator.

**MBAC 410L. Management Assessment and Development: Team Skills Laboratory (1)**
The course helps develop interpersonal and team management skills. The course is interactive and has recommended readings and extensive in-class participation in groups.

**MBAC 411. Strategic Issues and Applications I (1)**
The first two weeks of this course are an initial introduction to the full range of issues managers confront in the process of creating value in organizations and to the multiple skills required to deal effectively with them. This course also addresses in detail the issues and skills involved in strategic thinking and management, including analyzing industry and competitive environments, developing organizational objectives and strategies for the long term, integrating functional activities into implementable action programs, and structuring and leading the organization. Other managerial issues and skills introduced in the first two weeks of the course will be addressed in detail throughout the first year in the M.B.A. functional core courses.
MBAC 411A. Strategic Issues and Applications (3)
Student EAT teams are introduced to a comprehensive case study to discover the broad range and integrative aspects of management issues confronting organizations today. Functional teachers in the accelerated core courses will provide “just-in-time” coaching as students break down the complexities of the case.

MBAC 412. Management and Career Skills I (1)
This is a seminar course designed to build skills necessary for a successful job search and future career development. The course sessions are interactive and require extensive classroom participation.

MBAC 412A. Management and Career Skills (1)
Course explores communication skills, team building, and negotiations; classes are interactive. There will be recommended readings and extensive in-class participation in groups.

MBAC 412L. Career Development Skills (1)
This is a seminar course designed to build skills necessary for a successful job search and future career development. The course sessions are interactive and require extensive classroom participation.

MBAC 413. Human Value in Organizations (3)
Examines the behavioral sciences relevant to the effective management of people and the effective design of human resource systems, 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 organizational culture. A variety of methods, including experiential and interactive learning methods, are used to study these topics.

MBAC 413A. Human Values in Organizations (1)
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.

MBAC 413L. HVO Laboratory: Negotiation Skills (1)
This course is designed to build negotiation skills with recommended readings and extensive in-class participation. Available only to full-time M.B.A. candidates.

MBAC 414. Statistics and Decision Modeling (3)
This course provides quantitative foundations for modern business decisions making. It begins with an introduction to managerial statistics and data analysis, covering such topics as the use of graphical tools for data description, methods for estimation, comparison and hypothesis testing, and regression models. The second part of the course introduces management science techniques, including mathematical programming models, simulation and project management. Computer software is heavily used throughout.

MBAC 414A. Statistics and Decision Modeling (1)
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.

MBAC 415. Financial Reporting and Control (3)
This course examines the framework that underlies financial and managerial accountability, and how the information produced by these functions can be used by parties external to the firm, i.e., stockholders, creditors, and government, to evaluate the financial performance of an organization; and internal management to fulfill planning and control requirements.

MBAC 415A. Financial Reporting and Control (1)
The accounting component 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.

MBAC 416. Financial Management (3)
Finance is the study of the allocation of resources under uncertainty, especially as it involves contracts with the providers of funding. This first course develops finance reasoning and tools valuable to both financial and nonfinancial managers. Central topics include the use of accounting information to evaluate the sources of value, the techniques for valuing prospective cash flows in risky situations (including valuation of projects, and securities like stocks and bonds), capital budgeting, and the measurement of risk for asset pricing in capital markets. Teaching methods include lectures, discussions, cases, and extensive exercises.

MBAC 416A. Managerial Finance (1)
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.

MBAC 421. Strategic Issues and Applications II (2)
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. Prerequisite: MBAC 411.

MBAC 421H. Strategic Issues and Applications II (1)

MBAC 422. Management and Career Skills II (1)
This course explores communication skills, team building and negotiations. These are interactive classes. There will be recommended reading and extensive in class participation in groups. Prerequisite: MBAC 412.

MBAC 422H. Management and Career Skills II (1)

MBAC 423. Information Design and Management (3)
Organizations are technology and knowledge intensive systems. All their functions are driven by the flow and use of information. This course will enable students to develop the models, analytic techniques and critical attitudes needed to design effective, adaptable organizations. Students will learn to employ information technologies and new organizational forms to improve a firm’s functions and strategies.

MBAC 423A. Information Design and Management (1)
This course will cover systems thinking and the systems approach to structuring and solving problems. Topics include principles of the management of information systems, the biases and heuristics of decision making, linear models and decision support, the human aspect of information systems and the economics of IS. We will assume that students are aware of the range of application of IS to business problems, and that they have an appreciation of their potential administrative and strategic importance.

MBAC 424. Marketing (3)
This course focuses on managing marketing as a process of creating value and mutually desirable exchanges of value. 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, seg-
m entation and devising integrated marketing programs are introduced. Creating customer value and competitive advantage in worldwide markets is the central theme. Prerequisite: ACCT 401.

MBAC 424A. Marketing (1)
The marketing management course will focus on the process of identifying and developing strategies that capitalize on the firm’s unique capabilities and deliver superior customer value. That is the foundation of customer orientation and central theme of market driven management. Students will apply a broad range of marketing principles and techniques to marketing decision making in domestic and global settings. Knowledge of basic marketing concepts and models will be assumed.

MBAC 425. Operations Management (3)
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. 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. Prerequisite: QUMM 405 or MBAC 414.

MBAC 425A. Operations Management (1)
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.

MBAC 426. Economics for Management (3)
This course surveys the basic principles of micro and macroeconomics. The focus is on how these principles help managers to better understand the effect of the economic environment on their organization, so as to make more effective decisions. Topics covered include supply and demand, foreign trade and the foreign exchange market, market structures, and fiscal and monetary policies. Special emphasis is given to recent innovations in the study of strategic interactions between firms.

MBAC 426A. Economics (1)
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.

MBAC 440. Management Assessment and Development II (1)
In the outcome assessment, M.B.A. students reassess their management abilities and knowledge areas and measure the progress they have made during their learning experience at the Weatherhead School. This documentation of individual strengths is applied to students’ job search strategies and/or their postgraduate learning plans.

Management Courses (MGMT)
The following 400-level courses are interdisciplinary courses taught by faculty from various Weatherhead School departments.

MGMT 001. Supervised Professional Practicum - Semester 1 (0)
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.) Prerequisite: Junior standing.

MGMT 002. Supervised Professional Practicum - Semester 2 (0)
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.) Prerequisite: Junior standing.

MGMT 360. Special Topics and Issues in Management (1-9)
This course option is available to qualified students who are undertaking special projects in a management related field.

MGMT 400. Management Assessment and Development (2)
The Management Assessment and Development course is the cornerstone of the Weatherhead M.B.A. program that offers students an opportunity to take an active role in shaping their learning experience in the program. The objective of the course is to have students learn a method for assessing and developing the knowledge and abilities relevant to management throughout their careers. This is accomplished through helping students develop an individualized learning plan to enhance their abilities and knowledge areas as well as to help achieve their career objectives. Students engage in a number of assessment activities, then receive feedback, and interpret it. These activities take place in the context of an Executive Action Team where students collaboratively help each other assess their current capability and future development needs.

MGMT 401. Strategic Issues and Applications I (1)
The first two weeks of this course is an initial introduction to the full range of issues managers confront in the process of creating value in organizations and to the multiple skills required to deal effectively with them. This course also addresses in detail the issues and skills involved in strategic thinking and management, including analyzing industry and competitive environments, developing organizational objectives and strategies for the long term, integrating functional activities into implementable action programs, and structuring and leading the organization. Other managerial issues and skills introduced in the first two weeks of the course will be addressed in detail throughout the first year in the M.B.A. functional core courses.

MGMT 402. Strategic Issues and Applications I (1)
The SIA course sequence begins with an introductory course in which students are introduced to key analytical frameworks which are employed to help break down complex strategic issues into more manageable and understandable pieces. This course also provides a context for integrating the functional area courses which form the cornerstones of the M.B.A. curriculum. We introduce the concept of critical activities, those activities which can become a source of competitive advantage for the firm. We also examine a framework for assessing industry attractiveness and competitive strategy and learn how firms position themselves to achieve success.

MGMT 403. Management Assessment and Development (3)
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 eleven 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 413. Human Value in Organizations (3)
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 417H. Creative Value Management (3)
This course introduces the concept of function-oriented thinking and creative team-based problem-solving using the Value Analysis/Value Engineering methodology and demonstrates its application and techniques. The course demonstrates practical knowledge in specialized techniques used in value analysis such as: creativity, weighted evaluation, design-to-cost, life-cycle costing, function relationship diagramming and human relations. Course delivery will include lectures as well as in-class exercises to apply techniques to assigned problems. Each student will present an independent study on a mutually-agreed upon topic.

MGMT 418. Management and Career Skills (3)
MGMT 418A. Team Management (1)
Course will cover managing multi-cultural workgroups and team management skills.

MGMT 418B. Negotiation Skills (1)

MGMT 418C. Career Management Skills (1)
Seminar style course designed to build management skills and enhance career development opportunities.

MGMT 421. Business for Engineers (3)
This course is designed to assist practicing engineers to interface with the management of their organization. The focus of such interaction is with marketing, from whom the voice of the customer is relayed to engineering design, and with manufacturing, to whom the engineering function provides product and process designs. In addition, there are some integrative and contextual topics to round out the course. No M.B.A. credit. Prerequisite: Admission to Practice Oriented Master’s program.

MGMT 429. Management Assessment and Development II (1)

MGMT 430. Management Assessment and Development II (1)
Prerequisite: MGMT 400.

MGMT 431. Strategic Issues and Applications II (2)
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 course in a comprehensive case exercise. Students develop, document and present comprehensive, implementable strategic and tactical actions programs in groups. Prerequisite: MGMT 401.

MGMT 441. Planning for Personal Learning (3)
This course is designed for mid-life, mid-career professionals (health care, law, science and technology, management and the like) who may be moving toward new levels of leadership in their fields or organizations or who may be undergoing significant life or career transitions. Two three-day workshops (in August and January) plus three all day Saturday sessions in between are planned, along with individual follow-up in February or March. No M.B.A. credit.

MGMT 442. Seminar: Contemporary Management Issues I (3)
This is a two course sequence where a variety of current topics on leadership and management issues are presented in a seminar format. Specific topics for the year are selected in consultation with the participants. Previous topics have included re-engineering the corporation, marketing opportunity analysis, reinventing government, quality management, leadership and governance structures, and conflict management in organizations. In addition, each participant selects a subject for research. Proposals are prepared and reviewed by the faculty and class. Faculty guidance is offered. No M.B.A. credit.

MGMT 443. Seminar: Contemporary Management Issues II (3)
This is a two course sequence where a variety of current topics on leadership and management issues are presented in a seminar format. Specific topics for the year are selected in consultation with the participants. Previous topics have included re-engineering the corporation, marketing opportunity analysis, reinventing government, quality management, leadership and governance structures, and conflict management in organizations. In addition, each participant selects a subject for research. Proposals are prepared and reviewed by the faculty and class. Faculty guidance is offered. No M.B.A. credit. Prerequisite: MGMT 442.

MGMT 452. Japanese for Managers II (3)
Japanese for Managers II continues the introduction of fundamental Japanese grammar, pronunciation, and vocabulary essential for everyday business in Japan. In addition to language skills needed for specific situations (such as visiting, making appointments, extending invitations, business luncheons, etc.), the course will present, through discussion, video, and guest lecture, elements of Japanese society and culture relevant to conducting business in Japan. As the course emphasizes the development of productive oral and aural Japanese language skills, a major portion of each class meeting is devoted to the performance of dialogues and applied situational conversation. Prerequisite: Permission of instructor.

MGMT 453A. Working Spanish I (3)
Instruction in Spanish language and culture for managers with intensive study in Mexico.

MGMT 453B. Working Spanish II (1.5)
Continuation of MGMT 453A.

MGMT 455. Issues in Public Policy (3)
This course will introduce students to the primary frameworks and tools of public policy analysis. Such skills have become essential to business managers, who are increasingly called upon to perform quasi-public functions, especially at the CEO and vice-presidential levels. The course will begin by presenting analytical frameworks, drawn mostly from political science and economics. It will proceed to illustrate these frameworks using three public policy cases. Current plans are to discuss telecommunications regulation, urban development policy, and conflicts in the arts. This course is open for enrollment by E.M.B.A. students only. The course is designed to address these needs.

MGMT 456. Managing in a Global Economy (3)
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 460A. Managing in a Global Economy (3)

MGMT 460E. Managing in a Global Economy-E.M.B.A. (3)
This course is open for enrollment by E.M.B.A. students only. The 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. The course is offered during the Spring semester of the second
MGMT 461. History of Industrial Development (3)
The major theme of this course traces the development of concepts relating to business structures and capital markets and workplace values in the United States and other countries. Attention is given to the emergence of the professional manager and the exploration of current business issues from a societal and historical perspective.

MGMT 462. Technology and Society: Progress and Problems (3)
Rapid technological change has markedly transformed business and society. Managers operate in an environment where consequences of new technologies need to be understood from an economic and social perspective. Given the broad context within which technologies emerge and evolve, this course seeks to create an awareness of how technology is a driving (but sometimes subtle) force that (1) shapes nearly all aspects of our experiences, opportunities, satisfactions, and problems; (2) influences and is influenced by the network of increasingly governmental and private sector organizations and interests; (3) drives the emergence of social and ethical issues and, in dealing with these issues, shows the strengths and limitations of political and economic institutions; and (4) is a significant determinant of corporate strategy in a world where economic, political, and social considerations coexist.

MGMT 462A. Technology and Society: Progress and Problems (1.5)
Summer offering.

MGMT 462B. Technology and Society: Progress and Problems (1.5)
Fall offering. Prerequisite: MGMT 462A.

MGMT 464. Business Ethics (3)
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 465. Perspectives in European Management (3)
The European Summer Institute provides an introduction to international business through a unique combination of class meetings on campus and a two-week excursion to central Europe. While in Europe, students meet with local business people, consulate officials, and university professors to learn the prerequisites for doing business in the region. The trip features a number of site visits to local companies. (This course may be used for perspective course credit.) Prerequisite: Permission of instructor.

MGMT 466. Seminar in International Business (3)
This course is a continuation of MGMT 465 and includes an independent study component. (Approval for course credit in the student’s area of concentration may be approved by the instructor at the time of registration.) (Summer only.) Prerequisite: Permission of instructor.

MGMT 468. Perspectives in American Management (3)
MGMT 498. Process Improvement Consulting (3-6)
This course is highly recommended to students who are planning to pursue post-M.B.A. careers in consulting firms or as an in-company process improvement or quality management consultant. At the start of the course, students will be organized as five-member consulting teams and will be assigned a consulting project and a project manager from a major Cleveland organization. Students will be expected to spend at least one day a week at the organization facility. The student consulting teams will be taught to use several tools for process improvement, project management, and communication with clients. Faculty member will act as a “consulting partner” during the course to provide guidelines and advice during challenging periods of the projects and to keep the progress of the projects on schedule. Student consulting groups will be evaluated on the quality of their analysis, reports and presentations and on the significance of the cost-savings or profits which they have identified for the firm through their analysis. Prerequisite: Second-year status.

MGMT 499I. Field Consulting (3-12)
Action learning projects with a variety of organizations, as determined by specific offerings available in a particular semester. Complexity of project will determine credit hours. Students work in teams with faculty supervision.

MGMT 501. Special Problems and Topics (1-18)
This course is offered, with permission, to students undertaking reading in a field of special interest.

MGMT 563. Qualitative Research Methods (3)
This course emphasizes qualitative methods for organizational diagnosis. The major portion of the course will involve presentations and discussions of fieldwork experience. (Fall, alternate years)

MGMT 570. Research Theory and Method (3)
A range of traditions in the social science are introduced, highlighting different positions from the philosophy of science and epistemology that are drawn upon to guide contemporary research methods. Issues of research design and statistical analysis in laboratory and field settings are explored. Ph.D. standing is required.

MGMT 571. Measurement Theory and Method (3)
This course provides a broad understanding of the theoretical and methodological issues in social science measurement, emphasizes scale development and assessment procedure, and involves extensive use of multivariate statistics (e.g., via SAS or SPSSX) and structural equations modeling (e.g., via LISREL or EQS).

MGMT 572. Application of Multivariate Data Analysis (3)
This course provides an understanding of the assumptions, principles and applications of a diverse range of multivariate data analytic techniques, including Principal Component/Factor Analysis, Canonical Correlation Analysis, Multiple Discriminant Analysis, Cluster Analysis, Path Analysis and Latent Variable Structural Equations modeling. This course involves extensive use of statistical packages (e.g., SAS/SPSSX). Students also will use LISREL/EQS.

MGMT 575. Doctoral Research Project (3)
MGMT 582. Behavioral Theory (3)
Topics from the behavioral sciences that form the foundations for the study of individuals and groups in organizations are explored in this course. Subjects include: attributions and motivation, cognitive maps, decision-making, intra- and inter-group behavior, power and conflict, social constructionism, symbolic anthropology, and leadership and control.

MGMT 585. Research Analysis (3)
MGMT 586. Research Project (3)

MGMT 601. Special Topics (1-18)
This course is offered, with permission, to Ph.D. candidates undertaking reading in a field of special interest.

MGMT 601A. Special Topic: Research Methods (3)

MGMT 602. Advanced Topics (1-18)
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.
Health Systems Management Courses (HSMC)

A number of courses are cross-listed as HSMC to designate health systems management course content:

**HSMC 420. Health Finance (3)**
Prerequisite: ACCT 401 or permission of instructor. Cross-listed as BAFI 420.

**HSMC 421. Health Care Economics (3)**
The health care industry is one of the largest sectors of the economy, yet the usual supply and demand relationships are often violated because of the presence of large third-party-payers (insurers) and the heavy involvement of central governments. We will develop an understanding of the roles of health care consumers, providers, and large purchasers in health care markets, financial incentives contained in various reimbursement schemes, and of principles insurance. The policy intricacies of this sector have sparked a fruitful area of consulting with government agencies, health care systems, pharmaceutical firms, and even hospitals among the typical clients. The course will be taught from the perspective of a policy or economic consultant in health care and is appropriate not only for those with an interest in consulting, but also for prospective business leaders and decision makers who will have to evaluate policies for their organizations, and for corporate officers who need a better understanding of benefits management. Many topics and applications covered in this course may be of interest to decision makers in other sectors of the economy. These include cost-benefit analysis, or principles of insurance, to name but two. Cross-listed as ECON 421.

**HSMC 422. Health Systems Marketing (3)**
Prerequisite: MKMR 403 or MBAC 424. Cross-listed as MKMR 420.

**HSMC 427. Health Law (3)**
Cross-listed as LAWS 227.

**HSMC 432. Health Care Information Systems (3)**
Cross-listed as MIDS 432.

**HSMC 456. Issues in Health Care Management (3)**
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. Cross-listed as NURS 456.

**HSMC 501. Special Problems and Topics (1-18)**
This course is offered, with permission, to students undertaking reading in a field of special interest.

**HSMC 501G. Medical School Electives (1-3)**
Students complete requirements for three six-week electives offered by the Medical School and complete a paper to receive 3 hours of credit. For detailed information about this course, contact the Health Systems Management Center adviser in 370 Enterprise Hall (368-2143).

**HSMC 502. Health Care Executive Education Series (1-3)**
Students may choose six out of eight all day Friday seminars in the Health Care Executive Education Series, plus completion of a paper covering an aspect of the management of health care systems. Registration is 1 credit for Fall semester and 2 credits for the Spring Semester as seminars begin in the Fall and continue through the Spring semester. Limited to students admitted to the Health Systems Management Certificate program and those with approval from Barbara Bolek (bxp4@po.cwru.edu; 216-368-6403).

**HSMC 601. Special Problems and Topics (1-18)**
This course is offered, with permission, to Ph.D. candidates undertaking reading in a field of special interest.

Executive Doctor of Management (EDMP)

**EDMP 610. Culture and World Politics (3)**
Religion, ethnicity and nationalism are assuming increasing significance as defining factors in the post cold war period. These developments call for analysis of how culture affects domestic, regional and international integration and disintegration. They raise questions about how culture and social structure are interrelated with economic development. The seminar will examine ideas of political democracy and economic liberalism in relation to different cultural and religious ideas and explore relationships among social values, political structures and economics.

**EDMP 611. Theory and Practice of Collective Action (3)**
The dominant model of business behavior assumes that organizational actions are solely individualistic, autonomous and competitive. Recently, the importance of collective action, within and across industries and communities, has been recognized. This seminar will address the theory and practice of collective action in the business environment and examine problems and solutions in local, national and global contexts. Case studies of collective action problems, such as waste recycling, technology development and community revitalization, will be discussed.

**EDMP 612. Modes of Inquiry (3)**
This seminar will examine positivist ways of knowing, which assume that the world is entirely knowable, and relativist approaches, which assume that the world is only known through the observer’s interpretations. From these philosophical frames come various modes of analysis and interpretation. Their power, their limitations and their expression in the arguments used to formulate organizational and public policy will be considered. For example, participants will learn to expose the hidden premises about reality in a subordinate’s proposal, a consultant’s report, an academic article or a public policy study.

**EDMP 613. Leadership, Human Values, and World Citizenship (3)**
This seminar will promote reflection on the meaning and responsibilities of leadership in modern society. The role of sense-making—constructing the world of the organization in ways that make collective action possible—will be examined and discussed, using classical and modern literature that addresses the need for leadership. These discussions and participants’ own experiences in leading will form the basis for exploring three executive issues: the valuing of multiple beliefs and ideas that shape human intentions; the translation of that intention into possibilities for action; and the personal enactment of aspirations and visions that attracts others toward collective efforts in a global society. Assignments will include individual dialogue between participants and contemporary leaders to inquire about the experience of leadership and the current and future roles of the leader.

**EDMP 614. Economics, Organization, and Management (3)**
This seminar will examine the micro foundations for understanding the role of organizations in the economy, society and polity. Topics will include: the evolution of large-scale U.S. firms in the 19th century as a result of technological and organizational changes; the role of history, culture and finance in generating different business organizations in other countries (especially Japan and Germany); the new and looser forms of business organization that have emerged in response to more rapid technological change; and the business as part of a larger system with opportunities and responsibilities beyond the traditional boundaries, as well as the implications for corporate strategy and public policy. The links between microeconomic behavior and organization and macro-level performance will also be discussed.

**EDMP 615. Inductive Ways of Knowing (3)**
In this seminar we will explore basic concepts and methods of inductive inquiry and qualitative methods of social science. The seminar will emphasize conceptualization, theory building and theory assessment as they are relevant to each student’s own research interests. You will learn to critique qualitative research from within its own logic, and to retheorize and recast a research question in alternative ways. You will also conduct, in “pilot” mode, the different phases of an interview-based research project.

**EDMP 616. Global Economic Systems and Issues (3)**
This seminar will examine the major structural changes occurring in the world economy and their implications from the view points of the United States as well as other countries. Discussions will include comparisons and contrasts of the economic systems of the triad (the U.S., the European Union and Japan), those of developing countries, such as China and India, and economies in transition, such as Russia. Evolving patterns of global investment and trade, especially the emergence of regional trade and investment blocs, and the changing roles of international economic institutions, such as the World Bank, the International Monetary Fund and the World Trade Organization, will be analyzed.

EDMP 617. Technology and Social System Design (3)
Intensification of electronic technology, especially communication and computing technology, generates issues of technology assessment and social system design. Technology assessment concerns broad questions of how managers can anticipate and evaluate the potential consequences of existing and emerging technology, including social, economic and political implications. As technologies intensify, questions of social system design will replace parochial concerns with organization design. Interorganizational networks, citizen action networks and financial government structures will become primary management concerns. This seminar will draw on historical studies of communication technologies and their impact on society.

EDMP 618. Deductive Ways of Knowing (3)
The course aims to provide knowledge of selected quantitative methods for applied research at the doctoral level. Specifically, the seminar aims to cover three major areas with significant attention to the latter two topics: 1) approaches for data generation and validity assessment (excluding qualitative), 2) methods and techniques for hypotheses/model testing (data analysis), 3) visualizing and exploring with data (data playfulness).

EDMP 619. Comparative Analysis of Social Problem Solving (3)
Solutions to many problems of the environment depend more on social, organizational and political issues than on technical unknowns. Policy making about scientific technical matters involves unresolved issues concerning the formation of public perception, risk analysis, the role of experts in policy development and the often particularistic basis of democratic decision making. This seminar will examine these issues through the analysis of environmental issues such as deforestation and decertification, global food supply management, sustainable economic growth and population expansion. Success and failures of transnational collective action will be discussed.

EDMP 620. Synthesis and Application of Knowledge (3)
This capstone inquiry seminar will build upon the various perspectives and techniques covered in the first three seminars. Discussion will focus on how the different approaches complement and conflict with each other and how they may be used in concert. Emphasis will be on understanding the techniques and findings from a variety of studies and translating them into a common language, thus permitting decision making and action. These skills will be gained through group projects that allow participants to experience the thinking, doing, and evaluating necessary for effective action.

EDMP 621. Applied Research I (3)
Because the E.D.M. is a professional management degree program, conceptual analysis must be integrated with managerial practice. Through applied research projects, E.D.M. participants have opportunities to engage in individual and group projects of consequence to themselves, their organizations, their industries and their communities. Every semester during the first two years of the E.D.M. Program, participants will complete a course-related project focused on an area of high personal interest. Projects may be conducted individually or in groups of two or three, and each project will receive guidance from a faculty advisor. Participants will maintain individual portfolios containing the four projects undertaken during the first two years. One of these projects must be conducted individually, and another must be focused on issues external to the United States and, preferably, conducted abroad.

EDMP 622. Thematic Elective I (1-3)
Participants in the E.D.M. Program take a selected sequence of two coordinated elective courses that provide opportunities for advanced study in topic- or sector-specific areas. Sequences will be designed according to the shared interests of participant groups. For example, a sequence for participants with special interest in Nonprofit Management may consist of courses in Constitutional Issues, Nonprofit Organizations in the Marketplace, or The International Nonprofit Sector. A sequence designed for participants interested in Technology Management may include Foundations for Technology Management Leadership plus an additional course that integrates topics in Information Systems, Management Policy, Operations Management and Organizational Behavior.

EDMP 623. Thematic Elective II (1-3)
(See EDMP 622.)
EDMP 624. Applied Research II (1-4)
(See EDMP 621.)
EDMP 625. Thematic Elective III (1-6)
(See EDMP 622.)
EDMP 626. Applied Research III (1-9)
(See EDMP 621.)

EDMP 627. Applied Research IV (3-9)
(See EDMP 621.)
EDMP 699. Applied Research Project Continuation (1-9)
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 until April 30th of the next year to complete the Applied Research Project. Students will be required to take sufficient additional hours to satisfy 54 semester credit hours required to receive the E.D.M. degree. In each case, the major advisor for the Applied Research Project will be responsible for supervising additional hours of independent work.

Entrepreneurial Studies (ENTP)

ENTP 295. Emerging Venture Opportunities (3)
In this course, we will highlight the role of creativity, leadership, and risk-taking in the entrepreneurial process. Readings, in-class exercises, and case discussions are the principal vehicles for achieving our objectives. Students will also develop and refine their own ideas for an entrepreneurial venture. A major class project will involve the development of a high-quality business plan and presentation of the new venture proposal.

ENTP 310. Entrepreneurial Finance - Undergraduate (3)
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). Prerequisite or corequisite: ACCT 101 or ACCT 303 or consent of instructor.

ENTP 311. New Venture Creation (3)
This course explores all aspects of the creation of a new venture from idea through startup, growth, and beyond. Students will learn how to evaluate opportunities, develop strategies, create a business plan and acquire financing for a new venture. In this course students will develop a business plan for a new venture.

ENTP 312. Managing the New Venture (3)
The main objective of this course is to teach students to recognize and deal with the problems of managing a new venture during its lifecycle. The course will pay particular attention to the problem of successfully managing a rapidly growing company. Case analysis will be the primary method of instruction. Prerequisites: ENTP 310 or ENTP 311.
ENTP 418. New Enterprise Development (3)
This entrepreneurship course teaches how to start, acquire and manage one’s own business. Valuation, capital acquisition, turnarounds and growth strategies are featured, utilizing successful entrepreneurs and their companies to assure a real world learning experience. Cross-listed as PLCY 418.

ENTP 419. Entrepreneurship (3)
Utilizing active entrepreneurs, class exercises and original case studies, this course will explore the roles of the chief executive in smaller enterprises as negotiator, manager, leader and strategist. Cross-listed as PLCY 419.

ENTP 420. Managing the Family Firm (3)
The vast majority of U.S. firms are family controlled and present special problems in strategic management including the interaction of family and firm objectives, executive succession, management development and motivation, finance, estate planning, etc. This course explores solutions to these problems in the context of guiding the firm’s growth through the threshold between personal and professional management. The course pedagogy is participative and experiential. Cross-listed as PLCY 420.

ENTP 422. Managing an Emerging Growth Enterprise (3)
Students are exposed to what it is like to work in an emerging growth company with sales under $100 million. Prospective students might be individuals who are considering employment with middle market company, entrepreneurs who may start a company, or business persons who may buy a middle market company. The learning experience will stem from participating in an actual semester-long project. In-class discussions include: business planning, selling, managing technology transfer, and creativity/innovation, and guest presentations by CEOs from middle market companies. Prerequisites: ACCT 401 and BAFI 402 and MKMR 403 and MIDS 409 and consent of instructor. Cross-listed as PLCY 422.

ENTP 423. Domestic and International Entrepreneurship (3)
This course investigates various aspects of entrepreneurship and intrapreneurship. Topics of focus include: entrepreneurial characteristics, the entrepreneur and the entrepreneurial process, entrepreneurial self-assessment and creativity, opportunity analysis, creating the business plan, marketing evaluation and strategic positioning, the financial plan and sources of capital, the organizational plan and legal forms of organization, structure, legal issues and patents, and the role of venture capital and public and private offerings. Each topic is explored from a domestic and international perspective. The course also focuses on change as a way of life for organizations and societies of the present and future. Cross-listed as PLCY 423.

ENTP 424. Advanced Principles of Entrepreneurship (3)
This course will provide students with in-depth information on the entrepreneurial process by cross-cutting the stages of venture development with key functional business areas including marketing, operations, strategic planning, finance, and human resources. Each student will complete a practicum with a host company that consists of a weekly time commitment (work schedules will be set and agreed to by the course instructor, the host company and the student). Prerequisite: Approval of Ellen Blahut, EDI. Cross-listed as PLCY 424.

ENTP 426. International Entrepreneurship (3)
This course introduces the area of international entrepreneurship by focusing on various aspects of this area. Topics to be covered include: conditions making small, medium-sized, and new ventures increasingly important in international business; information sources relevant to international entrepreneurship; critical steps in deciding on doing international entrepreneurship, strategic planning and methods in conducting international entrepreneurship; and benefits and problems of going international as a new venture. Cross-listed as PLCY 426.

ENTP 427. Entrepreneurial Behavior (3)
This course focuses on the entrepreneurial process from a behavioral perspective by defining and developing the skills and behaviors necessary to be entrepreneurial in both the start-up and in the established firm setting. From the readings, case material and from interviews, you will develop a definition of the skills and competencies of entrepreneurs. You will also focus on developing your own competencies through exercises and a personal assessment of your entrepreneurial strategy. Finally, you will acquire strategies that will promote innovative thinking, idea championing, and change in established firms. Cross-listed as PLCY 427.

ENTP 428. Small Enterprise Consulting (3)
Student teams will apply their expertise and experience to solve a strategic problem for a small enterprise selected by COSE (Council of Small Enterprises). Teams are expected to meet with their client, manage the project workload, and provide a case report with recommendations. Up to two of the teams will be selected to present their case report in the Ohio Graduate Business Student Competition.

ENTP 429. New Venture Creation (3)
This course focuses on all aspects of creating a new venture from both an entrepreneurial as well as an intrapreneurial perspective. The primary focus of the course will be understanding all the aspects of the business plan both at start-up as well as growing the venture. This will involve understanding: sources of capital, the financial plan, the marketing plan, the organization plan, and the production plan all within the business plan framework. (Fall) Cross-listed as PLCY 429.

ENTP 434. Business and Nonprofit Entrepreneurship (3)
This course examines the power of entrepreneurship in the nonprofit sector. It will cover large scale policy initiatives, new services and for-profit activities. Course elements include vision, staffing, leadership, and funding. Cross-listed as ECON 434 and MAND 434.

ENTP 440. Entrepreneurial Finance (3)
This course explores the financing of entrepreneurial new ventures. The primary focus of the course will be the various financing methods and mechanisms available to entrepreneurs. This will involve understanding: estimation of capital requirements, bootstrap financing, angel investors, venture capitalists, private placements, firm valuation and initial public offerings. Cross-listed as PLCY 440.

ENTP 450. Entrepreneurial Marketing (3)
Cross-listed as MKMR 450B.

ENTP 501. Special Problems and Topics (1-36)
Nathan A. Berger, Dean
CWRU School of Medicine,
Room T-106
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Cleveland OH 44106-4915
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Since its founding in 1843, the Case Western Reserve University School of Medicine has been at the forefront of medical education and research.

Before the turn of the century, 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 University (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 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.

The medical school counts eight Nobel Prize holders among its alumni and current or former faculty:

John J.R. Macleod, physiology professor from 1903 to 1918, shared the 1923 Nobel Prize in Physiology or Medicine for work on carotid sinus reflexes.

Frederick C. Robbins, now medical school dean emeritus, university professor emeritus, and director of the Center for Adolescent Health, 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 won the award two years after joining the medical school.

Earl W. Sutherland, Jr., 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 AMP (adenosine monophosphate) in the regulation of cell metabolism.

Paul Berg, who earned his biochemistry degree at CWRU in 1952, received the 1980 Nobel Prize in Chemistry for pioneering research in recombinant DNA technology.

George H. Hitchings, who had been a biochemistry instructor from 1939 to 1942, shared the 1988 Nobel Prize in Physiology or Medicine for identifying the role of G proteins in cell communication. (Now he is professor and chair of the Department of Pharmacology at the University of Texas Southwestern Medical Center, Dallas.)

Ferid Murad, a 1965 graduate of the medical school, shared the 1994 Nobel Prize for Physiology or Medicine for identifying the role of G proteins in cell communication. (Now he’s chair of the Department of Integrative Biology, Pharmacology and Physiology at the University of Texas-Houston Medical School.)

Two other distinguished alumni have served as U.S. surgeon general: Jesse Steinfeld, a 1949 graduate, was surgeon general from 1969 to 1973, and David Satcher, a 1970 graduate, was appointed surgeon general in 1998.

The school is very proud of the contributions made by its educators and graduates, but doesn’t rest on its laurels. Today, the CWRU School of Medicine is among the top medical schools in the enrollment of minority students, and each class contains a high percentage of women. The curriculum responds to the latest findings in education and medicine and sets the pace for other schools.

The CWRU School of Medicine is the largest biomedical research institution in Ohio, as measured by funding received from the National Institutes of Health, the world’s largest funding agency of biomedical research. The medical school receives more NIH funding than all the other Ohio medical schools combined, and is in the top tier of medical schools nationally.

U.S. News and World Report repeatedly has ranked the CWRU School of Medicine as one of the top overall medical schools in the country and specifically has singled out the family medicine, primary care and biomedical engineering programs as being exemplary.

The CWRU 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. Also, a multimedia classroom and extensive fiber optic wiring bring the latest technological resources to the fingertips of faculty during classroom time and facilitate interactive education through video conferencing between many learning sites. But technology is used to enhance, not replace, the faculty-student interaction that occurs in the classroom, the laboratory and small group discussions.

History

Founded in 1843 as the medical department of Western Reserve College, the school moved into its first building 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 educa-
tional institutions.

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. In 1993, it was named the Harland Goff Wood Building in honor of the late chairman and professor of biochemistry and former provost of the university.

In 1971, the Health Sciences Center was completed to house the CWRU medical, dental, and nursing schools, as well as the Health Center Library. The proximity of these excellent research and educational centers to other prestigious CWRU 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 was opened. The $70 million building, attached to the original School of Medicine, added 154,000 square feet of research space and includes conference spaces, a lecture hall, public spaces, and a cafeteria. In 1994, the health sciences complex was named for now-retired U.S. Congressman Louis Stokes.

Faculty

CWRU medical school educators have received four Abraham Flexner Awards for Distinguished Service to Medical Education from the Association of American Medical Colleges, more than any other medical school in the country. The School of Medicine has 1,493 full-time and 2,089 part-time faculty members who teach in classroom, laboratory, small group, and clinical settings. These faculty members comprise the medical school’s 13 preclinical departments, 16 clinical departments, and dozens of centers.

Research

As a research institution, the School of Medicine also has a tradition of national leadership. The National Institutes of Health is the country’s largest funding source for biomedical research, and the CWRU School of Medicine consistently has ranked in the top tier of the nation’s medical schools for federal research funding from the NIH. In fact, fiscal year 1999 (the latest year for which figures were available) marked the 13th consecutive year that NIH funding to the medical school had increased.

For fiscal year 1999, the school received $142.3 million in grants from the NIH. The school ranked first among Ohio’s six medical schools, receiving more NIH funding than all the other Ohio schools combined. Nine of the school’s departments placed in the top 10 for NIH funding in their fields: Orthopaedic Surgery, first; Genetics, fourth; Pediatrics, fifth; Epidemiology and Biostatistics, and Nutrition, seventh; Dermatology, eighth; Neurosciences, eighth; Physiology and Biophysics, eighth; and Medicine, ninth. Thirteen other departments ranked in the top 100.

Every year, at least 30 of the school’s professors each receive $1 million or more in funding from the NIH and other sources.

Community Involvement

The School of Medicine also serves the northern Ohio community in many ways. Primarily, it is a critical link between scientific discovery and the delivery of health care 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.

The School of Medicine’s commitment to the community increased with the creation of the Institute for Public Health Sciences, involving the MetroHealth System and the School of Medicine. This program includes research into the prevention, diagnosis, and treatment of health problems in groups and communities, as well as educational programs for medical and graduate students, physicians, and other health care personnel.

Current community-based programs, including the Urban Area Health Education Center (AHEC) and the award-winning Cleveland Health Education Program, offer opportunities for students from several CWRU undergraduate and professional schools, especially the medical school, to interact with students in the Cleveland public schools and with the community at large. Also, though the master of public health degree program, students complete a public health field practicum in which they work on a project for a public agency and produce a report for the agency. M.P.H. 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.

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 global level, the School of Medicine has an international health program focusing on AIDS, parasitic diseases, tuberculosis, malaria, and other diseases that directly threaten world health.

Administration

The dean of the School of Medicine is also vice president for medical affairs at Case Western Reserve University and is responsible for the administration of the school; the university’s relationships with affiliated hospitals and medical health-related agencies and institutions; and community health care, education, and research programs involving the faculty of the School of Medicine. The person holding this position reports to the president of the university.

The chairpersons of university departments are delegated administrative responsibility in their respective areas and report to the dean.

The faculty of the School of Medicine, through the Faculty Council, plan and implement educational programs and formulate general policies and those regarding student affairs.

ADMINISTRATION

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Associate Vice President for Medical Affairs and Vice Dean
C. Kent Smith, M.D.
Vice Dean for Medical Education and Academic Affairs
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CWRU GENERAL BULLETIN 2000-2002

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Biomedical Engineering
Patrick Crago, Ph.D.

Environmental Health Sciences
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Epidemiology and Biostatistics
Alfred A. Rimm, Ph.D.

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Robert W. Farr, M.D. (University of Maryland)
Tim S. Whittingham, Ph.D. (University of Wisconsin)

ASSISTANT PROFESSORS
Barbara A. Bangert, M.D. (Eastern Virginia Medical School)
Jose I. Suarez, M.D. (Pontificia, Colombia)
Jeffrey L. Sunshine, M.D. (Case Western Reserve University)

DEPARTMENT OF OPHTHALMOLOGY
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CHARLES I. THOMAS. PROFESSOR.

PROFESSORS
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CLINICAL PROFESSORS
William E. Bruner, M.D. (Case Western Reserve University)
Mark Levine, M.D. (Hahnemann Medical College)
Lawrence J. Singerman, M.D. (Wayne State University)

ASSOCIATE PROFESSORS
Edward N Burney, M.D. (Case Western Reserve University)

ASSOCIATE CLINICAL PROFESSORS
Ramanakoppa H. Nagaraj, Ph.D. (University of California College of Medicine-Irvine)

PROFESSORS
Robert W. Tarr, M.D. (University of Maryland)

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Robert A. Ratcheson, M.D. (Northwestern University)

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Robert A. Ratcheson, M.D. (Northwestern University)
Douglas J. Ripkin, M.D. (Thomas Jefferson University)

O. D. Solomon, M.D. (University of Pittsburgh)

Robert L. Tomisk, M.D. (Case Western Reserve University)

Daniel T. Weidenthal, M.D. (Case Western Reserve University)

Nicholas Z. Zakow, M.D. (Columbia University)

ASSISTANT PROFESSORS

David S. Bardenstein, M.D. (University of Michigan)

Paul E. Cutarelli, M.D. (Case Western Reserve University)

Suber S. Huang, M.D. (Albert Einstein College of Medicine)

Michael S. Lee, M.D. (Yale University)

James J. Planter, Ph.D. (Case Western Reserve University)

Michael J. Prokopius, M.D. (Northeastern Ohio Universities College of Medicine)

Loretta B. Szczotka, D.O. (Ohio State University)

Stacia S. Yaniglos, O.D. (Ohio State University)

ASSISTANT CLINICAL PROFESSORS

Marc A. Abrams, M.D. (Case Western Reserve University)

David H. Adams, M.D. (Harvard University)

Carl F. Asseff, M.D. (Ohio State University)

Robert W. Beyer, M.D. (Case Western Reserve University)

William E. Cappaert, M.D. (Loyola University Chicago)

Louis P. Caravella Jr., M.D. (Saint Louis University)

Lorri A. Effron, M.D. (Ohio State University)

Kay E. Frank, M.D. (Thomas Jefferson University)

Bruce R. Jacobson, M.D. (Case Western Reserve University)

Stephen R. Kaufman, M.D. (Case Western Reserve University)

Charles K. Koster, M.D. (Saint Louis University)

Ronald H. Krasney, M.D. (University of Virginia)

Harvey Lester, M.D. (Chicago Medical School)

Lawrence E. Lohman, M.D. (Ohio State University)

Lisa D. Lystad, M.D. (Tufts University)

Matthew Mak, M.D. (University of Zurich, Switzerland)

Andreas Marcotty, M.D. (Wayne State University)

Arnold M. Mitchell, M.D. (Ohio State University)

Michael A. Novak, M.D. (Case Western Reserve University)

Charles A. Peter, M.D. (Saint Louis University)

Jack Plotkin, M.D. (Ohio State University)

Ronald L. Price, M.D. (Columbia University)

James F. Rambasek, M.D. (Case Western Reserve University)

Douglas J. Ripkin, M.D. (Albany Medical College)

Allen S. Roth, M.D. (Case Western Reserve University)

Philip R. Shands, M.D. (Ohio State University)

David B. Sholiton, M.D. (Case Western Reserve University)

Martha D. Snearly, M.D. (Wayne State University)

Robert V. Spurkey, M.D. (Case Western Reserve University)

Eric G. Stocker, O.D. (Ohio State University)

Stuart M. Terman, M.D. (Medical College of Wisconsin)

Joseph M. Thomas, M.D. (Case Western Reserve University)

Sheila M. Town, M.D. (University of Iowa)

Myron Volk, M.D. (Indiana University)

Douglas P. Webb, M.D. (Ohio State University)

Richard E. Wyszynski, M.D. (Case Western Reserve University)

Ihor Zachary, M.D. (Yale University)

SENIOR INSTRUCTORS

Julie K. Belkin, M.D. (Medical College of Ohio)

Beth Ann Benet, M.A. (Duke University)

Richard E. Gans, M.D. (Case Western Reserve University)

Sheri Martyn, M.D. (Case Western Reserve University)

SENIOR CLINICAL INSTRUCTORS

Thomas S. Chi, M.D. (New York University)

Michael V. Coseriu, M.D. (Medical College of Ohio)

Terry E. Daniel, D.O. (Ohio State University)

Carrie B. Davis, M.D. (Case Western Reserve University)

Marianne DiMarco, M.D. (Case Western Reserve University)

Gregory A. Eppert, M.D. (Medical College of Ohio)

Judith C. Gerblich, M.D. (Tel-Aviv University, Israel)

Christopher F. Harris, M.D. (Ohio State University)

Katherine A. Jacobs, M.D. (West Virginia University)

Ildiko T. Kondray, M.D. (State University of New York - Buffalo)

David J. Mitchell, M.D. (Case Western Reserve University)

Bernard D. Perla, M.D. (University of Cincinnati)

Michael V. Coseriu, M.D. (Medical College of Ohio)

Mark Pophal, M.D. (University of Cincinnati)

Neel F. Sika, O.D. (Ohio State University)

Richard A. Statesir, M.D. (Hahnemann Medical College)

Thomas J. Stokermans, Ph.D. (Case Western Reserve University)

Stephanie W. Thomas, M.D. (Ohio State University)

William R. Yeakley, M.D. (Case Western Reserve University)

INSTRUCTORS

Christine Thorne, M.D. (Case Western Reserve University)

CLINICAL INSTRUCTORS

Yael Dinar-Kushnir, M.D. (Tel-Aviv University, Israel)

Mary C. Gerhart, D.O. (University of California - San Francisco)

Michael E. Millstein, M.D. (University of Pennsylvania)

Denise M. Miranda, M.D. (Case Western Reserve University)

Mark D. Pfifer, D.O. (Ohio State University)

James L. Vendeland, M.D. (University of Cincinnati)

Secondary Appointments

PROFESSORS

Timothy S. Kern, Ph.D. (University of Wisconsin - Madison)

M. E. Medof, M.D. (University of Southern California)

ASSOCIATE PROFESSORS

Mark J. Morrow, M.D. (Boston University)

ASSISTANT PROFESSORS

Shukti Chakravarti, Ph.D. (University of Pittsburgh)

Forrest J. Ellis, M.D. (Indiana University)

Amy R. Jeffery, M.D. (State University of New York - Buffalo)

Eric Pearlman, Ph.D. (University of Texas - Dallas)

DEPARTMENT OF UROLOGY

CHAIRMAN OF DEPARTMENT

Martin I. Resnick, M.D. (Bowman Gray School of Medicine)

Lester Persky Professor of Urology

PROFESSORS

Donald R. Bodner, M.D. (Indiana University)

Jack S. Elder, M.D. (University of Oklahoma)

Mani Menon, M.D. (Madras University, India)

CLINICAL PROFESSORS

Ralph Straffon, M.D. (University of Michigan)

ASSOCIATE PROFESSORS

Stanley Althof, Ph.D. (Oklahoma State University)

Nehemia Hampel, M.D. (The Hebrew University of Jerusalem, Israel)

Allan D. Settel, M.D. (State University of New York - Downstate)

John P. Spinnak, M.D. (Emory University)

ASSOCIATE CLINICAL PROFESSORS

Layton Kest, M.D. (Northwestern University)

David Klein, M.D. (Case Western Reserve University)

Michael D. Pifer, D.O. (Ohio State University)

Denise M. Mirando, M.D. (Case Western Reserve University)

Mark D. Pfifer, D.O. (Ohio State University)

James L. Vendeland, M.D. (University of Cincinnati)

ASSISTANT PROFESSORS

Kurt Dinchman, M.D. (Ohio State University)

Howard B. Goldman, M.D. (Albert Einstein College of Medicine)

Christopher Haas, M.D. (Case Western Reserve University)
The MetroHealth System has been serving the medical needs of the Cleveland community for more than 160 years. Today the hospital system is one of the largest, most comprehensive health care providers in Northeast Ohio.

The MetroHealth System includes: MetroHealth Medical Center, MetroHealth Center for Rehabilitation, MetroHealth Centers for Skilled Nursing Care - East and West, MetroHealth Clement Center for Family Care, and a dozen urban and suburban primary care sites. In addition, in 2000, MetroHealth opened an outpatient surgery center on Cleveland’s west side. Together, these units provide a complete spectrum of health care services.

As Cleveland’s first hospital and the largest on the city’s west side, the 742-bed MetroHealth Medical Center is the flagship unit of the MetroHealth System. The medical center provides a full range of general and tertiary services for the acutely ill; rehabilitation services are provided through MetroHealth Center for Rehabilitation.

MetroHealth is nationally recognized for its advanced techniques in treating complex medical problems. Special interests include emergency and trauma care, surgical specialties, family health, senior health, internal medicine, oncology, dentistry, women’s and children’s services, psychiatry, rehabilitation, and subacute and long-term care.

As a principal teaching center of the CWRU School of Medicine, MetroHealth maintains a fine tradition of academics and research. All active staff physicians are full-time faculty of the CWRU School of Medicine and actively participate in undergraduate and graduate medical education. Intensive training for physicians and medical professionals is offered in more than 25 medical specialties.

MetroHealth Medical Center provides care to more than 24,000 inpatients, including more than 3,500 newborns, annually. More than 600,000 visits are recorded each year in the medical center’s 100 outpatient clinics. In addition, patient visits to the emergency room exceed 65,000.

**THE METROHEALTH SYSTEM**

**UNIVERSITY HOSPITALS HEALTH SYSTEM**

University Hospitals Health System (UHHS) is a regional health care delivery system that includes University Hospitals of Cleveland and its Rainbow Babies & Children’s Hospital, MacDonald Women’s Hospital, Lerner Tower, Mather Pavilion and Lakeside Hospital, University Psychiatric Center and Ireland Cancer Center; a network of community hospitals (UHHS Bedford Medical Center, UHHS Geauga Regional Hospital, UHHS Brown Memorial Hospital, UHHS Memorial Hospital of Geneva, UHHS Laurelwood Hospital & Counseling Center and Southwest General Health Center); physician groups; ambulatory and urgent care services; managed care products; and support services. In addition, UHHS and the Sisters of Charity of St. Augustine Health System jointly operate St. John West Shore Hospital, St. Vincent Charity Hospital, and Saint Luke’s Medical Center, all in Cuyahoga County, and Mercy Medical Center in Canton. UHHS serves patients at more than 110 locations in 55 northern Ohio communities.

School of Medicine students are trained at University Hospitals of Cleveland. University Hospitals boasts an ultramodern array of comprehensive services, advanced technologies, and exceptional hospitals and outpatient facilities. The medical staff consists of more than 1,300 physicians, representing 60 different medical specialties.

Taken together, University Hospitals and partner Case Western Reserve University comprise the largest center for biomedical research in the state of Ohio. In a recent year, physicians at University Hospitals received more than $65 million in funding from the National Institutes of Health for medical research. All active staff physicians are full-time faculty of the CWRU School of Medicine.

**INSTRUCTORS**

Eitan Gross, Ph.D. (Bar Ilan University, Israel)

**AFFILIATED HOSPITALS**

**STOKES VETERANS AFFAIRS MEDICAL CENTER**

The Louis Stokes Cleveland Department of Veterans Affairs Medical Center is a major teaching hospital of the CWRU 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, psychiatry and their subspecialties. Most VAMC physicians hold faculty appointments within the School of Medicine. The affiliation is overseen by the Dean’s 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 into an integrated service network. Inpatient
care is provided at the Wade Park and Brecksville divisions and includes medi-
cine, surgery, psychiatry, spinal cord in-
jury, neurology, and rehabilitation medi-
cine as well as a nursing home and a
domiciliary. Outpatient care is delivered
in primary and specialty care clinics lo-
cated at Wade Park, Brecksville, Canton,
Lorain and Youngstown. The medical
center serves more than 50,000 individual
veterans annually through approximately
9,000 hospital admissions and 400,000
outpatient visits.

An active research program includes ac-
tivities funded through the Department
of Veterans Affairs and other govern-
mental and private funding sources. Total
funding of approximately $11 million an-
nually (from all sources) supports more
than 50 principal investigators in a broad
range of research endeavors.

HENRY FORD HEALTH
SYSTEM

The academic and research programs of
the Henry Ford Health Sciences Center
are supported by Detroit’s Henry Ford
Health System (HFHS), a major inte-
grated health services network and a rec-
ognized leader in patient care, research,
and education. HFHS also is home to
Henry Ford Hospital and Medical Cen-
ters, which includes one of the nation’s
largest group practices, with a staff of 800
physicians offering diagnosis and treat-
ment in more than 40 medical and surgi-
cal specialties. A multidisciplinary ap-
proach to medical care makes the
hospital and medical centers a leading re-
ferral center, attracting patients from
more than 27 states and abroad.

Henry Ford Hospital and Medical Cen-
ters includes a 17-story outpatient center,
a 903-bed hospital and a designated re-
gional emergency and trauma center on
its Detroit campus, as well as a network
of 30 suburban medical centers that offer
primary and specialty care in neighbor-
hood settings.

Henry Ford Hospital and Medical Cen-
ters, through the Henry Ford Health Sci-
cences Center, is in the forefront of de-
velopments in many areas of medicine,
including heart and vascular disease; dis-
orders of the brain and spinal cord, in-
cluding stroke and migraines; organ
transplantation; bone and metabolic dis-
orders; cancer; sleep disorders; genetics
and birth defects; and chemical depen-
dency.

These advanced patient care programs
are backed by strong education and re-
search efforts. As a CWRU teaching af-
filiate, Henry Ford Hospital provides
training to third- and fourth-year medical
students. The affiliation also includes co-
operative research efforts with an ongo-
ing exchange of scientists and a combin-
ing of National Institutes of Health
funding.

The Henry Ford Health Sciences Cen-
ter School of Health Sciences trains more
than 1,000 physicians, nurses, and allied
health professionals each year through 71
education programs. Graduate and un-
dergraduate programs attract more than
600 physicians-in-training from around
the world in specialty areas.

Together with CWRU, the School for
Health Sciences continues to provide a
unique physician training curriculum that
focuses on the training of generalists
within an integrated undergraduate and
graduate program that emphasizes ambu-
latory care and management of care. Stu-
dents study with a full-time academic fac-
ulty of nearly 850 physicians, many of
whom have achieved national and inter-
national reputations. The school provides
students with experiences in urban, sub-
urban, tertiary, and primary care settings.

Amenities

CLEVELAND HEALTH
SCIENCES LIBRARY

The Cleveland Health Sciences Library
began operating in 1966 with an agree-
ment between the Cleveland Medical Li-
brary Association and Case Western Re-
serve University. CHSL operates in two
locations, the Allen Memorial Medical
Library, at the corner of Euclid Avenue
and Adelbert Road, and the Health Cen-
ter Library, connected to the School of
Medicine.

The CHSL collection consists of books,
journals, theses, government documents,
audio-visual items, and electronic re-
sources. The Dittrick Medical History
Center collection, located at the Allen
Memorial Medical Library, also contains
archives, rare books, and artifacts for re-
search in the history of medical technol-
ogy. The CHSL’s total collection num-
bers more than 390,000 volumes. CHSL
receives more than 2,000 print subscrip-
tions and has access to approximately
3,000 electronic journals. These resources
are included in the campus-wide online
catalog, EuclidPLUS (http://
catalog.cwru.edu), which also includes
materials held by the university library
branches, the law library, the Harris Li-
brary of the Mandel School of Applied
Social Sciences, the Cleveland Institute
of Music Library, and the Cleveland College
of Jewish Studies.

Complete information about the CHSL
can be found at the library’s home page
on the Web: http://www.cwru.edu/chsl/
homepage.htm.

HEALTH SCIENCES
BOOKSTORE

The CWRU Health Sciences Book-
store, located in the west basement of
the School of Medicine, is operated for
health science students, health profes-
sionals, and hospitals in northeastern
Ohio.

Customers may choose from a selection
of all required texts, as well as many basic
science and clinical books of special in-
terest. Also offered is a selection of sta-
tionery supplies, medical equipment, and
clinic wear at substantial discounts.

Order services exist for books and
equipment not carried in stock. Store
hours: Mondays, Wednesdays, Thursdays,
and Fridays, 9:30 a.m. to 5 p.m.; Tues-
days, 9:30 a.m. to 6 p.m.; and Saturdays,
10 a.m. to 1 p.m. Phone orders are wel-
come at (216) 368-3464. The store’s Web
site address is http://www.lb.com/cwru.

ENDOWED LECTURE FUNDS

The Nikaan B. Anderson Lecture

Established in 1974 by friends of the
late professor of anesthesiology (1969 un-
til his death in 1974), this fund enables
teachers of the science of anesthesia to
visit and to deliver an annual lecture.

The Claude S. Beck Scholarship Fund Visiting
Lectureship

This fund, established in 1989, supports
a lectureship in cardiovascular surgery at
the School of Medicine.
The Jack H. Berman, M.D., Lecture Fund
Established in 1999 by family, friends, and colleagues of this alumnus and associate clinical professor, this fund supports a program of guest lecturers who discuss the basic science behind disease and its application to patient care.

The Louis A. Bloomfield Memorial Lecture Fund
Established in 1955 in memory of the Cleveland attorney Theodore R. Bloomfield by his widow and his son, this fund 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 Courtney Burton Frontiers of Medicine Lecture Fund Lectures
Established in 1993, this fund supports an annual lecture 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.

The Alfred Cahan Memorial Lecture
This fund was established in 1965 to provide for a lecture series in gastroenterology.

The Frohring Presidential Lectureship in Medicine and Engineering
This fund was established in 1993 to support lecturers in medicine and engineering at the discretion of the CWRU president.

Nathan S. Greenfield Family Endowment Fund for Visiting Lecturers in Pharmacology
This fund was established in 1997.

The Zella Hall Lecture Fund
This fund was established in 1998 by the estate of Zella Hall to support an annual lecture or series of lectures by one or more distinguished visiting researchers selected by the dean of the School of Medicine or his or her designee.

The Robert R. Kohn Lecture Fund
This fund was established in 1991 by friends and colleagues of the late doctor.

The Olof H. Pearson, M.D., Lecture Fund
This fund was established in 1999 by family and friends of the late doctor, to support a lecture on a cancer-related topic at the School of Medicine.

The Robert S. Post, M.D., Visiting Lectureship
Established in 1995, this fund each year supports a distinguished visiting lecturer in the field of nephrology.

The Edward W. Purnell Lectureship in Ophthalmology
Established in 1991 and named for its honoree, this fund supports a visiting lecturer in the Department of Ophthalmology.

The Frederick C. Robbins Lecture Fund in the Department of Medicine Visiting Lecturer
Established in 1995 by the Department of Medicine in honor of Frederick C. Robbins, M.D., dean emeritus of the School of Medicine, university professor emeritus, and Nobel Prize winner, this fund supports a distinguished visiting lecturer each year in the Department of Medicine.

The Henry Z. Sable, M.D., Ph.D., Endowment Fund
Established in 1997 by Mrs. Florence M. Sable in honor of her late husband, Dr. Henry Z. Sable, professor emeritus of biochemistry, this fund is used to advance the study of biochemistry by means of a visiting lecturer 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 fund sponsors the 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 Endowment Fund for Visiting Lecturers in Pharmacology and Cancer Biology
 Originally established in 1990 by friends and family and named the Robert...
Sternlicht Memorial Fund, this fund was amended in 2000 and now provides for a distinguished lecturer whose presentation 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.

The Morton F. Utter Memorial Lecture Fund
This fund was established in 1981 in memory of the former professor of biochemistry and chair of the Department of Biochemistry for the presentation of lectures by scientists of the highest caliber in fields 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 chairman of the Department of Medicine of the School of Medicine and University Hospitals of Cleveland.

The Harland G. Wood Endowment Fund in the Department of Biochemistry
Established in 1994 in memory of the late chairman and professor of biochemistry and former provost of the university, this fund supports an annual Page-Wood symposium, co-sponsored by the CWRU 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.

Publications
Below are some of the many publications produced in hard-copy form by the Office of Public Affairs. Also see them on the Web; visit http://mediswww.cwru.edu and click on “electronic publications.”

COMMUNIQUÉ
Communiqué is the calendar of events for the School of Medicine. It is published monthly in hard-copy form and also is updated continuously on the Web.

MEDICAL BULLETIN
The Medical Bulletin is a 16-page magazine for faculty, students, alumni, friends, and media. Published three times a year, the Medical Bulletin contains feature articles highlighting research and education, as well as additional areas of interest. Articles provide a glimpse into the people behind the programs. Alumni receive an additional 16-page insert, Alumni News, which features class notes and obituaries as well as other news of interest to alumni. A stand-alone edition of Alumni News featuring reunion weekend is published once a year for alumni.

MEDLINES
MedLines, a newsletter for faculty, staff, students, alumni, media, and friends of the School of Medicine, is published six times a year. Its news articles highlight research, activities, academic programs, and noteworthy accomplishments and events involving the medical school community.

Admission to medical school
Those interested in obtaining a degree other than the medical degree should contact the appropriate school within the university. See individual schools’ listings elsewhere in this publication.

All inquiries about admission and application to the School of Medicine should be addressed to:
Office of Admissions
CWRU School of Medicine, T-308
Cleveland OH 44106-4920
Phone: (216) 368-3450

The information below pertains to prospective medical students. For more information, visit http://mediswww.cwru.edu and click on “admissions.”

GETTING STARTED
Students wishing to apply to the CWRU School of Medicine must initiate the process through the American Medical Colleges Application Service (AMCAS).

If applying to enter in 2001:
Obtain an application packet from the AMCAS by writing:
American Medical College Application Service
2501 M Street NW
Lobby-26
Washington, D.C. 20037-1300

Or contact the AMCAS via e-mail at amcas@aamc.org or by telephone at (202) 828-0600. Students also may be able to complete the AMCAS application electronically. To learn more about the AMCAS application process, visit http://www.aamc.org/stuapps/start.htm on the Web.

The premedical adviser’s office of the student’s college or university also may have an AMCAS application.

If applying to enter in 2002 or later:
Students may apply only through the Internet. Access the AMCAS application through the Web site of the Association of American Medical Colleges: www.aamc.org.

THE ADMISSIONS COMMITTEE
The CWRU School of Medicine admissions committee has a tough job to do. Each year, it receives thousands of applications from academically superior students with varied backgrounds. Each class is limited to about 145 spots, however, so it’s impossible to interview or extend offers of admission to all applicants.

Here’s how the medical school admissions process works at the school: Each application, when received from the AMCAS, will be screened by the admissions committee. The committee will send each student a final application or a preliminary rejection. If a student who receives a final application returns it to the committee, the committee will decide whether to grant the student an interview. If the student is granted an interview, afterward, the committee will decide whether to extend an offer of admission. The student will be notified of the committee’s decision no later than May 1, or October 1 if he or she applied through the early decision plan (see below).
ADMISSIONS CRITERIA

Although the Admissions Committee will consider grades and the score on the Medical College Admission Test (MCAT) in the admissions process, high grades and a high score on the MCAT alone are not sufficient criteria for admission (the MCAT is mandatory, however). Just as important are qualities such as integrity, interpersonal skills, and leadership ability.

MINIMUM ACADEMIC REQUIREMENTS

Students must have a solid foundation in the sciences needed to understand modern biomedical information. At a minimum, students should possess the following knowledge:

**Biology.** Students ordinarily satisfy this requirement if they’ve taken a one-year course in biology that stressed molecular and quantitative concepts. Courses in anatomy, taxonomy, botany and ecology will not satisfy this requirement.

**Chemistry (through organic).** Students normally meet this requirement if they’ve completed a one-year course in basic chemistry and a one-year course in organic chemistry. Other sequences, and courses that included organic/biologic chemistry content, are acceptable, too.

**Basic physics.** Students generally satisfy this requirement if they’ve taken a one-year course in physics.

**Writing skills.** Students typically meet this requirement if they’ve taken an introductory course in expository writing. The committee will consider other courses that required extensive writing, however.

Students must have taken these prerequisites at an accredited, four-year, degree-granting American or Canadian college or university.

Although no other courses are required, many students find that a general survey course in biochemistry helps them in the first semester of medical school.

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. Research strongly indicates that the choice of a major has little bearing on ultimate acceptance into medical school. Most applicants to medical school, however, are chemistry or biological science majors.

**EARLY DECISION PLAN**

If their credentials are strong and they’re certain that the CWRU School of Medicine is their first choice, students may apply to the medical school through the early decision plan. The School of Medicine must receive the preliminary application from the AMCAS no later than August 1; early decision plan students will be notified of the medical school admissions committee’s decision by October 1.

**FINANCIAL AID**

About 80 percent of CWRU 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 CWRU 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 would be expected to obtain a specific portion of his or her support from outside sources such as a Stafford Loan, savings and family. Once the student obtains this amount, the remaining aid would be provided through CWRU 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.

Programs such as the Medical Scientist Training Program and the M.D./Ph.D. in health services research program offer financial support for participants. For more information, see other entries in this publication and contact the specific program.

Also, the medical school’s Dean’s Scholars program and David Satcher, M.D., Ph.D.-Rubens Pamies, M.D. Minority Student Scholarships provides merit scholarships of $20,000 annually for up to four years for selected entering students selected each year. 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 gives preference to candidates who 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 will be the overall quality of college performance and general ability and potential. In most instances, students will be 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 will be placed on the student’s major field of study, the committee strongly favors the concept of a broad, general college education.

The School of Medicine values a widely diverse student body. Although preference is given to Ohio residents, out-of-state residents are strongly encouraged to apply.

To Students Who Have Been Out of College a Year of More

Students 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.
Academic Regulations for Medical School

M.D. STUDENT EVALUATION

The faculty of the School of Medicine is charged with evaluating all aspects of student performance that are pertinent to the development of a responsible, competent, and humane physician, including knowledge, skills, and personal characteristics. 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 during each of the four years, determines each medical 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 evaluations, as well as the professional attitudes and behavior manifested by the student. Medical school 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.

Medical student performance is evaluated throughout the four-year curriculum. To be eligible for promotion and graduation, students must complete the requirements and perform satisfactorily in each of the curricular components. Medical students are graded as satisfactory/identified-for-remediation in the first two years and as honors/commendable/satisfactory/identified-for-remediation in the clerkships of the third and fourth years. There is no class ranking.

Faculty-prepared interim examinations and a Year I comprehensive examination are administered in the Core Academic Program of the first two years. These examinations are secure, with a pre-determined pass mark, and are graded anonymously.

Medical students must complete all components of the Year 2 curriculum and pass the U.S. Medical Licensing Examination (USMLE) Step 1 at the end of the second year to advance to the third year. Evaluation of medical students during the clinical components of the first and second years is based on performance in the preceptor group, family care program, interviewing program, and physical diagnosis program. Subjective and objective assessments are used in the first and second years of the Flexible Program. In the core clerkships of the Patient-based Program, clinical skills, knowledge and personal characteristics are evaluated. Several methods are used, including instructor observation, personal interaction, review of write-ups, oral examinations, objective structured clinical examinations (OSCEs), written examinations and National Board of Medical Examiners subject examinations.

Senior medical students usually take the USMLE Step 2 in fall of the fourth year. To be eligible for graduation from the school, students must obtain at least the minimum passing score on this examination as established by the USMLE Composite Committee.

CODE OF ETHICS

Although a formal “honor” code has not been established at the school, the medical student code for Case Western Reserve University follows the Code of Medical Ethics for the American Medical Association, which asserts the following principles:

“A physician shall deal honestly with patients and colleagues and strive to expose those physicians deficient in character or competence, or who engage in fraud or deception.”

“A physician shall respect the rights of patients, of colleagues, and of other health professionals.”

“A physician shall continue to study, apply and advance scientific knowledge.”

“A physician shall recognize a responsibility to participate in activities contributing to an improved community.”

Because the purpose of medical education at Case Western Reserve University is to graduate physicians whose medical practice is consistent with the highest standards of the profession, these principles are considered to be applicable throughout the course of medical training. All procedures of the Committee on Students incorporate appropriate provisions for due process.

GRADUATION

A medical student who has satisfactorily completed all the required work in the School of Medicine may be granted the degree of Doctor of Medicine by Case Western Reserve University, provided that:

He or she has been registered in an accredited medical school for at least four academic years, the last two of which must have been at CWRU.

The Committee on Students approves his or her record of performance, and the faculty recommends him or her to the trustees for graduation.

He or she has discharged all financial obligations to the university.

He or she has completed all requirements for graduation.

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.

Medical Student Organizations

The list of organizations and activities available to medical students continually evolves to reflect the interests of current students.

Here’s a sampling of the organizations and activities currently available.
SPECIALTY RELATED GROUPS
Medical students have formed interest groups to explore and invite speakers to discuss:
- Geriatric medicine
- Emergency medicine
- Family medicine
- Integrative medicine
- Internal medicine
- Neuroscience
- Obstetrics
- Orthopedics
- Integrative medicine
- Pediatrics
- Psychiatry
- Surgery

OTHER MEDICAL STUDENT GROUPS AND ACTIVITIES
- Alpha Omega Alpha medical honor society
- American Medical Association
- American Medical Students Association
- Artists in Medicine
- Christian Medical and Dental Society
- Committee of Student Representatives
- governmental group
- Docapella vocal performance group
- Doc Opera annual student/faculty parody show
- Hippocrates Ball black tie dance for students and faculty
- Lesbian, Bisexual, and Gay People in Medicine
- Medical Students for Choice
- Phi Delta Epsilon medical student fraternity
- Physicians for Social Responsibility
- Student National Medical Association
- This Won’t Hurt sketch comedy group

Professional Program

The School of Medicine of Case Western Reserve University long has been recognized as a national leader in curriculum innovation and development. The educational philosophy and guiding principles include organ systems teaching by interdisciplinary teams of basic science and clinical faculty, introduction to patients in the first year, student anonymity in grading examinations and pass/fail evaluation in the first two years, elimination of class ranking, flexibly scheduled time, and student responsibility for self-education. These factors provide a stimulating and congenial learning environment, which is combined with large and diversified research programs and excellent facilities for patient care and clinical education.

The goal of the educational program is to develop responsible, competent, and humane physicians with the capacity and motivation for continued learning and the flexibility to recognize, adapt to, and influence future changes in medicine, health care delivery, and society.

EDUCATIONAL OBJECTIVES

The four years in medical school can be considered the general professional education of maturing students who, after graduation from medical school, will obtain training as specific preparation for their chosen careers in medical practice or scientific investigation. Therefore, one objective of the medical school phase of a physician’s education is to provide the basic knowledge and skills that are common to all physicians. Another objective is to enable students to develop habits of self-education, methods for solving unfamiliar problems, and enthusiasm for the continuing study of medical sciences. A third objective is to assist students in developing appropriate attitudes with respect to their responsibilities to their patients and to become skillful in meeting these responsibilities.

EDUCATIONAL AUTHORITY

Governance of the educational program 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 academic affairs carries the dean’s academic and administrative authority and has direct supervisory responsibility over the units which lead and support the curriculum.

The Curriculum Leadership Council is composed of the Curriculum Leadership Council chair and the basic science and clinical faculty teaching leadership of the first two years. The council is responsible for the strategic planning, content, design, selection of teaching leadership, and oversight of the Core Academic Program, and its members jointly oversee integration and coordination within the first two years of the curriculum.

The Clinical Rotation Development Council parallels the Curriculum Leadership Council for the clinical year. It is composed of the Clinical Rotation Development Council chair and all core clerkship directors. The council’s steering committee has representation from each core clerkship discipline, the Primary Care Track, and the school administration.

The Flexible Program Council is composed of the Flexible Program chair, faculty representatives, and curricular leaders participating in the program. An advisory committee assists the council’s planning and implementation of the Flexible Program.

The faculty’s Committee on Medical Education evaluates, reviews, and makes recommendations concerning the major units of the medical education program. Acting for the faculty, the Committee on Medical Education evaluates the achievement and outcomes of curricular objectives and reviews the curriculum as a whole. The majority of the members of the Committee on Medical Education are elected by the faculty; student representatives also serve on this committee and its various subcommittees.

EDUCATIONAL APPROACH

Great emphasis is placed on the creation of a graduate school intellectual environment in which students have the opportunity to demonstrate initiative and to assume a large measure of responsibility for their own education. Much value is attached to personal and informal communication between students and instructors, which is facilitated by small group teaching. During the first two years, lectures are used for approximately half of the teaching activities; small group conferences, multidisciplinary laboratories carried out in integrated teaching areas, clinical correlations, and symposia are other educational approaches used.
THE CURRICULUM

The four-year CWRU curriculum is composed of three interrelated components: the Core Academic Program, the Patient-based Program, and the Flexible Program. The Core Academic Program of Years I and II provides foundational training in the basic biomedical sciences and organ system pathophysiology, and introduces students to the social, economic, and interpersonal dimensions of the doctor-patient relationship. The Patient-based Program extends throughout the four years and prepares students in the skills, knowledge, and attitudes necessary to provide supervised patient care during graduate training. The Flexible Program provides students with elective opportunities for enrichment, research, and individualized study as well as dual degrees. Students must demonstrate satisfactory performance in all three components of the program to be eligible for graduation.

Core Academic Program

The 1999-2000 academic year represented an exciting new phase in the evolution of medical education at the CWRU School of Medicine. Nearly 50 years have passed since CWRU pioneered cross-disciplinary integration in the teaching of basic medical sciences, an idea considered revolutionary at the time and since adopted by medical schools throughout the world.

The revised Core Academic Program curriculum, introduced in August 1999 with the entering Class of 2003, builds on this successful foundation, incorporating new approaches to integration both within the basic science components of the teaching program and between the basic and clinical sciences. In addition, the learning environment continues to be enhanced by a major initiative to develop the use of electronic learning tools, including an electronic syllabus, to facilitate self-directed learning and exploration.

The current reforms build on the principles of cross-disciplinary integration in the basic sciences and early exposure to clinical experiences that have been hallmarks of the CWRU curriculum since the 1952 “revolution.” Whereas the 1952 reform focused on integrating disciplines (for example, anatomy and physiology) within each organ system, this new effort focuses on integrating learning across organ systems and in the context of biological and social factors that influence patterns of disease expression, treatment strategies and outcomes in individuals and communities.

To graduate physicians who are able to effectively integrate cutting-edge science, medical, and information technology, and comprehensive, humanistic care, such integration must be the very fabric of the medical school curriculum. The revised curriculum reflects this vision.

Major changes:

- Establishment of the Curriculum Leadership Council.
- Restructuring of the Year I and II curriculum so that the major emphasis in Year I is on normal structure and function of each organ system, whereas the major emphasis in Year II is on pathophysiology.
- Coordination of the basic science and clinical science modules in the Year I and Year II curricula so that case-based workshops in the clinical program relate to the concurrent basic science coursework.
- Establishment of vertical themes, including genetics, growth and development, aging, and diversity to provide cross-disciplinary integration throughout Years I-IV.
- Development of specific learning objectives for each component of the curriculum.
- Continued development of the electronic curriculum as a comprehensive tool for improved access to information, self-directed learning and exploration, and integrated evaluation.

The Core Academic Program consists of consecutive learning modules, or subject committees, representing the major content areas in basic and clinical medical science. Some subject committees are grouped together thematically into sections.

In Year I, these content areas are Cellular and Molecular Biology and Genetics, Integrative Human Biology, Fundamentals of Therapeutic Agents, and Biological Basis of Disease I.

In Year II, the content areas are Organ System Pathophysiology, Drug Action and Biodisposition, Hematology, and Mechanisms of Infection.

Running concurrently with these modules in Year I is the Integrated Clinical Experience (ICE), a program of small group, case-based, problem-solving workshops and lectures that engage students and faculty in topics ranging from the social and economic context of medicine, epidemiology, and biostatistics, to developing the tools of clinical decision-making, such as the critical evaluation and application of information (also known as evidence-based medicine). In addition, ICE workshops focus on dealing with issues that can challenge the doctor-patient relationship, such as death and dying, substance abuse, and sexuality. Self-directed learning skills, peer education, self-assessment and peer assessment, and the promotion of student-student and student-faculty collegiality are emphasized throughout the ICE program. The Year I curriculum begins with an introduction to the ICE program called Fundamentals of Medical Decision-Making.

The annual Curriculum Handbook of the School of Medicine provides a detailed description of the subject committees and sections in the Core Academic Program.

Patient-based Program

The Patient-based Program is a four-year continuum. It begins with early involvement with patients in the pre-clerkship activities of the first two years and builds toward intensive clinical experience in the core clerkships of the third year and clinical electives of the fourth year. The emphasis of the Patient-based Program in the first two years is concurrent progress in professional maturation in acquiring clinical skills, knowledge and attitudes. An essential foundation for supervised responsibility for patient care in graduate training, it reinforces and builds on the information base introduced in the Core Academic Program and is complemented by the Flexible Program. The In-
integrated Clinical Experience provides a unique link among these activities.

Preclerkship Years I and II
The three components of the Clinical Science Program are: the lecture series/preceptor groups (which are part of the Integrated Clinical Experience), the Family Care Program, and the Interviewing Program. Physical Diagnosis completes the pre-clerkship portion of the Patient-based Program.

Year I features all three components of the Clinical Science Program.

Year II focuses on Physical Diagnosis, but activities of the other three components continue.

The process of professional maturation requires developing skills, attitudes, and behaviors consistent with being a competent, humane, and open-minded physician. This process continues throughout the four-year continuum, but the primary focus of the Clinical Science Program and Physical Diagnosis in the first two years is on the various perspectives involved in becoming a professional.

Family Care Program
Early in the first year of medical school, each student is assigned to follow a pregnant woman. (The alternative of a geriatric patient is available for a small number of students.) The student has both an opportunity and a responsibility. The opportunity to observe and support the patient through her antepartum course, delivery, and the later care of her child is accompanied by a responsibility to be accessible to the patient. The student is the principal liaison to the physicians caring for the patient and as such is a part of the patient’s health care team. The process of physical examination begins in this setting. The student attends each clinic visit with the pregnant mother and is with her throughout labor and delivery. The student attends the well-child care visits of the baby through the second year of medical school. Workshops conducted by the medical directors of the family clinics during the first four weeks of medical school help prepare students for the Family Care experience. Workshop topics include the physical examination of the pregnant woman, the physiology and psychology of pregnancy, labor, and delivery, and interviewing.

Interviewing Program
This component of the ICE is designed to provide opportunities for students to receive instruction in and practice effective doctor/patient communication skills. Students complete two observational and two videotaped patient interviews during their first year. Each interview is observed by a preceptor and a student partner and followed by a structured feedback session to review the tape and analyze the student’s interviewing strengths and weaknesses. The patient also participates in the feedback session. Each session is preceded by a goal-setting session wherein the student identifies different skills to practice in each interview. An interviewing skills checklist is used to record the student’s progress in mastering the skills. Skills practice in self-assessment, the medical write-up, oral presentation skills, how to deliver effective feedback to a colleague, and consultation skills are also integral components of this program.

In Year II, students participate in two observational and two interview sessions with standardized patients to practice the specific interviewing skills of sexual history-taking and how to assess a patient’s readiness for behavioral change. They continue practicing self-assessment skills, oral presentation skills, preparing and delivering feedback, and consult skills. Goal setting before the interview and structured feedback session after each interview continue. In addition to being evaluated on the actual skills practiced, students are assessed in their professional development in the areas of responsibility in making and keeping appointments, receptiveness to feedback, and respectful demeanor to patients and colleagues.

Physical Diagnosis.
In a series of didactic lectures, demonstrations and small group sessions during Years I and II, students learn the basics of interviewing and physical exam methodology. Part One of the course focuses on basic techniques and normal physiology. Part Two focuses on abnormal findings. These teaching sessions consist of the demonstration of a regional physical exam technique and medical history-taking skill followed by supervised practice of the interview and examination with a student partner, hospital-based patient, and/or standardized patient. To support clarity and integration, each regional examination is coordinated whenever possible to the regions/organ systems being taught simultaneously in the Core Academic Program curriculum. Afternoon lectures and subspecialty-oriented physical diagnosis laboratories supplement the material presented in small group format.

Following completion of this introductory course, students are assigned to individual internal medicine or family medicine faculty mentors from various affiliated hospitals to perform a series of at least six complete histories and physical examinations on either hospital inpatients or patients in the ambulatory setting.

The Year II physical diagnosis experience includes a three-week pediatric physical diagnosis component emphasizing the unique aspects of the examination of the newborn, toddler and adolescent.

Assessment of the students’ skills is measured by tracking their progress on the physical diagnosis checklist and the medical history-taking checklist, as well as by verbal feedback from their instructors. Final assessment for the course is via a physical diagnosis objective structured clinical examination (OSCE) at the end of Year II.

CORE CLERKSHIPS

General Educational Goals and Process
The primary goal of the clerkships is for the student to acquire the skills to solve clinical problems scientifically, humanistically, and to the objective benefit of the patient. The student learns by case study method the collection of a comprehensive database, identification of problems, development of appropriate methodology for solution of the problems, and participation in treatment and observation of the course of the patient’s illness. The student learns to care for patients as human beings in whom organic or psychologic illness may have a profound socioeconomic and emotional impact. The student must learn to work harmoniously with all members of the health profession team to solve these broad patient problems. These fundamental skills can be
augmented in graduate training. The clinical faculty provide the framework for care to patients, in which students participate under supervision. Implicit in this relationship is acceptance of responsibility for the care of patients to a degree appropriate to the individual student’s level of training and the specific clinical situation. This is a new dimension in education for most students and may initially be a source of anxiety. The clinical faculty members are prepared to lend support when necessary. Experience indicates that the majority of students quickly acclimate to involvement in patient care.

In the majority of clerkships, the resident physicians, with the strong support of the clinical faculty, fill an important teaching role in the case study method by direct supervision of students in history-taking, physical examination, laboratory evaluation and problem formulation. The faculty also are responsible for ensuring the proper balance between learning experiences and service functions, and for the quality of supervision provided to students by the resident staff.

Evaluation of student performance in core clerkships also differs from the written examination format used in the core curriculum. Continuous accumulation of information and development of clinical skills are required in the case study method of learning. Students’ acquisition of information, application of knowledge, and development of clinical skills generally are assessed by faculty and house officers’ observations and questioning in the clinical setting. In all clerkships, written and/or oral examinations also are administered and must be passed.

An equally important component of evaluation of clerkship performance concerns behavioral characteristics of students as physicians-in-training. In particular, it is expected that students’ behavior reflects a high level of responsibility and commitment to their patients and colleagues, including an awareness of the necessity for some degree of personal sacrifice in caring for the ill. This includes the daily interpersonal relationships necessary for working in the team situation that characterizes contemporary health care delivery. Excellence in the fundamentals of medical knowledge is never sufficient to outweigh behavioral characteristics detrimental to considerate and ethical human relationships. It is the responsibility of the faculty to inform the student of his or her clerkship performance.

Revised Core Clerkship Year III

In the academic year 1999-2000, the Clinical Rotation Development Council created a 48-week core clerkship third year that was approved by the faculty to be implemented in July 2000 with the Class of 2002. Core clerkships are offered at approximately 21 clinical services in affiliated hospitals and practices. Required rotations through medicine, surgery, pediatrics, obstetrics/gynecology, psychiatry, family medicine, and neurosciences must be taken at one of these affiliates.

Each student is required to take the following in block format:

**Block No. 1**
- Neurosciences (4 weeks)
- Psychiatry (4 weeks)
- Surgery (8 weeks)

**Block No. 2**
- Inpatient Medicine (8 weeks)
- Ambulatory Medicine (3 weeks)
- Family Medicine (4 weeks)
- Psychiatry (1 week)

**Block No. 3**
- Obstetrics/Gynecology (7 weeks)
- Newborn Nursery (1 week)
- Inpatient Pediatrics (4 weeks)
- Ambulatory Pediatrics (3 weeks)
- Psychiatry (1 week)

Each clerkship is directed by a CWRU faculty member who is responsible for certifying to the School of Medicine that each student has achieved the educational goals stated for that clerkship. In this role, the clerkship directors represent the service directors of the affiliated hospitals in their teaching relationship with the School of Medicine. Additionally, the clerkship directors work with the Patient-based Program coordinator, who is responsible for administration of the clinical programs, and the chair of the Clinical Rotation Development Council. The Committee of Clerkship Directors, with representation from all clerkships at all sites, determines the general goals and monitors the educational processes of the required clerkships.

### Core Clerkship Descriptions

#### Medicine

The medicine clerkship builds on the knowledge of human biology and pathophysiology developed in the Core Academic Program and the basic interviewing and physical diagnosis skills acquired by students in the Clinical Science Program and Physical Diagnosis. The goals of the core medicine clerkship are that the student:

- increase skills in obtaining reliable and accurate knowledge regarding the anatomy, biochemistry and pathophysiology of a patient’s illness from the interview, physical examination, laboratory and imaging data, and the medical record;
- synthesize from these clinical data and his or her scientific, psychosocial and medical knowledge plausible pathophysiologic hypotheses explaining the problem that is to be evaluated through an ordered, efficient and cost-effective diagnostic algorithm;
- develop a management plan that incorporates medical therapeutics, attention to psychosocial and economic dimensions, and, wherever appropriate, preventive management of disease;
- develop appropriate professionalism; and
- develop an adequate fund of knowledge of internal medicine.

This clerkship consists of inpatient and ambulatory experiences. During these rotations, students participate as active members of the health care team.

#### Neurosciences

In this four-week rotation, students learn to perform and understand the neurologic examination, use a clinical database to localize lesions within the nervous system, and characterize the disease process in terms of pathogenic mechanisms. They also actively diagnose and manage inpatient and outpatient neurological and neurosurgical diseases under the supervision of neurology and neurosurgery house officers and attendings. Students participate in outpatient clinics and as members of the inpatient ward team on the neurology or neurosurgery service. Those choosing the neurosurgical clerkship become familiar with the techniques involved in common surgical pro-
undifferentiated problems commonly en-
tement of patients of all ages with
appropriate supervision, in managing pa-
ters, problems of normal growth and development, ambula-
to gain an understanding of normal re-
dy be the greatest challenge for the student to work with a continuity precep-
tary practice, and tertiary inpatient care. Students work side-by-side with a community or residency family doctor.

**Pediatrics**
The goals of the pediatrics clerkship are to provide an introduction to the field of pediatrics and to promote an awareness of the concept of disease in a rapidly growing person. The clerkship emphasizes developing the student’s competence in the skills necessary for the case study method of patient care, namely, effective data collection through the history and physical examination, synthesis and presentation of information, problem-solving, patient management, and communication with patients and their families. Students are exposed to the complete range of pediatric experiences (infancy through adolescence), problems of normal growth and development, ambulatory practice, and tertiary inpatient care. Students work as members of the ward team and are directly involved, with the appropriate supervision, in managing patients.

**Family Medicine**
This four-week clerkship enables the student to work with a continuity preceptor to gain experience with comprehensive diagnosis, assessment and management of patients of all ages with undifferentiated problems commonly en-
countered in the broad spectrum of primary care. This allows the student to structure their experience from the general to the specific.

This clerkship combines comprehensive office practice with interactive learning experiences in an individually tailored program for third-year students. Students work side-by-side with a community or residency family doctor.

**Psychiatry**
This clerkship provides intensive clinical experience on the inpatient service, in outpatient clinics, and/or on the consultation liaison service. Clerkship didactics and clinical work build on the didactics, group and interview experiences from the second year Mind Subject Committee.

The objectives of the psychiatry clerkship are to develop the skills and knowledge essential to the psychiatric evaluation, the mental status examination, interviewing techniques, and selection and implementation of treatment modalities. Emphasis is placed on descriptive characteristics of psychiatric disorders and therapies, the rationale for the use of a variety of psychiatric therapies, psychopharmacology, the major psychodynamic mechanisms, and unconscious processes and their applications in clinical situations. Students acquire the clinical experience needed to make accurate psychiatric diagnoses, gain a working knowledge of psychopharmacology, learn principles of treatment sufficient to make referrals, and expand their own understanding of the psychological effects of illness.

**Surgery**
The goal of this clerkship is to provide students with a broad clinical experience in which to develop diagnostic and management skills, improve their skills for the collection, organization, integration and presentation of data; procedural skills, recognition of treatment priorities; and management of emergencies. The emphasis in this clerkship is on problems unique to the surgical discipline and on participation in frequently used surgical therapeutic methods. At the same time, it becomes clear that surgical judgment and technical approaches require a broad background knowledge of the basic sciences as well as a firm clinical fund of knowledge from the non-surgical fields.

Objectives of this clerkship are to acquaint students with surgery as a discipline and to give them an appreciation for working with other members of the team. Students find this a useful time to review basic anatomy and physiology and are expected to acquire a basic understanding of the pathophysiology of surgical disease and the rationale for surgical treatments.

The annual Year III Core Clerkship Catalog of the School of Medicine provides more detail about the core clerkships.

**Flexible Program**

The Flexible Program encompasses the electives of the first two years, which mainly are short courses offered during the afternoons (Type A) and the clinical electives of one month or longer typically taken in the fourth year (Type B). Catalogs of both Type A and Type B electives are published and distributed to the students annually. Students may take an Area of Concentration (AoC) or take a broad range of electives in the Diversified Medical Sciences. The objectives of the Flexible Program are to:

- increase the student’s capacity for critical and analytical thinking in the medical sciences;
- provide opportunities for meaningful student involvement in scholarly activities, both independently and in consort with professional colleagues;
- allow students to pursue individual areas of concentrated study in depth and across traditional disciplinary boundaries;
- expose students to newer concepts, areas of controversy, issues of social relevance, and changing technology in medical science; and
- increase students’ initiative, responsibility, and capacity in self-education in the medical sciences.

The content of the Flexible Program is designed to complement the Core Academic Program and the Patient-based Program, to extend them, and to promote integration across the usual disciplinary boundaries.
Components of the Flexible Program

The Flexible Program includes two pathways: Areas of Concentration and Diversified Medical Sciences.

Areas of Concentration.

All students are required to participate in the Flexible Program, and the minimum course requirement is the same for all students. Within the Flexible Program and within the minimum course requirements, Areas of Concentration (AoCs) are offered to those students who wish to pursue them. Pursuit of an AoC is intended to allow the student to choose a single area and pursue this area in depth. We believe that scholarship of this type is of value for medical students and will establish patterns of study for physicians who must continue their own self-education throughout their lives. Additionally, the collegiality that results from faculty and students working together in areas of common interest adds much to the academic environment of this medical school. The following points describe the basic features on an AoC. They are modified from the guidelines used by the faculty in developing AoCs.

AoCs encompass both Type A and Type B units.

Independent scholarly activity is encouraged as a part of AoCs. It is often part of the minimum requirements for completion of an AoC.

Most AoCs require four to six Type A units (Year I and II) and two to three Type B units (Years III and IV) as minimum. Many students will devote more time to their AoC. The usual Type B AoC requirements are:

- Two sharply focused Type B electives or three Type B electives, of which two are sharply focused. AoC directors may choose to allow students to substitute 200 hours of independent scholarship for one of the required Type B units.

- Distribution requirements are included within some AoCs to ensure that the program’s objectives are met.

- Courses offered as part of an AoC usually are open to students in other AoCs and in Diversified Medical Sciences. Many courses satisfy requirements for more than one AoC.

Election of AoCs occurs in the second half of the first year. The option to change an AoC remains open as long as it is reasonable for students to meet the requirements of the AoC into which they wish to change. Students who do not elect an AoC will be enrolled in the Diversified Medical Sciences Program.

Students are encouraged to develop individual programs within an AoC. Students may initiate an AoC in an area not currently offered.

Students may not enroll in more than two Areas of Concentration.

The student’s completion of an Area of Concentration is recognized by notation on the official transcript. Students achieving excellence in an Area of Concentration are awarded distinction in the Area of Concentration. This award is granted by February of the fourth year, is recognized at commencement, and is noted also on the official transcript. Nomination for distinction is made by the Area of Concentration faculty. This nomination is then reviewed and the award made by an ad hoc faculty committee.

Diversified Medical Sciences

Diversified Medical Sciences students who do not choose an Area of Concentration participate in the Diversified Medical Sciences pathway. This path is intended to appeal to those students whose interests have not been refined to the point where they feel comfortable in committing themselves to the in-depth pursuit of a single area. Distribution requirements are imposed for the Type A unit requirements of the first two years as outlined in the Flexible Program Catalog of Type A Electives.

More information about the Flexible Program is available in the annual Type A Catalog and Type B Catalog of the School of Medicine.

THE ELECTRONIC CURRICULUM

The School of Medicine has developed an integrated electronic curriculum that contains a list of learning objectives for every hour of the core curriculum, as well as the resources that allow the students to achieve the objectives. These resources include references to traditional text-books 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.

An electronic testing system (using an SQL server) has been developed to administer multiple-choice examinations on the student desktop computers over CWRUnet, automatic grading of the examinations, and e-mail feedback to the students that includes the test score, a short descriptive phrase that describes the concepts that the student did not answer questions on correctly, and links to the places in the electronic curriculum where these concepts are introduced and explained. The electronic curriculum is being developed for the core clerkships and the Flexible Program.

Each student is given a notebook computer at the time of matriculation and is provided a series of computer orientation sessions. Students have access to the Internet and the electronic curriculum from their assigned personal desks via fiber optic Ethernet connection to CWRUnet. When off campus, access is through modem.

THE PRIMARY CARE TRACK (PCT)

The Primary Care Track is a track within the medical degree program. Continuing the School of Medicine’s history of educational innovation, this initiative trains students who wish to pursue careers as general internists, family physicians and general pediatricians. Students who have an expressed interest and commitment to primary care will find the PCT a program focused on their educational needs as well as the needs of the future health care system. After admission to the School of Medicine, students may apply for admission to the PCT early in the first semester of year one.

Students in this program have several advantages beginning in the first year of medical school:

- Association with a primary care faculty adviser.
- Early instruction in physical diagnosis.
Early experience in clinical medicine.
The opportunity to complete a health promotion project.
PCT students have a home base during third year at one of three affiliated teaching sites: Henry Ford Health System in Detroit, MetroHealth Medical Center, or University Hospitals/Veterans Affairs Medical Center in Cleveland. Their clerkships in the primary care disciplines of medicine, pediatrics, and family medicine all are completed at their home-base sites. In addition, PCT students pursue a longitudinal continuity preceptorship throughout the third year and participate in small-group activities organized around primary care topics that take advantage of educational strategies such as problem-based learning.

The PCT is designed to continue across the seven years of medical training. PCT students in their fourth year of medical school are given considerable autonomy in choosing their courses but are required to complete a one-month health policy clerkship. PCT students have the option of taking electives designed especially for the program, such as a pediatric or medicine subspecialty elective, or self-directed electives in international health, adolescent medicine, or women’s health. Another option for PCT students is to pursue an integrated fourth year at Henry Ford Health System.

PCT’s influence continues into the residency programs in general internal medicine, general pediatrics, and family medicine at the affiliated teaching sites. Faculty development programs have been designed to teach residents to become better teachers. Two defining milestones for all students are completion of requirements of awarding of the M.D. at the conclusion of the fourth year and completion of criteria for board certification in a relevant discipline after the seventh year.

For more information, call (216) 368-5966 or visit http://mediswwwмедs.cwru.edu/dept/pct/ on the Web.

Other Degree Programs
These degree programs require admission to two schools, the medical school and the other school associated with the particular program. Each school may have different deadlines and requirements for admissions. Please contact the other schools separately using information provided under that particular school’s listing in this publication. Please see departmental listings in this section of the General Bulletin for information about additional degree programs offered through the medical school’s departments.

**MEDICAL SCIENTIST TRAINING PROGRAM (MSTP)**

**CWRU School of Medicine, Room W-378**

10900 Euclid Ave.
Cleveland OH 44106-4965
Phone: (216) 368-3404
Director: John H. Nilson, Ph.D.
Associate Directors: Clark W. Distelhorst, M.D., and Sandra K. Lemmon, Ph.D.
Program Manager: Felicite M. Katz

A combined M.D./Ph.D. in basic sciences program, the Medical Scientist Training Program (MSTP) is available for students desiring academic careers in medicine and related biosciences. This program takes seven to eight years, depending on the time needed to complete the Ph.D. dissertation research.

Application and admission for the Ph.D. component is through the School of Graduate Studies. Candidates must meet established prerequisites for admission. Criteria include demonstrated motivation for and participation in research, in addition to superior undergraduate academic credentials. Descriptive materials and applications can be obtained by contacting the MSTP program using the above information.

The Ph.D. component is pursued under the aegis of a selected preclinical department or program of the medical school or the MSTP itself. Financial support includes stipend and tuition for up to eight years or the period needed to complete the program, whichever is shorter.

The first two years of the program are devoted to the medical school preclinical core curriculum, which occupies five mornings and one afternoon each week. The other afternoons are available for graduate courses and research recommended by the preclinical department or program selected by the student for thesis research. The next three to four years are devoted to completion of graduate courses and the Ph.D. thesis research. After the first research year, the MSTP student participates in a weekly clinical tutorial to enhance clinical skills. After the Ph.D. thesis is successfully defended, the student returns to medical school to qualify for the M.D. degree.

The program is administered by an MSTP Steering Committee consisting of faculty from both basic science and clinical departments. Its functions include selecting candidates for admission; designing and administering the program curriculum; advising students; evaluating and approving each trainee’s program, including the selection of a Ph.D. thesis advisor and the members of the thesis committee; appointing clinical advisors; and acting as liaison with the Faculty Council of the School of Medicine. A Policy Review Committee oversees the overall operation of the program.

**M.D./J.D.**

This program, offered in conjunction with CWRU’s School of Law, may be completed in six years. For more information, call the law school admissions office at (216) 368-3600 or (800) 756-0036 or e-mail lawadmissions@po.cwru.edu.

**M.D./M.B.A.**

This program, offered in conjunction with CWRU’s Weatherhead School of Management, may be completed in five to six years. For more information, visit http://weatherhead.cwru.edu/degree/experience/curriculum/mdmba.html on the Web, call the management school’s admissions office at (216) 368-2030 or (800) 723-0203, or e-mail questions@exchange.som.cwru.edu.

**M.E.D.**

The 30-hour master of education degree program, begun with the 1999-2000 academic year, is offered in conjunction with John Carroll University. One program is designed for medical students, another for faculty. For more information, call (216) 397-4331 or (216) 397-4389 or e-mail rosemary@jcu.edu.
M.D./PH.D. IN HEALTH SERVICES RESEARCH

This program prepares students for careers in academic medicine, health policy, public health, and/or health care management in group practices, HMOs or health-related industries. The program’s focus is especially pertinent to candidates interested in the health and health care problems of urban and vulnerable populations.

Initial admission is through the CWRU School of Graduate Studies, with the Ph.D. completed within the Department of Epidemiology and Biostatistics and its track in health services research. Students typically complete the Ph.D. by their fourth or fifth year after matriculation and the M.D. at the end of the sixth or seventh year.

For more information, contact Program Director Randall D. Cebul, M.D., at (216) 778-3901 or rdc@po.cwru.edu.

MASTER OF PUBLIC HEALTH (M.P.H.)

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 – those pursuing degrees in medicine, nursing, dentistry, law, social work, bioethics, management, and other fields.

The 36-hour program can be completed in two years. Students earn 15 credit hours through five required courses representing the fundamentals of public health: biostatistics, epidemiology, environmental health sciences, health services administration, and social and behavioral sciences. Also, students receive a total of nine credit hours for three courses in an area of concentration of their choice (biostatistics, epidemiology, health services research, health care administration, urban health, or disease prevention and health promotion), three credit hours for an elective course, and nine credit hours from a one-semester public health field practicum. In the practicum, students work on a project for a public agency and produce a report for the agency.

Initial admission is through the CWRU School of Graduate Studies. For more information, call (216) 368-3197 or e-mail shf2@po.cwru.edu.

GRADUATE COURSES

MPHP 408. Public Policy and Aging (3) Cross-listed as EPBI 408.

MPHP 411. Introduction to Behavioral Medicine (3)
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. Cross-listed as EPBI 411.

MPHP 431. Statistical Methods I (3)

MPHP 432. Statistical Methods II (3)
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. Prerequisite: MPHP 431. Cross-listed as BIOL 432 and EPBI 432.

MPHP 433. Public Health Management and Policy (3)
This course will discuss the basic concepts of sampling theory including simple random and systematic sampling, ratio and regression methods of estimation, stratified and cluster sampling, randomized response survey and their applications in health sciences. Prerequisite: MPHP 432. Cross-listed as EPBI 447.

MPHP 447. Sampling Finite Populations (3)
This course will discuss the basic concepts of sampling theory including simple random and systematic sampling, ratio and regression methods of estimation, stratified and cluster sampling, randomized response survey and their applications in health sciences. Prerequisite: MPHP 432. Cross-listed as EPBI 447.

MPHP 460. Health Research Methods I (3)
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 data study 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. Cross-listed as EPBI 460.

MPHP 463. Survey Design and Data Collection in Health Research (3)
The purpose for this course is to provide hands-on experience in designing and conducting surveys in health research. The topics include sampling, types of surveys (e.g., interviews, mail, telephone, medical records), questionnaire design (i.e., multiple indicator models, index and scale construction, assessing psychometric properties), field operations (i.e., data collection, editing and coding). Cross-listed as EPBI 463.

MPHP 467. Cost-Effectiveness Analysis in Health Care (3)
Evaluation of alternative medical treatments and drug therapies. Topics include cost-benefit, cost-effectiveness and cost-utility analysis. Measuring cost, benefits and health outcomes. Quality of life and other measures of effectiveness will also be addressed. Emphasis on case studies,
course project, and evaluation of publications. Some decision analysis and policy implications will also be included. Cross-listed as EPBI 467.

MPHP 468. The Continual Improvement of Healthcare: An Interdisciplinary Course (3)
The focus of this course is on collaborative work for the benefit of patients and community. Seminar classwork is combined with a field project, in which interdisciplinary student teams apply what they have learned to the improvement activities of a local health care organization. Successful completion of the course depends on participation in seminar sessions and completion of the interdisciplinary student team project. Prerequisite: Consent of instructor. Cross-listed as EPBI 468.

MPHP 488. Gender, Ethnicity, and Health Research (3)
The course is designed to acquaint students with the literature addressing the constructs of race, ethnicity, gender and social class; to examine critically the contexts in which these constructs are often applied; and to assess the relationship between each of these constructs and access to health care, quality of care, and health outcome. Cross-listed as EPBI 488.

MPHP 490. Epidemiology: Introduction to Theory and Methods (3)
Epidemiologic principles and methods needed to understand population-based statements of illness and health. Descriptive epidemiology, analytic epidemiology, and epidemiologic inference. Classification, morbidity and mortality rates, sampling, screening, epidemiologic models, field trials, controlled epidemiologic surveys, sources of bias, and causal models. Cross-listed as EPBI 490.

MPHP 491. Epidemiology: Application of Theory and Methods (3)
This course will cover the methods used in the conduct of epidemiologic research. Topics include: case control studies, cohort studies, clinical trials, cross-section studies, exposure measurement, subject selection, validity, reliability, sample size and power, effect modification, confounding, bias, chance, risk assessment, frequency matching, matching, meta-analysis. Analysis of data sets will be given as well. A statistical package will be used to analyze all data sets. Prerequisites: MPHP 431 and MPHP 491. Cross-listed as EPBI 491.

MPHP 492. Epidemiology: Statistical Methods (3)
The course focuses on strategies for model building. Topics include the analysis of cohort and case-control studies where the emphasis is on risk estimation. Students are expected to analyze a database obtained from a cohort study of the effects of maternal alcohol drinking on outcomes of pregnancy and from a related nested case-control study. The analysis of survival data focuses on parametric and non-parametric techniques and utilizes data from an ongoing study of quality of life of patients on kidney dialysis. In addition to regular class assignments, students are expected to write a report on each of the databases and present results to the class. Prerequisites: MPHP 431 and MPHP 491. Cross-listed as EPBI 492.

MPHP 493. Infectious Disease Epidemiology (3)
The epidemiology, prevention and control of representative infectious disease models. Emphasis on the triad of agent, host and environment and the molecular and genetics basis of agent and host interaction in the population. Prerequisites: MPHP 490 and microbiology course. Cross-listed as EPBI 494.

MPHP 501. Graduate Seminar (0)
Students and faculty have the opportunity to meet on a weekly basis to discuss papers in the literature. Each week a paper is reviewed in detail by a graduate student in a formal presentation. Discussion of the strengths and weaknesses of the work gives insight into the complexities of investigations in the public health arena. Cross-listed as EPBI 501.

MPHP 652. Public Health Capstone Experience (3-9)
The Public Health Capstone Experience consists of a 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 order priorities for major projects according to definable criteria; to use computers for specific applications relevant to public health; 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. This course is available only to Master of Public Health students.

Graduate Programs

Department of Anatomy

School of Medicine, Room W-520
Phone: (216) 368-2433

The development of independence in research and experience in teaching are essential factors for scholars. 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.

The graduate program in anatomy fulfills all requirements of the CWRU School of Graduate Studies. Graduate studies in the Department of Anatomy can lead to the master of science degree in applied anatomy and to the doctor of philosophy degree. The master’s degree may be obtained as part of a joint degree program for qualified individuals participating in other programs at CWRU, such as joint M.D./M.S. or D.D.S./M.S. degrees.

Every graduate student in the Department of Anatomy must successfully complete 17 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 coursework and, for the thesis M.S. and Ph.D. students, laboratory rotations and research, complete the graduate student’s 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.

Please see the Department of Anatomy Web site for additional information: http://www.cwru.edu/med/anatomy/.

Anatomy (ANAT)

UNDERGRADUATE COURSES

ANAT 312. Basic Histology (3)
Fundamental histology course covering microscopic structure, nomenclature, and function of normal cells, tissues, and selected organs (human emphasis).

ANAT 375. Human Evolution: The Fossil Evidence (3)
Survey of 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 for evolutionary biology. Prerequisites: ANTH 103 and BIOL 110. Cross-listed as ANTH 375.

ANAT 377. Human Osteology (4)
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). Cross-listed as ANTH 377.

ANAT 383. Evolutionary Anatomy (4)
This course will introduce graduate and advanced undergraduate students to primates comparative anatomy and will examine methods of reconstructing physiology and behavior from fossil remains. Prerequisites: ANTH 103 and BIOL 110. Cross-listed as ANTH 383.

ANAT 384. Development and Evolution of the Vertebrate Skull (3)
This course will approach vertebrate cranial diversity from the perspective of our rapidly improving knowledge of craniofacial morphogenesis. The course will thoroughly review craniofacial embryology, including new data regarding the genetics of pattern formation, and will cover all major events in vertebrate craniofacial evolution. Prerequisite: Permission of instructor.

ANAT 391. Embryology (3)
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. One or two sessions will be devoted to studying material with the light microscope. Prerequisite: BIOL 220.

ANAT 398. Anatomy Departmental Seminar (1)
During the first half of the course, the organization, preparation, and delivery of oral scientific presentations are discussed. During the second half of the course, students, faculty, and invited speakers give presentations. These presentations include literature reviews and/or summaries of individual research projects. Reports on current research opportunities and ethical issues will also be presented.

ANAT 399. Independent Study (1-4)
(Credit as arranged.) Student must obtain approval of a supervising professor before registration and list the professor’s name on the schedule card.

GRADUATE COURSES

ANAT 410. Medical Gross Anatomy (3)
An in-depth review and introduction to human gross anatomy. The course will be based on the curriculum at the CWRU School of Medicine and lectures will be given by the same faculty. One hour of lecture will precede 3 hours of dissection laboratory Monday through Friday. Lectures and dissection labs will cover all human anatomy, i.e., thorax, abdomen, pelvis and perineum, extremities and back, and head and neck. This is an intense course to which students should be prepared to devote more time than the scheduled hours of 1:00 to 5:00 p.m. Dissection labs are open 24 hours and a teaching assistant is available every morning. Prerequisite: Written permission of course director. B.A./B.S. or fourth year undergraduate.

ANAT 411. Gross Anatomy (2-6)
Dissection of the adult human cadaver. Prerequisite: Consent of instructor.

ANAT 412. Histology and Ultrastructure (3)
General histology and ultrastructure, with histo-physiological correlations.

ANAT 413. General Histology Laboratory (2)
Microscopic structure of tissues and organs.

ANAT 414. Neurological Anatomy (3)
This course provides a current and comprehensive survey of the structure of the human nervous system. It covers concepts which will be of practical value to students needing an understanding of the working mechanisms of the nervous system. The viewpoints of three closely dependent fields, neuroanatomy, neurophysiology and neurology, are presented, not with a view to covering them exhaustively but in the belief that a truly useful understanding of the morphology of the nervous system can only be attained by bringing together these three disciplines.

ANAT 424. Neural Integrative and Regulatory Mechanisms (3)
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. Prerequisite: ANAT 414 or permission.

ANAT 425. Techniques in Microscopy (3)
The microscopic technique course is designed for students to learn the basic knowledge and skills on light microscopy. Students will learn, through demonstration and hands-on experience, how to prepare complete microscopic slides. Routine histological stains, histochemical and immunohistochemical stains will be covered. Some knowledge about electron microscopy and confocal laser scanning microscopy will also be introduced.

ANAT 429. Medical Microscopic Anatomy (3)
This course covers condensed material in a microscopic anatomy course in most U.S. medical school curriculum. It is intended for students who are interested in professional schools of medicine, den-
tistry, nursing or allied health sciences or who simply want to learn the structure and functions of cells, tissues and organs of the human or mammalian body. It is for students who want to learn the subject material in a shorter summer session. It also serves as a review course for health professional students. The course will cover basic biology of cells and tissue types of the body. It will further cover how cells and tissues are organized to perform specific functions in organs and organ systems. The format includes lectures followed by laboratory sessions on the same topic using microscope slides and PowerPoint presentations. Optional weekly or biweekly review sessions will be scheduled for students who need these extra sessions.

ANAT 431. Statistical Methods I (3) Cross-listed as EPBI 431.

ANAT 435. Morphometrics of Biological Shape (3)
Morphometrics is the measurement of biological shape. This course will focus on the collection of data, especially landmarks, from biological forms directly and especially via imaging. We will use best fit and interpolant algorithms (Geometric Morphometrics) to compare two and three dimensional landmark configurations of an individual over time, different individuals to each other, and individuals to average forms. The results are interpreted with standard multivariate statistical techniques. These tools are especially relevant to applications in medical imaging and other areas of biometrics. Background in linear algebra and basic statistics is desirable.


ANAT 475. Human Evolution: The Fossil Evidence (3) (See ANAT 375.) Prerequisites: ANTH 103 and BIOL 110. Cross-listed as ANTH 475.

ANAT 477. Human Osteology (4) (See ANAT 377.) Cross-listed as ANTH 477.

ANAT 483. Evolutionary Anatomy (4) (See ANAT 383.) Cross-listed as ANTH 483.

ANAT 484. Development and Evolution of the Vertebrate Skull (3) (See ANAT 384.) Prerequisite: Graduate standing or permission of instructor.

ANAT 491. Embryology (3) 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 metazoon organisms. One or two sessions will be devoted to studying material with the light microscope. Prerequisite: BIOL 220.

ANAT 496. Fluorescence Spectral Imaging (2) Approaches to extracting quantitative biochemical and biophysical information from living cells and tissues using optical methods. Topics covered include basic fluorescence spectroscopy, digital image processing, low light level image detectors, fluorescence ratio imaging, multi-parameter fluorescence imaging, confocal imaging and fluorescence photo-bleaching recovery techniques. Includes both technology and modern applications.

ANAT 498. Anatomy Departmental Seminar (1) During the first half of the course, the organization, preparation, and delivery of oral scientific presentations are discussed. During the second half of the course, students, faculty, and invited speakers give presentations. These presentations include literature reviews and/or summaries of individual research projects. Reports on current research opportunities and ethical issues will also be presented.

ANAT 499. Independent Study (1-4)

ANAT 503. Readings and Discussions (1-18) In-depth consideration of special selected topics through critical evaluation of the literature.

ANAT 513. Surgical Anatomy of the Thorax and Abdomen (3) 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.

ANAT 601. Research (1-18) (Credit as arranged.)

ANAT 610. Oxygen and Physiological Function (2) 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.

ANAT 651. Thesis M.S. (1-9) Master’s Thesis Plan A.

ANAT 701. Dissertation Ph.D. (1-18) (Credit as arranged.)

ANAT 702. Appointed Dissertation Fellowship (9)

Department of Anesthesiology

2536 Lakeside Hospital Building Phone: (216) 844-8077

The master of science degree in anesthesiology is open to students who have an undergraduate degree from an institution recognized by Case Western Reserve University. Undergraduate degrees in biology, chemistry, and physics are preferred. Students who have received an undergraduate degree in an area other than a science may qualify for admission to the program if they have completed two years of biology with laboratory (including one semester each of human anatomy and human physiology), two years of chemistry with laboratory (including one year of organic chemistry), one year of physics with laboratory, one year of calculus for pre-medical/life sciences, and one year of English with one semester of expository writing. Students who have not completed a degree in a science or satisfied the aforementioned science requirements will not be considered for admission until these requirements are satisfied.

Students interested in obtaining admission to the program should present an above-average undergraduate GPA and complete the Medical College Admission Test (MCAT). International applicant admission requirements also include TOEFL (Test of English as a Foreign Language) and Education Credential
Anesthesiology (ANES)

ANES 403. Physical Methods for Anesthesiologist Assistants (2)
Basic concepts in electricity, gas/liquid interfaces, acid/base balance, immunology, hematology, statistics and computer systems needed for subsequent work. Prerequisite: Consent of department.

ANES 440. Patient Monitoring and Instrumentation I (3)
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. Prerequisite: Consent of department.

ANES 441. Patient Monitoring and Instrumentation II (3)
Continuation of ANES 440. Prerequisite: ANES 440.

ANES 456. Applied Physiology for Anesthesiologist Assistants I (3)
Basic and applied human systems physiology with emphasis on topics and areas of special concern to the anesthetist. Prerequisite: Consent of department.

ANES 458. Applied Physiology for Anesthesiologist Assistants II (3)
Continuation of ANES 456. Prerequisites: ANES 403 and ANES 456.

ANES 460. Introduction to Anesthesia (2)
Introduction to basic concepts dealing with clinical anesthesia. Medical terminology, human anatomy, medical chart interpretation, and drug dosage calculations. Prerequisite: Consent of department.

ANES 461. Orientation to Clinical Experience (3)
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. Prerequisite: Acceptance in the M.S. program in anesthesia.

ANES 462. Anesthesia Clinical Correlation I (1)
A series of conferences presented by students that applies to anesthetic theory as it relates to the clinical experience. Specific anesthetic situations are emphasized. Prerequisite: ANES 460.

ANES 463. Anesthesia Clinical Experience I (3)
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. BLS (Basic Life Support) certification is required for course completion. Prerequisite: ANES 461.

ANES 464. Anesthesia Clinical Correlation II (1)
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 Morbidity and Mortality conferences are included. Prerequisite: ANES 462.

ANES 465. Anesthesia Clinical Experience II (3)
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. Prerequisites: ANES 463 and BLS certification.

ANES 467. Anesthesia Clinical Experience III (4)
Extended exposure to all of the clinical subspecialties of anesthesia (obstetrics, pediatrics, neurosurgery, cardiovascular, etc.). Students alternate through rotations at several area hospitals. Prerequisites: ANES 465 and ACLS certification.

ANES 468. Anesthesia Clinical Correlation III (1)
The second-year equivalent of ANES 462. Prerequisite: ANES 464.

ANES 469. Anesthesia Clinical Experience IV (8)
A continuation of ANES 467. A comprehensive clinical examination is administered at the end of the semester. Prerequisite: ANES 467.

ANES 470. Anesthesia Clinical Correlation IV (1)
The second-year equivalent of ANES 464. Prerequisite: ANES 468.

ANES 471. Anesthesia Clinical Experience V (8)
A continuation of ANES 469. A comprehensive clinical examination is administered at the end of the semester. Prerequisite: ANES 469.

ANES 475. Pharmacology for Anesthesiologist Assistants (2)
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. Prerequisite: Consent of department.

ANES 477. Electrocardiography for Anesthesiologist Assistants (2)
Diagnosis and practical applications of electrocardiography and echocardiography as monitoring techniques in the operating room. Prerequisite: Consent of department.

ANES 480. Fundamentals of Anesthetic Sciences I (1)
A continuum of courses over the fall and spring semesters that covers a series of topics in basic medical science with spe-
cial emphasis on the effect of anesthetics on normal physiology. An examination is administered at the end of each semester. Prerequisite: Consent of department.

**ANES 499. Clinical Remediation (1-10)**
(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. Prerequisite: Consent of department.

**ANES 580. Fundamentals of Anesthetic Sciences II (1)**
The second-year equivalent of ANES 480. An examination is administered at the end of each semester. Prerequisite: ANES 480.

**ANES 599. Clinical Remediation (1-10)**
(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. Prerequisite: Consent of department.

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**Department of Biochemistry**

**School of Medicine, Room W-427**

**Phone:** (216) 368-3344  
**Fax:** (216) 368-3419

**Michael Weiss, M.D., Ph.D., Chair**

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 on 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 combined doctor of medicine/doctor of philosophy. Many interdisciplinary and interdepartmental programs available with other departments in the School of Medicine and at Case Western Reserve University provide many additional avenues of study.

Research interests within the department include a broad spectrum of modern biochemical topics in six broad areas: enzymology, protein chemistry, structural biology, gene expression, cell biology, and molecular medicine/gene therapy. These areas are described in detail later in this section. 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.

**UNGERGRADUATE PROGRAMS**

Please see the College of Arts and Sciences section of this publication.

**GRADUATE PROGRAMS**

**Master’s degrees**

The master’s of science degree programs provide advanced training for students who wish to continue beyond the B.A. or B.S. degree without committing themselves to the Ph.D. curriculum. Two lines of study are offered: the three-year research program leading to the master’s of science in biochemical research and the two-year coursework program leading to the master’s of science in biochemistry.

**Master of Science Degree in Biochemical Research**

The program leading to the M.S. 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 student pursues a flexible and individually designed schedule related to his or her research career and interests, which leads to an independent research project 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 opportunities. A more complete description of the program, admission policies and financial aid is available from the departmental office.

**Master of Science Degree in Biochemistry**

The program leading to the M.S. 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. The student typically enrolls in three courses for each of four semesters. Required courses are BIOL 407 (General Biochemistry) and BIOL 408 (Molecular Biology). Other lecture courses are selected by the student in consultation with an academic advisor who is assigned to the student upon matriculation into the program. A more complete description of the program and admission policies is available from the departmental office.

**Ph.D. in Biochemistry**

The aim of the Ph.D. 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. Schedules are flexible and are individually tailored to each student’s needs. Although students choose from the various tracks within the department, they 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 select a multidisciplinary, integrated curriculum in cellular and molecular biology in addition to specialized courses in biochemistry.

Most Ph.D. students in biochemistry are admitted through the Biomedical Sciences Training Program (BSTP). This program, which combines 13 graduate programs in the School of Medicine, is described under a separate listing in this publication. A complete description of the program, including research activities,
admission policies and financial aid, may be obtained from the departmental office or the BSTP coordinator.

**Integrated Graduate Program in Biochemistry**

Undergraduate biochemistry majors in the College of Arts and Sciences are eligible to apply for an Integrated Graduate Program in Biochemistry. This program allows CWRU biochemistry majors to enter graduate school at the end of the junior year and to obtain the B.A. degree while completing the first year of graduate school at CWRU. The first year of coursework in graduate school substitutes for the last year of undergraduate coursework. The admitted student takes the same coursework and chooses a thesis advisor from among the faculty in the same fashion as do other Ph.D. students. The program is highly competitive, and only one or two outstanding graduates may be selected in any year.

**Biochemistry Medical Scientist Training Program**

Students may pursue a Ph.D. in biochemistry as part of the combined M.D./Ph.D. program. Information on this program may be obtained from the departmental office or the Medical Scientist Training Program coordinator. Please see the separate listing in this publication for information on the MSTP program.

**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 CWRU departments and with scientists at other Cleveland research institutions. The specific areas of active research within the department are outlined below.

**Enzymology**

Research in this area studies the detailed functions of proteins and RNAs as biological catalysts. Specific areas of research include RNA helicases, RNA polymerase, enzymes of fatty acid synthesis, RNA splicing, processing of peptide hormone precursors, and enzymes of intermediary metabolism.

**Protein Chemistry**

Research in this area combines chemical, biochemical, and molecular biological approaches to define critical structural and functional regions of proteins. A major focus is the posttranslational modification of proteins, including glycosylation, proteolysis, phosphorylation, methylation, and oxidation. Proteins being studied are involved in the initiation of protein translation, RNA transcription, signaling by hormones and neurotransmitters, and intermediary metabolism.

**Structural Biology**

Three dimensional structures of proteins and nucleic acids are required to understand the detailed function of these complex molecular systems. Techniques include x-ray crystallography, as well as NMR and Raman spectroscopy. Areas of research include hormones, neurotransmitters and their receptors, bacterial toxins, dehydrogenases, and transcription factors.

**Gene Expression**

Control of development and tissue-specific responses necessary for the survival of multicellular organisms is accomplished by several mechanisms that regulate gene expression. Research in the department is concerned with hormonal and developmental control of gene transcription, pre-mRNA splicing, initiation of protein synthesis, post-translational modifications of proteins.

**Cell Biology**

The control of the metabolism, differentiation, and cell signaling within and between cells is a key part of understanding the interplay necessary for the growth and metabolic regulation of multicellular organisms. Research in the department is focused on protein traffic, inflammatory responses, G-protein coupled receptors, transforming growth factors, enzyme regulation in metabolism, and the control of respiration.

**Molecular Medicine/Gene Therapy**

Many human diseases are caused by defects in specific proteins caused by mutations. Delivery of normal DNA replacement to cells harboring defective genes is the goal of research in the department. Other efforts are aimed at understanding the structure and function of biochemical targets of therapeutic agents, which in turn may lead to the rational design of new drugs and treatments. Research in the department is targeted at cancer, diabetes, and schizophrenia. Other work is developing transgenic mice as models of human diseases.

**Biochemistry (BIOC)**

**GRADUATE COURSES**

**BIOC 407. General Biochemistry (4)**

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. Prerequisite: CHEM 223 or CHEM 224. Cross-listed as BIOL 407.

**BIOC 408. Molecular Biology: Genes and Genetic Engineering (4)**

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 development. Current literature is discussed briefly as an introduction to techniques of genetic engineering. Prerequisite: BIOL 205 or BIOC 307. Cross-listed as BIOL 408.

**BIOC 412. Macromolecular Structure and Function (3)**

Interactions between biomolecules are discussed in a system-based approach that stresses quantitative and structural characterization. Topics discussed include site-directed mutagenesis of enzymes, DNA-protein and protein-protein interactions. Prerequisites: BIOC 307 and CHEM 301 and CHEM 302.
BIOC 420. Molecular Genetics of Cancer (3)
Using a combination of lectures and student presentations, this course provides an in-depth analysis of cancer as a genetic disease in the Mendelian sense of inheritance and in the sense of causation by somatic mutation. The objectives of the course are to examine both the proto-oncogenes and tumor suppressor genes that are the targets of oncogenic mutations and the mechanisms of mutational change. Discussions emphasize experimental approaches used to identify and study oncogenes and tumor suppressor genes. This course also covers viral mechanisms of oncogenesis which involve interactions among viral proteins and the products of cellular proto-oncogenes or tumor suppressor genes. Prerequisites: CBIO 453 and CBIO 454 and CBIO 455 and CBIO 456. Cross-listed as MBIO 420 and MVIR 420.

BIOC 430. Advanced Methods in Structural Biology I (3)
Provides students with an in-depth introduction to biophysical techniques used to quantify macromolecular structures. A major part of the course will deal with the use of nuclear magnetic resonance to derive a 3-D structures of macromolecules in solution. Other topics include electron spin resonance, absorption, fluorescence and circular dichroism spectroscopies, Raman and infrared spectroscopies and methods used in modeling. Offered with BIOC 431 in alternate years. BIOC 430 deals with protein hydrodynamics and thermodynamics, crystallography, and mass spectrometry. The course will be mostly lecture-based and will provide an extensive overview for graduate students specializing in structural biology. Cross-listed as CHEM 430, PHRM 430, and PHOL 430.

BIOC 431. Advanced Methods in Structural Biology II (3)
This course provides an introduction to biophysical techniques for graduate students who are interested in structural biology and biophysical chemistry. Offered with BIOC 430 in alternate years. Advanced Methods I (430) focuses on NMR and optical spectroscopies. Advanced Methods II deals with protein hydrodynamics and thermodynamics, crystallography, and mass spectrometry.

BIOC 434. Structural Biology of Proteins, Enzymes, and Nucleic Acids (3)
A detailed consideration of the structure and function of proteins and enzymes. Topics include: enzyme structure, kinetics, and mechanisms; structural biology of proteins and protein-DNA complexes; and techniques for structural analysis. Prerequisite: BIOL 205 or BIOC 307. Cross-listed as BIOL 434.

BIOC 452. Nutritional Biochemistry and Metabolism (3)
Prerequisite: BIOC 307 or equivalent. Cross-listed as NTRN 452.

BIOC 453. Protein Biosynthesis (3)
Mechanism and regulation of protein biosynthesis with emphasis on eukaryotic systems. The area is examined in fundamental detail to provide the student with an understanding of biochemical methodology and techniques at the level of the research literature. Topics include initiation and elongation in protein synthesis; mRNA structure and function; secretory proteins; influence of viral infection on protein synthesis. Prerequisite: BIOC 307.

BIOC 473. Protein Biosynthesis (3)
Didactic lectures cover the areas of enzyme mechanisms of DNA biosynthesis and recombination, RNA-dependent DNA synthesis and RNA transcription and processing, using examples from viral systems. Emphasis is on understanding basic research design to help students make the transition from the literature to the lab bench. Prerequisite: BIOC 407. Cross-listed as CLBY 474 and MVIR 474.

BIOC 486. Protein Structure, Folding, and Design (3)
Reading in the current literature with computer program and model-building workshops. Prerequisite: BIOC 407.

BIOC 523. Advanced NMR Spectroscopy in Structural Biology (3)
Cross-listed as PHOL 523.

BIOC 601. Biochemical Research (1-18)
(Credit as arranged.) Prerequisite: BIOC 407.

BIOC 605. Independent Project in Biochemical Research (1-18)
(Credit as arranged.) Limited to students in the M.S. program in biochemical research. Prerequisite: BIOC 407 and BIOC 601.

BIOC 611. Biochemistry Seminar I (1)
Discussion of current research. Prerequisite: BIOC 407.

BIOC 612. Biochemistry Seminar II (1)
Discussion of current research. Prerequisite: BIOC 407.

BIOC 618. Special Topics in Biochemistry (2)
Prerequisite: BIOC 407.

BIOC 641. Proposition I (2)
Design of research proposal. Prerequisite: BIOC 407.

BIOC 643. Proposition II (2)
Design of research proposal. Prerequisite: BIOC 407.

BIOC 651. Thesis M.S. (1-6)
(Credit as arranged.)

BIOC 701. Dissertation Ph.D. (1-18)
(Credit as arranged.)

Biomedical Sciences Training Program

School of Medicine, Room W-G46
Phone: (216) 368-3347
E-mail: bstp@po.cwru.edu

The Biomedical Sciences Training Program (BSTP) offers graduate studies leading to the Ph.D. degree. The program is designed to prepare qualified and motivated students for careers in research and teaching.

The BSTP is comprised of 14 graduate programs in the School of Medicine and the College of Arts and Sciences. These programs have more than 200 faculty, based in both basic science and clinical departments. The research of this faculty covers the entire range of biomedical research. 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.

THE FIRST YEAR

Coursework
Students take an integrated series of courses in cell and molecular biology (CBIO 453, 454, 455, and 456). This year-long series emphasizes the molecular approach that forms the basis of modern biology. Qualified students also may take more specialized elective courses.
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 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 adviser

In February of the first year, students select an adviser for the dissertation research. Each student also joins the training program with which the adviser is affiliated. Once a student has chosen a program, the specific requirements of that program are followed to obtain the Ph.D. The emphasis of the Ph.D. work is on research, culminating in the completion of an original, independent research thesis.

Participating Training Programs

Anatomy
Biochemistry
Biology
Cell biology
Developmental and Human Genetics
Developmental Biology
Environmental Health Sciences
Molecular Biology
Molecular and Cellular Basis of Disease
Molecular Virology
Neuroscience and Bioengineering
Neurosciences
Nutritional Sciences
Pharmacological Sciences

Training faculty, course offerings and individual degree requirements are described in detail in the separate listings for each of these programs.

Biomedical Sciences Training Program (BSTP)

BSTP 400. Research Rotation in Biomedical Sciences Training Program (0-6)
Prerequisite: Consent of MSTP or BSTP program coordinator.

Cell Biology Program

Pathology 115
Phone: (216) 368-5544
E-mail: amt10@po.cwru.edu

The Cell Biology Program provides educational and research opportunities through its journal clubs and colloquia and through graduate training toward the Ph.D. degree. The research environment includes all the basic science departments of the School of Medicine, the Department of Biology, and several laboratories at University Hospitals of Cleveland and the Cleveland Clinic Foundation. These departments collectively cover a diverse set of areas of contemporary interest in the cell biology of higher animals, plants, yeast, and other microorganisms. These include the extracellular matrix, secretion and endocytosis, cell adhesion, the cytoskeleton, the nuclear envelope, and others. Many of these areas interface with local research in biochemistry, genetics, immunology, molecular biology, neuroscience, pharmacological sciences, and physiology and biophysics.

First-year graduate students follow the Correlated Curriculum in Cell and Molecular Biology (CBIO 453-456, 12 credit hours) along with students from all graduate departments. They also complete three laboratory rotations (starting July 1) among the laboratories of training faculty, which span the entire campus. The goal of the rotations is to guarantee that the student has sufficient breadth of familiarity with cell biology faculty to allow him or her to make the best choice of a permanent research laboratory. In all cases, this selection must be made, with the consent of the sponsor and his or her department, before nine months have elapsed. First-year students also actively participate in the weekly Cell Biology Journal Club and attend the cell biology colloquia.

During the subsequent years, students devote most of their time to laboratory research, while also attending courses, seminars, and journal clubs. The courses may be given by any department or program on campus. Students must take a total of 36 credit hours of courses and maintain a B average.

Preparation for the qualifying exam and the writing of research proposals and the dissertation match the norm of the department in which the student elects to do his or her thesis work; however, the content of the exams and proposal(s) must have a clear emphasis on cell biology itself.

All efforts should be made to complete the Ph.D. within four years. It is expected that the student will be the first author on at least two articles accepted for publication in highly regarded scientific journals.

Participating Faculty


Courses in Cell Biology

Required (first year)
CBIO 453-456. Correlated Curriculum in Cell and Molecular Biology (12 credits)

Representative Electives
BIOC 408 Molecular Biology: Genes and Genetic Engineering (4)
PHRM 413 Molecular Pharmacology (3)
PATH 444 Neurodegenerative Diseases: Pathological, Cellular and Molecular Perspective (3)
NEUR 473 Introduction to Neurobiology (3)
PATH 477 Cellular and Molecular Basis of Immune Dysfunction (3)
PATH 481 Immunology of Infectious Diseases (3)
GENE 500 Advanced Eukaryotic Genetics (3)
GENE 510 Human Genetics (3)
GENE 520 Gene Expression in Replication and Differentiation (3)
CLBY/PATH 527 Mechanisms of Cell Growth Control (3)
CLBY 701 Dissertation (credit as arranged)

**Cellular Biology (CLBY)**

**GRADUATE COURSES**

CLBY 416. Fundamental Immunology (3)
Cross-listed as PATH 416.
CLBY 417. Cytokines: Function, Structure and Signaling (3)
Cross-listed as BIOL 417 and PATH 417.
CLBY 466. Cell Signaling (3)
Cross-listed as PHOL 466.
CLBY 468. Membrane Physiology (3)
Cross-listed as PHOL 468.
CLBY 474. RNA and DNA Biosynthesis (3)
Cross-listed as BIOC 474 and MVIR 474.
CLBY 487. Cell Biology of the Nucleus (3)
Prerequisites: CBIO 453 and CBIO 454 or consent of instructor. Cross-listed as PATH 487.
CLBY 488. Yeast Genetics and Cell Biology (3)
Cross-listed as Mbio 488.
CLBY 501. Genetic Control of Development (3)
CLBY 518. Cell Surfaces and Matrices (3)
Lecture and discussion course emphasizing current advances in cell-cell and cell-substrate interactions. Cross-listed as NEUR 518.
CLBY 519. Molecular Biology of RNA (3)
Cross-listed as Mbio 519.
CLBY 601. Special Problems (1-18)
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.
CLBY 701. Dissertation Ph.D. (1-18)
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.

**Department of Environmental Health Sciences**

**School of Medicine, Room W-G19**
**Phone: (216) 368-5961**

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. This realization was the impetus for the creation of the department. 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 participates in the integrated Biological Sciences Training Program (BSTP) and offers M.S. and Ph.D. degrees. In addition to participating in the flexible program and offering research opportunities to medical students, the department sponsors an M.D./M.S. program that allows students to complete the requirements for both degrees within a four-year period.

**GRADUATE PROGRAMS**

The master of science and doctor of philosophy degree programs are designed to increase the student’s knowledge of environmental health science as well as to provide a firm foundation in the life sciences. The programs are multidisciplinary and emphasize cancer biology, environmental toxicology, and nutrition and toxicology. They are based on a core classroom curriculum in the biological sciences, including biochemistry, biostatistics, microbiology, genetics, molecular biology, pharmacology, epidemiology, and toxicology.

Current areas of research of the participating faculty include genetic toxicology, xenobiotic metabolism, cytogenetics, radiation biology, DNA damage and repair, radical mechanisms in carcinogen metabolism, approaches to the study of structure, activity relationships, and clinical and forensic toxicology.

**Master’s Degree Programs**

The department also offers a doctor of medicine/master of science 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.

Thesis (Plan A) and non-thesis (Plan B) master of science degree programs are offered to students who have completed an undergraduate degree program from an accredited university or college. Course schedules are arranged to accommodate individuals who wish to enroll on a part-time basis. Both programs require a total of 27 semester hours at the 400 level or higher. A minimum of 27 semester hours of formal course work is required for the non-thesis degree, and a minimum of 18 semester hours is required for the thesis degree. The remaining credits may be research credits (EVHS 651). Students enrolled in the non-thesis program must pass a comprehensive examination before being awarded the degree. The requirements for the master’s program must be completed within five consecutive calendar years after matriculation.

**Ph.D. Program**

Admission to the doctoral degree program may follow successful completion of the undergraduate degree or master’s degree program. A minimum of 36 semester hours of graduate study is required for students entering with an undergraduate degree, and 18 semester hours typically are required for students who have completed an M.S. program. A proposal-type examination is required before admission to candidacy. Awarding of the Ph.D. is dependent on successful completion of an original, independent research project under the guidance of a faculty adviser as well as the submission and defense of a written dissertation. There is no foreign
Financial support is available for Ph.D. candidates and for a limited number of full-time master’s degree candidates.

**FACILITIES AND EQUIPMENT**

Research laboratories and instrumentation are located in the medical school and affiliated hospitals. These include laboratories for general preparation, metabolic studies, and restricted-access toxicology cell culture and biohazard facilities. Supporting these laboratories are specialized rooms for instrumentation, the weighing of toxic substances, constant temperature studies, and low temperature storage.

Equipped terminals are housed within the computer, and microcomputers and modems have a dedicated DEC VAX-I 1/750 computer. Equipment includes centrifuges, liquid scintillation counters, chromatographic equipment (HPLC), spectrophotometers, spectrophuorometers, incubators, freezers, and microscopes. Also, the department has a dedicated DEC VAX-I 1/750 computer, and microcomputers and modern-equipped terminals are housed within the department and at special terminal sites.

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**Environmental Health Sciences (EVHS)**

**GRADUATE COURSES**

**EVHS 401A. Fundamentals of Environmental Health Sciences: Biochemical Toxicology (1.5)**

Fundamentals of biochemical toxicology. Specific topics include oxidations reductive reactions. Phase I and II xenobiotic metabolism, and mechanisms of cellular toxicity.

**EVHS 401B. Effects of Exposure to Environmental Mutagens (1.5)**

Overview of compounds found in the environment. The toxicity, mutagenicity, carcinogenicity, and teratogenicity of these environmental agents and the potential for human exposure to these agents through environmental, occupational and medicinal routes are discussed. Prerequisite: EVHS 402A.

**EVHS 402A. Fundamentals of Environmental Health Sciences: Risk Assessment (1.5)**

This course presents an overview of the scientific approaches used to determine whether environmental agents are potentially dangerous to people. Criteria utilized for establishing exposure limits are presented and short-term assays, epidemiology studies, and clinical trials are discussed and subsequently used to assess the impact of environmental exposure on normal and genetically susceptible individuals.

**EVHS 402B. Fundamentals of Environmental Health Sciences: Biochemical Toxicology II (1.5)**

This core course focuses on pharmacology. General principles of pharmacology, drug transport and absorption, drug metabolism, neuropharmacology, immunopharmacology, and pharmacokinetics are discussed. (See EVHS 402A.)

**EVHS 403A. Radiation Biology: Cells, Tissues, Organisms (1.5)**

Major emphasis on cellular and molecular radiation biology. Includes discussion of the physics and chemistry of radiation; factors that modify the cellular response to radiation; molecular and genetic effects of radiation on cells, individuals and populations; analysis of risks vs. benefits of diagnostic and therapeutic radiation, the molecular biology of the radiation response.

**EVHS 403B. Cellular and Molecular Radiation Oncology (1.5)**

Topics include: time, dose, dose rate, and fractionation in the therapeutic use of radiation; molecular biology of the radiation response and manipulation of the response for therapeutic benefit; the physics, chemistry, biology, and molecular biology of alternate treatment modalities, including hyperthermia and photodynamic therapy.

**EVHS 405. Radioisotopes (3)**

Presents fundamentals necessary for understanding the applications and limitations involved in using radioisotopes in research. Topics include theory of nuclear events, the different types of nuclear decay (their energies, detection, penetration and interaction with matter, shielding, the body burden), use of stable isotopes, considerations for setting up laboratories, including in vitro and in vivo experimental design, complications with toxic materials, and regulations on the use of these materials.

**EVHS 502. Genetic Toxicology II: DNA Damage and Repair (3)**

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 representative of major current areas of interest. Topics covered include fidelity of DNA replication, excision repair, mismatch repair, transcription-linked repair, SOS repair, and recombinational 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. Prerequisites: EVHS 401A, EVHS 401B, EVHS 402A, and EVHS 402B.

**EVHS 506. Independent Study in Environmental Health Sciences (1-6)**

**EVHS 510. Molecular Oncology (3)**

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)**

**EVHS 701. Dissertation Ph.D. (1-9)**

(Credit as arranged.)

**EVHS 702. Appointed Dissertation Fellowship (9)**

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**Department of Epidemiology and Biostatistics**

**School of Medicine, Room W-G57**

**Phone: (216) 368-3195**

The Department of Epidemiology and Biostatistics has outstanding faculty involved in many projects, including HIV/TB research in Uganda and Thailand, genetic epidemiology, minority access to health care, modeling of disease, cancer prevention and control, and AIDS. The department has offices at CWRU and at MetroHealth Medical Center in Cleveland. This hospital has been recognized as one of the premier public hospitals in the United States.
The Department of Epidemiology and Biostatistics has maintained a Scientific Computer Center comprised of three Sun servers that provide an overall disk storage of 500 gigabytes. Two servers are located at CWRU at the School of Medicine and one at MetroHealth Medical Center.

The main server is an Enterprise 450 with four 300 MHz processors and 1 gigabyte of RAM, and the other servers are Sparc 1000. The storage on the enterprise 450 is a raid5 configuration that hosts 240 gigabytes of disk space. Several national health care and demographic databases are stored on the servers.

The department also maintains two computer labs to assist the instructional and research needs of our students, faculty, and other departments in the School of Medicine. The labs are located at CWRU in the School of Medicine and at MetroHealth Medical Center. Each lab is equipped with PCs running Windows NT plus a combination of Microsoft Office 2000 and various statistical applications. Multiple LaserJet printers are available in both labs.

The department offers M.S. and Ph.D. degrees in four tracks: biostatistics, epidemiology, genetic and molecular epidemiology, and health services research. Please also see the separate listing for the Institute for Public Health Sciences in this publication.

Epidemiology and Biostatistics (EPBI)

GRADUATE COURSES

EPBI 407. Basic Biostatistics for Medical Scientists (1)
A survey course designed to introduce residents and fellows of clinical departments to the terminology, concepts and methods of biostatistics as applied to clinical and basic medical research. Medical examples will illustrate statistical concepts and methods including descriptive statistics and graphical presentation, estimation and hypothesis testing, power and sample size considerations, statistical analysis on continuous and categorical data, parametric and nonparametric methods, regression and correlation and basics of statistical modeling and survival analysis.

EPBI 408. Public Policy and Aging (3)

EPBI 410. Principles of Biomedicine for Epidemiology and Biostatistics (3)
Basic principles of human biology, biochemistry and immunology necessary for understanding the biomedical issues in epidemiology and biostatistics.

EPBI 411. Introduction to Behavioral Medicine (3)
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. Cross-listed as MPHP 411.

EPBI 414. Introduction to Statistical Computing (3)
This course introduces the use of computers in epidemiologic investigations and biostatistical applications. Topics covered include an overview of microcomputer hardware, computer operating systems including Windows 95 and UNIX, the use of the Internet and World Wide Web, and database and spreadsheet concepts, along with instruction in the use of several useful software packages for database management, spreadsheet construction, statistical analysis, and graphics. 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 and UNIX systems maintained by the department. Knowledge of basic statistics is recommended but is not vital to understanding the material in this course.

EPBI 420. Structured Computer Programming (3)
This course introduces structured computer programming as a discipline beginning with the precise statement of a problem, development and stepwise refinement of an algorithm using pseudo-code, and the final expression of the algorithm in a modern high-level programming language. Emphasis is placed on both the process of algorithm development and the details of the high-level, structured programming language in which the final algorithm is expressed. Students will be required to complete assignments in the C language using personal computers and UNIX systems maintained by the department.

EPBI 430. Mathematics for Biomedical Sciences (0)
This refresher course is divided into three sections. The first section reviews basic concepts of algebra, linear and quadratic equations, exponential, logarithmic, and trigonometric functions, and differential calculus. The second section reviews linear approximation and integral calculus. The final section reviews matrix algebra and includes discussion of the functional geometric interpretation of vectors and matrices. Statistical concepts such as maximum likelihood and linear modeling are used as examples throughout the three sections.

EPBI 431. Statistical Methods I (3)
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. Prerequisite: Two semesters of calculus or consent of instructor. Cross-listed as ANAT 431 and BIOL 431.

EPBI 432. Statistical Methods II (3)
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. Prerequisite: EPBI 431. Cross-listed as BIOL 432 and MPHP 432.

EPBI 435. Survival Data Analysis (3)
Basic concepts of survival analysis including hazard function, survival function, types of censoring, Kaplan-Meier estimates, log-rank tests, and the generalized Wilcoxon tests. Parametric inference will include exponential and Weibull distributions with and without censoring. The proportional hazard and other methods of handling covariates will be discussed. Prerequisite: EPBI 432.
EPBI 441. Biostatistics I (3)
Sampling techniques and statistical methods applicable to data derived from sampling surveys. Principles of random sampling, stratification, systematic sampling, and cluster sampling. Emphasis on sampling problems encountered in surveys. Prerequisite: EPBI 432.

EPBI 442. Biostatistics II (3)
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. Prerequisite: EPBI 441. Cross-listed as MPH 442.

EPBI 443. Applied Multivariate Analysis (3)
Starts with review of matrix algebra as it pertains to multivariate statistics, then proceeds to study inference about multivariate means: Hotelling’s T2, Manova, Mancova, growth curves, and other linear models, such as simultaneous confidence interval, and linear discriminant analysis and its relationship to logistic model. Prerequisite: EPBI 432.

EPBI 444. Sample Survey Design and Analysis (2)
Prerequisite: EPBI 431 or EPBI 432.

EPBI 446. Experimental Design for Biomedical Sciences (3)
This course deals with basic problems of experimental design. Topics will include completely randomized and balanced incomplete block designs, parallel groups designs, Youden and Latin squares, repeated measurements studies, factorial experiments, and designs for bioassays and response surfaces. Prerequisite: EPBI 432.

EPBI 447. Sampling Finite Populations (3)
This course will discuss the basic concepts of sampling theory including simple random and systematic sampling, ratio and regression methods of estimation, stratified and cluster sampling, randomized response survey and their applications in health sciences. Prerequisite: EPBI 432. Cross-listed as MPH 447 and STAT 468.

EPBI 448. Genetic Analysis Programs (3)
Theory underlying software developed specifically for the genetic analysis of family data. The course will focus mainly on the programs in the SAGE (Statistical Analysis for Genetic Epidemiology) program package, but will also cover other programs that are available. Use of these programs to determine genetic components of complex traits and writing up reports summarizing the results. Prerequisites: EPBI 452 and EPBI 457.

EPBI 450. Clinical Trials and Intervention Studies (3)
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.

EPBI 451. Principles of Genetic Epidemiology (3)
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. Prerequisites: EPBI 431 and EPBI 490 or consent of instructor. Cross-listed as GENE 451.

EPBI 452. Statistical Methods for Genetic Epidemiology (3)
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. Prerequisites: EPBI 431 and EPBI 451.

EPBI 453. Categorical Data Analysis (3)
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. Prerequisite: EPBI 441.

EPBI 454. Population Genetics for Genetic Epidemiology (3)
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. Prerequisite: EPBI 431.

EPBI 455. Genetic Epidemiology of Complex Diseases (3)
This course gives an integrated view to the process of genetic epidemiology as applied to complex diseases. To provide a basis, we initially study concepts of logic and causality. We then investigate the steps involved with a coherent approach to deciphering complex diseases in genetic epidemiology. In particular, the course covers: migrant studies, familial aggregation, linkage, disequilibrium, association studies, characterizing genes, gene-environment interactions, molecular epidemiology, ecogenetics, and pharmacogenomics. Prerequisite: EPBI 451.

EPBI 456. Genetic Epidemiology of Cancer (3)
This course describes the methods of quantitative analysis aimed at elucidating the genetic mechanisms governing or influencing the development of cancer. A variety of designs and analytic approaches appropriate to such investigations will be considered. Specific characteristics of cancer biology, diagnosis, development and mechanism that require consideration in the statistical genetic analysis of cancer data will be elucidated, as well as aspects of population genetics, screening and other issues that have implications for genetic epidemiologic studies of cancer. Prerequisites: EPBI 451, EPBI 452, and EPBI 457.
EPBI 457. Genetic Linkage Analysis (3)
Methods of analyzing human data to detect genetic linkage between disease traits, discreet and continuous, and poly-morphic 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 model score analysis. Prerequisite: EPBI 452.

EPBI 458. Statistical Methods for Clinical Trials (3)
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. Prerequisite: EPBI 432.

EPBI 459. Longitudinal Data Analysis (3)
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-ef-fects models, generalized estimating equations, and missing data. Prerequisite: EPBI 432.

EPBI 460. Health Research Methods I (3)
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. Cross-listed as MPHP 460.

EPBI 461. Health Research Methods II (3)
Focus on measurement strategies for key health services research concepts including case mix, severity of illness, functional status, and patient outcomes. Examine the interplay between physician practice patterns, geography, standards of care, and practice guidelines and patient management and outcomes. Statistical methods especially useful in health services research (e.g., cost/effectiveness and cost/benefit analysis, conjoint analysis, utility assessment, and meta-analysis) will be introduced as well as examining approaches to the assessment of care quality. Prerequisite: EPBI 460.

EPBI 462. Computation Methods in Genetic Epidemiology (3)
Methods for computing genetic likelihoods and estimating genetic parameters; Elston-Stewart algorithm, IBD computation; Markov chain Monte Carlo methods; Gibbs sampling; Newton-Raphson; E-M algorithm. Prerequisites: EPBI 457 and EPBI 482.

EPBI 463. Survey Design and Data Collection in Health Research (3)
The purpose for this course is to provide hands-on experience in designing and conducting surveys in health research. The topics include sampling, types of surveys (e.g., interviews, mail, telephone, medical records), questionnaire design (i.e., multiple indicator models, index and scale construction, assessing psychometrics properties), field operations (i.e., data collection, editing and coding). Cross-listed as MPHP 463.

EPBI 464. Decision Support Systems (3)
Review of methods for decision support in medicine. Discussion of the need for such methods motivated by psychological literature on human perceptual and judgmental limitations. Review of existing methods for aiding decisions including artificial intelligence and statistical methods to enhance diagnostic accuracy (Bayesian methods, classical multivariate analysis, dynamic screening (Markov models). Methods for improving the display of information. Theoretical and empirical limitations of these decision aids. Prerequisite: MATH 491.

EPBI 465. Clinical Decision Analysis (3)
Application of decision trees to clinical problems, estimation and revision of probabilities including Bayes theorem, utility analysis, cost benefit and cost effectiveness, sensitivity analysis, roc curves, and microcomputer programs for clinical decision analysis.

EPBI 467. Cost-Effectiveness Analysis in Health Care (3)
Evaluation of alternative medical treatments and drug therapies. Topics include cost-benefit, cost-effectiveness and cost-utility analysis. Measuring cost, benefits and health outcomes. Quality of life and other measures of effectiveness will also be addressed. Emphasis on case studies, course project, and evaluation of publications. Some decision analysis and policy implications will also be included. Cross-listed as MPHP 467.

EPBI 468. The Continual Improvement of Health Care: An Interdisciplinary Course (3)
The focus of this course is on collaborative work for the benefit of patients and community. Seminar classwork is combined with a field project, in which interdisciplinary student teams apply what they have learned to the improvement activities of a local health care organization. Successful completion of the course depends on participation in seminar sessions and completion of the interdisciplinary student team project. Prerequisite: Consent of instructor. Cross-listed as MPHP 468 and NURS 468.

EPBI 471. Special Topics in Biostatistics (3)
Sampling methods, bioassay, statistical genetics, multivariate analysis, sequential analysis, and stochastic models. Prerequisite: EPBI 442.

EPBI 472. Special Topics in Statistical Genetics (1-4)
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. Prerequisite: EPBI 452.

EPBI 481. Theoretical Statistics I (3)

EPBI 482. Theoretical Statistics II (3)
Prerequisite: MATH 223 or STAT 445 or consent of instructor. Cross-listed as STAT 446.
EPBI 486. Seminar in the Epidemiology of Violence (2)
Graduate standing only. Epidemiology of injuries caused by violent behavior based on analysis of current literature with emphasis on use of epidemiologic tools in studying fatal and nonfatal injuries. Consideration of: (1) methods of surveillance of injuries; (2) epidemiologic analytic studies; (3) development and evaluation of interventions, using national and local databases. Students and field workers will give oral and written presentations.

EPBI 487. Pharmacoepidemiology (3)
Basis principles underlying pharmacoepidemiology, including study design and sample size; ethical issues in drug testing and approval; the use of large databases for research; and pharmacoconomics. Prerequisites: EPBI 490 and EPBI 491.

EPBI 488. Gender, Ethnicity, and Health Research (3)
This course is designed to acquaint students with the literature addressing the constructs of race, ethnicity, gender and social class; to examine critically the contexts in which these constructs are often applied; and to assess the relationship between each of these constructs and access to health care, quality of care, and health outcome. Cross-listed as MPH 488.

EPBI 489. Biomedical Perspectives on Women's Health (3)
This course explores constructs of gender, women's access to healthcare, the quality of women's healthcare, and women's participation in biomedical research. These themes are examined in the context of various substantive areas, including reproductive health, mental health and illness, cancer, and cardiovascular disease. The course also examines methodological issues in study design that are related to gender.

EPBI 490. Epidemiology: Introduction to Theory and Methods (3)
Epidemiologic principles and methods needed to understand population-based statements of illness and health. Descriptive epidemiology, analytic epidemiology, and epidemiologic inference. Classification, morbidity and mortality rates, sampling, screening, epidemiologic models, field trials, controlled epidemiologic surveys, sources of bias, and causal models. Prerequisite: STAT 201 or STAT 207 or STAT 312 or equivalent. Cross-listed as MPH 490.

EPBI 491. Epidemiology: Application of Theory and Methods (3)
This course will cover the methods used in the conduct of epidemiologic research. Topics include: case control studies, cohort studies, clinical trials, cross-section studies, exposure measurement, subject selection, validity, reliability, sample size and power, effect modification, confounding, bias, chance, risk assessment, frequency matching, matching, meta-analysis. Analysis of data sets will be given as well. A statistical package will be used to analyze all data sets. Prerequisites: EPBI 431 and EPBI 490. Cross-listed as MPH 491.

EPBI 492. Epidemiology: Statistical Methods (3)
Focuses on strategies for model building. Topics include the analysis of cohort and case-control studies where the emphasis is on risk estimation. Students are expected to analyze a database obtained from a cohort study of the effects of maternal alcohol drinking on outcomes of pregnancy and from a related nested case-control study. The analysis of survival data focuses on parametric and nonparametric techniques and utilizes data from an ongoing study of quality of life of patients on kidney dialysis. In addition to regular class assignments, students are expected to write a report on each of the databases and present results to the class. Prerequisites: EPBI 432 and EPBI 491. Cross-listed as MPH 492.

EPBI 493. Epidemiology of Cardiovascular Disease (3)
Prerequisite: EPBI 490.

EPBI 494. Infectious Disease Epidemiology (3)

EPBI 495. Psychiatric Epidemiology (3)
Provides an overview of various topics in the area of psychiatric epidemiology. These include a history of psychiatry as it is relevant to psychiatric epidemiology, methodological issues critical to research in this area, the social, ethical, and legal context of research in this area, and the epidemiology of various psychiatric disorders.

EPBI 496. Mathematical Models of Disease (3)
This course covers introductory concepts of stochastic processes, with particular emphasis on Poisson, renewal and Markov processes. Examples highlight the art of modeling, focusing on models of chronic and infectious disease progression and infectious disease transmission. Simulation methods are used to obtain solutions. Prerequisites: EPBI 492 and EPBI 420.

EPBI 497. Epidemiologic Studies of Cancer Etiology and Prevention (3)
Descriptive epidemiology of most major types of cancer. Current knowledge of the role that host factors, lifestyle, chemicals, radiation, viruses, familial factors, and benign diseases play in the etiology of various cancers, as determined from studies of human populations. Applications of epidemiologic principles to programs of primary and secondary cancer prevention. Prerequisite: EPBI 490.

EPBI 498. Cancer Data Analysis (3)
Practical experience in analysis of cancer data including defining a hypothesis, conducting a literature search, designing appropriate analyses, analyzing the data, and reporting the findings. Students analyze cancer data sets currently on file, such as National Cancer Institute's surveillance, epidemiology, and end results (see program data, using contemporary epidemiologic methods as taught in EPBI 432 and EPBI 491). Prerequisites: EPBI 432 and EPBI 492.

EPBI 499. Independent Study (1-18)

EPBI 501. Graduate Seminar (0)
Students and faculty have the opportunity to meet on a weekly basis to discuss papers in the literature. Each week a paper is reviewed in detail by a graduate student in a formal presentation. Discussion of the strengths and weaknesses of the work gives insight into the complexities of investigations in the Public Health arena. Cross-listed as MPH 501.

EPBI 502. Seminar in Genetic Epidemiology (0)
Presentation of original research or recent journal publications by faculty and students.

EPBI 503. Seminar in Biostatistics (0)
Presentation of original research or recent journal publications by faculty and students in the area of Biostatistics.
EPBI 507. Environmental Epidemiology (2)
EPBI 508. Ethics, Law, and Epidemiology (3)
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. Prerequisites: EPBI 490 and EPBI 491.

EPBI 514. Advanced Statistical Computing (3)
Computational aspects of statistics and statistical modeling, including both graphical and analytic methods. The S-Plus programming language. The use of S-Plus and other computational tools to explore and analyze data in ways that are difficult to accomplish with standard statistical packages. Prerequisites: EPBI 414 and EPBI 420 and EPBI 482.

EPBI 515. Secondary Analysis of Large Health Care Data Bases (3)
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 context, 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. Prerequisites: EPBI 414 or equivalent; EPBI 431 or EPBI 460 and EPBI 461 (for HSR students) or EPBI 495 (for EPI students).

EPBI 535. Topics in Advanced Survival Analysis (3)
Topics or current research interest in survival analysis. Topics may change from year to year. Prerequisite: EPBI 435.

EPBI 563. Pattern Recognition Techniques in Biomedical Research (3)

EPBI 592. Selected Topics in Epidemiology (1-10)
Vaccine development; epidemic models; nutritional epidemiology, genetic epidemiology; opportunistic infections; nosocomial infections; prevention strategies.

EPBI 601. Master's Project Research (1-18)
EPBI 602. Practicum (1-3)
EPBI 651. Thesis M.S. (1-18)
Prerequisite: Departmental prospectus form.

EPBI 701. Dissertation Ph.D. (1-18)

Department of Family Medicine

The Department of Family Medicine offers a master’s degree in family medicine. The program includes basic training in biostatistics, epidemiology and research methods, with a specific emphasis on the family. The department has particular research strengths in health services and prevention.

Family Medicine (FAMD)

GRADUATE COURSES

FAMD 421. Professional Academic Ethics (3)
What it means to be a successful member of the professoriate in an academic medical center is explored through a case-study approach in academic ethics. Topics include: higher education governance, promotion and tenure, participation in school and university committees, informed consent, and grievance procedures.

FAMD 601. Independent Study (1-18)
FAMD 651. Thesis M.S. (1-18)
Center for Adolescent Health

Frederick C. Robbins, M.D.
Professor Emeritus, Dean Emeritus, and Director of the Center
School of Medicine, Room W-G51
Phone: (216) 368-3190

The School of Medicine established the Center for Adolescent Health in 1990 in recognition of the multidimensional, biopsychosocial problems of contemporary youth. It was formed by educators and researchers from a variety of disciplines seeking to bring their expertise to bear on the serious problems facing youth. The center seeks to address these issues through an integrated, transdisciplinary approach that incorporates research, professional education, programmatic intervention, and collaboration among community agencies and programs. This unique program has four objectives:

- To promote and coordinate collaborative research activities relevant to adolescents;
- To provide interdisciplinary educational training at undergraduate, post-baccalaureate, and post-graduate levels for professionals interested in adolescent health;
- To serve as a resource for Greater Cleveland community agencies that provide services for adolescents; and
- To help promote the development of rational public policies addressing health and social issues that concern youth.

Although based at the School of Medicine, the center has developed relationships with other schools and departments at Case Western Reserve University and the community at large. In addition, the center is the umbrella organization for Cuyahoga County’s Adolescent Consortium, a networking organization for local youth-serving agencies. In addition, the center provides evaluation services and consultation to community-based youth-serving projects.

Current research interests of the faculty include adolescent sexuality, mental health, school-based and school-linked health care, and interpersonal violence.

Center for Bio-architectonics

Raymond J. Lasek, Ph.D.
Professor and Director of Center
School of Medicine, Room E-718
(216) 368-2930

Bio-architectonics is the study of complex biological architectures. This unit was established to explore practical and integrative approaches for analyzing complex biological patterns. Ultimately, biological data take their meaning only in relation to living systems. Often, however, the complexities of these systems make it difficult to put the detailed data back into the context of real organisms. This center is dedicated to working out the methodology by building this bridge.

The center emphasizes two concurrent research efforts:

- The construction of practical theories and paradigms for rigorously analyzing complex architectures, and
- The application of these techniques to the analysis of complex cytoplasmic patterns, using the intracellular dynamics of axoplasm as the model system.

Center for Biomedical Ethics

Stuart J. Youngner, M.D.
Susan E. Watson Professor of Biomedical Ethics and Director of the Center
School of Medicine, Room T-401
Phone: (216) 368-6196

The Center for Biomedical Ethics offers a forum for the study and discussion of ethical issues in medicine. Its mission 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 center has offices at CWRU’s School of Medicine and at MetroHealth Medical Center and has faculty from several disciplines, including philosophy, religion, law, political science, anthropology, nursing, and medicine.

Center faculty teach in both core and elective components of the medical school curriculum, undergraduate courses in ethics, and an intensive course in ethics of scientific work for Ph.D. students in the Biomedical Sciences Training Program. The center also has a highly successful master’s degree program in bioethics.

Center 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 Center for Biomedical Ethics publishes two newsletters, CenterViews and MetroEthics. CenterViews 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, center events, and master’s degree alumni information.

The Center for Biomedical Ethics has a Web site where visitors can read CenterViews online, obtain information about the master’s degree program, and learn about center and faculty activities: http://www.cwru.edu/med/bioethics/bioethics.html.

Master of Arts Degree in Bioethics

The Center for Biomedical Ethics 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 advanced 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 Center 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, including 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 (three credits). This course requires a minimum of 10 hours of clinical experience per week during two 10-week rotations. Although there are some didactic and seminar sessions, 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 adviser. Electives must enhance the student’s understanding of bioethical issues and must be relevant to the student’s academic goals.

The center currently offers dual degree programs with the Department of Genetics, the School of Law, and the Frances Payne Bolton School of Nursing at CWRU. Students must apply and be accepted to each program to qualify.

Admission policies conform to those of the CWRU 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.

For more information, contact:
Coordinator for Graduate Programs Center for Biomedical Ethics CWRU School of Medicine 10900 Euclid Ave. Cleveland OH 44106-4976 Phone: (216) 368-8718 E-mail: dxc38@po.cwru.edu

Bioethics (BETH)

UNDERGRADUATE COURSE

BETH 271. Bioethics: Dilemmas in Research and Clinical Practice (3)
We have the genetic technology to change nature and human nature, but is this the right thing to do? We have the medical technology to extend almost any human life, but is this always good for people? Should we clone human beings? Should we allow doctor-assisted suicide to hasten the deaths of the terminally ill? This course invites students from all academic disciplines and fields to begin thinking now about current and likely future issues in bioethics. These general areas are covered: theory and method in bioethics, death and dying, organ transplantation, genetics, research, neonatology, aging and dementia, fertility and reproduction, distributive justice in health care access, and concepts of health and disease. In addition to classroom learning with Center for Biomedical Ethics faculty well known nationally for their contributions in all of these general areas, students will benefit from visits to clinical settings under the guidance of the center’s experienced clinical ethicists. Cross-listed as PHIL 271 and RLGN 271.

GRADUATE COURSES

BETH 401. Foundations in Bioethics I (6)
The first of the two required seminar courses, this course covers five basic topic areas in bioethics: death and dying; health professional-patient relationship;
examples from psychiatric writings and general literature on the philosophy of mind. Advance reading is necessary. Classes include a combination of lecture presentation, student presentations from pre-reading, and discussion around key questions.

**BETH 463. Anthropology and Bioethics (3)**

This course will review theoretical work on anthropology and values, the discipline of bioethics, its philosophical roots, the body of anthropological work in bioethics, and critically examine a number of current bioethical issues in the United States and internationally. Cross-listed as ANTH 463.

**BETH 501. Advanced Seminar in Bioethics (3)**

Special topics of interest, such as advanced studies in theory and method in bioethics, ethics and reproduction, the ethics of research with human subjects, religion and medicine, historical perspectives on medical ethics, cross-cultural issues in bioethics, or ethics in applied settings such as hospitals and long-term care facilities. Seminar typically taught by visiting professor in intensive format. Consult the term roster of courses for the specific topic. Prerequisite: BETH 401 or concurrent enrollment.

**BETH 602. Special Topics in Bioethics (1-3)**

Students will explore particular issues and themes in biomedical ethics in depth through independent study and research under the direction of a faculty member. Prerequisite: Consent of instructor.

### Center for International Health

**James W. Kazura, M.D.**

**Professor and Director of Center**

**School of Medicine, Room T-505**

**Phone: (216) 368-6321**

The Center for International Health in the School of Medicine was established in 1987 to link the numerous international health resources of the university, its affiliated institutions, and the northern Ohio community in multidisciplinary programs of research and education related to global health. The challenges presented by world health problems are enormous, and the opportunities presented to the university community are great. In meeting these challenges and in responding to these opportunities at CWRU, those affiliated with the center have the opportunity to promote health in the world and to enrich the community.

Center faculty are appointed with secondary appointments, their primary appointments being in departments throughout the university. The center has both faculty and community advisory committees.

The center endeavors to foster programs that encourage creative people from many disciplines and cultures to work toward solutions of global health issues. The center was built on a strong base of specialized strengths in international health in many academic units of the university and its community. For example, the School of Medicine and its affiliated hospitals have substantial international health research, training, and clinical care programs in the departments of medicine, pediatrics, epidemiology and biostatistics, family medicine, molecular biology and microbiology, and pathology. Other examples of international health programs are found at CWRU's Frances Payne Bolton School of Nursing, Weatherhead School of Management, and Department of Anthropology.

The division of geographic medicine in the School of Medicine is one of the world's leading centers for research and training in the application of modern immunology and molecular biology to global health problems. The Uganda-CWRU International Collaboration for AIDS Research is a large, multifaceted program for the study of AIDS and its complications in Uganda, with funding from many national and international agencies. These and other activities are conducted by faculty from multiple departments in the school, including pediatrics and medicine.

Educational programs sponsored by the Center for International Health include an annual course in international health, electives in international health and overseas rotations for medical students, and training programs at CWRU for visiting students and scholars from developing countries.

In the Greater Cleveland community, substantial international expertise and experience exist in corporate, private, institutional, and voluntary agency sectors. Citizen interest and commitment is high. The center seeks to provide a focal point for this interest, encouraging collaborative activities among these groups and academic units of the university.

Specific objectives of the center:

**Linkages.** To foster interdisciplinary and intercultural linkages related to international health in the university and our community.

**Training.** To promote training programs throughout the university that will equip a cadre of scientists from diverse backgrounds to address global health issues.

**Research.** To facilitate collaborative, multidisciplinary research programs by investigators from CWRU and elsewhere that will lead to improved health in the world.

**Application.** To work with institutions and agencies in developing countries to help design and establish research and education programs that meet their needs and function as models of sustainable health systems.

### International Health (INTH)

**INTH 801. Annual Course in International Health (4)**

Comprehensive, intensive course in international health given during four weeks in September with approximately 27 classroom hours each week. Modalities of primary health care and the major infectious and parasitic diseases of developing countries are considered in depth. Lectures, including presentations by internationally recognized expert visiting faculty, as well as CWRU faculty, are supplemented by problem solving exercises and laboratories. The course presumes an M.D. degree; other health professionals or health science students may be admitted with consent of the course director. Prerequisite: Permission of course director.

### Center for Physical Medicine and Rehabilitation

**Patrick K. Murray, M.D., M.S.**

**Interim Director of Center**

**Phone: (216) 778-3205**

Physical medicine and rehabilitation is a medical specialty devoted to restoring
people’s maximal functional ability following a wide variety of disabling medical conditions, from traumatic brain injury and spinal cord injury to acute and chronic back or knee pain. The Center for Physical Medicine and Rehabilitation was established in 1995 to coordinate and expand the research and training activities of the CWRU medical school that are devoted to the rehabilitation of people with disabling conditions and injuries.

The goals of the center:

- To foster high-quality innovative research that concerns impairments, disabilities, and handicaps resulting from illness, injury, and developmental processes; and that focuses on health-related improvement (physical, cognitive, behavioral, and social) in human functioning and quality of life.
- To promote and conduct effective teaching and training of principles and methods for rehabilitation of people with disabling chronic conditions and injuries at the undergraduate, graduate and post-graduate levels of medical education.
- To enhance the quality and access to physical medicine and rehabilitation clinical services at CWRU-affiliated medical centers.
- To foster collaborative rehabilitation training and research among clinicians and basic scientists from a wide range of disciplines within the university. The center’s faculty includes physicians and psychologists with varied backgrounds who have a broad array of clinical and research interests. Current research is focused on: 1) enhancing motor recovery and functional ability following paralysis from spinal cord injury and stroke; 2) improving methods for managing bladder and bowel dysfunction following spinal cord injury; and 3) outcomes research related to health and human functioning, from specific functional abilities that can be enhanced by individual therapy methods to the cost-benefit of integrated trauma and rehabilitation care systems. Many opportunities are available for physicians, graduate students and allied health trainees to gain knowledge and skills related to clinical rehabilitation and/or related research areas.

## Department of Genetics

### School of Medicine, BRB Phone: (216) 368-3431

The Department of Genetics embraces a unified program devoted to outstanding research and teaching in all areas of genetics, with a particular emphasis on human genetics. Research interests in the department include the genetic basis of human disease; the molecular biology and genetics of embryonic development; sex determination and recombination in Drosophila, Caenorhabditis elegans, the mouse, and humans; chromosome structure and function; human and mouse genome mapping; and regulation of gene expression.

Programs leading to the Ph.D. or combined M.D./Ph.D. degrees, as well as a M.S. in genetic counseling, are offered. Students are encouraged to pursue a program of research and study that meets their goals and interests. Advanced courses are offered in specialized areas as outlined later in this section.

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 applications to the doctoral program by those who have significant prior research experience in genetics and are committed to training in human genetics, molecular genetics, and/or developmental genetics. Direct admission into the program provides for an accelerated course of study in one of the more than 20 laboratories. Alternatively, the department also participates in the integrated Biomedical Sciences Training Program (BSTP, please see separate listing in this publication). Students interested in pursuing the combined M.D./Ph.D. program are admitted through the Medical Scientist Training Program (MSTP, please see separate listing in this publication). Those students interested in a career in genetic counseling may apply directly to the Genetic Counseling Training Program in the department.

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 chromosome structure and behavior, human genome mapping, the molecular basis of inherited disease, and the genetic dissection of complex disease, as well as providing clinical care and training for postdoctoral fellows and genetic counseling students.

### Genetics (GENE)

#### GRADUATE COURSES

**GENE 451. Principles of Genetic Epidemiology (3)**

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. Prerequisites: EPBI 431 and EPBI 490 or consent of instructor. Cross-listed as EPBI 451.

**GENE 488. Yeast Genetics and Cell Biology (3)**

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. Cross-listed as MBIO 488.

**GENE 500. Advanced Eukaryotic Genetics I (3)**

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. Prerequisite: BIOL 362.

**GENE 503. Readings and Discussions in Genetics (0-3)**

(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)**

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. Prerequisite: GENE 500 or permission of instructor.

**GENE 508. Bioinformatics and Computational Genomics (3)**

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. Prerequisites: GENE 500 and GENE 504 or permission of instructor.

**GENE 509. Complex Genetic Traits (3)**

A combination of lecture, readings-based, and discussions that survey the origins of variation and disease and the genetic and phenotypic analysis of complex traits. The course emphasizes the sources of variation, genetic and phenotypic analysis of complex traits, and gene families and physiological pathways. Prerequisites: GENE 500 and GENE 504 or permission of instructor.

**GENE 510. Advanced Human Genetics (3)**

Comprehensive course surveying major areas of contemporary human genetics, including population genetics, Mendelian genetics, chromosome abnormalities, genetic disease, genomics, and molecular genetics. Prerequisite: GENE 500.

**GENE 511. Specialized Topics in Human Genetics (2)**

Presentation and discussion of any aspect of human genetics but emphasizing recent molecular insights into defects in humans. Both classical and recent papers covered to provide basis for independent study.

**GENE 512. Structural Analysis of Complex Genomes (3)**

Lectures, readings and discussion course surveying the status of mapping and sequencing the human genome and those of model organisms. Prerequisites: GENE 500 and GENE 504.

**GENE 513. Developmental Genetics (3)**

This course focuses on the genetic control of animal development. Topics covered include the organization of genetic regulatory circuits which govern the determination of embryonic axes, germ layers and cell fates as well as the cell interactions and cell movements which lead to emergence of the basic body plan of the organism. Emphasis is placed on the use of the genetic approach and genetic tools to uncover the molecular basis of these developmental processes. Prerequisites: GENE 500 and GENE 504.

**GENE 514. Mammalian Cytogenetics (3)**

Overview of classical and molecular cytogenetic methods available to study mammalian chromosomes with interphase and metaphase preparations, and a summary of the origin, etiology and phenotypic consequences of chromosome abnormalities, primarily in the human. Prerequisites: GENE 500 and GENE 504 or permission of instructor.

**GENE 515. Chromosome Structure and Function (3)**

An advanced literature-based course examining specific topics relating to the structure and function of eukaryotic chromosomes. Topics will vary from year to year. Examples include: chromosome and chromatin organization; centromeres and kinetochores; chromosome segregation, recombination, and nondisjunction; genomic imprinting, its molecular mechanisms, and its effect on gene expression; heterochromatin and position effect variation; and molecular mechanisms of chromosome abnormalities. Prerequisites: GENE 500 and GENE 504.

**GENE 516. Introduction to Clinical Genetics (3)**

The major focus of this course is to allow graduate students in human genetics to become familiar with the medical genetics and counseling aspect of the genetics evaluation and counseling process. It provides the student an opportunity to see an application of bench research in the clinical arena as well as to observe and appreciate the various functions, roles and responsibilities of different members of the medical genetics team. Course includes seminars and clinical observations. Prerequisite: Consent of instructor.

**GENE 517. Principles of Biomedical Technology Development (3)**

Analyses of strategies employed by biomedical companies in identifying and developing new technologies, highlighting genomics and gene therapy companies. Topics of discussion will include the financial analysis of new gene-based technologies, the challenges of developing technologies in-house versus licensing, and the impact of intellectual property (especially patent law) on gene-based product development. An overview of relevant federal regulatory law will also be provided, concentrating on current FDA requirements for new drugs and devices. Prerequisite: Consent of instructor.

**GENE 519. The Genetics of Emerging Infectious Diseases (3)**

This course will survey the genetics, transmission and life cycle of emerging infectious agents. Lecturers will include local and visiting scientists internationally recognized as experts in infectious disease research. Prerequisite: Consent of instructor.

**GENE 521. Principles of Developmental Biology (3)**

Developmental biology is at the core of all biology. The egg divides to give rise to many millions of cells, which form structures as complex and varied as eyes, arms, heart and brain. The process by which genes control cell behavior to determine pattern and form will be the focus of the course. Basic principles in establishing body plans and organ systems will be emphasized. Model systems such as vertebrates, *Drosophila*, nematodes, sea urchins, and plants will be used to illustrate key concepts. Basic features of
embryology will also be introduced. Prerequisite: Permission of instructor.

**GENE 522. Genetics of the Cardiovascular System (3)**
The course covers the newest concepts in the development and function of the cardiovascular system. Topics include the genetics of cardiovascular diseases in humans and the comparative genetics and biology of animal models of cardiovascular diseases. Prerequisite: GENE 500.

**GENE 523. Embryonic Patterning in Development (3)**
This course will focus on current understanding of patterning mechanisms in animal development. The seminal contributions of Turning, 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. Prerequisite: Permission of instructor.

**GENE 524. Advanced Medical Genetics: Cytogenetics (2-3)**
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. Prerequisite: Consent of instructor.

**GENE 525. Advanced Medical Genetics: Clinical Genetics (2-3)**
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. Prerequisite: Consent of instructor.

**GENE 526. Advanced Medical Genetics: Molecular and Quantitative Genetics (2-3)**
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. Includes quantitative principles of pedigree analysis, segregation analysis, Bayes theorem; linkage analysis and disequilibrium; risk assessment and consanguinity. Prerequisite: Consent of instructor.

**GENE 527. Advanced Medical Genetics: Biochemical Genetics (2-3)**
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. Prerequisite: Consent of instructor.

**GENE 528. Principles and Practices of Genetic Counseling (3)**
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. Prerequisite: Consent of instructor.

**GENE 529. Psychosocial Issues in Genetic Counseling (3)**
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. Prerequisite: Consent of instructor.

**GENE 530. Ethical and Professional Issues in Genetic Counseling (2)**
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. Prerequisite: Consent of instructor.

**GENE 532. Clinical Practicum in Genetic Counseling (3-6)**
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. Prerequisite: Admission to Genetic Counseling Training Program.

**GENE 601. Research in Genetics (1-9)**
(Credit as arranged.)

**GENE 651. Thesis M.S. (1-9)**
(Credit as arranged.)

**GENE 701. Dissertation Ph.D. (1-9)**
(Credit as arranged.)

**GENE 702. Appointed Dissertation Fellowship (9)**

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**Institute for Public Health Sciences**

**Alfred A. Rimm, Ph.D.**
Director of the Institute
Department of Epidemiology and Biostatistics

**School of Medicine, Room W-G57**
Phone: (216) 368-3195
E-mail: gradpro@hal.cwru.edu

The Institute for Public Health Sciences, located at MetroHealth Medical Center and at the School of Medicine, incorporates the disciplines of epidemiology and biostatistics, bioethics, and environmental health sciences to form the scientific foundation for public health research and education at the School of Medicine. The institute faculty members are engaged in numerous research projects in the complementary disciplines and conduct collaborative studies with the basic and clinical science departments in the School of Medicine.
GRADUATE PROGRAMS

Bioethics (M.A.)
The master of arts in bioethics program, through the Center for Biomedical Ethics, examines the ethical, cultural, and policy dimensions of health care, technology, and the life sciences. The program contains a significant clinical component in which students become familiar with the clinical, psychological, social, professional, and institutional context in which ethical problems arise. Please see the Center for Biomedical Ethics listing in this publication for more information.

Biostatistics (M.S. and Ph.D.)
The biostatistics track deals with concepts underlying the scientific method in biomedical research, the interpretation of medical and biological data, and both the theory and the practical realities of study design, data collection, statistical analysis and computing, and the reporting of results. An important activity involves the design and analysis of randomized clinical trials and intervention studies, either for prevention or treatment of disease in humans.

Epidemiology (M.S. and Ph.D.)
The epidemiology track includes the search for factors causing disease in humans and the study of the occurrence and distribution of diseases in human populations. The field of epidemiology also is concerned with the education of the public and strategies for adopting good health behavior practices.

Genetic and Molecular Epidemiology (M.S. and Ph.D.)
The track in genetic and molecular epidemiology involves the role of genetic factors in the etiology of disease in human populations, including investigation of their interactions with environmental and cultural factors as part of the disease process. Its integrated approach brings together genetic and epidemiologic perspectives to answer critical questions about human disease.

Health Services Research (M.S. and Ph.D.)
The health services research track focuses on the description, analysis, and evaluation of the organization; staffing; financing; utilization; and delivery of health care, with emphasis on equity of access, cost/effectiveness, and certainty of quality of care to all individuals.

Integrated Biological Sciences

School of Medicine, W-378
Phone: (216) 368-3404
The four-year curriculum of the School of Medicine provides a general education in medicine. It does not provide the highly specialized and concentrated training necessary for research and teaching in the biological medical sciences. The faculty of the School of Medicine recognizes the great importance of the recruitment and training of future teachers and investigators, however, and encourages qualified candidates to plan careers in basic biomedical science.

The most direct route toward a career in research and teaching in the preclinical sciences is through the doctor of philosophy programs offered by the basic biomedical science departments: anatomy, biochemistry, biology, biomedical engineering, environmental health sciences, epidemiology and biostatistics, genetics, macromolecular science, molecular biology and microbiology, neurosciences, pathology, pharmacology, and physiology and biophysics. In some instances, Medical Scientist Training Program (MSTP, please see separate listing in this publication) or other M.D./Ph.D. students may be advised to take one or more segments of the basic science portion of the regular or preclinical curriculum in the School of Medicine (see IBIS 401-404).

Inquiries about specific doctoral programs should be addressed to the department in which the candidate wishes to work. Formal admission and registration is through the School of Graduate Studies.

For some students who plan scientific careers in teaching and research, the MSTP, leading to both the doctor of philosophy degree and the doctor of medicine degree, is offered. This program takes seven to eight years to complete, depending on the student's previous preparation and the time needed to complete the dissertation research. Admission to the Ph.D. portion of the program is through the School of Graduate Studies; full tuition and stipend are provided on a competitive basis for up to eight years.

Inquiries for more information should be addressed to:
Program Manager
Medical Scientist Training Program
School of Medicine
Case Western Reserve University
10900 Euclid Ave.
Cleveland OH 44106
Phone: (216) 368-3404
Please note: Courses IBIS 401-404 refer to the medical school core curriculum and are available only to MSTP and other M.D./Ph.D. students.

Integrated Biological Sciences (IBIS)

GRADUATE COURSES

IBIS 401. Integrated Biological Sciences I (1-9)
A four-semester sequence encompassing anatomy, biochemistry, physiology, pharmacology, pathology, and microbiology.

IBIS 402. Integrated Biological Sciences II (1-9)
A continuation of IBIS 401.

IBIS 403. Integrated Biological Sciences III (1-9)
A continuation of IBIS 402.

IBIS 404. Integrated Biological Sciences IV (1-9)
A continuation of IBIS 403.

IBIS 411. Clinical Science I (2)

IBIS 412. Clinical Science II (2)

IBIS 413. Clinical Science III (2)

IBIS 414. Clinical Science IV (2)
Department of Molecular Biology and Microbiology

School of Medicine, Room W-235  
Phone: (216) 368-3420

The Department of Molecular Biology and Microbiology provides teaching and research related to the structure, regulation and expression of genes. The organisms under study in the laboratories of the faculty include viruses (especially retroviruses), prokaryotic and eukaryotic microorganisms (bacteria and yeast), and animal cells (from both parasitic nematodes and vertebrates).

Members of the department participate in the teaching of first-year medical students in several committees. In the cell biology committee, for example, department faculty present material on the molecular basis for gene action and its relationship to human disease, emphasizing the methods and results that have led to the recent explosion of knowledge in this area. In addition, faculty offer special courses specifically designed for medical students.

GRADUATE PROGRAMS

The Department of Molecular Biology and Microbiology participates in the Biological Sciences Training Program (BSTP, please see separate listing in this publication) and offers a program of study leading to the Ph.D. degree. The program emphasizes direct research participation under the guidance of a faculty mentor. Its goal is to produce scientists who will function as independent researchers at the forefront of biomedical science. Students may pursue their thesis research in several areas of eukaryotic and prokaryotic molecular biology. A minimal amount of didactic material is included in the first two years to provide a base of knowledge for selecting a research area and to prepare the students to read and critically interpret the primary literature.

First-year students are admitted to the BSTP and may choose laboratory rotations within the department. They participate in the integrated cellular and molecular biology sequence. (CBIO 453, 454, 455, and 456) and in department seminars. They also may be required to take a biochemistry course if proficiency cannot be demonstrated. Near the end of the first year, students select a thesis advisor and are assigned to a department.

After successful completion of the first-year curriculum, students are expected to complete a minimum of 12 credit hours of advanced course work. Any combination of courses from within or outside the department can fulfill the requirement as long as it has the approval of the student’s committee. Students take a qualifying examination to determine their readiness for advancement to candidacy. This exam consists of oral and written components and is given near the end of the second year. In subsequent years, students pursue their research activities full-time.

Each laboratory is fully equipped for state-of-the-art research in molecular biology and microbiology. In addition, several major instrument systems (oligonucleotide synthesis and purification, DNA sequence analysis, machine shop and instrumentation shop, etc.) are available to all members of the department.

Current research programs: post transcriptional modification of RNA and its role in gene expression; mechanisms of viral, messenger, and ribosomal RNA processing; pre-messenger RNA splicing; RNA editing; retrovirus host interactions; regulation of viral and cellular oncogene expression and tumorigenesis by oncogenes; RNA catalysis; cell surface biochemistry and architecture; molecular parasitology; genetics and biochemistry of intracellular transport and sorting in yeast; bacterial cell division; biochemistry and genetics of bacterial transport systems; molecular biology of antibiotic resistance; and mechanisms of bacterial pathogenesis. Extensive interdepartmental collaborations ensure that a broad range of resources are available to every student.

Molecular Biology and Microbiology (MBIO)

UNDERGRADUATE COURSES

MBIO 399. Undergraduate Research (1-3)  
Permits qualified undergraduates to work in a faculty member’s laboratory.

MBIO 420. Molecular Genetics of Cancer (3)  
Cross-listed as BIOC 420 and MVIR 420.

MBIO 433. Membrane Transport Processes (3)  
Cross-listed as PHRM 433.

MBIO 434. Mechanisms of Drug Resistance (3)  
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). Cross-listed as MVIR 434 and PHRM 434.

MBIO 461. Prokaryotic Molecular Biology (3)  
Basic techniques and research topics of microbial genetics and pathogenesis. Lecture and discussion format.

MBIO 472. Transcriptional Mechanisms (3)  
A literature-based course considering the transcriptional machinery and process of the RNA polymerases I, II, and III.

MBIO 488. Yeast Genetics and Cell Biology (3)  
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. Cross-listed as CLBY 488, GENE 488, and PATH 488.

MBIO 518. Cell Surfaces and Matrices (3) Molecular mechanisms by which cells interact with and are regulated by extracellular matrices and other cells. Cross-listed as NEUR 518.

MBIO 519. Molecular Biology of RNA (3) Selected topics regarding editing, enzymatic function, splicing, and structure of RNA. Cross-listed as CLBY 519.

MBIO 601. Research in Molecular Biology and Microbiology (1-18)


Molecular Virology Program

School of Medicine, Room W-427
Phone: (216) 368-3344

The Molecular Virology Program offers graduate studies leading to the Ph.D. and combined M.D./Ph.D. degrees. The training program is designed to prepare highly qualified and motivated students for careers in biomedical research focused on viruses, viral vectors, and virus-host interactions. The program has 18 faculty drawn from several departments at Case Western Reserve University, University Hospitals of Cleveland, and the Lerner Research Institute of the Cleveland Clinic Foundation. The faculty have particular strengths in the areas of viral replication, virus-host interactions, viral oncogenesis, and the use of viral vectors for gene therapy.

The Molecular Virology Program participates in the Biomedical Sciences Training Program (BSTP, please see separate listing in this publication), which is a Ph.D. program consisting of 12 additional graduate training programs within the School of Medicine. Students interested in graduate training in molecular virology are admitted into the BSTP and are afforded the opportunity to study in any of the training program’s laboratories. During their first year, graduate students divide their time between course work, research rotations, and research seminars.

All first-year students take the integrated BSTP core curriculum in cell and molecular biology (12 credit hours). They also complete at least three research rotations in laboratories of prospective advisers chosen by the students with the aid of a faculty adviser. These rotations provide the basis for choosing a permanent research adviser, which is done during the second semester of the first year. By choosing a faculty member who is affiliated with the Molecular Virology Program and deciding to satisfy its degree requirements, a student becomes a member of the program.

Students in the combined Medical Sciences Training Program (MSTP, an M.D./Ph.D. program, please see separate listing in this publication) also may join the Molecular Virology Program by the same route involving research rotations and selection of a program faculty member as the thesis adviser.

During the subsequent years, students devote most of their time to laboratory research while also completing four advanced courses, participating in the monthly virology seminar series, and attending journal clubs and other research seminars. By the end of the second year, each student must write and defend a research proposal, which serves as the qualifying exam for Ph.D. candidacy. The final requirement for the Ph.D. degree is the submission and defense of an acceptable dissertation based on original research of the student.

FACULTY


Molecular Virology (MVIR)

MBIO 399. Undergraduate Research (1-3) Permits qualified undergraduates to work in a faculty member’s laboratory.

MBIO 420. Molecular Genetics of Cancer (3) Cross-listed as BIOC 420 and MVIR 420.

MBIO 433. Membrane Transport Processes (3) Cross-listed as PHRM 433.

MBIO 434. Mechanisms of Drug Resistance (3) 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). Cross-listed as MVIR 434 and PHRM 434.

MBIO 461. Prokaryotic Molecular Biology (3) Basic techniques and research topics of microbial genetics and pathogenesis. Lecture and discussion format.

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MBIO 488. Yeast Genetics and Cell Biology (3) 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, chromo-
some segregation, cytoskeleton, mating response, and signal transduction. Cross-listed as CLBY 488, GENE 488, and PATH 488.

**MBIO 518. Cell Surfaces and Matrices (3)**
Molecular mechanisms by which cells interact with and are regulated by extracellular matrices and other cells. Cross-listed as NEUR 518.

**MBIO 519. Molecular Biology of RNA (3)**
Selected topics regarding editing, enzymatic function, splicing, and structure of RNA. Cross-listed as CLBY 519.

**MBIO 601. Research in Molecular Biology and Microbiology (1-18)**

**MBIO 651. Thesis M.S. (1-18)**

**MBIO 701. Dissertation Ph.D. (1-18)**

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**Neuroscience and Bioengineering Program**

**Departments of Neurosciences and Biomedical Engineering**

**School of Medicine and School of Engineering**

**Case Western Reserve University**

**Phone: (216) 368-4930**

This interdisciplinary program was developed to provide neuroscience training and research opportunities for students with prior experience and interest in the physical sciences and engineering. This Ph.D. program is designed to emphasize the quantitative and physical aspects of neuroscience research and to increase the coupling between theoretical and experimental approaches. Students will learn to describe and understand the mechanisms underlying neuronal function and to explore and develop means to interface the nervous system with the outside world.

The faculty participating in this new program are involved in the field of neuroscience using a basic science and engineering approach. These faculty members are, therefore, recruited from several departments in the medical, arts and sciences, and engineering schools of Case Western Reserve University as well as University Hospitals of Cleveland. The program is administered by the Department of Neurosciences.

The major goal of this program is to provide neuroscience researchers with a solid background in not only molecular, cellular, and system neuroscience, but also in instrumentation, signal processing, computational neuroscience, neuro-imaging, and modeling. The goal is to train neuroscientists capable of bridging the gap between advances of neuroscience and those in mathematics, physics, and engineering. This interdisciplinary training develops a new breed of researchers with powerful tools to face the formidable task of understanding and simulating brain function and the design of brain-machine interfaces.

**AREAS OF CONCENTRATION**

**Neuro-electric Phenomena**

This area of research is concerned mainly with the electrophysiology of neurons. Examples of topics covered at CWRU include membrane biophysical properties, characterization of the ionic channels, description of electrical events associated with channel opening and closing, mechanisms underlying information transmission across neuronal tissue, and analysis of the information processing in dendritic trees. The methods applied to these topics include patch-clamp recording of single channel currents and whole cell as well as micro-electrode recordings in dissociated neurons and in-vitro brain slice preparations. These experimental methods are combined with modeling and analysis techniques developed in mathematics and engineering to provide a quantitative understanding of the electric phenomena in the neural tissue.

**Molecular Neurobiology**

Techniques of molecular biology provide novel approaches to the quantitative study of information processing by the nervous system at the molecular level. Site-directed mutagenesis of key players in various signal transduction pathways makes it possible to test kinetic models of ligand receptor interactions, receptor-mediated enzyme activation, and the generation of intracellular signals that modify neuronal behavior. Although these processes occur in many cells, they have attained an unparalleled level of sophistication and plasticity in the nervous system. Physical and molecular analyses of enzyme catalysis, protein-protein interactions, and the molecular components of signal transduction pathways constitute areas of training.

**Neuro-imaging and Molecular Sensing**

Recent advances in computer-enhanced video microscopy and the availability of detection systems that resolve a variety of cellular and tissue parameters have led to the development of powerful tools for the study of neuronal function. Optical indicators have made it possible to image a growing list of chemical species within single cells, their distribution in various brain regions, and changes in their spatial concentration induced by physiological stimuli. Structural markers permit visualization of cytoskeletal elements that contribute to neuronal pathfinding during development and regeneration after injury. Chemical sensors allow the measurements of concentration of compounds generated used by neurons. Together, these techniques provide new insights into the chemical events taking place in the nervous systems.

**Quantitative Systems Neuroscience**

Quantitative systems neuroscience is aimed at the study of neuronal assemblies displaying a high level of integration between cells. The first goal of quantitative systems neuroscience is to apply the techniques and methods developed in basic science and engineering to understand the behavior of neuronal networks in terms of the electric and pharmacologic properties of the neurons. A second goal is to explore approaches to interface computer with neuronal systems. The neural mechanisms underlying animal behavior, respiration and eye movements, and the development of neuronal prosthetic systems are some of the areas of activity represented by the neuroscience and engineering program faculty.

**Computational Neuroscience**

The goal of computational neuroscience is to bridge the gap between experimental observations of neuronal systems and theoretical models. These models typically are implemented on computers from equations derived theoretically. In this program, emphasis is placed on testable...
models of experimentally observed behavior of neuronal system. Examples include models of ion concentrations dynamics, channels kinetics, neuronal electrophysiology, synaptic transmission, single neuron computation, and neuronal networks.

**ADMISSION REQUIREMENTS**

Admission requirements for this interdisciplinary program were designed to provide suitable preparation for coursework in both quantitative and life sciences. Required coursework is intended to provide the factual background and intellectual tools that permit students to approach contemporary problems in neuroscience with modern physical and mathematical tools. Placement examinations will be available. Laboratory rotations will serve as an integral part of student training. Applications for the program are available from the Department of Neurosciences of Case Western Reserve University.

The requirements for this program:

- A B.A., B.S. or M.Sc. degree with an emphasis on physical sciences or engineering.
- GRE scores (plus TOEFL for international students).
- Three letters of recommendation.

Admission to the program is decided by a committee of faculty members from both the neuroscience and the biomedical engineering departments based on the application forms and an interview by several faculty.

**DESCRIPTION OF THE PROGRAM**

Entering students are assigned an adviser from the program’s faculty to guide the student and design a program of study. The first year is devoted to coursework and rotations with the goal that students will choose a research laboratory by the end of the first year. A committee consisting of the program coordinators and the student’s research adviser reviews the program of study of each student yearly and monitors his or her progress. The minimal requirement for the program is 36 semester hours of coursework for the Ph.D. program beyond the B.S. and 18 hours of research thesis. For students with master’s degrees, additional courses may be required to provide greater depth and breadth related to the area of research.

The core curriculum consists of courses in both neurosciences and quantitative sciences. The neurosciences courses cover cell biology, neurobiology, cell and molecular neurosciences, and system neurosciences. The quantitative courses cover instrumentation, signal processing, mathematics, modeling and numerical methods.

**Course Requirements**

A core collection of required courses exposes students to the problems and methods that define contemporary neuroscience research. Elective courses expose students to problems specific to their areas of research.

**Core courses (Credit hours)**

- CBIO 455 Molecular Biology (3)
- NEUR 473 Introduction to Neurobiology (3)
- CBIO 454 Cell Biology (3)
- NEUR 406A Systems Neuroscience (3)
- EBME 403 Biomedical Transducers (3)
- EBME 409 Signals and Systems (3)
- NEUR 478 Computational Neuroscience (3)
- NEUR XXX* Quantitative Approaches to Neurobiological Problems

**Electives (3)**

- NEUR 601 Laboratory Rotations (3)
- Ethical issues in science
- Research Seminar (4)

Total for course work: 36

Research Thesis: 18

*under development

**Elective Courses**

A minimum of three elective courses are required. Two such electives courses must include quantitative material, and one must be from the biomedical engineering department. The elective courses should be chosen based on the student’s research area.

**Biomedical engineering courses**

- EBME 407 Applied Neural Control
- EBME 519 Parameter Estimation
- EBME 504 Transport in Biomedical Systems
- EBME 410 Medical Imaging Fundamentals

- EBME 412 Digital Signal Processing
- EBME 414 Real Time Data Acquisition
- EBME 523 Biosensors

**Biological sciences**

- NEUR 405 Cell and Molecular Neurosciences
- NEUR 406B Neuro-anatomy
- NEUR 475 Sensory and Motor Physiology
- NEUR 427 Developmental Neuroscience
- PHOL 610 Oxygen and Physiological Function
- PHOL 460 Molecular Biology
- PHOL 607 Electrophysiology

**Mathematical Sciences**

- STAT 412 Statistics for Design and Analysis in Engineering and Science
- MATH 431 Introduction to Numerical Analysis

**Laboratory Rotations**

A minimum of three rotations (time equivalent of six weeks full-time each) is required. These rotations are to be completed by the end of the first year. The rotations introduce the students to the diverse techniques and approaches for studying neural function and serve as a basis for choosing a laboratory for their research topics. Students must write reports describing their projects at the conclusion of each rotation.

**Qualifying Examination**

Students must pass a two-part qualifying examination to be admitted to candidacy for the Ph.D. program in accordance with university guidelines. The first part, given at the end of the first or second academic year, consists of an oral examination testing a student’s knowledge in basic sciences and in neuroscience. The second examination, taken by the end of the second year, consists of writing and defending a research proposal in the chosen area of research to demonstrate that each student is capable of integrating modern physical and mathematical tools to their areas of research.

**Thesis Requirements**

A minimum of 18 hours of research credits (NEUR 701) must be taken to satisfy the requirements of the School of Graduate Studies. A thesis committee will be composed of at least five mem-
bers, including the research adviser and at least one representative member from both the biomedical engineering and neurosciences departments. The composition of the committee is chosen to ensure that the thesis project will have a strong quantitative component.

Sample organization of the Ph.D. course curriculum:

1. With emphasis on cellular and molecular neuroscience
   Year 1:
   Fall
   CBIO 453 Cell Biology 1 (3)
   CBIO 455 Molecular Biology (3)
   NEUR 473 Introduction to Neurobiology (3)
   Spring
   NEUR 478 Computational Neuroscience (3)
   NEUR 405 Cellular and Molecular Neurosciences (elective) (3)
   NEUR 601 Research in Neuroscience (3)
   Summer
   NEUR 601 Research in Neuroscience (3)

   Year 2:
   Fall
   NEUR 406A Systems Neuroscience (elective) (3)
   EBME 403 Biomedical Transducers (3)
   EBME 409 Signals and Systems (4)
   Spring
   NEUR XXX Quantitative approaches to Neurosciences (3)
   Elective course (3)
   NEUR 701 Research
   Summer
   NEUR 701 Research

2. Curriculum with emphasis on system neuroscience
   Year 1:
   Fall
   CBIO 455 Molecular Biology (3)
   CBIO 453 Cell Biology I (3)
   NEUR 473 Introduction to Neurobiology (3)
   Spring
   NEUR 478 Computational Neuroscience (3)
   NEUR 601 Laboratory Rotation (3)
   Summer
   NEUR 601 Laboratory Rotation (3)

   Year 2:
   Fall
   EBME 409 Signals and Systems (3)
   NEUR 601 Research in Neuroscience (3)
   EBME 403 Biomedical Transducers (3)
   Spring
   NEUR XXX Quantitative approaches to Neurosciences (3)
   Elective course (3)
   NEUR 701 Research
   Summer
   NEUR 701 Research
   Years 3 and 4:
   Elective course
   NEUR 701 Research

Administration of the program
The program is administered by the Department of Neurosciences. A program committee of faculty members from the neuroscience and biomedical engineering departments reviews the applications for the new students and reviews the program of study and the progress of the students. Financial assistance is provided for the first year by the neurosciences department. The stipend and tuition for the following year are charged to the student’s research adviser’s grant account.

The program coordinators: Dominique M. Durand, Ph.D. Department of Biomedical Engineering (216) 368-3974 and David D. Friel, Ph.D. Department of Neurosciences (216) 368-4930

Participating faculty
chemistry. The application of molecular biological tools to questions of synaptic function will be addressed. Prerequisite: BIOL 473.

NEUR 406. Systems Neurosciences (4)
A comprehensive course designed to give graduate students a wide-ranging introduction to the organization and function of the nervous system. Topics to be covered include the anatomy, physiology and function of the mammalian central nervous system, as well as the organization of simple nervous systems. Lectures, laboratories, and student presentations of classic papers will be used.

NEUR 411. Neurobiology of Disease (1)
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 myasthenia gravis, dementia (including Alzheimer’s disease), multiple sclerosis, Duchenne’s muscular dystrophy, poliomyelitis, seizures and strokes. Prerequisite: NEUR 405 or NEUR 406.

NEUR 427. Principles of Neural Development (3)
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. Cross-listed as BIOL 427.

NEUR 429. Neural Development and Plasticity (3)
Focus on the development of specific neural systems and brain regions. The development of the vertebrate hindbrain, cerebellum and cerebral cortex will be examined in detail. Other topics include the visual system, the neuromuscular system, endocrine responsive brain regions and the olfactory system. Offered in alternate years, NEUR 427 and NEUR 429 are meant to serve as complementary, but independent, explorations of the major issues surrounding the development of the nervous system. Students wishing to specialize in neural development may wish to take both 427 and 429. Cross-listed as BIOL 429.

NEUR 432. Biochemical and Molecular Aspects of Vision (3)
Increasingly, progress in the study of visual science is requiring multidisciplinary approaches that draw from the areas of biochemistry, genetics, molecular biology, neuroscience and pathology. We have recognized this fact and have adapted this course to fit the needs of tomorrow’s scientists. This course encompasses the basic science aspects of the eye. Subjects include retinal anatomy and function; biochemical, molecular aspects of retinal disease and cataract; cellular and molecular neuroscience aspects pertinent to the visual system. Cross-listed as PATH 432 and PHRM 432.

NEUR 433. Membrane Transport Processes (3)
Cross-listed as PHRM 433.

NEUR 440. Synaptic Transmission (2)
This course will explore the basic mechanisms of synaptic transmission that operate at central and peripheral synapses. Students will read and present a mixture of historical and modern papers that established the fundamental principles of synaptic transmission and plasticity. The course will begin with a brief review of cellular neurophysiology and the techniques used to study synaptic potentials. We will then read classic papers by Katz and colleagues that defined the mechanisms controlling transmitter release at the neuromuscular junction. Next we will consider the role of calcium in regulating the release of neurotransmitters and in short-term modulation of synaptic potentials. We will then explore pre- and postsynaptic processes such as receptor saturation and vesicle dynamics that govern the amplitude and time course of post-synaptic potentials. Quantal analysis and silent synapses will be discussed in the context of the present-day controversies regarding long-term potentiation at central synapses. We will also consider the relationship between short- and long-term synaptic plasticity and behavioral functions such as learning and memory. Occasional faculty lectures will complement student presentations on primary research articles. Student grades will be based on two short (5 page) essays and class participation. Prerequisite: Permission of the course director.

NEUR 473. Introduction to Neurobiology (3)
Cross-listed as BIOL 473.

NEUR 474. Neurobiology of Behavior (3)
(See BIOL 374.) Cross-listed as BIOL 474.

NEUR 476. Neurobiology Laboratory (3) Cross-listed as BIOL 476.

NEUR 478. Computational Neuroscience (3)
Computer simulation 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 circuits, as well as to cable theory, passive and active compartmental modeling, numerical integration methods, models of plasticity and learning, models of brain systems, and their relationship to artificial neural networks. Term project required. Two lectures per week. Cross-listed as BIOL 478 and ECES 478.

NEUR 479. Seminar in Computational Neuroscience (3)
Readings and discussion in the recent literature on computational neuroscience, adaptive behavior, and other current topics. Cross-listed as BIOL 479.

NEUR 518. Cell Surfaces and Matrices (3)
Lecture and discussion course emphasizing current advances in cell-cell and cell-substrate interactions. Cross-listed as CLBY 518 and MBIO 518.

NEUR 601. Research in Neuroscience (1-18)

NEUR 701. Dissertation Ph.D. (1-18)

NEUR 702. Appointed Dissertation Fellowship (9)

Department of Nutrition

School of Dentistry Building, Room 201
Phone: (216) 368-2440
Fax: (216) 368-6644
Henri Brunengraber, M.D., Ph.D., Chair

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, dentistry, or nursing. Graduate programs include dietetics, public health nutrition, nutritional biochemistry, and molecular nutrition.

The Department of Nutrition offers programs leading to the bachelor of science in nutrition degree, bachelor of arts degree in nutrition, bachelor of arts degree in nutritional biochemistry and metabolism, bachelor of science degree in nutritional biochemistry and metabolism degree, master of science degree in nutrition, master of science degree in public health nutrition, and doctor of philosophy degree.

Specialty programs are available in areas such as maternal and child nutrition or gerontology. The specialty is in addition to the basic graduate degree. Special announcements describing the various programs and providing additional information are available from the department.

UNDERGRADUATE PROGRAMS

Please see the section titled “College of Arts and Sciences” in this publication.

GRADUATE PROGRAMS

Master of Science Degree in 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 6 to 9 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 6 hours of advanced human nutrition. In addition, students are encouraged to pursue complementary studies in the biomedical sciences, social and behavioral sciences, or management. 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 or molecular nutrition.

The individual program also may be planned to fulfill the academic requirements for dietetic registration and membership in the American Dietetic Association.

Master of Science Degree in 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 35 semester hours of combined academic work and field experience is required to earn the degree. Coursework focuses on human nutrition, dietetics, and the public health sciences. Field experience is concurrent with coursework utilizing local community agencies for direct application of theory to practice. The final phase of the program is an eight-week, full-time experience with a public health agency that has a strong nutrition component. Throughout the program, the student works closely with an adviser on an individual basis.

In addition to the general 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 semester hours 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 (R.D.) examination, the program is accredited by the Commission on Accreditation for Dietetics Education (CADE) of the American Dietetic Association as an internship. CADE is a specialized accrediting body recognized by the Commission on Recognition of Postsecondary Accreditation and the U.S. 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. Please contact the Department of Nutrition for information regarding application.

Doctor of Philosophy Degree in Nutrition

The doctor of philosophy degree in nutrition is awarded for study and research in nutrition. Areas of concentration include clinical or community nutrition, nutritional biochemistry and metabolism, and molecular nutrition. Information about graduate degree programs may be obtained from the department.

Nutrition (NTRN)

GRADUATE COURSES

NTRN 410. History of Food and Nutrition (3)
Investigations of the development of nutrition as a science and interactions with medicine, agriculture, public health and dietetics. Food and technological effects on health. Prerequisite: Consent of instructor.

NTRN 433. Advanced Human Nutrition I (4)
Emphasis on reading original research literature in energy, protein and minerals with development of critical evaluation and thinking skills. Prerequisites: NTRN 201 and CHEM 223 and BIOL 220 or equivalent.

NTRN 434. Advanced Human Nutrition II (3)
Emphasis on reading original research literature on vitamins with development of critical evaluation and thinking skills. Prerequisite: NTRN 433 or consent.

NTRN 435. Maternal and Child Nutrition (3)
Study of current research literature on nutrition for pregnancy, lactation, infancy and childhood, including assessment and requirements. Prerequisite: Nutrition major or consent of instructor.

NTRN 437. Evaluation of Nutrition Literature (3)
Reading and appraisal of food and nutrition literature written for the general
public, including books, periodicals and audio and visual sources. Prerequisite: Nutrition major or consent of instructor.

NTRN 438. Trends in Diet Therapy (3)
Evaluation and interpretation of modern concepts of nutrition related to abnormalities requiring dietary modifications. Prerequisite: NTRN 365 or equivalent.

NTRN 440. Nutrition for the Aging and Aged (3)
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. Prerequisite: Nutrition major or consent of instructor.

NTRN 446. Advanced Maternal Nutrition: Special Topics (3)
Analysis of the problems commonly associated with high-risk pregnancies and fetal outcome. Discussion of causes, mechanisms, management and current research. Prerequisite: NTRN 435 or consent.

NTRN 451. Food Service Systems Management (3)
Application of organizational theory and skills in the preparation and service of quantity food. Laboratory experiences in professional food services are included. Students will analyze one aspect of food service management in depth. Prerequisite: Nutrition Major or consent.

NTRN 452. Nutritional Biochemistry and Metabolism (3)
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. Prerequisite: BIOC 307 or equivalent. Cross-listed as BIOC 452.

NTRN 454. Isotope Tracer Methodology (3)
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. Prerequisite: BIOC 407.

NTRN 455. Molecular Nutrition (3)
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. Prerequisite: BIOC 407.

NTRN 460. Sports Nutrition (3)
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. Prerequisite: NTRN 363 or NTRN 433 or consent.

NTRN 516. Seminar in Dietetics I (4)
Study of scientific basis for clinical and community nutrition practice and developments in food service systems management. Prerequisite: Dietetic internship.

NTRN 517. Seminar in Dietetics II (4)
Study of scientific basis for clinical and community nutrition practice and developments in food service systems management. Prerequisite: Dietetic internship.

NTRN 528. Introduction to Public Health Nutrition (3)
Philosophy, objectives, organization, and focus of government and voluntary agencies with emphasis on nutrition components. Prerequisite: Public health nutrition majors only.

NTRN 530. Public Health Nutrition (3)
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. Prerequisite: Consent of instructor.

NTRN 531. Public Health Nutrition Field Experience (1-6)
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. Prerequisite: Open to public health nutrition students only.

NTRN 532A. General Nutrition Care (1-3)
Individually arranged clinical experience.

NTRN 532C. Public Health Nutrition (1-3)
Individually arranged clinical experience.

NTRN 532D. Hospital Dietetics (1-3)
Individually arranged clinical experience.

NTRN 532E. Clinical Research: Methods in Nutrition and Metabolism (3)
Individually arranged.

NTRN 533. Nutritional Care of Neonate (3)
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. Prerequisite: NTRN 435 or consent.

NTRN 550A. Advanced Community Nutrition (3)
Development of skills needed by the community dietitian. Emphasis on effective tools for service development and delivery. Recommended courses of action for the professional.

NTRN 550B. Seminar: Dietetics (1)

NTRN 551. Seminar in Advanced Nutrition (2-3)

NTRN 561. Investigative Methods in Nutrition (1-4)
Research methods appropriate for nutrition. Methods for conducting research in nutrition and food sciences, food service management and dietetics. Designing research proposals. Prerequisite: Nutrition major or consent of instructor.

NTRN 601. Special Problems (1-18)

NTRN 651. Thesis M.S. (1-18)

NTRN 701. Dissertation Ph.D. (1-18)

NTRN 702. Appointed Dissertation Fellow (9)

Department of Pathology

Institute of Pathology
2085 Adelbert Road
Phone: (216) 368-0360
Web site: http://www.cwru.edu/med/pathology/

GRADUATE PROGRAMS

The Department of Pathology offers graduate educational and research programs in a diverse set of areas, collectively referred to as experimental pathology. The doctoral program is designed to train the graduate for a career in basic biomedical science, academic medicine or industry via an experience that provides a fundamental understanding of normal and disease processes and an ability to apply sophisticated research tools for their analysis. Training leading to the Doctor of Philosophy (Ph.D.) degree can be predoctoral, postdoctoral (Doctor of
Pathology (PATH)

UNDERGRADUATE COURSES

PATH 390. Undergraduate Research in Cancer Biology, Immunology, or Pathology (1-3)
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. Prerequisites: One year of college chemistry and consent of instructor.

PATH 395. Selected Readings in Immunology, Cancer Biology, or Pathology (1-3)
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. Prerequisite: Consent of instructor.

GRADUATE COURSES

PATH 410. Aging and the Nervous System (1)
Lectures and discussion on aspects of neurobiology of aging in model systems; current research on Alzheimer’s, Parkinson’s, and Huntington’s diseases. Prerequisite: Consent of instructor.

PATH 412. Theories of Aging and Longevity (1)
Insight into current theories of aging of molecules, cells, extracellular elements and their relationship to lifespan in human beings and other vertebrates. Lecture/journal club format. Prerequisite: Consent of instructor.

PATH 415. Cytoskeleton and Disease (1)
Discussion of recent papers that have added to knowledge of normal cytoskeletal functions and their alterations in disease. Prerequisite: Consent of instructor.

PATH 416. Fundamental Immunology (3)
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 and basic molecular biology of B and T lymphocytes. Lectures emphasize experimental findings leading to the concepts of modern immunology. Prerequisites: BIOL 210, graduate standing and consent of instructor. Cross-listed as BIOL 416 and CLBY 416.

PATH 417. Cytokines: Function, Structure, and Signaling (3)
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. Prerequisite: PATH 416 or equivalent. Cross-listed as BIOL 417 and CLBY 417.

PATH 418. Tumor Immunology (2)
Interactions between the immune system and tumor cells. Topics include the historical definition of tumor specific transplantation antigens, immune responses against tumor cells, the effects of tumor cell products on host immune responses, molecular identification of tumor specific transplantation antigens and recent advances in the immunotherapy of human cancers. Prerequisite: PATH 416.

PATH 430. Oxidative Stress and Disease Pathogenesis (1)
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. Prerequisite: Consent of instructor.

PATH 432. Biomedical and Molecular Aspects of Vision (3)
Increasingly, progress in the study of visual science is requiring multidisciplinary approaches that draw from the areas of biochemistry, genetics, molecular biology, neuroscience and pathology. We have recognized this fact and have adapted this course to fit the needs of tomorrow’s scientists. This course encompasses the basic science aspects of the eye. Subjects include retinal anatomy and function; biochemical, molecular aspects of retinal disease and cataract; cellular and molecular neuroscience aspects pertinent to the visual system. Cross-listed as PHRM 432 and NEUR 432.

PATH 444. Neurodegenerative Diseases: Pathological, Cellular and Molecular Perspectives (3)
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. Prerequisite: Consent of instructors.

PATH 465. Advanced Immunobiology (3)
Advanced immunology topics course covering the most important and recent advancements in specific areas of immunobiology. Course organization includes lectures by the faculty to give an overview of each topic emphasizing the recent advancements in that area, followed by student presentations of important papers and discussion on related topics. Course also includes participation in
an immunology journal club (literature review/discussion session). Prerequisite: PATH 416.

PATH 477. Cellular and Molecular Basis of Immune Dysfunction (3)
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. Prerequisite: PATH 416 or consent of instructor.

PATH 480. Immunology, Evolution, and Logic (3)
Review and discussion of current research papers and selected sections of scientific books to explore connections between immunological recognition, evolution and logic. Emphasis placed on student analysis of scientific concepts, interpretation of data and synthesis of ideas. Prerequisite: PATH 416 or PATH 510 or consent of instructor.

PATH 481. Immunology of Infectious Diseases (3)
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. Prerequisite: PATH 416 or consent of instructor. Cross-listed as MVI 481.

PATH 487. Cell Biology of the Nucleus (3)
Discussion of current cell biology research on the structure and functions of the nuclear envelope, the matrix and chromatin. Prerequisites: CBIO 453 and CBIO 454 and CBIO 455 and CBIO 456 or consent of instructor. Cross-listed as CLBY 487.

PATH 488. Yeast Genetics and Cell Biology (3)
Prerequisites: CBIO 453 and CBIO 454 and CBIO 455 and CBIO 456. Cross-listed as MBO 488.

PATH 510. Basic Pathologic Mechanisms (4)
An interdisciplinary introduction to the fundamental principles of molecular and cellular biology as they relate to the pathologic basis of disease. Lectures, laboratories, conferences. Prerequisite: Consent of instructor.

PATH 511. Experimental Pathology
Seminar I (1)
Weekly discussions of current topics and research by students, staff and distinguished visitors.

PATH 512. Experimental Pathology Seminar II (1)
Weekly discussions of current topics and research by students, staff and distinguished visitors.

PATH 516. Experimental Pathology (3)
Lecture series in cell injury, inflammation, degenerative and aging processes. Morphologic and biochemical considerations. Emphasis on investigational approaches and current work. Prerequisite: Consent of instructor.

PATH 527. Mechanisms of Cell Growth Control (3)
In-depth study of examples of cellular growth control involving hormonal, metabolic, transcriptional and post-translational mechanisms in higher eukaryotes using current scientific reviews and research articles. During each class period, students summarize research articles orally and lead discussions of the scientific points raised in the papers, with facilitation by the instructor. Emphasis placed not only on the scientific content of the papers, but also on developing skills of interpretation of published work and oral presentation. Attendance at research seminars relevant to the topic also required. Prerequisites: CBIO 453 and CBIO 454 and CBIO 455 and CBIO 456 and consent of instructor.

PATH 601. Special Problems (1-18)
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. Prerequisite: Consent of Chair of Graduate Committee.

PATH 651. Thesis M.S. (1-18)
PATH 701. Dissertation Ph.D. (1-18)
PATH 702. Appointed Dissertation Fellow (9)

Department of Pharmacology

School of Medicine, Room W-319
Phone: (216) 368-3384
Graduate Program

The Department of Pharmacology offers training leading to the Ph.D. or M.D./Ph.D. for highly qualified post-graduate candidates committed to academic research careers in the biomedical sciences. Adequate preparation in the biological sciences, calculus, 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, and clinical aspects of the pharmacologic sciences. Areas of faculty expertise include drug/xenobiotic metabolism; drug/hormone/mediator receptors, receptor-ligand interactions, and biochemical reaction mechanisms; cell biology and structure of membrane components; macromolecular structure and function; intracellular signaling, endocrine, and metabolic regulation; hormonal regulation of gene expression; neuroscience/neuropharmacology-ontology; psychopharmacology; developmental biology/pharmacology; structural analysis of function; and clinical pharmacology.

Students seeking the Ph.D. degree are admitted through the Biomedical Sciences Training Program (BSTP, please see separate entry in this publication), which provides an introduction to many related training areas within the biomedical field during the first year. Thus, students follow an integrated first-year sequence of coursework 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 adviser is made before the end of the first year.

Students selecting the Pharmacological Sciences Training Program pursue advanced-level courses – including a core of courses on molecular pharmacology, fundamentals of therapeutic agents, and pharmacokinetics – that emphasize principles of molecular structure, drug receptor interactions, mechanisms of drug action, and the absorption, distribution, metabolism and excretion of drugs, as well as adverse drug interactions illustrating these principles.

Admission to Ph.D. candidacy is based on successful coursework, laboratory per-
Pharmacology (PHRM)

UNDERGRADUATE COURSES

PHRM 301. Undergraduate Research (1-18)

PHRM 333. Membrane Transport Processes (3)
(See PHRM 433.)

GRADUATE COURSES

PHRM 413. Molecular Pharmacology (3)
Seminar on the concepts of drug receptor interactions and the molecular bases or drug action.

PHRM 421. Fundamentals of Therapeutic Agents (3)
A rational approach to the use of drugs based upon a knowledge of receptor theory and a consideration of the pharmacokinetic factors that limit the duration of drug action. Prerequisite: Consent of instructor.

PHRM 423. Drug Action and Biodisposition (3)
Mechanisms of therapeutic action and adverse side effects for major drug classes leading to a rational approach to drug choice using a problem-solving approach based on selected disease states. Prerequisite: Consent of instructor.

PHRM 430. Advanced Methods in Structural Biology I (3)
Cross-listed as BIOC 430.

PHRM 432. Biochemical and Molecular Aspects of Vision (3)
Increasingly, progress in the study of visual science is requiring multidisciplinary approaches that draw from the areas of biochemistry, genetics, molecular biology, neuroscience and pathology. We have recognized this fact and have adapted this course to fit the needs of tomorrow’s scientists. This course encompasses the basic science aspects of the eye. Subjects include retinal anatomy and function; biochemical, molecular aspects of retinal disease and cataract; cellular and molecular neuroscience aspects pertinent to the visual system. Cross-listed as PATH 432 and NEUR 432.

PHRM 433. Membrane Transport Processes (3)
Energetics, genetics, protein structure and regulation of prokaryotic and eukaryotic membrane transport systems. Cross-listed as MBIO 433, NEUR 433, and PHOL 433. Prerequisite: BIOC 307 or BIOC 407. Corequisite: CBIO 453.

PHRM 434. Mechanisms of Drug Resistance (3)
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). Cross-listed as MVIR 434 and MBIO 434.

PHRM 450. Research Proposition Tutorial (3)
Individualized library project aimed at the development of an original research proposal. Prerequisite: Consent of instructor.

PHRM 506. Central Nervous System Pharmacology (3)
Principles of neurotransmission in the central nervous system: the pharmacology of drug-induced alterations in these central systems and neurochemical basis of behavior and selected neurological and psychiatric diseases. Lecture seminar.

PHRM 511. Pharmacology Seminar Series (1)
Current topics of interest in the pharmacologist sciences.

PHRM 514. Pharmacokinetics (2)
Seminar on drug absorption, distribution, metabolism and excretion and the mechanisms of adverse drug interaction. Prerequisite: PHRM 413.

PHRM 515. Endocrine Pharmacology (3)
Seminar lecture course on regulation at the molecular level of selected interrelated endocrine systems.

PHRM 520. Cellular and Molecular Biology of Cancer (3)
Principles of carcinogenesis and cancer chemotherapy. Lecture, literature.

PHRM 523. Advanced NMR Spectroscopy in Structural Biology (3)
Cross-listed as PHOL 523.

PHRM 525. Topics in Cellular and Molecular Pharmacology (3)
Individual library research project under the guidance of a pharmacology sponsor.

Facilities

The Department of Pharmacology occupies more than 20,000 net square feet in the School of Medicine Harland Goff Wood Building. It currently houses the Basic Sciences Instrumentation Shop, a nuclear magnetic resonance spectrometer, and a darkroom. In addition to cell/tissue culture and advanced chromatographic separation capabilities, more specialized research techniques utilized include various aspects of recombinant DNA and hybridoma technology, in situ hybridization histochemistry, and both mass spectroscopy and two-dimensional NMR spectroscopy.
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. Prerequisite: Consent of instructor.

**PHRM 543. Developmental Pharmacology** (3)
Principles of ontogeny related to drug sensitivity. Lecture, literature.

**PHRM 563. Cardiovascular Pharmacology** (3)

**PHRM 601. Independent Study and Research** (1-18)

**PHRM 651. Thesis M.S.** (1-18)

**PHRM 701. Dissertation Ph.D.** (1-18)

**PHRM 702. Appointed Dissertation Fellow** (9)

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**Department of Physiology and Biophysics**

School of Medicine, Room E-541
Phone: (216) 368-5529

**GRADUATE PROGRAMS**

The Department of Physiology and Biophysics offers graduate training in contemporary physiology and biophysics and has three programs leading to the Ph.D. It also has a program leading to a master of science in exercise physiology.

The major goals of the Ph.D. 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 biophysics. These goals are accomplished by a series of foundation and advanced topic courses, skill development courses, laboratory rotations, and thesis research.

The department offers four graduate-level programs, each of which use state-of-the-art biophysical instrumentation and experimental approaches that provide excellent training in these areas.

The Department of Physiology and Biophysics has expanded its faculty, defined a new research and educational focus, and completely renovated its facilities.

The revitalization is part of the renaissance of the basic science departments in the School of Medicine at Case Western Reserve University, which has resulted in the formation of a major center of excellence in biomedical research and graduate and medical education.

**Admission Requirements for the Ph.D. programs**

Applications to the program are available from and should be submitted to the Department of Physiology and Biophysics. Typically, entering students will have a B.A., B.S. or M.Sc. degree in physical or life sciences. Requirements for admission:

- An appropriate undergraduate or master’s degree.
- Undergraduate/graduate transcripts.
- GRE scores (plus TOEFL for international students).
- Three letters of recommendation.

Status of admission to the program is determined by a committee of faculty members based on application information and (often) candidate interviews. Normally, students enter the program in the fall semester.

Students apply for financial assistance when they apply to the program. A majority of admitted students receive a stipend, health insurance, and full tuition remission during the duration of their studies in the program.

**Functional Description of the Ph.D. Programs**

Entering students are advised by the program steering committee until they pass their Ph.D. qualifying exam (usually at the end of their second fall semester), at which point their progress is overseen by a pre-thesis/thesis committee in conjunction with a research preceptor. The research progress of the student is then overseen by this committee through a series of periodic progress report meetings.

Specific requirements for graduation include satisfactory general knowledge in cell physiology or systems physiology. In some cases, the qualifying exam committee may pass the student but make recommendations for additional coursework to be completed to address areas of weakness in the student’s knowledge and expertise.

Following satisfactory completion of the qualifying exam, the student and his or her Ph.D. preceptor submit a list of four to six faculty to serve on the student’s pre-thesis/thesis advisory committee; this list is submitted to the director of the program for approval/revision in consultation with the steering committee of the program. The research progress of the student is then overseen by this committee through a series of periodic progress report meetings.

Specific requirements for graduation include satisfactory general knowledge in biophysics and bioengineering, specific expertise in the student’s chosen area of research, completion of dissertation, and completion by the student and acceptance by major peer-reviewed journals of two full first-authored research papers.
**Ph.D. in Physiology and Biophysics**

The Ph.D. in physiology and biophysics focuses on the major research areas represented in the department, such as cell physiology and molecular biophysics, with an emphasis on intracellular signaling. The research projects cover different levels of organization, ranging from the investigation of subcellular events to whole-organ physiology.

**Ph.D. in Biophysics and Bioengineering**

The Ph.D. program in biophysics and bioengineering is taught in conjunction with the Case School of Engineering. It draws on the combined expertise of the faculty from the departments of physiology and biophysics and biomedical engineering.

**Master of Science in Exercise Physiology**

The master of science program in exercise physiology has been designed to meet the needs of today’s society in terms of the increased emphasis on fitness. It can serve as a terminal degree for those interested in a career in exercise physiology in a variety of settings; as an intermediate step to obtaining an advanced degree in physiology; or as a supplement to the education of medical students and resident physicians who wish to gain knowledge in the field of exercise physiology as an adjunct to their clinical training.

**Ph.D. in Cell Physiology**

One of the major research areas represented in the department is cell biology and cellular regulation, with a focus on membrane transport and intracellular signaling. The faculty of this program conduct very active research activities focused on the study of protein structure and function, functional genomics, control of cell metabolism, regulation of ionic and electrical gradients, and regulation of various cellular functions. Most of the experimental approaches use cell biology, protein chemistry, molecular biology, and electrophysiological tools.

Cell biology encompasses the study of membrane proteins, including receptors and ion channels, signaling pathways, protein phosphorylation, enzyme regulation, transport mechanisms, and gene expression. Research programs in this department are directed toward understanding specialized functions of a variety of cell types, including epithelial, mesodermal and neuronal cells, and cells of endocrine glands. Several investigators are attempting to understand mechanisms for the targeted transport of macromolecules along biosynthetic and endocytic pathways, as well as across nuclear membranes. Studies also are under way to determine how cellular machinery might be utilized for therapeutic purposes, including receptor-mediated gene therapy.

Molecular biologic techniques are powerful tools for the study of biologic phenomena and also are the driving force behind the biotechnology industry. Many investigators in the Department of Physiology and Biophysics are using molecular genetic techniques in their research program. This work seeks to understand how transcription factors turn on specific genes at the appropriate time and in the appropriate tissue, how messenger RNA levels are regulated by RNA editing and splicing, how introducing mutant receptors and structural proteins into cultured cells and transgenic animal affects cell function and animal development, and how viral and cellular oncogenes perturb normal cell function and cause cancer. These studies are important for the understanding of critical events regulating cardiovascular development, skin differentiation, ion homeostasis, receptor signaling, and cancer progression.

The research interests of several faculty in the Department of Physiology and Biophysics are directed at understanding the electrophysiologic properties of nerve, muscle, and other tissues at a variety of different levels. This includes everything from investigating the structural basis of ion channel function to identifying the mechanism of cardiac arrhythmias. Several different molecular and biophysical approaches are used to address these questions. These approaches include the cloning and expression of ion channel proteins, reconstitution of channels in artificial lipid bilayers, and recording single-channel and whole-cell currents using various voltage-clamp techniques. Mathematical models and computer simulations also are used to describe and predict the electrical behavior of everything from single ion channels to whole organs.

**Planned Program of Study for Cell Physiology**

**First Year**

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<tr>
<th>Course (Credit Hours)</th>
<th>PHOL 432 Cell Structure and Function (3)</th>
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<tr>
<td></td>
<td>PHOL 460 Introductory Molecular Biology (3)</td>
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<td>PHOL 480 Physiology of Organ Systems (3)</td>
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<td>PHOL 498-01 Physiology and Biophysics Seminar (1)</td>
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<td>PHOL 505-01 Laboratory Research Rotation (3)</td>
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<td>PHOL 456 Structure and Function of Proteins (3)</td>
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<td>PHOL 465 Responsible Conduct in Scientific Research (1)</td>
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<td>PHOL 466 Cell Signaling (3)</td>
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<td>PHOL 498-02 Physiology and Biophysics Departmental Seminar (1)</td>
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<td>PHOL 505-02 Laboratory Research Rotation (3)</td>
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<td>PHOL 505-03 Laboratory Research Rotation (3)</td>
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**Ph.D. in Systems Integrated Physiology**

The revolutionary advances in cell and molecular biology have provided spectacular insights into the understanding of the structures and functions of biologic systems. Integrative systems physiology is a discipline that embraces the concepts of cell/molecular physiology, biochemistry, and allied sciences, and applies the principles and experimental approaches to the study of human or animal organ systems. The major goal of the graduate program in systems integrated physiology is to provide trainees with intensive training in interdisciplinary sciences with an emphasis on integration of the functions of the cardio-respiratory systems at the molecular, cellular, organ, and whole animal or human levels. Examples of specific areas of research include cardiac metabolism, transmitters and second messengers in control of cardio-respiratory systems, excitation-contraction coupling, sudden
infant death syndrome, and computational biology. The faculty in this program use a vast repertoire of experimental approaches ranging from whole body physiology to organ and cellular and molecular physiology.

**Planned Program of Study for Systems Integrated Physiology:**

**First Year**

**Fall**

**Course (Credit Hours)**

PHOL 432 Cell Structure and function (3)

PHOL 460 Introductory Molecular Biology (3)

PHOL 480 Physiology of Organ Systems (3)

PHOL 498-01 Physiology and Biophysics Seminar (1)

PHOL 505-01 Laboratory Research Rotation (3)

**Spring**

EPBI 407 Basic Biostatistics for Medical Scientists (1)

PHOL 465 Responsible Conduct in Scientific Research (1)

PHOL 468 Membrane Physiology (3)

PHOL 514 Principles of Cardiovascular Research from Organ to Cellular Systems (3)

PHOL 518a Integrative Approaches Cardiorespiratory Research (3)

PHOL 498-02 Physiology and Biophysics Departmental Seminar (0)

PHOL 505-02 Laboratory Research Rotation (3)

PHOL 505-03 Laboratory Research Rotation (3)

**Ph.D. Program in Biophysics/Bioengineering**

The CWRU Biophysics and Bioengineering Program was formed in 1991 in response to (1) dramatic advances in computers and instrumentation; (2) spectacular progress in biochemistry and molecular biology; and (3) the realization that integrated systems/engineering approaches are becoming critical for the understanding of biologic processes.

These synergistic advances provide tremendous opportunities for researchers interested in biology who are equipped to take quantitative approaches. A spectacular example is found in the area of structural biology, where the number of high-resolution 3-D structures of biologic macromolecules solved and deposited into the Brookhaven Protein Databank has jumped from an average of 40 structures per year from 1975 to 1985 to 1,850 structures in 1997 alone. Another example is found in electrophysiology, where now it routinely is possible to measure transmembrane currents conducted by single ion channel protein molecules. Further, the tools of molecular biology now routinely are used to facilitate the large-scale preparation of proteins and nucleic acids, thereby providing access to a host of biomedically and biotechnologically important molecules that previously were unavailable in significant quantities.

The various genome projects are generating a staggering quantity of sequence data that will lay the basis for much of the biological and biomedical research of this new century. As a result of such advances and developments, new approaches to explaining, exploiting, and controlling the components of biologic systems for basic science, biotechnologic, or medical reasons are both required and feasible.

The Biophysics and Bioengineering Program is an interdisciplinary Ph.D. program, co-sponsored by the Department of Physiology and Biophysics in the medical school and the Department of Biomedical Engineering. The program complements other graduate programs of those departments. The goals of the program are to provide students with the necessary knowledge base in cellular and molecular biology and with the quantitative biophysics and engineering skills required to perform studies that exploit and advance the cutting edge of advanced biophysics technologies. These goals are accomplished through a flexible curriculum that is tailored to the specific needs of the student and by providing a wide range of available faculty expertise and research opportunities.

The program has particular strengths in cellular/electrophysiology and biophysics, biologic imaging, biosensors, tissue engineering, modeling, biomaterials, and structural biology. Many of the participating faculty are affiliated with the Cleveland Center for Structural Biology, which includes state-of-the-art NMR and x-ray diffraction instrumentation. The program is overseen by a steering committee.

**Planned Program of Study for Biophysics & Bioengineering:**

**First Year**

**Fall**

**Course (Credit Hours)**

PHOL 432 Cell Structure and Function (3)

PHOL 460 Introductory Molecular Biology (3)

EBME 409 Systems and Signals (3)

One of the following*:

PHOL 498 Physiology and Biophysics Departmental Seminar (1)

PHOL 499 Biophysics/Bioengineering (1)

PHOL 505-1 Laboratory Research Rotation (3)

**Spring**

PHOL 456 Structure and Function of Proteins (3)

PHOL 465 Responsible Conduct of Scientific Research (1)

PHOL 468 Membrane Transport (3)

PHOL 498/99-2 Physiology and Biophysics Departmental Seminar* (1)

PHOL 505-2 Laboratory Research Rotation (3)

Elective (5)

**Ph.D. program for M.D.s**

To address the need to train M.D.-scientists, the Department of Physiology and Biophysics has instituted an accelerated Ph.D. program specifically geared to physicians interested in research. The key features of the program are its selectivity in terms of admissions qualifications – it is open only to those holding medical degrees – and its accelerated nature based on a rigorous course of study and research training. The program is subdivided into advanced specialty courses (cell physiology electives) and hands-on research training and problem-solving (laboratory rotations, departmental seminars, qualifying examination, and thesis research). All students enrolled in the program must fulfill the general academic regulations for doctoral degrees as set forth by the School of Graduate Studies. Application is open to any individual holding a medical degree or expecting to receive one before entry into the pro-
gram. Selection for admission is based on the applicant’s potential for independent and innovative research as evidenced by an outstanding academic record in basic science disciplines, previous research experience, and three letters of recommendation. The full-time plan of study consists of a minimum of 22 semester hours of coursework and 18 semester hours of thesis research. The program can be linked to research-oriented residency programs such as the Clinical Investigator Pathway, approved by the American Board of Internal Medicine, and similar programs in pediatrics and surgery.

**Master of Science in Exercise Physiology**

The Department of Physiology and Biophysics master’s program in exercise physiology offers not only a strong didactic component but also, unique within the existing programs at the master of science level, strong research training. This is a Plan A, thesis required, program. The solid basis for the program includes the department’s outstanding faculty and resources, along with faculty who are currently involved in the applied practice of exercise physiology. The didactic components include solid basic science, clinical science and practical applications.

The program has several goals. A primary goal is to serve as a terminal degree for graduates who will pursue careers in exercise physiology in a variety of settings, including counselors in health clubs, personal trainers, clinical technicians in performance function laboratories, and other careers. Another goal is to prepare students for additional advanced work in the field of physiology leading to the Ph.D. degree. A third goal is to supplement the education of medical students and resident physicians who wish to acquire additional knowledge and training in the field of exercise physiology as an adjunct to their clinical careers.

A unique feature of the program is the emphasis on research. All students are expected to complete two laboratory rotations, ultimately selecting a project that leads to a successful thesis. All students will select an advisor no later than the end of the first term of studies. For evaluation of the thesis, each student will select with his/her advisor two additional faculty members to serve as committee members. The thesis work must result in at least one major paper with the student as first author.

Students will take 19 hours of didactic course work, six hours of laboratory rotations and nine hours of thesis, thus meeting the requirements of the School of Graduate Studies.

An earned quality point average of B+ (3.1) or better is required to remain in good standing in the program.

**Admission Requirements for Exercise Physiology**

All students must meet requirements for admission to the School of Graduate Studies of Case Western Reserve University. Additional requirements:

- The general section of the Graduate Record Exam (GRE).
- The following courses: one year of biology; chemistry courses, including organic chemistry; and introductory physics.
- The following courses are recommended: biochemistry and statistics. A working knowledge of computers also is recommended.
- Enrollment as full-time medical student in the School of Medicine at Case Western Reserve University or the previous attainment of a medical degree may replace the above requirements.

**Planned Program of Study for Exercise Physiology**

**Students enrolled solely in the School of Graduate Studies:**

**Course (Credit hours)**

- ANAT 377/477 Human Musculoskeletal Anatomy (4)
- BIOC 452 Nutritional Biochemistry (3)
- PHOL 440 Integrative & Cellular Physiology of Exercise (3)
- PHOL 444 Assessment of Human Performance Testing (3)
- PHOL 446 Cardiovascular Training (2)
- PHOL 465 Responsible Conduct in Scientific Research (1)
- PHOL 480 Organ System Physiology (3)
- PHOL 505 - 1 & -2 Laboratory Rotations (2 x 3 credits each)

Minimum credit hours in coursework: 25

PHOL 651 M.S. Thesis (minimum 9)

**Students enrolled in the School of Medicine:**

The requirements for organ system physiology and anatomy will be waived for these students because this material is covered in the medical school curriculum. These students still must achieve the minimum number of hours for the School of Graduate Studies.

Students apply for financial assistance when they apply to the program. A majority of students receive tuition remission and paid health insurance during the duration of their studies in the program.

**Physiology (PHOL)**

**UNDERGRADUATE COURSES**

**PHOL 351. Independent Study (1-6)**

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)**

Weekly one-hour reviews by faculty or invited speakers of their research. Students will present literature reviews or summaries of their research.

**GRADUATE COURSES**

**PHOL 430. Advanced Methods in Structural Biology I (3)**

Cross-listed as BIOC 430.

**PHOL 432. Cell Structure and Function (3)**

This course is designed to provide a 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 basic cell and organelle structure, materials movement inside cells, cell interaction with the external environment, energy generation, the role of membrane potential, regulation of cell cycle and cell death, and mechanisms of signal transduction and membrane transport. 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. Prerequisite: Permission required.

PHOL 433. Membrane Transport Processes (3)
Cross-listed as PHRM 433.

PHOL 440. Integrative and Cellular Physiology of Exercise (3)
This course provides a thorough presentation of the physiological responses to exercise. Emphasis is placed on understanding both the acute and chronic adaptation of the musculoskeletal, endocrine, pulmonary, and cardiovascular systems to physical exercise. Clinical uses of exercise in the prevention, diagnosis and treatment of disease will be discussed.

PHOL 444. Assessment of Human Performance Fitness (3)
This course provides detailed descriptions of a broad range of methods for the assessment of human performance. These include basic principles, techniques and norms for accurate and effective performance/fitness testing in a normal population. The student will learn not only how to perform a test and measure physiological variables, but also will learn how to process, analyze and interpret the information collected during the test. Topics include assessment of aerobic and anaerobic power, breath-by-breath pulmonary gas exchange, functional capacity in a clinical setting, as well as measurement of human strength and body composition, and examination of muscle via biopsy. Some of the most recent techniques for studying muscle oxygenation and metabolism, as well as techniques for the assessment of physical activity or fitness in the field will also be covered.

PHOL 446. Cardiovascular Training (3)
A concentrated course focusing on training and conditioning and program design following the American College of Sports Medicine’s guidelines. Includes determining goals and objectives, exercise selection, methods of evaluation and recording progress. Physical fitness component designed for the evaluation and development of personal fitness. Practical emphasis on physical assessment, personal training and program design.

PHOL 451. Independent Study (1-18)
Guided program of study in physiology textbooks, reviews and original articles. Independent laboratory projects to reproduce and extend classical physiological experiments.

PHOL 456. Proteins: Structure and Function (3)
The goal of this course is to provide a basic working knowledge of protein structure, how proteins catalyze reactions, and how proteins are studied. The goal is to provide students with general knowledge of proteins that can be used in experimental work and facilitate understanding of the scientific literature. The course begins with a discussion of protein structure as a preamble to discussion of protein function. The course also presents fundamental methods of protein purification and characterization. Cross-listed as BIOL 457.

PHOL 460. Introductory Molecular Biology (3)
This course focuses exclusively on technologies and concepts relating to the study of nucleic acids and the application of molecular technology. A major goal of this course is to provide students with the tools to read and understand molecular scientific literature, and to learn how to apply this technology for the study of physiological models. The first segment of the course is a basic review of the role of nucleic acids in cells. The second and third sections focus on molecular technology and its application in physiological systems. In these sessions the students are taught how to clone a gene and then how to use this tool (clone) in animal and cell-based studies. Cross-listed as BIOL 460.

PHOL 465. Ethical Conduct in Science (1)
This lecture/discussion course discusses the ideals motivating scientific research, the problems resulting from the breakdown of these ideals, and how those entering scientific research can prepare themselves to deal with these issues. Issues and practices regarding the use of animals, chemicals, and isotopes will also be discussed.

PHOL 466. Cell Signaling (3)
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. Cross-listed as CLBY 466.

PHOL 468. Membrane Physiology (3)
This lecture/discussion/journal course focuses on biological membranes. Topics discussed include thermodynamics and kinetics of membrane transport, oxidative phosphorylation and bioenergetics, electrophysiology of excitable membranes, and whole and single channel electrophysiology, homeostasis and pH regulation, volume and calcium regulation. Cross-listed as CLBY 468.

PHOL 480. Physiology of Organ Systems (3)
This course presents an advanced introduction to the fundamental physiological principles governing the major organ systems in mammals. The function of the nervous, endocrine, digestive, muscle, circulatory, respiratory, and urinary systems are discussed. At the conclusion of the semester, integrative aspects of the major organ systems will be illustrated through consideration of exercise and high altitude physiology. Cross-listed as BIOL 480.

PHOL 498. Physiology and Biophysics Departmental Seminar (1)
Weekly one-hour reviews by invited speakers of their research. Students present literature reviews or summaries of their research.

PHOL 499. Biophysics/Biomedical Engineering Seminar (1)
Weekly one-hour reviews by faculty or invited speakers of their research. Students present literature reviews or summaries of their research.

PHOL 505. Laboratory Research Rotation (3)
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.

PHOL 512. Methods in Cardiovascular Research (3)
Laboratory demonstrations to acquaint students with “state of the art” techniques in whole body, organ and cellular physiology related to cardiovascular research. These include: demonstration of cardiovascular reflexes in anesthetized animals and effects of neurotransmitters on cardiac and baroreceptor sensory activities. Demonstration of Starling’s principles using isolated mammalian heart preparation; measurements of force ve-
Locality in cardiac myocytes and intracellular calcium. Biochemical methodology include membrane fraction of cardiac and vascular smooth muscle cells.

PHOL 514. Introduction to Cardiovascular Research (3)
The goal of this course is to provide students with an introduction to the heart and vasculature. The course beings with a gross description of the anatomy of the heart and blood vessels, progresses through lectures on the function of the organs, tissues and cells involved in the cardiovascular system, and ends with a discussion of pathological states which may effect the heart and blood vessels.

PHOL 518. Integrative Approach to Cardiorespiratory Research I (3)
This course is designed to integrate the biochemical and cellular aspects of the cardiorespiratory system with in vivo physiology and pathology. This course emphasizes cardiovascular aspects, while PHOL 519 emphasizes the pulmonary aspects of cardiopulmonary physiology. Prerequisite: Permission of instructor.

PHOL 519. Integrative Approach to Cardiorespiratory Research II (3)
This course is designed to integrate the biochemical and cellular aspects of the cardiorespiratory system with in vivo physiology and pathology. This course emphasizes pulmonary aspects, while PHOL 518 emphasizes the cardiovascular aspects of cardiopulmonary physiology. Prerequisite: PHOL 518 or permission of instructor.

PHOL 522. Special Topics in Cardiac Electrophysiology (3)
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 523. Advanced NMR Spectroscopy in Structural Biology (3)
Theory, application, and practical aspects of multidimensional high-resolution NMR spectroscopy in solution and solid state. Cross-listed as BIOC 523, CHEM 523, and PHRM 523. Prerequisite: PHOL 430 or BIOC 312/412 or consent of instructor.

PHOL 530. Technology in Physiological Science (3)
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. Prerequisites: CBIO 453 and CBIO 454.

PHOL 531. Transcription Factor Regulation of Gene Expression (2)
A reading and presentation course designed to expand knowledge of the mechanisms that regulate transcription factor activity and the mechanisms whereby transcription factors regulate gene expression. The major transcription factor classes are covered (i.e., Apl, Spl, NFkappaB, POU domain, etc). Students are required to summarize a group of manuscripts that focus on a particular transcription factor signaling process and coherently present this information in class. Prerequisite: Consent of course director.

PHOL 601. Research (1-18)
Laboratory research activities in cellular physiology according to interests of staff and students.

PHOL 607. Electrophysiology (2)
Lecture/discussion course. Generation of electrical activity by voltage- and ligand-gated ion channels with emphasis on neurons and other excitable cells, regulation of electrical activity by neurotransmitters and hormones, kinetic modeling of individual ion channels, macroscopic ionic currents, electrical behavior of entire cells and theoretical and practical aspects of patch clamp and other electrophysiological techniques.

PHOL 609. New Methods in Biophysics (1)
Lecture/discussion course will cover spectroscopy and imaging technology for the understanding of membrane transport and intracellular signaling.

PHOL 651. Thesis M.S. (1-18)

PHOL 701. Dissertation Ph.D. (1-18)

PHOL 702. Appointed Dissertation Fellowship (9)
Frances Payne Bolton School of Nursing
Frances Payne Bolton School of Nursing

HISTORY

The Frances Payne Bolton School of Nursing has a proud heritage beginning with the Lakeside Hospital Training School for Nurses established in 1898. With a generous endowment from Frances Payne Bolton, who was the first woman congressman from Ohio, the school of nursing 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. Currently, the Bolton school is ranked fourth by US News and World Report and fifth in funding from the National Institutes of Health. Graduate level specialty majors also are in the top five.

The Bolton school is noted for its innovation, leadership and excellence in education, research and practice. To support this mission, the school has seven endowed chairs, the largest number in the world for a school of nursing. The Bolton school is a World Health Organization Collaborating Center in Home Care. The Sara Cole Hirsch Center for Best Nursing Practices Based on Evidence was established in 1998 and is the only 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.

Values

The Frances Payne Bolton School of Nursing espouses a set of values that characterize the finest tradition of nursing leadership:

• Excellence
• Integrity
• Diversity
• Health for all
• Creativity
• Curiosity
• Stewardship

STRATEGIC GOALS

The Frances Payne Bolton School of Nursing sets the following goals for the period 1998-2000 in order to carry out its mission:

I: Expand global leadership in research and scholarship.
II: Expand global leadership in teaching/learning.
III: Achieve global leadership for the profession.
IV: Recruit, retain, and develop a highly qualified and diverse group of students, faculty, and staff members.
V: Add value to the work of the school by developing and refining an information technology infrastructure.
VI: Initiate funded, targeted projects in selected areas.
VII: Increase collaboration, partnerships, and joint ventures.
VIII: Ensure the accountability of all programs.

Purpose

The Frances Payne Bolton School of Nursing is 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.

The purpose of the school 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.

Philosophy

To accomplish the stated mission, the School of Nursing has set forth the following philosophy:

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 the Bolton School 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 strate-
gies 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. Their 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.

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 physiologic, 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.

Conceptual Framework

The conceptual framework of the Bolton School of Nursing is consistent with the definition of nursing adopted by the faculty.

“The science and art of enhancing, through the professional encounter, the health-seeking behaviors of individuals as they strive to attain, maintain or regain an optimal level of health within an environment of care.”

Relevant concepts include:

- Optimal Level of Health: 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 level of 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 performs acts for clients that facilitate their health-seeking behaviors.

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 facili-
tate 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 asset, 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 it 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

Bachelor of Science in Nursing and Master of Science in Nursing programs are accredited by the National League for Nursing. National League for Nursing 61 Broadway-33rd Floor New York, NY 10006 212-363-5555 Ext. 153 www.accrediting-comm-nlnac.org

The Council on Accreditation of Nurse Anesthesia Programs accredits the nurse anesthesia program.

American Association of Nurse Anesthetists 222 South Prospect Avenue Park Ridge, Illinois 60068-4001 (847) 692-7050 info@aana.com

The nurse midwifery program is accredited by the American College of Nurse Midwives. American College of Nurse Midwives 818 Connecticut Ave. NW, Suite 900 Washington D.C. 20006 202-728-9860 info@acnm.org

The School of Nursing is approved by the State of Ohio Board of Nursing and is a member of the Council of Baccalaureate and Higher Degree Programs of the National League of Nursing. Ohio Board of Nursing 17 High Street Suite 400 Columbus, OH 43215-3413 614-466-3947 www.state.oh.us/nur

The North Central Association of Colleges and Schools Commission on Institutions of Higher Education 30 N. LaSalle Street, Suite 2400 Chicago, IL 60602-2504 (800) 621-7440 info@ncaicihe.org

INSTRUCTIONAL FACILITIES

With a highly qualified faculty engaged in teaching, research, and community service, the Bolton school offers high quality academic programs. Instruction includes lectures, seminars, individual conferences and small groups 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 a aggregate of specialized hospitals that includes Alfred and Normal 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, houses most of the collections of the University. The library enables users to integrate both traditional resources and state-of-the-art technology into teaching, research, and learning. CWRUnet (the fiber optic network) faceplate connections are at nearly every seat in the library. Two multi-media rooms include scanners, sound and video digitizers. Available are individual study spaces, meeting rooms, conference areas, and social gathering places. Compact shelving allows the library to keep most of the collection on-site for immediate access to print materials. The interface to the on-line catalog, databases, and other resources is self-explanatory as possible, allowing 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. Collections at the CWRU 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 CWRUnet. These include OhioLINK, a state-funded network that links libraries at 18 Ohio institutions and 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 345,072 volumes, 2780 current periodicals, and audiovisual materials. Approximately 8,800 volumes are specifically nursing texts, and 108 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.

COMPUTER SERVICES

Case Western Reserve University constructed a fiber optic backbone for a computer network in 1990. Since that time the CWRUnet (the name for this fiber optic backbone) has served as a national prototype for education and research computing. In 1999, Yahoo named CWRU as the most wired campus in the nation. The CWRUnet supports full Internet services, including voice, video and data transmission. The University Web Server (http://www.cwru.edu) provides linkages to and from Case Western Reserve resources. Statistical software and the other software packages can be accessed through CWRUnet. E-mail and Internet access are also available. Two support teams, Library and Information Technologies and the Information Network Services provide technical support. The Information Network Services of CWRU oversees the university Web server as well as additional Novell and Macintosh file servers.

Computer laboratories and services are available campus-wide during weekday, evening and weekend hours. CWRUnet includes access to a multimedia system of communication, including the library system and the two university mainframe computers. This access is possible through personal computer or any of the two large and several smaller computer centers on campus, libraries, resident halls or through the computer facilities on the second floor of the School of Nursing. In addition, 24-hour dial in access to CWRUnet is also available to students, faculty and staff.

ORGANIZATIONS

Student Organizations

All enrolled students are members of their respective Undergraduate or Graduate Student Organizations that promote collegiality among the students and provide social, cultural activities and educational. They are also members of the National Student Nurses’ Association, and after paying dues, member of the Bolton School’s chapter of this organization. Ph.D. students elect one member and one alternate to the Graduate Student Senate of the School of Graduate Studies. The Nurses’ Christian Fellowship is an affiliate of the Inter-Varsity Christian Fellowship. Selected by the student organizations, students also are members of some standing committees of the Bolton School.

Sigma Theta

Sigma Theta Tau is a national professional honor society, and Alpha Mu is the chapter at the Bolton School. Members are selected from students enrolled in one of the school’s nursing programs or nurses in the community with a B.S.N., M.S.N., Ph.D. or N.D. degree. Candidates are chosen based on superior scholastic achievement, potential for leadership and desirable personal qualities.

Alumni Association

Upon graduation, all nursing students are inducted into the Alumni Association. This begins a life-long membership and relationship with the School of Nursing. An elected board of directors and officers administer the association. Alumni are generous in their support of the school and provide funds for students and the Bolton school through the Annual Fund and other gifts and bequests. Activities of the alumni are reported in the Haelan (to heal) magazine published by the nursing school.

ADMINISTRATION

Dorothy J. Brooten, Ph.D., FAAN (University of Pennsylvania)
Dean of Nursing
Director of WHO
Beverly L. Roberts, Ph.D., FAAN, FGSA (Case Western Reserve University)
Associate Dean of Academic Programs
JoAnne Youngblut, Ph.D., FAAN (University of Michigan)
Associate Dean for Research
Director of Sarah Cole Hirsh Institute for Best Nursing Practices
May L. Wykle, Ph.D., FAAN, FGSA (Case Western Reserve University)
Associate Dean for Community Affairs
Director, Center on Aging and Health
Kathleen Montgomery, M.S.N. (Case Western Reserve University)
Assistant Dean for Student Services
Marilyn B.otas, Ph.D., RN (University of Michigan)  
Director, B.S.N. Program  
Georgia Narsavage, Ph.D., (University of Pennsylvania)  
Director, M.S.N. Program  
Theresa Stanfield, Ph.D. (Case Western Reserve University)  
Director, N.D. Program  
Jaclene A. Zauszniewski, Ph.D. (Case Western Reserve University)  
Director, Ph.D. Program  
Elizabeth Madigan, Ph.D. (Case Western Reserve University)  
Director, Center for Research and Scholarship  
Nora Hennessey, B.A. (Walsh University)  
Executive Director of Development and Alumni Relations  
Susan Frey, M.Acc. (Cleveland State University)  
Director of Finance and Administration  

PROFESSORS  
Gene C. Anderson, Ph.D., FAAN (Wisconsin, Madison)  
Edward J. and Louise Mellen Professor of Nursing  
Dorothy Brooten, Ph.D., FAAN (University of Pennsylvania)  
Dean and John Barry Professor of Nursing  
Joyce J. Fitzpatrick, Ph.D., MBA, FAAN (New York University)  
Elizabeth Brooks Ford Professor of Nursing  
Marie R. Haug, Ph.D. (Case Western Reserve University)  
Professor Emerita  
Beverly L. Roberts, Ph.D., FAAN, FGSA (Case Western Reserve University)  
Professor of Nursing  
Ray L. Wyck, Ph.D., FAAN, FGSA (Case Western Reserve University)  
Florence Cellar Professor of Nursing  
JoAnne Youngblut, Ph.D., FAAN (University of Michigan)  
Professor of Nursing  

ASSOCIATE PROFESSORS  
Claire M. Andrews, Ph.D., FAAN (Wayne State University)  
Associate Professor of Nursing  
John Clochesy, Ph.D., FAAN (Case Western Reserve University)  
独立基金会教授护理教育  
Barbara J. Daly, Ph.D., FAAN (Bowling Green University)  
Associate Professor of Nursing  
Judith A. Maloni, Ph.D., FAAN (University of Pittsburgh)  
Associate Professor of Nursing  
Shirley M. Moore, Ph.D. (Case Western Reserve University)  
Associate Professor of Nursing  
Diana L. Morris, Ph.D., FAAN (Case Western Reserve University)  
Associate Professor of Nursing  
Carol Musil, Ph.D. (Case Western Reserve University)  
Associate Professor of Nursing  
Georgia Narsavage, Ph.D. (University of Pennsylvania)  
Associate Professor of Nursing  
E. Ronald Wright, Ph.D. (Purdue University)  
Associate Professor of Nursing  
Jaclene A. Zauszniewski, Ph.D. (Case Western Reserve University)  
Associate Professor of Nursing  

ASSISTANT PROFESSORS  
Kimberly Adams-Davis, N.D., FAAN (Case Western Reserve University)  
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Assistant Professor of Nursing  
Donna Dowling, Ph.D. (University of Illinois)  
Assistant Professor of Nursing  
Carol D. Epstein, Ph.D. (Case Western Reserve University)  
Assistant Professor of Nursing  
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Assistant Professor of Nursing  
Marion M. Hemstrom, D.N.Sc. (Rush University)  
Assistant Professor of Nursing  
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Assistant Professor of Nursing  
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Assistant Professor of Nursing  
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Assistant Professor of Nursing  
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Assistant Professor of Nursing  
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Assistant Professor of Nursing  
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Assistant Professor of Nursing  
Christine Winkelman, Ph.D. (Case Western Reserve University)  
Assistant Professor of Nursing  

INSTRUCTORS  
Gloria F. Antall, N.D. (Case Western Reserve University)  
Instructor of Nursing  
Jeanine Bernstein, M.N. (University of California, Los Angeles)  
Instructor of Nursing  
Paul R. Blakeley, M.S.N. (Case Western Reserve University)  
Instructor of Nurse Anesthesia; Director, Cleveland Clinic Foundation Nurse Anesthesia Program  
Rhonda Draper, N.D. (Case Western Reserve University)  
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Evelyn G. Duffy, M.S. (University of Wisconsin, Madison)  
Instructor of Nursing  
Carol A. Kelley, M.S. (University of Rochester)  
Instructor of Nursing  
David R. Hall, M.S.N. (Case Western Reserve University)  
Instructor of Nurse Anesthesia  
Jack R. Kless, M.S.N. (Case Western Reserve University)  
Instructor of Nurse Anesthesia  
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Instructor of Nursing  
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Instructor of Nursing  
Kathleen Massoli, M.S.N. (University of Akron)  
Instructor of Nurse Anesthesia  
Rita McNulty, M.S.N. (Catholic University of America)  
Instructor of Nursing  
Instructor of Nursing  
Instructor of Nursing  
Instructor of Nursing  
Instructor of Nursing  
Instructor of Nursing  
Instructor of Nursing  
Instructor of Nursing  
Instructor of Nursing  
Instructor of Nursing  
Instructor of Nursing  

LECTURERS  
Elizabeth A. Crooks, M.S.N. (Case Western Reserve University)  
Lecturer of Nursing  
Mary Harrison, M.S.N. (Kent State University)  
Lecturer of Nursing  
Marcella Hovancsek, M.S.N. (Case Western Reserve University)  
Lecturer of Nursing  

Bachelor of Science in Nursing  

The B.S.N. program is one of the few to offer an integrated curriculum. This enables our students to begin their clinical experience during the first term of enrollment, freshman year. Students graduate with more than 1,450 hours of clinical ex-
experiences, exceeding other schools of nursing.

Students practice skills from taking blood pressures to administering intravenous fluids and medications in the Nursing Skills Lab. They then move to working with patients in a variety of hospitals, skilled care facilities, and home health care settings.

The opportunities available to students are limitless. They can be involved in collaborative, funded research projects with exceptional faculty who are committed to teaching and scholarly inquiry. Students are exposed to health care issues in the global arena and have the opportunity to participate in international experiences coordinated through the Bolton School’s World Health Organization (WHO) Collaborating Center of Home Care.

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

ADMISSION REQUIREMENTS

Freshman
- Application for undergraduate admission to the University
- Recommendation from secondary school report/counselor
- Secondary school transcript
- Writing sample
- SAT/ACT scores

Transfer
- Application for undergraduate admission to the University
- Secondary school transcript
- Teacher recommendation
- Statement of good standing
- College transcripts
- Personal statement
- SAT/ACT scores

DEGREE REQUIREMENTS

Candidates for the Bachelor of Science in Nursing degree must complete the following:

1. Minimum of 122 hours as specified by the requirements with a 2.0 GPA
2. A minimum of C for all courses taken in nursing.
3. A minimum of 50 credit hours in 300 and 400 level courses
4. A modified core curriculum described in the Case Western Reserve University General Bulletin

PROGRESSION IN THE B.S.N. 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 courses. Although the University accepts a D as a passing grade, the grading policy of the Bolton School is a, B, C, F. Students who receive two unsatisfactory grades (D or F) in nursing and/or natural and behavioral science courses will be subject to separation from the school of nursing. See the Undergraduate Student Handbook 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 an F for a nursing course must register for that course the next semester that it is offered. If the overall GPA falls below the required cumulative GPA, the student is placed on academic probation. If the GPA does not improve the next semester, the Academic Standing Committee of the University Undergraduate Faculty will review the student’s record to determine whether extenuating circumstances warrant an additional semester of probation or separation from the university.

CURRICULUM

This four-year generic program for high school graduates leads to a B.S.N. degree. Upon successful completion of the program, graduates will be eligible to sit for the examination for licensure as a registered nurse (RN). This examination is given by State Boards of Nursing, and satisfactory completion of this examination enables the graduate to practice as a RN in the state for which the examination was written.

The B.S.N. program includes nursing, science and liberal arts courses. A minimum 122 credit hours, with at least 50 credits from upper division courses, are required for awarding of the B.S.N. degree. Forty-one of these credits are courses offered by other departments and schools within the University. Students must complete a minimum of 17 semester hours of natural and mathematics science, 12 hours of arts and humanities, 3 hours of global and cultural diversity, 3 hours of English composition and 6 hours of social sciences. Eighty-one credits are courses offered by the School of Nursing. 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 B.S.N. program is located on the next page.

RN/B.S.N. ENTRY OPTION

Registered nurse graduates of an associate or diploma program in nursing can obtain their B.S.N. by fulfilling the core requirements of the University and the
upper division nursing courses developed specifically for this program.

**ADMISSION REQUIREMENTS**
- Completion of an accredited associate degree or diploma program in nursing with a minimum GPA of 2.5
- Current RN licensure
- Transcripts of all academic work

**PROGRAM REQUIREMENTS**
Based on passing the NCLEX examination for licensure, 30 semester hours of proficiency in clinical nursing will be granted. Upon satisfactory completion of 62 credits of the University’s core requirements for a baccalaureate degree, the required 30 hours of upper division nursing courses, and the 30 hours of proficiency in clinical nursing (total of 122 credits), students will be granted a Bachelor of Science in Nursing degree. Transfer credit will be evaluated for content and equivalence to University courses by the appropriate academic department. To be considered by transfer, course syllabi may have to be provided along with the academic transcript.

**NURSING CORE REQUIREMENTS**
To satisfy University core requirements, 62 semester hours of coursework must be completed in the following areas:
- English Composition
- Natural and Mathematical Sciences
- Arts and Humanities
- Social Sciences
- Global and Cultural Diversity
- Physical Education

**Upper Division Nursing Courses**

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<th>Course</th>
<th>Hours</th>
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<td>NURS 318 Nursing in the Community</td>
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<td>NURS 320 Nursing Research</td>
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<td>NURS 345 Nursing Informatics III</td>
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<td>NURS 346 Nursing Informatics IV</td>
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<tr>
<td>NURS 391 Home Health Care</td>
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**PROGRAM PLAN FOR GENERIC BACCALAUREATE STUDENTS**

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<td>Social Sciences Requirement:</td>
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<td>PSCL 101 OR ANTH 102 OR SOC 112</td>
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<tr>
<td>BIOL 110 Principles of Biology</td>
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<tr>
<td>BIOL 119 Molecular View of Biology</td>
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<td>ENGL 150 Expository Writing</td>
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<td>PHED 019 Physical Education</td>
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<td>NURS 110 Foundations of the Discipline</td>
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<td>NURS 111 Foundations of the Practice</td>
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<tr>
<td>Social Sciences Requirement:</td>
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<tr>
<td>SOCI 203 OR Human Development</td>
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<td>BIOL 150 Anatomy &amp; Human Physiology</td>
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<td>NURS 230 Nursing Care of the Adult &amp; Older Adult I</td>
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<td>STAT 201 Basic Statistics</td>
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<td>NURS 344 Trends &amp; Issues in Professional Nursing</td>
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<td>NURS 345 Informatics III: NIS</td>
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<td>NURS 351 Acute Care II</td>
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<td>NURS 353 Principles of Critical Care</td>
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<td>NURS 201 Nutrition</td>
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<td>NURS 122 Nursing Assessment</td>
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<td>NURS 120 Nursing Informatics: Introduction</td>
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<td>PHED 019 Physical Education</td>
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<td>NURS 342 Medical Microbiology</td>
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<td>NURS 240 Nursing Care of the Adult &amp; Older Adult II</td>
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<td>NURS 222 Nursing Informatics II: Biostatistics</td>
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<td>NURS 346 Informatics IV</td>
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<td>NURS 352 Acute Care III OR</td>
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<td>NURS 354 Critical Care: Adults OR</td>
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<td>NURS 356 Critical Care: Children</td>
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- Global & cultural diversity - 3 semester hours
- Social sciences - 6 semester hours
- English composition - 3 semester hours

- Natural & mathematic sciences - 17 semester hours
- Arts & humanities - 12 semester hours
Master of Science in Nursing

The Master of Science in Nursing program prepares registered nurses for advanced practice specialization either as a nurse practitioner, clinical specialist, nurse midwife or nurse anesthetist. Dual degree programs are offered in bioethics (M.S.N./MA), anthropology (M.S.N./MA) and business administration (M.S.N./MBA).

CHARACTERISTICS OF THE GRADUATE
Develops and teaches educational offerings and provides consultation with other professionals/populations and communities about health, illness and health-seeking behavior
Identifies clinical research problems, initiates utilization of research and participates in scientific inquiry
Assumes functions and role of the Advanced Practice Nurse
Assumes leadership positions in organizations at the local/state/national level
Applies ethical principles in Advanced Practice Nursing
Initiates interdisciplinary teams to enhance practice
Establishes effective communication systems among clients and colleagues
Contributes to policy development through active participation in legislative processes

ENTRY OPTIONS

RN with National Certification in Advanced Nursing Practice
This is a M.S.N. completion program designed to assist certified advanced practice nurses to complete a Masters of Science in Nursing degree. Registered nurse applicants must have a Bachelor in Nursing Science from an accredited nursing program.

Applicants must have certification from a national accredited organization as a nurse practitioner, clinical nurse specialist, nurse midwife, nurse anesthetist or AORN first assistant. The national certification in advanced nursing practice takes the place of the clinical coursework in the specialty where the person holds certification. A Master of Science in Nursing can be obtained by completing 18 credits (6 courses) at the Bolton School of Nursing. These include courses in the Inquiry, Professional practice and Pharmacology in the advanced practice cores.

Professional Development Core
NURS 443 Professionalism in Advanced Practice ................................. 3
NURS 444 Health Care Delivery, Legal and Ethical Issues in Advanced Practice ........................................... 3

Scientific Inquiry Core
NURS 405 Inquiry I ........................................ 3
NURS 415 Inquiry II ....................................... 4
NURS 503 Inquiry III .................................... 2

Advanced Practice Core
NURS 430 Pharmacology and Therapeutics ........................................ 3

RN/M.S.N. Entry Option
Registered nurse graduates of an associate degree or diploma nursing program may enter the Masters of Nursing program after completing undergraduate prerequisites for master level nursing courses.

Undergraduate Prerequisites to Master of Nursing Courses

Fall Semester Weekend Classes
NURS 392 Dynamics of Nursing Practice Management ............................... 4
NURS 393 New Applications of Nursing Practice Management .................. 4

January Intensive Classes
NURS 345 Nursing Informatics III .......... 2
NURS 318 Nursing in the Community .......................... 4

May Intensive Classes
NURS 346 Nursing Informatics IV ........ 2
NURS 320 Nursing Research .......................... 3

Total Semester Hours ........................................... 19

RN with a B.S. or B.A. Degree
Applicants with a B.A. or B.S. degree in a field other than nursing and who have graduated from a NLN or AACN accredited associate degree or diploma program may submit a portfolio detailing professional accomplishments. If the portfolio is approved, the applicant may enter the Master of Science of Nursing program directly.

RN with B.S.N. Degree
Applicants with a B.S.N. degree from an AACN- or NLN-accredited nursing program are admitted directly into the Master of Science in Nursing program.

ADMISSION REQUIREMENTS

• Three professional recommendations
• Eligible for RN licensure in Ohio
• Satisfactory scores on the Miller Analogies Test (MAT) or the Graduate Record Examination (GRE).
• Completion of an accredited first professional degree program in nursing.
• Within 5 years of admission, satisfactory completion of a college or university statistics course with content comparable to CWRU STAT201.

Applicants who do not meet the above requirements may be referred to the M.S.N. Admissions Committee for special consideration, and may be required to fulfill additional prerequisites and demonstrate clinical nursing proficiency.

PROGRAM REQUIREMENTS

Candidates for a Master of Science in Nursing with a B.S.N. degree or a Certificate in Professional Nursing from CWRU must satisfactorily complete a minimum of 36 semester hours of graduate study or 18 credits if admitted in the masters completion option. Students seeking specialty certification as a nurse practitioner, clinical specialist, nurse midwife or nurse anesthetist need additional course work. A maximum of 15 semester hours of credit in approved graduate courses, where a grade of B or above was attained, may be accepted from another accredited university. This credit will be evaluated for transfer upon receipt of the official transcript and syllabi for the courses to be reviewed. The clinical interests, learning needs and career goals of students are considered when the academic program is designed. Research experience forms an integral part of graduate study in nursing. Degree requirements must be completed within five years after initial enrollment in the School of
Nursing. The ratio of clinical classroom hours is 8 to 1 and for lab experiences it is 2 to 1.

The general curriculum includes the following core requirements.

**Clinical Nursing Core**  
(See specific program majors) ........ 12-22

**Professional Development Core**
- NURS 443 Professionalism in Advanced Practice ................. 3
- NURS 444 Health Care Delivery, Legal and Ethical Issues in Advanced Practice .......................... 3

**Scientific Inquiry Core**
- NURS 405 Inquiry I ........................ 3
- NURS 415 Inquiry II ........................ 4
- NURS 503 Inquiry III ..................... 2

**Advanced Practice Core**
- NURS 430 Pharmacology and Therapeutics .......................... 3
- NURS 453 Advanced Physiology ........... 4
- NURS 459 Advanced Assessment .......... 3

**PROGRESSION REQUIREMENTS**

Progression in the M.S.N. 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 will be separated from the School of Nursing.

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.

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 M.S.N. program. If the grade of F or U in a course that is not required for the M.S.N. program, the student must register for the same course or a substitute course and achieve a passing grade to continue in the M.S.N. program. If the student receives a grade of F or unsatisfactory performance (F, U & NP) in two courses, he/she will be separated from the Bolton School.

**DEGREE REQUIREMENTS**

The Master of Science in Nursing program requires a minimum of 36 semester hours of graduate credit for the student who enters with a B.S.N. degree. Other degree requirements must be fulfilled for those entering with the portfolio or RN/M.S.N. entry options. A maximum of 15 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. To be awarded a M.S.N. degree, the student must have completed a cumulative GPA of 3.0 and received satisfactory grades in all nursing courses taken for credit as a M.S.N. student. Degree requirements must be completed within 5 years of initial enrollment.

**Nurse Practitioner**

Nurse practitioners promote optimal health, detect illness and facilitate restoration and maintenance of health. They often practice independently in a variety of settings. Three specialties are available for acute care nurse practitioners and six specialties are available in primary care. These programs contain at least 500 hours of clinical experience. Graduates are eligible to sit for the national certification examinations for these specialties.

**ACUTE CARE NURSE PRACTITIONER**

There are practice requirements for these specialties. Two years of experience in acute care is required for the Acute Care Adult Nurse Practitioner. One year of experience in neonatal intensive care is required for the Neonatal Nurse Practitioner, and two years pediatric experience is required for the Acute Care Pediatric Nurse Practitioner.

*Note: Courses listed under the area of Professional Development, Scientific Inquiry and Advanced Practice Core may be taken alone or with Clinical Nursing Courses, and may be taken during any semester offered. Clinical Nursing Courses must be taken in the semester and sequence listed above. Clinical course availability is based upon enrollment.*

**Acute Care Adult Nurse Practitioner**

Professional Development .................. 6  
NURS 443 ........................................ 3  
NURS 444 ........................................ 3  
Scientific Inquiry ............................. 9-11  
NURS 405 ........................................ 3  
NURS 415 ........................................ 4  
NURS 503 OR NURS 500 .................. 2-4  
Advanced Practice Core .................... 10  
NURS 430 (Spring) ............................ 3  
NURS 453 (Fall) ............................... 4  
NURS 459 ........................................ 3  
Clinical Nursing Courses .................. 14  
Semester I (Fall) ..............................  
NURS 438 Theoretical Foundations of Acute Care Nursing ............ 4  
Semester II (Spring) ......................... 6  
NUNP 443 Acute Health Problems of the Adult II .................... 6  
Semester III (Fall) ......................... 4  
NUNP 444 Advanced Management of Acutely Ill Adults ............. 4  
Total Semester Hours ........................ 39-41

**Neonatal Nurse Practitioner**

Professional Development .................. 6  
NURS 443 ........................................ 3  
NURS 444 ........................................ 3  
Scientific Inquiry ............................. 9-11  
NURS 405 ........................................ 3  
NURS 415 ........................................ 4  
NURS 503 OR NURS 500 .................. 2-4  
Advanced Practice Core .................... 10  
NURS 430 (Spring) ............................ 3  
NURS 453 (Fall) ............................... 4  
NURS 459 ........................................ 3  
Clinical Nursing Courses .................. 15  
Semester I (Fall) ..............................  
NUNP 405 Neonatal Nurse Practitioner I .................. 2  
Semester II (Spring) ......................... 4  
NUNP 412 Neonatal Nurse Practitioner II .................. 4  
Semester III (Summer) ....................... 3  
NUNP 413 Neonatal Nurse Practitioner III .................. 3  
Semester III (Fall) ............................  
NUNP 414 Neonatal Nurse Practitioner IV .................. 6  
Total Semester Hours ........................ 40-42

**Acute Care Pediatric Nurse Practitioner**

Professional Development .................. 6  
NURS 443 ........................................ 3  
NURS 444 ........................................ 3  
Scientific Inquiry ............................. 9-11  
NURS 405 ........................................ 3  
NURS 415 ........................................ 4  
NURS 503 OR NURS 500 .................. 2-4
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<td>Clinical Nursing Courses</td>
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<td>NUNP 401 Health Promotion of Children</td>
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<td>Semester I (Fall)</td>
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<td>NUNP 410 Health Promotion Across the Lifespan</td>
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<td>Semester II (Spring)</td>
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<td>NUNP 419 Family Health Nursing: Health of Adults and Older Adults</td>
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<td>NUNP 429 Family Health Nursing: Health of the Family During Childbearing Years</td>
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<td>NUNP 439 Family Health Nursing: Health of Children &amp; Adolescents</td>
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### Primary Care Nurse Practitioner

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<td>NUNP 432 Common and Acute Health Problems in the Adult I</td>
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<td>NUNP 433 Common and Acute Health Problems in the Adult II</td>
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<td>NUNP 434 Advanced Management in Adult Primary Care</td>
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### Family Nurse Practitioner

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<td>Advanced Practice Core</td>
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<td>NURS 430 (Spring)</td>
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<td>NURS 453 (Fall)</td>
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<td>NUNP 459 Advanced Management in the Primary Care of the Older Adult</td>
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<td>NURS 444</td>
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<tr>
<td>Scientific Inquiry</td>
<td>9-11</td>
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<td>Clinical Nursing Courses</td>
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<td>NURS 430 (Spring)</td>
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### Women's Health Nurse Practitioner

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<td>NURS 503 OR NURS 500</td>
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<td>Advanced Practice Core</td>
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<tr>
<td>NURS 430 (Spring)</td>
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<td>NURS 453 (Fall)</td>
<td>4</td>
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<td>NURS 459</td>
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*Note: Courses listed under the area of Professional Development, Scientific Inquiry and Advanced Practice Core may be taken alone or with Clinical Nursing Courses, and may be taken during any semester offered. Clinical Nursing Courses must be taken in the semester and sequence listed above. Clinical course availability is based upon enrollment.*
Clinical Nursing Courses .......................... 14
Semester I (Fall)
NURS 454 Well Woman Health Care ........... 3
Semester II (Spring)
NURS 455 The Childbearing Family ............. 4
Semester IV (Fall)
NUNP 410 Health Promotion Across the Lifespan ............................................. 2
NURS 559 Advanced Practice in Nursing Care of Women .................................. 5
Total Semester Hours .................................. 19

**NURSE ANESTHESIA**

Nurse anesthesia focuses on preoperative evaluation, intraoperative management and postoperative evaluation of patient anesthesia care. Nurse anesthetists are primarily responsible for direct patient care and are prepared as expert clinicians.

Clinical courses provide students with 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. The student will 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 one full year of recent experience in one of the following acute care settings: recovery room, emergency room, or medical, surgical, neonatal or pediatric intensive care. Completed credentials must be on file in the Office of Student Services prior to January 15 of the expected year of enrollment.

**Nurse anesthesia**

Semester I (Fall)
NURS 443 Professionalism in Advanced Practice Nursing .......................... 3
NUAN 449 Chemical and Physical Principles of Anesthesia .......................... 2
NUAN 455 Anesthesia Nursing I .................. 2
NUAN 450 Pharmacological Strategies in Anesthesia Practice .................... 2

Semester II (Spring)
NURS 405 Inquiry I ................................. 3
NUAN 451 Physiological Variables and Responses I ............................... 2
NUAN 452 Physiological Variables and Responses II .............................. 3
NUAN 456 Anesthesia Nursing II .................. 1

Semester III (Summer)
NUAN 457 Anesthesia Nursing III ............ 1
NUAN 453 Physiological Variables and Responses III ............................... 4
NURS 444 Health Care Delivery, Legal and Ethical Issues .......................... 3

Semester IV (Fall)
NURS 415 Inquiry II ............................... 4
NUAN 453 Physiological Variables and Responses IV ............................... 4
NUAN 551A Nurse Anesthesia: Advanced Practice I ............................... 2

Semester V (Spring)
NURS 551B Nurse Anesthesia: Advanced Practice I ............................... 1
NURS 503 Inquiry III ............................... 2

Semester VI (Summer)
NUAN 551C Nurse Anesthesia: Advanced Practice I ............................... 1

Semester VII (Fall)
NUAN 552 Nurse Anesthesia: Advanced Practice II ............................... 1

Total Semester Hours .................................. 40

**NURSE MIDWIFERY**

Nurse-midwifery focuses on the clinical and scientific areas of women's health maintenance. A nurse-midwife is primarily responsible for direct care in the areas of gynecologic health, antepartum, intrapartum, postpartum, family planning and parent education. Students work one-on-one with a clinical preceptor and select and work in birth centers, health maintenance organizations and private practices. Graduates are eligible to sit for the certification examination for nurse midwifery from the American College of Nurse Midwives.

**Nurse-midwifery**

Semester I (Fall)
NURS 405 Inquiry I ................................. 3
NURS 454 Well Woman Health Care .......... 3
NURS 459 Integrated Assessment-APN ........ 3
NURS 453 Physiological Foundations - APN ............................................ 4

Semester II (Spring)
NURS 455 The Childbearing Family .......... 4

NURS 430 Pharmacology and Therapeutics .............................................. 3
NURS 415 Inquiry II ............................... 4

Semester III (Fall)
NURS 457 Labor and Birth ......................... 7
NUNP 410 Health Promotion Across the Lifespan ...................................... 2
NURS 444 Health Care Delivery, Legal and Ethical Issues .......................... 3

Semester IV (Spring)
NURS 557 Advanced Nurse-Midwifery ...... 6
NURS 443 Professionalism in Advanced Practice Nursing .......................... 3
NURS 503 Inquiry III ............................... 2

Total Semester Hours .................................. 47

**CLINICAL NURSE SPECIALIST**

Two specialties are in the clinical nurse specialist track in the masters program. Medical-surgical nursing focuses on the care of patients recovering from illness and living with chronic illness. The student selects a specialty in critical care, oncology, wound care/ostomy, infection control, diabetes education or other specialty adult medical-surgical areas. The student then does clinical practicum in these areas. The focus of the Community Health program is on mobilizing and empowering the community to act on its own behalf in matters affecting health and well being. Interventions are designed in collaboration with the community and interdisciplinary personnel. Graduates of these tracks are eligible to sit for certification examinations as a clinical nurse specialist.

**Medical-Surgical Nursing**

Professional Development ......................... 6
NURS 443 ............................................. 3
NURS 444 ............................................. 3
Scientific Inquiry .................................... 9-11
NURS 405 ............................................. 3
NURS 415 ............................................. 4
NURS 503 OR NURS 500 ......................... 2-4
Advanced Practice Core ............................ 10
NURS 430 (Spring) ................................. 3
NURS 453 (Fall) ..................................... 4
NURS 459 ............................................. 3
Clinical Nursing Courses .......................... 12
Semester I (Fall)
NURS 438 Theoretical Foundations of Acute Care Nursing ......................... 4
Semester II (Spring)
NURS 424 Theoretical Basis for Medical-Surgical Nursing ......................... 5
The curriculum for this joint degree reflects clinical nursing majors other than nurse anesthesia and community health.

M.S.N./M.A.

Required Nursing Courses
Clinical Major Courses ................. 12-22
NURS 443 Professionalism in Advanced Practice Nursing ................................... 3
NURS 444 Health Care Delivery, Legal and Ethical Issues .................................. 3
NURS 453 Physiological Foundations ........................................ 4
NURS 459 Integrated Assessment .......... 3
NURS 430 Pharmacology and Therapeutics ............................................ 3
NURS 405 Inquiry I .............................. 3

Required Anthropology Courses
ANTH 480 Anthropology of Health & Illness Part I ........................................ 3
ANTH 481 Anthropology of Health and Illness Part II .................................... 3
Anthropology Electives in health-related courses............................................ 9-12

Total Semester Hours 31-41

Combined Total Credits 53-63

M.S.N./M.A. (ANTHROPOLOGY) JOINT DEGREE

The Master of Science in Nursing/Master of Business Administration joint degree program is designed for nurses with managerial and organizational skills needed to manage patient care environments or health programs and to participate in the strategic and operational leadership of health care agencies. This program integrates nursing and management courses taken concurrently. A nine-hour practicum must be taken in one semester.

Orientation and Statistics Preparation Workshops begin week before Fall courses.

Semester I (Fall)
MBAC 410 Management Assessment and Development I .................................. 2
MBAC 410 (Lab) Team Development Seminars ............................................. 1
MBAC 411 Strategic Issues and Applications I .............................................. 1
MBAC 412 Career Management Seminars ............................................ 1
MBAC 414 Statistics and Decision Modeling ............................................. 3
MBAC 415 Financial Reporting and Control ............................................. 3
NURS 405 Inquiry I ............................... 3

Semester II (Spring)
MBAC 413 Human Values in Organizations ............................................. 3
MBAC 421 (Lab) Negotiations and Collaboration ........................................ 1
MBAC 424 Strategic Issues and Applications II ...................................... 2
MBAC 424 Marketing ........................................ 3
NURS 415 Inquiry II ............................ 4
NUND 483 Health Care Policy and Planning ............................................. 3

Semester III (Fall)
MIDS 409 Information Design & Management ........................................ 3

*Note: Courses listed under the area of Professional Development, Scientific Inquiry and Advanced Practice Core may be taken alone or with Clinical Nursing Courses, and may be taken during any semester offered. Clinical Nursing Courses must be taken in the semester and sequence listed above. Clinical course availability is based upon enrollment.
Semester I (Fall)
Open elective (WSOM) ...................... 3
NURS 456 Issues in Health Management or HSMC 456 (Thematic elective) ...... 3
NURS 577 Nursing Practice ................. 9

Semester II (Spring)
ECON 405 Economics .......................... 3
NURS 499 The Nurse Executive .............. 3

Semester III (Fall)
NURS 503 Inquiry III .......................... 2

Semester IV (Spring)
Open elective (WSOM) ...................... 3

Semester V (Fall)
Open elective (WSOM) ...................... 3
Open elective (WSOM) ...................... 3
Open elective (WSOM) ...................... 3
MBAC 440 Exit Skills Assessment .......... 1
NURS 499 The Nurse Executive .............. 3

Total Semester Hours 78

Note: This program may be done part time. See advisor for details.

JOINT PROGRAMS WITH FRONTIER NURSING SERVICE

M.S.N./CNEP
The Community-Based Nurse-Midwifery Education Program (CNEP) is a distance education program leading to a certificate in nurse-midwifery. Students complete course and clinical work in their communities. CNEP is housed in the Frontier School of Midwifery and Family Nursing in Hyden, Kentucky. The program is administered by a Certified Nurse-Midwife with over 40 Certified Nurse-Midwifery faculty members. Through an innovative affiliation agreement, students attending CNEP receive full course credit towards a Master’s Degree in Nursing from Case Western Reserve University.

Course of Study for CNEP Curriculum
Semester (Fall) Hours
NURS 405 Inquiry I ............................. 3
NURS 415 Inquiry II ............................. 4
NURS 503 Inquiry III ........................... 2

M.S.N./CFNP
The Community-Based Family Nurse Education Program is an innovative joint degree program with the Frances Payne Bolton School of Nursing at Case Western Reserve University. The program is designed for aspiring family nurse practitioners who complete course and clinical work in their communities. The program is designed with a 24 month full-time or a 36 month part-time option. The Master’s degree is awarded by Case Western Reserve University. For more information, contact: Frances Bolton Payne School of Nursing and Family Nursing
10900 Euclid Avenue
Cleveland, Ohio 44106
OR
Frontier School of Midwifery and Family Nursing
www.frontierfnp.org

Doctor of Nursing

The Doctor of Nursing Program (N.D.) is an innovative academic program designed to prepare leaders in nursing. This is a four-year program leading to both a Masters of Science in Nursing and Nursing Doctorate degrees. The Doctor of Nursing program is designed with multiple entry points to accommodate students with diverse prior educational backgrounds. The two-year prelicensure portion is designed for baccalaureate prepared college graduates from a variety of disciplines ranging from the social and natural sciences to the humanities and arts. The post licensure portion is designed for entry of B.S.N. and M.S.N. prepared nurses and prepares advanced practice nurses. The Doctor of Nursing program is characterized by educational depth and emphasis on advanced practice, nursing inquiry, management, and policy required for clinical leadership in nursing. Upon successful completion of the prelicensure portion of the N.D. program, the student receives a Certificate of Professional Nursing that qualifies them to sit for the professional nursing licensing examination (NCLEX-RN). A Masters of Science in Nursing and a Nursing Doctorate are awarded after successful completion of the post licensure portion of the N.D. program.

CHARACTERISTICS OF THE GRADUATE

Initiates and develops educational offerings and provides consultation with other professions/populations and communities about health, illness and health seeking behavior.

ENTRY OPTIONS

Prelicensure Portion of the N.D. Program Graduates from an accredited college or university with a baccalaureate degree in a non-nursing field.

Students currently enrolled in a four-year baccalaureate program at a participating accredited liberal arts college after three years of study. The student earns a B.A. or B.S. from the liberal arts college upon successful completion of one year of the N.D. prelicensure level. (Senior Year in Professional Studies)

Post Licensure Portion of the N.D. Program

RNs with an associate or diploma degree
RNs with a B.S or BA in a discipline other than nursing
RNs with a B.S.N. degree
RNs with M.S.N. degree

PROGRESSION IN THE N.D. PROGRAM

Academic Performance

Progression in the prelicensure portion of the N.D. program is contingent upon achieving passing grades in all courses taken in the preceding semester and having a GPA of 2.5 for that semester. Successful completion of STAT 201 or its equivalent is a prerequisite to enrolling in the second year of the prelicensure portion of the N.D. program. Students not meeting these requirements and a semester GPA of 2.5 will be placed on probation. If the GPA is less than 2.5 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 withdrawal from the N.D. program is warranted.

Progression in the post licensure portion of the N.D. program is contingent on a semester GPA of 3.0. If the GPA is below 3.0 during any semester, the student will be placed on academic probation. To continue in the program, the student must obtain a cumulative GPA of 3.0. If the student is not removed from academic probation within one academic semester, the student will be withdrawn from the program.

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.

A student who receives a grade of F for a required course must register for the course the next semester it is offered. If the student receives a grade of F or unsatisfactory performance (F, U & NP) in two courses, he/she will be separated from the Bolton School.

**Thesis Defense**

The thesis is an independent research study designed by the student in collaboration with a 3-member thesis committee approved by the Associate Dean of Academic Programs and Associate Dean of Research of the School of Nursing. The thesis must be a significant contribution to existing nursing knowledge and suitable for publication in a peer reviewed journal or a book. Students must prepare their own thesis, and joint theses are not permissible. The procedures and written thesis must conform to the regulations of the Bolton School of Nursing.

Students must successfully defend their thesis in an oral examination with their thesis committee members who are also responsible for certifying that it meets acceptable scholarly standards. The thesis defense is open to University faculty and students, but the chair determines whether the defense is open to others outside of the University.

The thesis committee determines the adequacy of the oral examination and written thesis. A student will pass if two or more of the committee members agree that the student successfully responded to questions during the examination and the thesis met scholarly standards.

**DEGREE REQUIREMENTS**

Candidates for the Doctor of Nursing degree must complete all required courses, including the courses required in their master level clinical major. Post licensure students will be awarded a Master of Science in Nursing if they meet the degree requirements for this degree (See p. Error! Reference source not found.). However, if the student completes NURS 520 or NURS 521, they do not need to complete NURS 503 to be awarded a M.S.N. degree.

Non-nurses enrolled in the N.D. program must complete the program within 7 years of initial enrollment. B.S.N. graduates must complete the post licensure portion of the program in 5 years. M.S.N. graduates must complete the program within 4 years. If not completed, the student's record 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.

Students who enter the N.D. program in the prelicensure portion, must achieve a cumulative GPA of 2.75 in all courses taken for credit as a N.D. student at the Bolton School. Students who enter the program at the post licensure portion of the N.D. program must achieve a GPA of 3.0 or above in all courses taken for credit as an N.D. student at the Bolton School.

**N.D. PRELICENSURE PROGRAM**

The first two years of the Nursing Doctorate Program is the prelicensure portion that includes all course work required to sit for the professional nursing licensing examination (NCLEX-RN) required to practice nursing. During this portion of the program, the student receives instruction in nursing theory, clinical skills, and the nursing sciences. At the successful completion of this portion of the N.D. prelicensure program, students receive a Certificate of Professional Nursing. After passing the NCLEX, the student may practice as a registered nurse (RN) while completing the post licensure portion of the N.D. program.

**ENTRY OPTIONS**

Graduates from an accredited college or university with at least a baccalaureate degree in a non-nursing field.

Students currently enrolled in a four-year baccalaureate program at a participating accredited liberal arts college after three years of study. The student earns a B.A. or B.S. from the liberal arts college upon successful completion of one year of the N.D. prelicensure level. (Senior Year in Professional Studies)

**Admission Requirements:**

Graduated from an accredited college or university with at least a baccalaureate degree in non-nursing field.

Overall GPA of 2.75 (in a 4 point system)

Undergraduate education must include a sound background in the social/behavioral and natural sciences with a minimum grade point average of 2.5 or higher (in a 4 point system).

Satisfactory scores on the Graduate Record Examination (GRE).

Three recommendations about academic competence, personal adjustment, prediction of contribution to the nursing profession, and success as a graduate student.

An interview with faculty to discuss career goals, either by telephone or in person. Personal interviews are preferred.

For more specific requirements, refer to N.D. Program brochure.

**SENIOR YEAR IN PROFESSIONAL STUDIES**

A student in a college with a formal arrangement with the Bolton School may enroll in the Senior Year in Professional Studies. Current colleges participating are Albion, Allegheny, Asbury, Ashland, Baldwin-Wallace, Brescia, Heidelberg, Hiram, Juniata, Kenyon, Lake Erie, Marietta, Muskingum, Pfeiffer, Thiel, Westminster, Wheaton, and Wooster Colleges. The current universities participating are Case Western Reserve University, Dension, John Carroll and Wittenberg. Students whose undergraduate institutions do not have an agreement with the Bolton School...
School may arrange a Senior Year in Professional Studies on an individual basis. Information about arranging this program is available from Office of Student Services. Students earn a BA or BS from the participating college or university upon successful completion of the first year of the N.D. program.

Students at Case Western Reserve University must apply through the undergraduate dean of their respective schools at the beginning of their junior year. To be awarded a BS or BA degree at the end of the successful completion of the first year of the N.D. program, the following must be met:

Completion of the Case Western Reserve University Core Curriculum and two semesters of physical education, unless excused from the latter.

Completion of three quarters of the major and minor concentration requirements

Ninety semester hours of academic credit. Completed at least 90 semester hours of academic credit of which the final 60 hours being while in residence with no more than 6 semester hours earned in courses taken in another institution, either by cross-registration or by approved transfer of credit.

**N.D. Prelicensure Plan of Study**

**Semester I (Fall)**

- NUND 230 Foundations of Nursing Practice 2
- NUND 410 Health Assessment 2
- NUND 342 Microbiology 3
- NUND 412 Anatomy and Physiology 6
- NUND 213 Nursing Strategies and Interventions 4

**Semester II (Spring)**

- NUND 224 Acute Care: Adults 10
- NUND 220 Altered Human Functioning 3
- NUND 211 Pharmacology 2
- NUND 232 Introduction to Genetics and Embryology 1
- NUND 233 Human Growth and Development 1

Successful completion of STAT 201, Basic Statistics for the Social and Life Sciences I (or a comparable course), is a prerequisite to enrolling in Level II of the program.

**Semester III (Fall)**

- NUND 315 Parents and Neonates in Health and Illness 4.5

**Semester IV (Spring)**

- NUND 316 Children and Adolescents in Health and Illness 4.5
- NUND 317 Psychiatric-Mental Health Nursing 4.5

**N.D. POST LICENSURE PROGRAM**

After completing the prelicensure portion of the N.D. program, students select an advanced practice specialty. Students with a B.S.N. or a M.S.N. enter in this portion of the N.D. program. For those entering with a B.S.N., course work consists of master level courses in the chosen specialty, N.D. core courses and a N.D. thesis. For those entering with a M.S.N., course work consists of N.D. core courses and N.D. thesis. After successful completion of the course requirements for masters clinical track, the student receives a Masters of Science in Nursing degree and is eligible to sit for national certification examinations in advanced nursing practice. The Acute Care Nurse Practitioner, Acute Care Pediatric Nurse Practitioner, Neonatal Nurse Practitioner and Nurse Anesthetist specialties have requirements for clinical experience before entering these clinical tracks (See descriptions of each specialty requirements in the Master of Science in Nursing section). The N.D. core requirements prepare the student in nursing management and nursing inquiry, and an independent research study. N.D. thesis, is a component of the post licensure portion of the program.

**Entry Options**

RN with a diploma or associate degree in nursing (See RN/M.S.N. program described under the masters program)

RN with a B.S. or B.A. degree in a discipline other than nursing (See portfolio option described under the masters program)

Nurse with a B.S.N. degree

Nurse with a M.S.N. degree

**ADMISSION REQUIREMENTS**

**RN with Diploma and Associate Degree**

See the description of the RN-M.S.N. program described under the masters of nursing program.

Satisfactory completion of undergraduate pre-requisites for the masters of nursing program.

Written statement of academic and career objectives and research interest.

**RN with B.S. or B.A. Other than Nursing**

See the description of the portfolio option described under the masters of nursing program.

Written statement of academic and career objectives and research interest.

**RN with a B.S.N.**

Graduated from an accredited college or university with a baccalaureate degree in nursing with an overall GPA of 2.75 (in a 4 point system) or above is required. The Graduate Record Examinations, including verbal, quantitative and analytical sections.

Transcripts from all colleges and universities where academic work was done Interview with faculty to discuss career plans. This can be done by phone. Additional evidence of academic ability may be required.

Undergraduate records will be reviewed for comparability to the prelicensure
portion of the N.D. program. Additional coursework may be required. Written statement of academic and career objectives and research interest

**RN with a M.S.N.**

Graduated from an accredited college or university with a masters degree in nursing with an overall GPA of 2.75 (in a 4 point system) or above is required. The Graduate Record Examination, including verbal, quantitative and analytical sections.

Transcripts from all colleges and universities where academic work was done. Interview with faculty to discuss career plans. This can be done by phone. Written statement of academic and career objectives and research interest. Nationally certified or qualified to sit for a certification exam in advanced practice nursing.

**N.D. Program of Study for Students with a M.S.N.**

Prerequisite for Research Strand

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Research I

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Research II

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Management Systems

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Management

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Advanced Practice Core

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Clinical Nursing Courses

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Semester II (Spring)

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Semester III (Fall)

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Semester IV (Fall)

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Total Semester Hours Minimum 61

**NURSE PRACTITIONER**

Nurse practitioners promote optimal health, detect illness and facilitate restoration and maintenance of health. They often function independently in a variety of settings. Three specialties are available for acute care nurse practitioners and six specialties are available in primary care. Two years of experience in acute care is required for the Acute Care Adult Nurse Practitioner. One year of experience in neonatal intensive care is required for the Neonatal Nurse Practitioner, and two years pediatric experience is required for the Acute Care Pediatric Nurse Practitioner. These programs contain at least 500 hours of clinical experience. Graduates are eligible to sit for the national certification exams for these specialties.

**Acute Care Adult Nurse Practitioner**

Professional Development

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Scientific Inquiry

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Total Semester Hours Minimum 60

**Neonatal Nurse Practitioner**

Professional Development

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Scientific Inquiry

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<td>NUND 441</td>
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Semester II (Spring)

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Semester III (Summer)

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Semester IV (Fall)

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Total Semester Hours Minimum 61

**Adult Nurse Practitioner**

Professional Development

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Scientific Inquiry

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<td>NURS 405*</td>
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<td>NURS 415*</td>
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<td>NURS 503 or NURS 520 &amp; NURS 521</td>
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Semester I (Fall)

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Semester II (Spring)

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Semester IV (Fall)

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Total Semester Hours Minimum 61

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*Prelicensure students take these in year 2 of the prelicensure portion of the N.D. program.

Note: Courses listed under the area of Professional Development, Scientific Inquiry and Advanced Practice Core may be taken alone or with Clinical Nursing Courses, and may be taken during any semester offered. Clinical Nursing Courses must be taken in the semester and sequence listed above. Clinical course availability is based upon enrollment.
### Advanced Practice Core
- NUND 441: Family Health Nursing: Health Provisions for Children and Adolescents
- NUND 483: Theoretical Basis of Individual Therapy
- NUND 484: Theoretical Basis of Group and Family Therapy
- NUND 491: Public Policy and Aging
- NUSD 500: Advanced Management in Pediatric Primary Care
- NUSD 501: Advanced Management in Adult Primary Care
- NUSD 502: Advanced Management in Older Adult Primary Care
- NUSD 503: Advanced Management in Children Primary Care
- NUSD 520: Advanced Management in Acute Care
- NUSD 521: Advanced Management in Chronic Care
- NUSD 522: Advanced Management in Palliative Care
- NUSD 523: Advanced Management in Geriatric Care

### Gerontological Nurse Practitioner
- NUND 441: Family Health Nursing: Health Provisions for Children and Adolescents
- NUND 483: Theoretical Basis of Individual Therapy
- NUND 484: Theoretical Basis of Group and Family Therapy
- NUSD 500: Advanced Management in Pediatric Primary Care
- NUSD 501: Advanced Management in Adult Primary Care
- NUSD 502: Advanced Management in Older Adult Primary Care
- NUSD 503: Advanced Management in Children Primary Care
- NUSD 504: Advanced Management in Acute Care
- NUSD 520: Advanced Management in Chronic Care
- NUSD 521: Advanced Management in Palliative Care
- NUSD 522: Advanced Management in Geriatric Care

### Pediatric Nurse Practitioner
- NUND 441: Family Health Nursing: Health Provisions for Children and Adolescents
- NUND 483: Theoretical Basis of Individual Therapy
- NUND 484: Theoretical Basis of Group and Family Therapy
- NUSD 500: Advanced Management in Pediatric Primary Care
- NUSD 501: Advanced Management in Adult Primary Care
- NUSD 502: Advanced Management in Older Adult Primary Care
- NUSD 503: Advanced Management in Children Primary Care
- NUSD 504: Advanced Management in Acute Care
- NUSD 520: Advanced Management in Chronic Care
- NUSD 521: Advanced Management in Palliative Care
- NUSD 522: Advanced Management in Geriatric Care

### Family Nurse Practitioner
- NUND 441: Family Health Nursing: Health Provisions for Children and Adolescents
- NUND 483: Theoretical Basis of Individual Therapy
- NUND 484: Theoretical Basis of Group and Family Therapy
- NUSD 500: Advanced Management in Pediatric Primary Care
- NUSD 501: Advanced Management in Adult Primary Care
- NUSD 502: Advanced Management in Older Adult Primary Care
- NUSD 503: Advanced Management in Children Primary Care
- NUSD 504: Advanced Management in Acute Care
- NUSD 520: Advanced Management in Chronic Care
- NUSD 521: Advanced Management in Palliative Care
- NUSD 522: Advanced Management in Geriatric Care

### Psychiatric Mental Health Nurse Practitioner
- NUND 441: Family Health Nursing: Health Provisions for Children and Adolescents
- NUND 483: Theoretical Basis of Individual Therapy
- NUND 484: Theoretical Basis of Group and Family Therapy
- NUSD 500: Advanced Management in Pediatric Primary Care
- NUSD 501: Advanced Management in Adult Primary Care
- NUSD 502: Advanced Management in Older Adult Primary Care
- NUSD 503: Advanced Management in Children Primary Care
- NUSD 504: Advanced Management in Acute Care
- NUSD 520: Advanced Management in Chronic Care
- NUSD 521: Advanced Management in Palliative Care
- NUSD 522: Advanced Management in Geriatric Care

### Total Semester Hours Minimum
- Family Nurse Practitioner: 63
- Gerontological Nurse Practitioner: 61
- Pediatric Nurse Practitioner: 61
- Psychiatric Mental Health Nurse Practitioner: 61
- Women's Health Nurse Practitioner: 61
NURS 415* ............................................. 4
NURS 503 or NURS 520 & NURS 521 ................... 2-6
  NURS 504 ........................................... 3
  STAT 301 ........................................... 3
N.D. Thesis (NURS 500) Minimum .................. 6
N.D. Management ........................................ 9
  NUND 483 ........................................ 3
  NUND 441 ........................................ 3
  NURS 471 ........................................ 3
Advanced Practice Core ............................. 10
  NURS 430 (Spring) ................................ 3
  NURS 453 (Fall) .................................... 4
  NURS 459 ........................................ 3
Clinical Nursing Courses ............................. 20
  Semester I (Fall)
    NURS 454 Well Woman Health Care .............. 3
  Semester II (Spring)
    NURS 453 (Fall) .................................... 4
    NURS 459 ........................................ 3
  Semester III (Fall)
    NURS 457 Labor and Birth ........................ 7
  Semester IV (Spring)
    NURS 557 Advanced Nurse-Midwifery .......... 6
Total Semester Hours Minimum .......................... 66

CLINICAL NURSE SPECIALIST

Two specialties are in the clinical nurse specialist track in the masters program. Medical-surgical nursing focuses on the care of patients recovering from illness and living with chronic illness. The student selects a specialty in critical care, oncology, wound care/ostomy, infection control, diabetes education or other specialty adult medical-surgical areas. The student then may do clinical practicum in these areas. The focus of the Community Health program is on mobilizing and empowering the community to act on its own behalf in matters affecting health and well being. Interventions are designed in collaboration with the community and interdisciplinary personnel. Graduates of these tracks are eligible to sit for certification examinations as a clinical nurse specialist.

Medical-Surgical Nursing

Professional Development .......................... 6
  NURS 443 ........................................ 3
  NURS 444* ........................................ 3
Scientific Inquiry ..................................... 15-19
  NURS 405* ........................................ 3
  NURS 415* ........................................ 3
NURS 503 or NURS 520 & NURS 521 ................. 2-6
  NURS 504 ........................................ 3
  STAT 301 ........................................ 3
Advanced Practice Core ............................. 10
  NURS 430 (Spring) ................................ 3
  NURS 453 (Fall) .................................... 4
  NURS 459 ........................................ 3
Clinical Nursing Courses ............................. 20
  Semester I (Fall)
    NURS 454 Well Woman Health Care .............. 3
  Semester II (Spring)
    NURS 455 The Childbearing Family .............. 4
  Semester III (Fall)
    NURS 457 Labor and Birth ........................ 7
  Semester IV (Spring)
    NURS 557 Advanced Nurse-Midwifery .......... 6
Total Semester Hours Minimum .......................... 66

*Prelicensure students take these in year 2 of the prelicensure portion of the N.D. program.

Note: Courses listed under the area of Professional Development, Scientific Inquiry and Advanced Practice Core may be taken alone or with Clinical Nursing Courses, and may be taken during any semester offered. Clinical Nursing Courses must be taken in the semester and sequence listed above. Clinical course availability is based upon enrollment.
Doctor of Philosophy in Nursing

The Ph.D. 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 Ph.D. 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). Ph.D. students are culturally diverse, and many develop and apply knowledge relevant to global health needs.

CHARACTERISTICS OF THE GRADUATE

Mentors others in the process of knowledge development
Synthesizes and generates knowledge for the discipline of nursing with cross-disciplinary implications
Identifies health issues amenable to research; disseminates data and evidence to improve health
Assumes leadership roles in the global community
Identifies and analyzes ethical issues and standards related to science and knowledge development
Initiates and contributes to interdisciplinary work in the scientific community
Uses multiple modalities in generating discussion and debate of issues, research findings, and theoretical knowledge
Generates knowledge relevant to health care policy; actively participates in policy formation, implementation, and evaluation

ENTRY OPTIONS

Registered nurses with a Bachelors of Science in Nursing degree.
Registered nurses with a Masters of Science in Nursing degree.
Registered nurses with a Nursing Doctorate degree

ADMISSION REQUIREMENTS

Applicants to the Ph.D. program in nursing apply to the School of Graduate Studies. Applications and information for admission are available from the Bolton School. Application requirements are:

1. A professional degree from an accredited school of nursing leading to a B.S.N. or N.D. degree.
2. Three recommendations describing professional nursing competence, and success in the Ph.D. program and potential for making a significant contribution to nursing. Two of these recommendations should be from Ph.D. prepared individuals, preferably in nursing.
3. Satisfactory performance on the Graduate Record Examination that includes quantitative, verbal and analytical sections.
4. Two to three page statement of academic and career objectives and how the applicant’s research interest is consistent with the research expertise of the faculty.
5. Written responses to questions contained in the application packet.
6. Interview with two faculty members. This can be done by phone.

PROGRAM REQUIREMENTS

Course Requirements

The Ph.D. program is a post baccalaureate program, and course requirements including both masters and doctoral level courses provide a foundation for a dissertation. Programs are individually planned so that applicants with a M.S.N. degree with a clinical nursing major with supervised practice can build on their prior masters education. A minimum of 54 semester credits in core requirements is required, and courses are listed below. Additional course work may be required and will be determined by the faculty advisor.

M.S.N. Clinical Nursing .......................... 12
M.S.N. Research Methods ..................... 3
M.S.N. Statistics ................................. 3

M.S.N. Related Courses ....................... 6
M.S.N. Independent Research Study ........ 4
Ph.D. Research Methods ................... 9
NURS 530 Advanced Nursing Research I ................. 3
NURS 531 Advanced Nursing Research II ............... 3
Methods elective ............................. 3
Ph.D. Statistics ............................... 6
NURS 630 Advanced Statistics for Nursing Research: Linear Models ........ 3
Statistics elective ........................... 3
Ph.D. Related Courses ....................... 3-6
NURS 609 Health Policy ..................... 3
Substantive elective .......................... 0-3
Ph.D. Nursing Science: Theory & Research ............. 15-18
NURS 506 Nursing Epistemology .......... 3
NURS 511 Strategies for Theory Development ............. 3
NURS 615 Topical Seminar in Nursing 6-9
NURS 670 Proposal Development .......... 3
Dissertation (NURS 701) minimum ...... 18

To register for NURS 701, the academic advisor and Associate Dean of Academic Programs must provide written permission that is submitted to the School of Graduate Studies. Students who have not been advanced to candidacy status (successful completion of course work and candidacy examination) may register for not more than 3 credit hours of NURS 701 per semester. They must maintain continuous limited registration for NURS 701 until advanced to candidate status. A maximum of 9 credit hours may be taken prior to advancement to candidacy. After advancement to candidacy, students can register for up to 9 credits of NURS 701 per semester. When students complete 18 credits of NURS 701, they may subsequently register for a minimum of 1 credit hour a semester.

Students who have been advanced to candidacy and have met all coursework requirements, including 18 credit hours of NURS 701, and are within their five-year time limit for completion of the degree, but have not completed the dissertation, can register for Dissertation Fellowship (NURS 702) upon recommendation to the School of Graduate Studies. Students may take NURS 702 for a maximum of four consecutive semesters. Students are considered to have full-time appointment (9 credit hours of 702), and tuition is charged at the rate of one credit hour. If the dissertation is not completed and defended in
the fourth semester of the fellowship, the Ph.D. candidate must register for a minimum of one credit hour of NURS 701 each semester.

A maximum of 36 semester hours of post-baccalaureate credit in approved graduate courses may be accepted from another university if they are taken within 5 years of initial enrollment and a grade of B or better was attained for the course. The academic advisor, dean of the School of Nursing (or designee) and dean of the School of Graduate Studies must approved transfer of credits. No credit for dissertation will be accepted from another university.

**Research Practicum**
A research practicum is required before taking the candidacy examination (described below). The research process is complex and course work provides the student with only theoretical understanding. The integration of research concepts and their application can best be learned through practical experience. The research practicum provides the hands on experience in the daily functioning of a research study. Often presentations and publications with faculty are outcomes of this experience.

The student works with a faculty mentor on that faculty's research for 240 hours in a 12-month period. The academic advisor, student and faculty mentor who the student will be working with will develop objectives for the research practicum. It is recommended that the practicum begin during the first year of study. The practicum must be completed before the student will be advanced to candidate status.

**Dissertation**
The dissertation is an independent research study designed by the student in collaboration with a 4-member dissertation committee approved by the Associate Dean of Academic Programs and Associate Dean of Research of the School of Nursing. The dissertation must be a significant contribution to existing nursing knowledge and suitable for publication in a peer reviewed journal or a book. Students must prepare their own dissertations, and joint dissertations are not permissible. The procedures and written dissertation must conform to the regulations of the School of Graduate Studies.

**PROGRESSION IN THE PH.D. PROGRAM**

**Academic Performance and Progression**
A student who receives a grade of F for a required course must register for the course the next semester it is offered. If the student receives a grade of F or unsatisfactory performance (F, U & NP) in two courses, he/she will be separated from the Bolton School.

A cumulative GPA of 3.0 must be maintained. If the cumulative GPA falls below 3.0, the student will be placed on academic probation. If the student does not raise the GPA to 3.0 or above in the next semester enrolled, the student will be separated from the University.

Grade of incomplete (I) will be assigned only for extenuating circumstances, and only when a student fails to complete a small segment of the 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 11 th week of the session following the one in which the I was received. 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. 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 are allowed only one extension of no more than one additional semester to complete the work.

Students must maintain continuous registration throughout their degree programs unless granted a leave of absence. Students who do not register for an academic term will be automatically withdrawn from the program. They must then petition for reinstatement to continue graduate study. The Director of the Ph.D. Program and the Dean of Graduate Studies must approve the petition before students may register for further coursework. In each case of readmission with full standing, the student will receive a letter stating 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, the Office of Graduate Studies may request more information.

**Advancement to Candidate Status**
To advance to candidate status, Ph.D. students must pass an oral candidacy examination and provide a written research proposal at the time of the examination. The examination and proposal are evidence of the student's knowledge and ability to synthesize and apply research methodologies and existing knowledge. The oral examination focuses on the nursing discipline, research methods, statistics, and substantive knowledge. The candidacy committee consists of three doctorally prepared Bolton School faculty members.

The student works with the candidacy committee to develop a research proposal. During this time, the student enrolls in NURS 670 “Proposal Development”. A minimum of 3 credits of NURS 670 is required, and the student may be required to take up to 12 credits of this course, if needed, to complete the proposal. Prior to scheduling the candidacy examination, the student must have completed the research practicum and all course requirements with a cumulative GPA of 3.0.

The candidacy committee determines the adequacy of responses to the oral examination and the research proposal presented at the time of the examination. A student who fails the candidacy examination may be permitted within one year of the failing the examination to retake it, provide a written response to questions from the committee or submit a revision of the proposal. The committee may also require additional course work. A student who fails the examination a second time will be separated from the Bolton School of Nursing.

A student who is not advanced to candidacy may not undertake further study for credit towards a Ph.D. within the Bolton School. With the approval of Ph.D. Council and the School of Graduate Studies, the student may take additional coursework to complete a masters degree or enter the graduate program of another University academic department.
Proposal Defense
The purpose of the proposal defense is for students to demonstrate their synthesis and application of substantive knowledge and research methods and statistics. Students defend their dissertation proposal to their dissertation committee comprised of three doctoral prepared nursing faculty members and another doctoral prepared member from another department within the University. The written dissertation proposal is presented to the committee three weeks prior to the proposal defense. The dissertation committee determines the adequacy of the responses to questions and the dissertation proposal. A student who does not pass the proposal defense may be required to repeat the defense, revise the dissertation proposal or provide written responses to questions. The student must pass the proposal defense before implementing the dissertation proposal.

Dissertation Defense
Students must successfully defend their dissertation in an oral examination with their dissertation committee members who are also responsible for certifying that the dissertation meets acceptable scholarly standards.

The student must provide a copy of the dissertation to committee members at least 10 days before the defense. The dissertation defense must be scheduled with the School of Graduate Studies three weeks prior to the defense. The time and place of the dissertation defense must be announced within the University. The dissertation defense is open to University faculty and students, but the dissertation chair determines whether the defense is open to others outside of the University.

The dissertation committee determines the adequacy of the oral examination and written dissertation. A student will pass if three or more of the dissertation committee members agree that the student successfully responded to questions during the examination and the dissertation met scholarly standards for a dissertation.

DEGREE REQUIREMENTS
A student will be awarded a Ph.D. degree upon completion of all required coursework in their curriculum as detailed in their Program of Study. All students must complete 36 semester hours of course work at the University. A cumulative GPA of 3.0 or above in all courses taken for credit (excluding grades of S) as a Ph.D. student at the University is required for awarding the Ph.D. degree.

Residency must have been established before a degree is conferred. This requirement insures a period of intensive academic interaction with faculty and other Ph.D. students. Ph.D. students are considered in residence when they are fully engaged in academic work. As a resident, students may teach at the University, take graduate courses, assist in course development or engage in research with Bolton School faculty. Regardless of the nature of the work, the presence of the student at the University is expected during fulfillment of the residency requirement. Moreover, the residency requirement may be fulfilled by six semesters (fall, spring and/or summer) of consecutive of continuous registration in two calendar years at any time after matriculation until degree requirements have been met. The period while students are on a leave of absence do not count towards fulfilling the residency requirement.

All requirements for the Ph.D. degree must be completed within five years from the time the student first registers for dissertation credit (NURS 701), including leaves of absences. If the student fails to complete the degree requirements within this 5-year time period, including leaves, they may request a 1-year extension approved by the advisor, Director of the Ph.D. Program and the dean of the School of Graduate Studies. If the degree requirements are still not met during this extension or an extension was never approved, the student will be separated from the School of Nursing. However, they may reapply to the Ph.D. program to continue to study using an abbreviated application process. After a review of the application and the student’s academic record, the Ph.D. Admissions Committee makes recommendations about admission and additional course work that may be required to the Director of the Ph.D. program at the Bolton School.

OTHER STUDENT CATEGORIES

Non-Degree Students
An applicant with basic preparation in nursing may apply to register as a non-degree student. The application form is available in the Nursing School Registrar’s Office for M.S.N. and N.D. programs and the Office of Graduate Studies Admissions for the Ph.D. program. The applicant must obtain written permission from the faculty teaching the course, and the Associate Dean for Academic Programs in the Bolton School for those taking Ph.D. courses. Clinical courses may NOT be taken as a non-degree student. Continuation of this status is at the discretion of the administrative officer of the Bolton School. Status as non-degree student does not imply acceptance into the Bolton School. If the non-degree student applies for admission to the Bolton School, 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.

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 Ph.D. programs. They must meet the admission requirements for the program that they select. Additional admission requirements are:

Application should be submitted approximately one year before the desired date of enrollment.

English translations of transcripts are required.

2. 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 Educational Testing Service administers the test. Write to the following to arrange to take the test:

Educational Testing Service (ETS)
Test of Spoken English
PO Box 6151
Princeton, NJ 08541-6151
609-951-1100

Students whose native language is English are exempt. Those whose native language is not English, a score of 550 on the paper test or 220 for the computer test is desired. Students must take English courses at the English Language Services Center (ELS) at the University. Students must complete English courses through the 109 level or its equivalent. Students who demonstrate English language proficiency may request to be exempt from these courses.

Students applying to clinical programs must be eligible for licensure as a registered nurse in Ohio and obtain this license before any clinical courses are taken. To obtain registered nurse licensure in the state of Ohio, the student must sit for the professional nursing examination (NCLEX-RN). To be eligible to take this examination, the student must sit for the English language proficiency test. Students who demonstrate English language proficiency may request to be exempt from these courses.

The following is a brief description of the financial aid opportunities available to students at the Bolton School of Nursing. Undergraduate students can find a more detailed description of undergraduate aid in the pamphlet, Financial Aid at CWRU, obtained from the CWRU Financial Aid Office. Some types of aid are not available to all students, and the awarding of some grants and scholarships may make you ineligible to receive other grants or scholarships. If you have questions or would like more information, contact the Bolton School of Nursing or Case Western Reserve University Financial Aid Offices.

### Financial Assistance

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### GRADUATE

Graduate programs at the Bolton School of Nursing are the M.S.N., N.D., Ph.D., RN-M.S.N., and the joint degree programs (M.S.N./M.B.A., and M.S.N./M.A.).

### Full and Half-Time Students

Full-time enrollment is at least 9 credit hours Fall and Spring semesters, and at least 6 credit hours, Summer semesters. Half-time enrollment is 5-8 credit hours Fall and Spring semesters, and 3-5 credit hours Summer semester. To be eligible for financial aid for summer semesters, the student must also be eligible for aid in the following Fall and/or Spring semesters.

### Federal Loans

All students are encouraged to complete the Free Application for Federal Student Aid (FAFSA). Information from this form would be placed in the following fall and/or spring semesters.
and the CWRU Financial Aid application will be used to determine the student’s financial need, and the amount of loan for which they are eligible. The majority of students receive enough loans to cover the estimated cost of tuition and expenses.

There are two basic types of federal loans: subsidized and unsubsidized. Both types of loan repayments do not begin until a student’s enrollment falls below half-time or six months after graduating, whichever comes first. Students may begin repayments earlier if they choose.

Subsidized loans do not accrue interest until after you graduate or fall below half-time enrollment. Unsubsidized loans begin accruing interest immediately, although it does not need to be paid until repayments begin.

Private Loans
For those students who do not receive federal loans or wish to borrow more money than is provided by federal loans, private lenders may be an option. More information on private lenders can be found at the FINAID website (www.finaid.com).

Part-Time Students
Students enrolled in less than 5 credit hours Fall and Spring Semesters, and less than 3 credit hours Summer Semesters are NOT eligible for federal aid. However, some private lending agencies do give loans to part-time students. Contact the Bolton School of Nursing Financial Aid Office for more information, or check the FINAID website (www.finaid.com).

Intensive Students
Students enrolled only in intensive courses are NOT eligible for federal aid because regulations require enrollment in courses that span at least a ten-week period, but students may receive loans from some private lending agencies. Contact the Bolton School of Nursing Financial Aid Office for more information, or check the FINAID website (www.finaid.com).

SCHOLARSHIPS AND GRANTS
Some of the following grants, scholarships and assistantships are given directly by the Bolton School of Nursing, while others are outside sources of assistance. Students should seek other sources of assistance on their own. Direct questions regarding the following grants and scholarships to the Bolton School of Nursing Financial Aid Office.

Professional Nurse Traineeship Grant
This Department of Health and Human Services grant, awarded to the Bolton School of Nursing, is distributed to full-time M.S.N. students and post-licensure N.D. students seeking the M.S.N.. To be eligible, the student must be enrolled full-time (on a continuing basis) for two or more semesters and have the Statement of Appointment of Trainee and Statement of Acceptance of Traineeship forms on file in the Bolton School of Nursing Financial Aid Office.

National Health Service Corps Scholarship
This is an excellent opportunity for full-time students in the Family Nurse Practitioner and Nurse Midwifery programs. Awarded from the Bureau of Primary Health Care (BPHC), National Health Service Corps (NHSC) Scholarship Program, the scholarship includes full tuition and a monthly stipend. There is a one-year work commitment (minimum of two years) for each year or partial year the scholarship is awarded. To fulfill the work commitment, awardees must obtain employment in an under-served public or private facility approved by the National Health Service Corps. Employment is not necessarily with the federal government. Employment opportunities can be found across the United States in urban, suburban and rural settings. This Scholarship is very competitive and seeks applicants who are dedicated to the mission of the BPHC. Applications are available from the Bolton School of Nursing Financial Aid Office, in late February. Application deadline is in late March.

The N.D. Student Grant
Pre-licensure N.D. students may receive this Bolton School of Nursing Grant. Based on financial need, $1,000 - $3,000 is an award for each year of the pre-licensure component of the N.D. program.

Other Grants
Some advanced practice majors have additional financial assistance available. Please contact the Bolton School of Nursing Financial Aid Office.

Employment
Many employers of health care professionals offer tuition assistance of varying levels. While you should not expect that the assistance would cover your entire tuition, it is often a significant amount. Check with your employer for more information.

Student employment may be available at the Bolton School of Nursing or at other campus locations. Also, part-time employment may be available at local hospitals or other health care agencies.

OTHER RESOURCES
There are many private scholarships, grants and loans available to undergraduate and graduate students. Students should check local organizations (i.e. churches, parents’ employers, students’ employers and service organizations). Public libraries have books on scholarships, and the Internet is another good source of information. When searching or applying for scholarships always be alert for scams. While most scholarships are legitimate, there are some that are not.

Searching on the World Wide Web
FASTWEB (www.fastweb.com) is a free search service. After completing a profile, this services searches through its database to identify scholarships that may meet student’s eligibility.

Since the database is continually updated, check back often. Also, complete numerous profiles that cover all of the student’s qualifications and interests because different profiles may produce different results.

FINAID (www.finaid.com) is a financial aid information page. It covers a wide variety of financial aid topics, including sources of aid, private loans and links to several free scholarship search services.

Information from the University

Bolton School of Nursing
Website: http://fpb.cwru.edu/
Charlene Quinn, Registrar/Financial Aid Director:
Direct: 216-368-2183
Toll free: 800-825-2540 ext. 2183
e-mail: cfq@po.cwru.edu

CWRU Financial Aid Office
Website: http://finaid.cwru.edu/
Submit questions via the website, and a financial aid counselor will respond by e-
mail in the order that questions are received.
Phone: 216-368-4530

Professional Courses

Nursing Anesthesia

NUAN 449. Chemical and Physical Properties of Anesthesia (2)
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/activity, relationships and their significance in pharmacology. Emphasis will be on the integration and practical application of these principles to clinical nurse anesthesia practice. Prerequisite: Admission to program.

NUAN 450. Pharmacological Strategies in Anesthesia Practice (2)
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. Prerequisite: NUAN 449.

NUAN 451. Physiological Variables and Responses I: Respiratory System (2)
A detailed study of the anatomic structures and 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 patients attempt to attain, maintain, or regain optimal health. Implications for all types of surgery in view of effect of anesthesia on cardiovascular system, however, special attention on surgery involving this specific system. Corequisite: NUAN 451.

NUAN 453. Physiological Variables and Responses III: Pediatric, Obstetric, Endocrine and Geriatric (4)
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. Prerequisites: NUAN 451 and NUAN 452.

NUAN 454. Physiological Variables and Responses IV: Renal and Neurologic Systems (3)
Systematic investigation of the physiologic factors related to health-seeking behaviors with special emphasis on pathophysiology of the renal and neurological systems. Focus will be on the integration of this knowledge into the planning, implementation, and evaluation of patients requiring nurse anesthesia intervention. Prerequisite: NUAN 453.

NUAN 455. Anesthesia Nursing I (2)
An introduction to the art and science of nurse anesthesia including basic anesthetic principles and beginning clinical practice 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)
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. Prerequisite: NUAN 455.

NUAN 457. Anesthesia Nursing III (1)
Graduated, guided instruction in clinical management of clients receiving various types of anesthesia. Focus 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. Prerequisite: NUAN 456.

NUAN 551A. Nurse Anesthesia: Advanced Practice I (2)
(See NUAN 551C.)

NUAN 551B. Nurse Anesthesia: Advanced Practice I (1)
(See NUAN 551C.) Prerequisite: NUAN 457.

NUAN 551C. Nurse Anesthesia: Advanced Practice I (1)
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. Prerequisite: NUAN 457.

NUAN 552. Nurse Anesthesia: Advanced Practice II (1)
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. Prerequisites: NUAN 551A and NUAN 551B and NUAN 551C.

Nursing (NUND)

NUND 211. Pharmacology (2)
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. Prerequisite: NUND 342.

NUND 213. Nursing Strategies and Interventions for Alterations in Human Function (4)
An introduction to specific nursing strategies and interventions designed to support the maximum health potential of the adult patient. The fundamentals of nursing care
are incorporated into a laboratory setting and practiced in an acute care medical-surgical facility. Particular emphasis is placed on the nursing strategies and interventions. Evaluation of the effectiveness of interventions is integrated throughout the course. Prerequisite: Admission to N.D. program.

NUND 220. Altered Human Functioning (3)
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. Prerequisite: NUND 412.

NUND 222. Nursing Informatics II: Biostatistics (1)
This course focuses on advanced concepts in quantitative methods for nursing, including application to nursing problems, and solution strategies using computer software.

NUND 224. Acute Care Nursing I - Adult and Older Adult (10)
The focus of this course is the integration of nursing process and clinical practice. Human response to significant life events and health alterations will be analyzed. Application of relevant physiology, psychosocial dimensions, and pharmacology will be included. Particular emphasis is placed on nursing strategies and interventions and the evaluation of their effectiveness. Prerequisites: NUND 213 and completion of first semester of N.D. curriculum.

NUND 230. Foundations of Nursing Practice (2)
This course introduces the discipline of nursing and its attributes for clinical practice. Critical historical, societal, and philosophical influences that have affected nursing as a profession will be critiqued. Nursing theories are introduced. The individual, the group, the family, and the community as clients of the nurse are introduced. Nursing strategies to promote therapeutic communication are emphasized.

NUND 232. Introduction to Genetics and Embryology (1)
Introduction to the theories and concepts relevant to genetics and embryological development of humans.

NUND 233. Human Growth and Development (1)
Introduction to the theories, concepts and nursing applications relevant to the physical, psychological and social growth and development across the lifespan.

NUND 315. Parents and Neonates in Health and Illness (4.5)
The study of parents and neonates and their health-seeking behaviors from a developmental perspective. Nursing knowledge and skills related to assessment of health status of parents and neonates, and nursing strategies focused on interventions to promote, restore and maintain health are discussed. Strategies are based on understanding growth and development of individuals, families, and other relevant groups in response to change inherent in the childbearing process, within the context of intervening variables such as high risk perinatal designation. Prerequisite: NUND 224.

NUND 316. Infants, Children, and Adolescents in Health and Illness (4.5)
The study of infants, children, and adolescents and their 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. These strategies are based on understanding advanced concepts of children’s and adolescents’ responses in acute health/illness states. Prerequisite: NUND 213.

NUND 317. Psychiatric-Mental Health Nursing (4.5)
The course is designed to address health-seeking behavior patterns within the contexts of psychiatric and mental health-nursing concepts. The focus is on clients with acute 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. Prerequisite: NUND 224.

NUND 318. Nursing in the Community (4.5)
The study of the promotion of health and the primary, secondary and tertiary prevention of health problems of a population. Focusses on the community as client with nursing care of individuals, families and groups. The clinical component focuses on developing and evaluating health promotion programs, family assessment, community assessment, and community-based home care within the context of the community. Prerequisite: NUND 224.

NUND 341. Concepts of Management (3)
Study of basic concepts relative to leadership and working with groups of people in providing nursing care. Concepts include: decision making, power, authority, roles, teaching-learning, evaluation, leader behaviors, work groups, legal aspects, change.

NUND 342. Medical Microbiology, Immunity, and Infectious Diseases (3)
Microbial structure, growth, genetics, and metabolic control function and dysfunction of the human immune response. Manifestations of infectious disease and review of selected infectious diseases.

NUND 343. Issues and Ethics in Health Care (2)
Designed to introduce the students 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.

NUND 400. Guided Study (1-6)
Selected topics in basic nursing. May include clinical experiences.

NUND 410. Health Assessment (2)
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.

NUND 412. Anatomy, Physiology, and Metabolic Function of the Human Body (6)
Basic concepts of normal human anatomy, physiology, biochemistry, and nutrition presented with emphasis placed on the interrelatedness of human body systems and their holistic interactions. A review of the normal anatomy and physiology of the major body systems’ normal structure and function and compensatory alterations under stress will be presented. Basic biochemical and metabolic control mechanisms will be reviewed with emphasis placed on their impact on normal and compensatory physiologic function. Dietary sources of the major nutrients metabolized by the human body will also be discussed. An observational laboratory of human cadaver dissection will be provided.

NUND 441. Management in Advanced Practice (3)
This course focuses on management issues...
Nurse Practitioner (NUNP)

NUNP 401. Health Promotion in Children and Adolescents (2)
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. Corequisite: NUNP 410.

NUNP 402. Common and Acute Health Problems of Children (6)
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. Prerequisites: NURS 445, NURS 449, NUNP 410, and NUNP 430. Corequisite: NURS 430.

NUNP 403. Advanced Management in Pediatric Primary Care (5)
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. Prerequisite: NUNP 402.

NUNP 405. Neonatal Nurse Practitioner: Introduction (2)
This course introduces the role of the Neonatal Nurse Practitioner as it relates to families and other health care professionals providing care for high risk newborns. Analysis of nursing strategies to optimize health-seeking behaviors in families with well and ill neonates is highlighted.

NUNP 410. Health Promotion Across the Life Span (2)
This course introduces health promotion fundamental to advanced practice nursing.
NUNP 419. Family Health Nursing: Health of Adults and Older Adults (5)
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. Prerequisites: NUNS 430, NUNS 453, NUNS 459, and NUNS 410. Corequisite: NUNS 430.

NUNP 425. Acute Problems of the Child II (2)
This course emphasizes pathophysiology, assessment, and diagnostic approaches specific to acute health problems of children. Advanced therapies and case management are introduced. Application of nursing strategies to optimize health-seeking behaviors in children and their families are emphasized.

NUNP 429. Family Health Nursing: Health of the Family During Childbearing Years (4)
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. Prerequisite: NUNS 410 or NUNS 419.

NUNP 432. Common and Acute Health Problems of the Adult I (5)
This course introduces the common and acute health problems occurring across the adult life span. A body system approach is used with emphasis on the biological, psychological, social and cultural aspects of care. Pathophysiology, assessment and diagnostic strategies specific to the acute and common problems of adults and adolescents will be stressed. Nursing strategies used to enhance, maintain and restore health will be emphasized. Prerequisites: NUNS 430, NUNS 453, NUNS 459, and NUNS 410. Corequisite: NUNS 430.

NUNP 433. Common and Acute Health Problems of the Adult II (3)
This course is a continuation of NUNS 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 (6)
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. Prerequisite: NUNS 433.

NUNP 435. Advanced Management of Acutely Ill Children (4)
This course continues the study of acute health problems occurring in hospitalized children as well as the management of complex multidimensional health problems. 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 process within interdisciplinary teams. The effectiveness of interventions will be evaluated. Applications of nursing strategies to optimize health-seeking behaviors in children and their families are emphasized. Prerequisite: NUNS 425.

NUNP 439. Family Health Nursing: Health of Children and Adolescents (4)
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. Prerequisite: NUNS 429.

NUNP 443. Acute Health Problems of the Adult (6)
Emphasis is on the pathophysiology, assessment, and diagnostic approaches specific to acute health problems of adults. The clinical laboratory focuses on development of advanced therapeutics and case management skills. Prerequisite: NUNS 438.

NUNP 444. Advanced Management of Acutely Ill Adults (4)
This course focuses on concepts specific to complex, multidimensional health problems of hospitalized adults. Pathophysiology, assessment, and diagnostic strategies specific to complex health problems are emphasized. Clinical practice focuses on case management of acutely ill hospitalized adults with complex health problems. Prerequisite: NUNS 443.

NUNP 449. Primary Care of Older Adults (3)
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. Prerequisite: NUNS 419.

NUNP 459. Advanced Management Care of Elderly (3)
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. 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. Prerequisite: NUNS 449.

Nursing (NURS)

NURS 110. Foundations of the Discipline (1)
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 af-
Assessment strategies, diagnostic testing, and interventions in human functioning. Assessment strategies, diagnostic testing, and pharmacological principles with emphasis on nursing interventions are integrated into the nursing process. Prerequisite: BIOL 150.

NURS 315. Parents and Neonates in Health and Illness (4.5)
This course focuses on the study of childbearing 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. Prerequisite: Junior standing.

NURS 316. Infants, Children, and Adolescents in Health and Illness (4.5)
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. Prerequisite: Junior standing.

NURS 317. Psychiatric-Mental Health Nursing (4.5)
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. Prerequisite: Junior standing.

NURS 318. Nursing in the Community (4-4.5)
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. Prerequisite: Junior standing.

NURS 320. Nursing Research (3)
Introduction to scientific inquiry and research process in nursing. Discussion of issues and problems in systematically evaluating reports of empirical research on nursing phenomena. Appropriate use of the nursing research literature and research findings in clinical practice is discussed. Prerequisite: STAT 201.

NURS 341. Concepts of Management (3)
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 (3)
Microbial structure, growth, genetics, and metabolic control. Function and dysfunction of the human immune response. Manifestations of infectious disease and review of selected infectious diseases. Prerequisite: Completion of three semesters of B.S.N. program.

NURS 343. Issues and Ethics in Health Care (2)
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 344. Trends and Issues in Professional Nursing (2)
Influences of social, political, religious, and economic forces on the development of nursing and nursing practice in present-day society. Examination of issues from historical and current viewpoints with projections for the future.

NURS 345. Nursing Informatics III: Clinical NIS (2)
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. Prerequisite: NURS 240 or RN license.

NURS 346. Nursing Informatics IV: Applications (2)
The focus of this course is directed toward the advanced informatics concepts and the implementation of selected applications within the health care setting. Systems analyzed and implemented may range from those used for patient care within the
NURS 351. Acute Care II: Management of Care (4.5)
Application of management concepts in providing care to individuals and groups of patients. Learning opportunities include experiences with members of the multidisciplinary health care team in planning, implementing, and evaluating patient outcomes. Prerequisites: NURS 315 and NURS 316 and NURS 317 and NURS 318.

NURS 352. Acute Care III (9)
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. Prerequisites: NURS 351 and NURS 353.

NURS 353. Principles of Critical Care I (4.5)
This course provides the knowledge and technical skills foundational to the care of critically ill patients. Clinical practice is directed towards the care of the critically ill patient with a focus on patient assessment, use of biomedical technology, development of psychomotor skills, and planning basic care. Prerequisites: NURS 315 and NURS 316 and NURS 317 and NURS 318.

NURS 354. Nursing Care of Critically Ill Adults (9)
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 towards 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. Prerequisites: Grade of “B” or higher in NURS 353. Consent of instructor.

NURS 356. Nursing Care of Critically Ill Neonates, Infants, and Children (9)
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 neonates, infants and children and their families. Prerequisites: Grade of “B” or higher in NURS 316. Consent of instructor.

NURS 391. Home Health Care Nursing (5)
This course focuses on the knowledge and skills necessary to provide nursing care in home health settings for clients with complex problems. Emphasis is on nursing strategies designed to provide comprehensive care to clients and their families. Clinical practice is directed toward the care of client/family in the home.

NURS 392. Dynamics of Nursing Practice Management (4)
Analysis of management and leadership concepts in complex situations and their applications to nursing practice, usually as it involves working with groups of people in providing nursing care. This course introduces the topics of strategic planning, resource management and the use of information technology in the clinical setting.

NURS 393. New Applications in Nursing Practice Management (4)
Application of management and leadership concepts in a clinical practicum that is individualized for the students on the basis of their previous experiences and goals. Students will be expected to apply concepts of strategic planning and resource management to promote health-seeking behaviors of clients.

NURS 399. Independent Study (1-12)
Independent guided study for undergraduates with special needs or interests. Prerequisite: Permission of the program director.

NURS 400. Guided Study in Nursing (1-18)
Independent study for students with special needs and interests.

NURS 405. Inquiry I (3)
Introduction to theoretical thinking in nursing. Study of knowledge development in nursing, conceptual structures and their uses, relationship of theory to research process as a basis for nursing practice, and the process of critical thinking in nursing.

NURS 415. Inquiry II (4)
Introduction to scientific inquiry. Study of research process, particularly design, sampling, data collection and analysis, and interpretation and reporting of findings. Experience in writing a proposal for nursing research. Prerequisite: NURS 405.

NURS 424. Theoretical Basis of Medical/Surgical Nursing II (5)
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 430. Pharmacology and Therapeutics (1-3)
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. Prerequisite: NURS 453 recommended.

NURS 438. Theoretical Foundations of Acute Care Nursing (2-4)
This course focuses on advanced practice by examining common health and illness phenomena in the acute care setting. Concepts, theories, and phenomena will be analyzed for their relevance in planning and evaluating nursing care strategies and modalities. Individualized clinical experience in the acute care setting with a selected patient population is part of the advanced practicum. Prerequisites or corequisites: NURS 453 and NURS 459.

NURS 443. Professionalism in Advanced Practice (3)
Study of the multiple roles integrated into advanced practice nursing in order to assist individuals, families, groups and communities to attain, maintain and regain optimal health. Principles of education, management, leadership, consultation and collaboration will be discussed.

NURS 444. Health Care Delivery: Legal and Ethical Issues in Advanced Practice (3)
Study of multiple factors that influence the health care delivery system and those factors that particularly affect the advanced practice nurse. The focus of the course is critical analysis and discussion of health policy, legal and ethical issues. Application of nursing informatics concepts will be integrated throughout the course.

NURS 446. Collaboration and Administration in the Health Care Delivery System (3)
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, di-
recting, 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. Physiologic Foundations for Advanced Practice Nursing (4)**

This course is designed to build upon the student’s preexisting knowledge of basic human anatomy, physiology, and nursing science. Selected body systems are examined in order to provide in-depth integration of normal physiologic functions with specific intervening variables and pathologic mechanisms associated with life span development and dysfunction.

**NURS 454. Well Woman Health Care (3)**

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 non-pregnant clients. Individually planned experiences with nurse faculty who are serving as primary care givers in maternity, family planning and gynecologic care settings. Prerequisites or corequisites: NURS 453 and NURS 459.

**NURS 455. The Childbearing Family (4)**

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. Prerequisite: NURS 454. Corequisite: NURS 430.

**NURS 456. Issues in Health Care Management (3)**

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. Crosslisted as HSMC 456.

**NURS 457. Labor and Birth (7)**

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. Prerequisite: NURS 455.

**NURS 459. Integrated Assessment for Advanced Nursing Practice (3)**

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 therapeutic and case management.

**NURS 460. Theoretical Basis of Nursing Interventions with Individuals (2)**

Study of the theoretical basis of individual work with persons experiencing emotional crises and disturbances. The nurse therapist enhances the health-seeking behaviors of individuals as they strive to attain, maintain or regain optimal health. Emphasis on theories, psychotherapy, and crisis intervention. Prerequisite: Graduate standing in Nursing.

**NURS 461. Practicum and Supervision of Individual Therapy (1-2)**

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. Prerequisite: NURS 460.

**NURS 462. Practicum and Supervision of Group and Family Therapy (2-3)**

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. Prerequisite: NURS 467.

**NURS 463. Theoretical Basis of Practice and Supervision in Consultation and Mental Health (1-3)**

Indirect care experience. Theories of consultation. Adult education. Exploration of issues related to the role of the clinician in the enhancement of health-seeking behaviors of individuals and communities as they strive to achieve optimal levels of health. Examination of the consultative, administrative and educational processes in the practice of consultation and community education. Seminars, group, and individual supervision. Prerequisites: NURS 460 and NURS 462, and graduate standing or consent of instructor.

**NURS 466. Practicum and Supervision in Role of Clinician (3)**

The professional encounter between the psychiatric mental health clinical nurse specialist, staff and agency personnel providing mental health services, and clients receiving services in the context of an environment of care is emphasized. Intrapersonal, interpersonal and extrapersonal variables that influence the health-seeking behaviors of individuals, families and groups as they seek to attain, maintain or regain optimal levels of mental health are employed.

**NURS 467. Theory of Family and Group Modalities (2-3)**

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 the application of knowledge and skills of continuing education. Theories of consultation and community education. Seminars, group, and individual supervision of data. Prerequisite: NURS 468.

**NURS 468. Continual Improvement of Health Care: An Interdisciplinary Course (3)**

The goal of this course is to equip health professions students (medicine, nursing, and health administration) with the ability and confidence to contribute to continual improvement in health care. Through seminar and field experiences students will be given the opportunity to learn the philosophy, knowledge and skills of continuous quality improvement, teamwork and
interdisciplinary work. The focus is on collaborative work for the benefit of patients and communities. Prerequisite: Consent of instructor. Cross-listed as EPBI 468.

NURS 471. Organizational Theories (3) Examination of intervening variables which affect health care organizations including structure, dynamics and processes of change.

NURS 479. Public Policy and Aging (3) Cross-listed as EPBI 408.

NURS 480. Public Health and Epidemiology (3) Study of health care problems within the larger social/environmental context. Epidemiology as a method of reasoning leading to the making of casual inferences. Principles underlying epidemiology as a method of study and the scope, potentialities and limitations of this approach. Prerequisite or corequisite: Statistics or consent of instructor.

NURS 481. Curriculum and Instruction (3) Study of the role of the nurse as an educator and the contributions of nursing education to knowledge development and transmission. Concepts related to curriculum development and their use in determining philosophy and objectives of nursing curricula, new developments in planning and organizing nursing curricula, determining program objectives and course objectives and selecting and organizing appropriate learning experiences to meet objectives. Introduction of strategies and methods to evaluate components of a nursing curriculum. Prerequisite: One semester of graduate study in a nursing specialty or consent of instructor.

NURS 482. Teaching and Evaluation in Nursing Education (3) Roles and functions of the teacher of nursing. Principles of learning applied in the classroom and clinical setting through lectures, seminars, and guided clinical teaching practice. Concepts related to selection, development and use of appropriate evaluation procedures as applied to clinical and classroom teaching will be studied.

NURS 491. Community Health Nursing I (4) This is the first course in the Community Health Nursing major. It is designed to introduce students to the specialist practice of community health nursing and emphasizes the importance of population based practice. A population or a geopolitical community focus will be identified by the student, and a comprehensive appraisal of its health status conducted. Priority health concerns and strategies to enhance health-seeking behaviors and mechanisms will be identified. Prerequisites: Undergraduate Community Health Nursing courses; graduate standing in nursing.

NURS 495. Community Health Nursing II (4) In this course students will design a feasible plan to address the identified priority concern for a selected population or geopolitical community. Program planning models will be examined, and a model useful to address the priority concern selected. Evaluation techniques will be identified and included in the program design. Interventions to enhance health-seeking behaviors based on primary, secondary and tertiary prevention strategies will be implemented in the clinical component of the course. Prerequisite: NURS 491.

NURS 496. Community Health Nursing III (4) This course completes the Community Health Nursing major. Based on work successfully completed during the previous two courses the student will conclude program implementation and conduct a summative evaluation of overall program effectiveness. As part of the leadership experience, the student, in partnership with the community or population, will explore external funding for program continuation. Issues influencing health care delivery and community health nursing practice will be examined. Prerequisites: NURS 491 and NURS 495.

NURS 499. The Nurse Executive-Personal and Professional Challenges in Health Care (3) 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) Systematic investigation of a research problem selected by the student for independent study. Prerequisite: NURS 415.

NURS 501. Special Topics in Nursing (1-3) Use of theory and research to examine selected topics and issues in nursing. Prerequisites: Ph.D. standing in Nursing and written consent of instructor.

NURS 503. Inquiry III (2) Development of competencies in scientific inquiry. Experience in either (a) pilot study of aspect of Inquiry II proposal; (b) in depth paper on aspect of Inquiry II proposal; or (c) involvement in faculty research project and written report of experience. Prerequisite: NURS 415.

NURS 504. Nursing Theory (3) Theory development in nursing, issues in theory development, and uses of theory. Seminar discussions. Prerequisite: One year of graduate study in nursing or consent of instructor.

NURS 506. Nursing Epistemology (3) This course involves the study of knowledge shared among members of the discipline, the patterns of knowing and knowledge development, and criteria for evaluating knowledge claims. 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 511. Strategies for Theory Development (3) 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) 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 520. Advanced Nursing Research I (3) The development of research questions within a nursing framework and related research designs will be studied. The foci of the course will be problem formulation, selected research designs and sampling. Prerequisites: STAT 301 and consent of instructor.
NURS 521. Advanced Nursing Research II (3)
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. Prerequisites: NURS 520 and consent of instructor.

NURS 530. Advanced Research I (3)
This is the first in a two-course sequence in research methods. The course focuses on sampling, measurement, and data collection strategies as well as survey, quasi-experimental and qualitative designs. The emphasis is on the application of these strategies while encouraging flexibility in conceptualizing a study using different research methods. Develop a research study using methodologies consistent with theoretical and empirical knowledge and the nursing perspective.

NURS 531. Advanced Research II (3)
This course is the second in a two-course sequence of research methods. It focuses on power analysis, data management, experimental and epidemiologic designs and designs to assess change and multiple comparisons. 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. Prerequisite: NURS 530.

NURS 550. Theoretical Basis for Clinical Practice (3)
In this course the advanced clinician will explore, analyze, and develop a personal conceptual framework for advanced clinical practice that integrates the art and science of the discipline of nursing. Seminars will focus on integrating concepts, theories, conceptual and theoretical models within the discipline of nursing and explore the usefulness of models from other disciplines; analyze the development of the advanced clinician concept and its impact on the discipline and profession of nursing; promote the foundations of specializing while developing innovative care strategies. Prerequisite: NURS 405.

NURS 557. Advanced Midwifery (6)
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. Prerequisite: NURS 457.

NURS 559. Advanced Practice in Nursing Care of Women (2-5)
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. Prerequisite: NURS 455.

NURS 577. M.S.N./M.B.A. Management Practicum (9)
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 may 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.

NURS 579. Public Policy and Aging (3)
Cross-listed as EPBI 408.

NURS 601. Special Problems (1-12)

NURS 609. Health Policy Seminar (3)
Seminar offers a formal introduction to the role of research in the formulation of health policy. Students will participate in a seminar designed to illuminate the policy components and implications of clinical nursing research. Special emphasis is placed on selected national health policy issues that form the socio-political context of nursing research and practice. Prerequisite: Matriculated to Ph.D. or written consent of instructor.

NURS 615. Topical Seminars in Nursing Research (3)
Variety of topical seminars are offered in rotation and students select seminars most closely related to their own area of research. All courses provide in-depth knowledge of research and research issues in a given area and opportunities to apply this knowledge in further development of their research interests and ideas.

NURS 630. Advanced Statistics for Nursing Research (3)
This course is one of a two-part series focused on advanced procedures for data analysis and statistical inference in nursing and health research. The course is devoted to discussion of linear models, including simple and multiple regression, factor analysis and causal modeling. 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. Prerequisites: NURS 530 and NURS 531.

NURS 670. Guided Study in Proposal Development (3-12)
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. Prerequisites: NURS 506 and NURS 531.

NURS 701. Dissertation Ph.D. (1-18)

NURS 702. Appointed Dissertation Fellowship (9)
Guide to Abbreviations
## Course Identification Codes

The following four-letter course identification codes are used at Case Western Reserve University. They must be used when entering courses on the schedule form during registration (e.g., English 150 would be listed as ENGL 150).

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<td>APMU</td>
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<td>Art Studio and Art Education</td>
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<td>Labor &amp; Human Resource Policy</td>
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<td>Mandel Center for Nonprofit Organizations</td>
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Program Codes

This is a list of all coding used for academic programs of study at CWRU. It does not imply that the program is currently available as a major. Some of these codes are for concentrations, minors and for majors no longer offered. It is necessary to maintain this list in its entirety for purposes of maintaining historical records.

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<tr>
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<td>Accounting</td>
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<tr>
<td>AFR</td>
<td>Auditing &amp; Financial Reporting</td>
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<td>Artificial Intelligence</td>
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<td>Amer Stud &amp; Museum Stud</td>
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**UNIVERSITY ABBREVIATIONS**

The following abbreviations are used at Case Western Reserve University and appear in this publication.

- AACSB: American Assembly of Collegiate Schools of Business
- AADSAS: American Association of Dental Schools Application Service
- AAMC: Association of American Medical Colleges
- ACT: American College Testing Program
- ALA: American Library Association
- ALAS: Auxiliary Loan to Assist Students
- AMCAS: American Medical Colleges Application Service
- ANA: American Nurses’ Association, Inc.
- ARJCC: Andrew R. Jennings Computer Center
- CIA: Cleveland Institute of Art
- CIM: Cleveland Institute of Music
- CLEP: College Level Examination Program
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How to Reach CWRU
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The University is about five miles east of downtown Cleveland on Euclid Avenue (U.S. Routes 6, 20, and 322). Most road maps of Ohio have the University clearly indicated.

By Car
If you are coming from the east via Interstate 90, exit at Martin Luther King Jr. Boulevard. Proceed south for about a mile to the East 105th traffic light; cross over East 105th and turn right over the traffic circle, continuing along Martin Luther King Jr. Boulevard to Euclid Avenue. Turn left onto Euclid and watch for the Information Booth at the right.

If you are coming from the east via Interstate 80 (Ohio Turnpike), remain on the Turnpike until you reach Interstate 480, which merges with Interstate 271. Exit I-271 at Cedar Road and follow it westbound towards Cleveland. Where Cedar starts down a steep hill and lane-switching lights are hanging overhead, look for a sign identifying Case Western Reserve University at the corner of Murray Hill Road (the first light at the bottom of the hill). Turn right onto Murray Hill, bear left at the traffic light, and turn left at the three-way stop on the other side of the bridge. You will be on Adelbert Road near the center of campus.

If you are coming from the west via the Ohio Turnpike, exit at Interchange 8A and follow Interstate 90 east. In the downtown area, exit on Chester Avenue and proceed east to Euclid Avenue. Turn left onto Euclid and look to the right for the Information Booth.

If you are coming from the south via Interstate 71 (or Interstate 77), proceed north until I-71 (or I-77) merges with Interstate 90, take I-90 east, then exit onto Chester eastbound as above.

Parking
See the campus map on the next page for designated visitor parking locations on campus.

By Air
Arrive at the Cleveland Hopkins International Airport. The fastest, most economical means of reaching the University from Hopkins is the RTA (Regional Transit Authority) Rapid Transit train eastbound to the University Circle station, which is just south of campus. A free University Circle shuttle bus connects the station with all areas of the campus.

By Bus
The city’s central bus depot is located downtown on Chester Avenue near East 14th Street. Taxis are available, or walk one block south on East 14th street to Euclid Avenue. There you can catch RTA Bus No. 6 eastbound to the Adelbert Road, Cornell Road, or East 115th Street stops.

By Train
Arrive at the AMTRAK station in downtown Cleveland. Take the new RTA Waterfront rail line to Tower City and transfer to a train eastbound for University Circle. A free University Circle shuttle bus connects the station with all areas of the campus. Taxis are also available at the AMTRAK station.

Lodging
Overnight accommodations are available at the Glidden House Inn (a bed-and-breakfast located on the north side of campus), at the Omni International (East 96th Street and Carnegie Avenue), and at motels and hotels in the downtown area, twenty minutes by car from campus.
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