ENGR 101. Engineering for Non-Engineers. 3 Units.
This course is an introduction to basic principles used in engineering and the application of these principles to the technology in the world around us. You will also explore social, economic, and political implications of this technology. The course is specifically geared to non-engineers. Mathematical concepts and tools that are needed to represent and analyze the scientific and engineering principles in the course will be developed in class. You will have the opportunity to learn about engineering principles, apply them in experiments, and then see how they are used in current technology. This is partly a lecture class, partly a discussion class, largely a hands-on course. You learn about engineering by working with actual devices. Counts for CAS Quantitative Reasoning Requirement.

ENGR 131. Elementary Computer Programming. 3 Units.
Students will learn the fundamentals of computer programming and algorithmic problem solving. Concepts are illustrated using a wide range of examples from engineering, science, and other disciplines. Students learn how to create, debug, and test computer programs, and how to develop algorithmic solution to problems and write programs that implement those solutions. Matlab is the primary programming language used in this course, but other languages may be introduced or used throughout. Counts for CAS Quantitative Reasoning Requirement.

ENGR 131B. Introduction to Engineering and Programming. 3 Units.
Students will learn the fundamentals of engineering analysis and computer programming using a hands-on, project-based approach. During each project, students will apply engineering skills, such as data analysis or prototyping, in addition to programming, to complete a given task. MATLAB will be the primary coding language. Potential projects include building a motor, balancing a ball on a beam, and creating a water filter. In addition, students will learn about the engineering profession and practice presentation skills.

ENGR 145. Chemistry of Materials. 4 Units.
Application of fundamental chemistry principles to materials. Emphasis is 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. Prereq: CHEM 111 or equivalent.

ENGR 200. Statics and Strength of Materials. 3 Units.
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. Prereq: PHYS 121.

ENGR 200S. Statics and Strength of Materials - Supplemental. 0 - 1 Units.
This course allows students who are seeking transfer credit for ENGR 200 for a Statics course taken an another educational institution to obtain missing Laboratory content and to show passing proficiency in this content.

ENGR 210. Introduction to Circuits and Instrumentation. 4 Units.

ENGR 210S. Introduction to Circuits and Instrumentation - Supplemental. 1 - 3 Units.
This course allows students who are seeking transfer credit for ENGR 210 for a Circuits course taken at another educational institution to obtain missing Laboratory content and to show passing proficiency in this content.

ENGR 225. Thermodynamics, Fluid Dynamics, Heat and Mass Transfer. 4 Units.
Elementary thermodynamic concepts: first and second laws, and equilibrium. Basic fluid dynamics, heat transfer, and mass transfer: microscopic and macroscopic perspectives. Prereq: PHYS 121 or PHYS 123. Prereq or Coreq: MATH 223 or MATH 227.

ENGR 225B. Thermodynamics, Fluid Mechanics, Heat and Mass Transfer (abroad). 4 Units.
Elementary thermodynamic concepts: first and second laws, and equilibrium. Basic fluid dynamics, heat transfer, and mass transfer: microscopic and macroscopic perspectives. The course is taught as a faculty-led study abroad course, and engineering applications are discussed in the context of regional issues specific to the host country. Prereq: CHEM 111, ENGR 145, and PHYS 121. Coreq: MATH 223.

ENGR 225S. Thermodynamics, Fluid Dynamics, Heat and Mass Transfer - Supplemental. 0 - 2 Units.
This course allows students who are seeking transfer credit for ENGR 225 for a Thermodynamics course taken another educational institution to obtain possible missing content in the area of fluid dynamics, heat, or mass transfer and to show passing proficiency in this content.
ENGR 350U. Global Health Design in Uganda. 1 - 3 Units.
The CWRU Anthropology-Engineering Collaborative (AEC) offers this unique course applying social science and engineering skills and expertise to address global health issues in Uganda. The AEC is part of a longstanding collaboration between CWRU and Makerere University in Kampala, Uganda. Students collaborate with students at Makerere University in Kampala, Uganda and the CWRU student group, Global Health Design Collaborative (GHDC), to design and implement solutions to specific health issues in Luwero, Uganda. Students meet weekly during the semester to learn about global health technology design and anthropology. Students work with GHDC and program faculty on specific projects; activities may include conducting needs assessment, prototype development, design validation and verification, and preparation of a project report. Current projects focus on designing a pediatric pulse oximeter, identifying means to preserve the cold chain for vaccine outreach and improving medical waste disposal. In Uganda, students and their Makerere University counterparts travel together to Luwero district where they visit health centers to collaborate with local staff to review current design prototypes and issues. Activities include: talking to health center staff at different levels of the health care system, observing a community health outreach, and meeting with diverse stakeholders in Luwero and Kampala. Students gain hands-on experience in engineering design, social science methods, and working in transnational, interdisciplinary teams and contribute directly to ongoing efforts to address global health issues in Uganda. Students are encouraged to contribute to the projects through ongoing work with GHDC. The course may be taken as either ENGR 350U or ANTH 300. The course fee covers travel and on-the-ground expenses. The class is open to all majors but enrollment is by application and instructors' consent. Students who enroll in 3 credits may count the class for the CSE humanities/social science requirement and/or the CAS Global and Cultural Diversity requirement. Offered as ENGR 350U and ANTH 300.

ENGR 390. Basic Visual Communication. 2 Units.
This course is focused on fundamental visual communication techniques for product development. Students will learn to explore and present their ideas through sketching, rendering, orthographic drawing and physical modeling. Drawing and modeling skills in this course will be practiced manually rather than digitally (i.e., pen and paper, hand-built models). Studio time will include group demos, in-class assignments and exercises, and one-on-one instruction. Coursework is tailored for Case students, however attempts will be made to align this course with the standard Industrial Design Communication Skills Course at The Cleveland Institute of Art (CIA). This will allow opportunities for networking and collaboration with CIA students. Prereq: Must be a Sophomore or above or in a declared Engineering major.

ENGR 395. Community-engaged, Interdisciplinary Team-based Design Projects. 1 - 3 Units.
Interdisciplinary, team-based design projects under faculty guidance and with professional mentorship as appropriate. Each enrolled student will be part of a project team. Class will meet weekly for training, design reviews and progress updates. Teams will additionally meet outside of class time. Engagement with community partner (customer) is expected. Projects may be long term, possibly preceding and extending beyond the engagement time of individual students. Team members will have individual roles and responsibilities. Course may be taken for 1-3 credits, and level of responsibility will be proportional. Course deliverables will include rigorous maintenance of project documentation, including a transition report, and oral presentations. Intended for second-year students and above. Students in all disciplines are welcome. Projects may involve international partnerships, but travel is not mandatory.

ENGR 397. Interdisciplinary Solutions to Global Health Issues. 3 Units.
This unique course brings together the expertise of engineers and social scientists to address global health issues through a combination of classroom-based learning and experiential learning through team-based design projects and field-based community assessments. Students will experience the process of engineering design by participating in teams organized around solutions to real-world health problems in the developing world. Methods from social sciences will be practiced and brought to bear in the process, including assessment of global health needs, and evaluation of success of interventions. Students will study and discuss current key issues in global health, and ethics surrounding health care, disparity, methods of intervention, and develop skills in how to define and frame problems and communicate effectively across disciplines. The course is organized around ongoing projects that seek to design technical solutions to global health issues, with a focus on Uganda. The teams will also work and learn with students and faculty of Biomedical Engineering and Social Sciences at Makerere University of Kampala (MUK), Uganda. Examples of interactions with MUK will include discussion of common readings, peer-review, and joint planning, implementation, and review of fieldwork. Students enrolled in ANTH 303/ ENGR 397 are eligible to travel to Uganda to participate in project activities over Spring Break. Travelers must be enrolled in ENGR 350U. This course is an approved SAGES Departmental Seminar. A student in the Case School of Engineering may use this course to meet an Engineering Core Breadth requirement, either in place of ENGL 398 and ENGR 398, or as a Social Science course (ANTH 303 cross-list). No student may count the course to satisfy both of these requirements. Offered as ANTH 303 and ENGR 397. Counts as SAGES Departmental Seminar. Counts for CAS Global & Cultural Diversity Requirement. Prereq: Passing letter grade in a first year seminar in FSSC, FSSO, FSSY, FSNA, FSCS or FSTS.

ENGR 398. Professional Communication for Engineers. 1 Unit.
Students will attend lectures on global, economic, environmental, and societal issues in engineering, which will be the basis for class discussions, written assignments and oral presentations in ENGL 398. Recommended preparation: ENGL 150 or FSCC 100 or equivalent and concurrent enrollment in ENGL 398 (ENGL 398 and ENGR 398 together form an approved SAGES departmental seminar). Counts as SAGES Departmental Seminar.

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

ENGR 401C. Graduate Cooperative Education. 0 Unit.
An academic opportunity designed for graduate students to enhance their classroom, laboratory, and research learning through participation and experience in various organizational/industrial environments where theory is applied to practice. Graduate Cooperative Education experiences may be integrated with the student's thesis or research project areas, or be solely for the purpose of gaining professional experience related to the student's major field of study. Registration in this course will serve to maintain full-time student status for the period of time that the student is on a co-op assignment. Prereq: ENGR 400C.
ENGR 410C. Graduate Cooperative Education Part-time. 0 Unit.
An academic opportunity designed for graduate students to enhance their classroom, laboratory, and research learning through participation and experience in various organizational/industrial environments where theory is applied to practice. Graduate Cooperative Education experiences may be integrated with the student's thesis or research project areas, or be solely for the purpose of gaining professional experience related to the student's major field of study. This is a 0 credit course that allows students to enroll in the co-op program while working up to 20 hours per week. Students must be enrolled as a full-time student to be eligible for this course. Proof of full-time enrollment is required.

ENGR 480. Professional Development for Graduate Students. 2 Units.
The course aims (1) to provide students with an appreciation of the linkage of business and management issues to successful (and sometimes not) R&D and commercialization in industry; (2) to develop a common language around innovation and an entrepreneurial mindset; and (3) to develop skills associated with the development of compelling value propositions with frequent practice via writing and speaking. Concepts from project management, finance, strategy and entrepreneurship will be introduced via readings, discussions and occasional case studies, and proposals emphasizing needs-based innovation. This course has emerged based on discussions with industry over the past decade regarding expectations of M.S. and Ph.D. graduates.

ENGR 600. M.S. Engineering Culminating Experience. 0 Unit.
Culminating experience for MS course focused track in engineering. Prereq: M.S. student in Engineering - course focused track.