

# Engineering Courses (College of Engineering) (ENGR)

This is a list of core engineering courses. For more information, see College of Engineering.

## **ENGR:0000 Engineering Internship/Co-op 0 s.h.**

For engineering majors participating in the Cooperative Education and Internship Program and averaging 35-40 hours per week on assignment.

## **ENGR:0002 Engineering Half-Time Internship 0 s.h.**

For engineering majors participating in the Cooperative Education and Internship Program and averaging 15-20 hours per week on assignment.

## **ENGR:0004 Engineering Academic Internship arr.**

Academic credit for engineering majors participating in the Cooperative Education and Internship Program. Requirements: for international students—F-1 or J-1 visa, engineering undergraduate standing, full-time internship offer letter in hand (at least 40 hours/week and one semester in length), internship approved by International Student and Scholar Services for F-1 Curricular Practical Training (CPT) or J-1 Academic Training (AT), concurrent registration in approved 3 s.h. distance education or evening course, and preapproval of internship by Engineering Professional Development; non-international students may be eligible on case-by-case basis.

## **ENGR:0006 Engineering Global Internship/Co-op 0 s.h.**

For engineering majors participating in the Cooperative Education and Internship Program working on a global assignment.

## **ENGR:1000 Engineering Success for First-Year Students 1 s.h.**

Introduction to engineering student life; electronic resources; keys to and skills for success; coping with adversity; selecting a major; advising; curriculum choices and career objectives; ethics; communication; internships and co-ops; job search skills.

## **ENGR:1029 First-Year Seminar arr.**

Introduction to engineering fields of study; work closely with a faculty member or senior administrator; participation that eases the transition to college-level learning; cutting-edge research taking place in the College of Engineering.

## **ENGR:1100 Introduction to Engineering Problem Solving 3 s.h.**

Development and demonstration of specific problem solving skills; directed project or case study involving actual engineering problems and their solutions.

## **ENGR:1300 Introduction to Engineering Computing 3 s.h.**

Engineering problem solving using computers; introduction to digital computations, problem formulation using a procedural high-level language; structured, top-down program design methodology; debugging and testing; introduction to use of software libraries; examples from numerical analysis and contemporary applications in engineering. Corequisites: MATH:1550.

## **ENGR:1430 Introduction to Engineering Design 3 s.h.**

Problem-solving skills taught through a design-development process; use of solid-modeling computer design software to create, analyze, and communicate models of product solutions. Requirements: enrollment in Project Lead The Way program and consent of UI Project Lead The Way director.

## **ENGR:1431 Principles of Engineering 3 s.h.**

Introduction to engineering and engineering technology; exploration of varied technology systems and manufacturing processes to show how engineers and technicians use math, science, and technology to solve engineering problems and help people; concerns about social and political consequences of technological change. Requirements: enrollment in Project Lead The Way program and consent of UI Project Lead The Way director.

## **ENGR:1432 Digital Electronics 3 s.h.**

Applied logic, with focus on application of electronic circuits and devices; use of computer simulation software to design and test digital circuitry before circuits and devices are built. Requirements: enrollment in Project Lead The Way program and consent of UI Project Lead The Way director.

## **ENGR:1433 Computer Integrated Manufacturing 3 s.h.**

Builds on computer solid modeling skills developed in ENGR:1430 on of robotics and automation principles; robotics in automated manufacturing, design analysis; students use CNC equipment to produce models of their 3-D designs. Requirements: enrollment in Project Lead The Way program and consent of UI Project Lead The Way director.

## **ENGR:1434 Civil Engineering and Architecture 3 s.h.**

Overview of civil engineering and architecture; interrelationship and dependence of each field on the other; roles of civil engineers and architects, project planning, site planning, building design, project documentation and presentation; students use state-of-the-art software to solve real-world problems and provide solutions for projects and activities. Requirements: enrollment in Project Lead The Way program and consent of UI Project Lead The Way director.

## **ENGR:1435 Aerospace Engineering 3 s.h.**

Experience applying scientific and engineering concepts to design materials and processes for aeronautics and flight; aerospace information systems, star sailing or astronautics rocketry, propulsion, physics of space science, space life sciences; habitat and crew systems with life support, biology of space science, principles of aeronautics, structures and materials, systems engineering. Requirements: enrollment in Project Lead The Way program and consent of UI Project Lead The Way director.

## **ENGR:1436 Biotechnical Engineering 3 s.h.**

Experiences from the fields of biotechnology, bioengineering, biomedical engineering, and biomolecular engineering; biomechanics, cardiovascular engineering, genetic engineering, agricultural biotechnology, tissue engineering, biomedical devices, human interface, bioprocess engineering, forensics, bioethics. Requirements: enrollment in Project Lead The Way program and consent of UI Project Lead The Way director.

**ENGR:1437 Computer Science Principles 3 s.h.**

Implementation of the College Board's 2013 Computer Science Principles framework; development of computational thinking, career paths that utilize computing, professional tools to foster creativity and collaboration; use of Python as a primary tool; incorporation of multiple platforms and languages for computation; development of programming expertise, exploration of Internet workings; projects and problems including app development, visualization of data, cybersecurity, robotics, simulation. Requirements: enrollment in Project Lead The Way program and consent of UI Project Lead The Way director.

**ENGR:1438 Computer Science A 3 s.h.**

Development of computational thinking skills through Android app development for mobile platforms; utilization of industry-standard tools such as Android Studio, Java programming language, XML, and device emulators; students collaborate to create original solutions to problems of their own choosing by designing and implementing user interfaces and Web-based databases; curriculum is a College Board-approved implementation of AP Computer Science A. Requirements: enrollment in Project Lead the Way program and consent of UI Project Lead the Way director.

**ENGR:1440 Environmental Sustainability 3 s.h.**

Investigation and design of solutions in response to real-world challenges related to clean and abundant drinking water, food supply issues, and renewable energy; application of knowledge through hands-on activities and simulations. Requirements: enrollment in Project Lead The Way program and consent of UI Project Lead The Way director.

**ENGR:1450 STEM Innovator: Solving Problems Through Innovation and Entrepreneurship 3 s.h.**

Work with STEM (science, technology, engineering, mathematics) industry mentors to engage in innovation and entrepreneurship by employing conceptual understandings and practices of engineering and science within an entrepreneurship framework; students solve real-world STEM problems that are of interest to them and their community, and acquire and demonstrate 21st-century skills working on authentic, meaningful, and cross-curricular projects; exposure to potential STEM careers and preparation to be successful in postsecondary STEM majors and careers of the future. Requirements: enrollment in Project Lead the Way program and consent of UI Project Lead the Way director.

**ENGR:1550 FIRST Tech Challenge - Introduction to Engineering Problem Solving 3 s.h.**

Introduction to engineering problem solving and design; projects introduce students to common elements of engineering problem solving and design (e.g., application of organizing principles to describe engineered systems, economic analysis upon which to base decisions, technical presentation and analysis of data), and provides an opportunity for students to apply common elements of problem solving in the solution of engineering problems in context of a structured problem solving and design process. Taught in high schools by state certified teachers.

**ENGR:2110 Engineering Fundamentals I: Statics 2-3 s.h.**

Vector algebra, forces, couples, moments, resultants of force couple systems; friction, equilibrium analysis of particles and finite bodies, centroids; applications. Prerequisites: MATH:1550. Corequisites: MATH:1560 and PHYS:1611.

**ENGR:2120 Engineering Fundamentals II: Electrical Circuits 3 s.h.**

Kirchhoff's laws and network theorems; analysis of DC circuits; first order transient response; sinusoidal steady-state analysis; elementary principles of circuit design; SPICE analysis of DC, AC, and transient circuits. Corequisites: MATH:2560.

**ENGR:2130 Engineering Fundamentals III: Thermodynamics 3 s.h.**

Basic elements of classical thermodynamics, including first and second laws, properties of pure materials, ideal gas law, reversibility and irreversibility, and Carnot cycle; control volume analysis of closed simple systems and open systems at steady state; engineering applications, including cycles; psychrometrics. Prerequisites: PHYS:1611 and CHEM:1110. Corequisites: MATH:1560.

**ENGR:2510 Fluid Mechanics 4 s.h.**

Fluid properties; hydrostatics; transfer of mass, momentum, and energy in control-volume and differential forms; dimensional analysis and similitude; laminar and turbulent flow in conduits; flow past bluff bodies and airfoils; engineering applications; experimental laboratories, computer simulation projects. Prerequisites: MATH:2560 and ENGR:2710. Corequisites: ENGR:2130.

**ENGR:2710 Dynamics 3 s.h.**

Vector calculus, Newton's laws, 3-D motion of particles and multiparticle systems, 2-D motion of rigid bodies applications. Prerequisites: ENGR:2110 and MATH:1550.

**ENGR:2720 Materials Science 3 s.h.**

Concepts and examples of selection and applications of materials used by engineers; mechanical, electrical, and thermal properties that govern a material's suitability for particular applications; lectures supplemented by laboratory experiments. Prerequisites: CHEM:1110. Corequisites: MATH:1550.

**ENGR:2730 Computers in Engineering 2-3 s.h.**

Advanced programming; good software engineering techniques including pseudocode and documentation, dynamic data structures, recursive programming, procedural and object-oriented computing, inheritance, and standard template library; contemporary and global impact of software and computers on society; robot programming lab arranged (using C/C++ language). Prerequisites: ENGR:1300.

**ENGR:2750 Mechanics of Deformable Bodies 3 s.h.**

Elementary theory of deformable bodies, stress, strain; axial, transverse, bending, torsion, combined and buckling loads; deflection of beam. Prerequisites: ENGR:2110. Corequisites: MATH:2560.

**ENGR:2760 Design for Manufacturing 3 s.h.**

Fundamentals of design, engineering graphics, and manufacturing processing; computer graphics using Pro/ENGINEER for CAD and CAM; typical industrial processes, including casting, welding, machining, forming; laboratory exercises and projects. Corequisites: ENGR:2720.

**ENGR:4000 Engineering Honors Seminar 1 s.h.**

Completion of an approved project under the supervision of a faculty member. Requirements: engineering honors and junior or higher standing.

**ENGR:4001 Leadership Seminar: Mediocrity is Not an Option** 1 s.h.

Skills needed to gain competitive edge in professional world with understanding that mediocrity is not an option; importance of developing a career plan, power of networking, significance of soft skills, value of mentoring; participation in series of discussions and activities; deeper insight of strengths and weaknesses, how to enhance skills that employers desire, and become effective leaders in workplace; presentation by retired chief operating officer of a leading aerospace company.

**ENGR:4005 Developing Cultural Intelligence for STEM Leadership** 1 s.h.

How cultural values impact technological innovation; knowledge and strategies to develop skills for leadership in the global marketplace; activities include the Cultural Intelligence (CQ) assessment and mapping of cultural values and case studies for innovation; students use CQ dimensions to develop a plan to deepen CQ skills; exploration of culturally intelligent collaboration and problem solving in science, technology, engineering, and mathematics (STEM) fields; how to represent these skills in professional settings. Requirements: upper-level undergraduate or graduate standing.

**ENGR:4010 Engineering Grand Challenges Program Fellow** 0 s.h.

The Engineering Grand Challenges Program is designed to prepare tomorrow's engineering leaders to solve the grand challenges facing society during the next century; through completion of components of the program, students have the opportunity to engage in research relating to their selected grand challenge, explore interdisciplinary course work, gain an international perspective, engage in entrepreneurship, and give back to the community through service learning; for students who have been accepted as a fellow into the Engineering Grand Challenges Program and are working on completion of the program requirements. Requirements: acceptance to the Engineering Grand Challenges Program.

**ENGR:4011 Engineering Grand Challenges Program Scholar** 0 s.h.

The Engineering Grand Challenges Program is designed to prepare tomorrow's engineering leaders to solve the grand challenges facing society during the next century; through completion of components of the program, students have the opportunity to engage in research relating to their selected grand challenge, explore interdisciplinary course work, gain an international perspective, engage in entrepreneurship, and give back to the community through service learning; for students who have been accepted as a scholar to the Engineering Grand Challenges Program and are working on completion of the program requirements. Requirements: acceptance to the Engineering Grand Challenges Program.

**ENGR:4012 Engineering Grand Challenges Program Final** 0 s.h.

The Engineering Grand Challenges Program is designed to prepare tomorrow's engineering leaders to solve the grand challenges facing society during the next century; through completion of components of the program, students have the opportunity to engage in research relating to their selected grand challenge, explore interdisciplinary course work, gain an international perspective, engage in entrepreneurship, and give back to the community through service learning; for students who have been accepted to the Engineering Grand Challenges Program and are in the final semester of completing the program requirements. Requirements: acceptance to the Engineering Grand Challenges Program.

**ENGR:5200 COE Fellows Seminar** 1 s.h.

Aspects of professional development for academic research, including applications for graduate fellowships, types of student aid, stewardship of discretionary accounts, identifying and meeting milestones in the Ph.D. process, integrating into the research team, teaching in a variety of academic settings, writing research articles, developing a curriculum vitae, networking in professional organizations, preparing research presentations, critical thinking, creating inclusive laboratory and classroom environments, and the impact of engineering on sustainability.

**ENGR:6431 Concepts of Physical Science and Principles of Engineering** 5 s.h.

Understanding the field of engineering and engineering technology; technology systems and manufacturing processes explored to learn how engineers and technicians use math, science, and technology to solve engineering problems and benefit people; concerns about social and political consequences of technological change. Requirements: Project Lead The Way high school teacher.

**ENGR:6433 Concepts in Physical Science with Computer Integrated Manufacturing Applications** 5 s.h.

Introduction to high-tech, innovative nature of modern manufacturing; opportunities related to understanding manufacturing; manufacturing processes, product design, robotics, automation; students may earn a virtual manufacturing badge recognized by the National Manufacturing Badge system; proper paradigm for relating these concepts to secondary level students. Requirements: Project Lead The Way teacher.

**ENGR:6434 Concepts of Physical Science with Civil Engineering Applications** 5 s.h.

Civil engineering and architecture field experience; proper paradigm for relating concepts to secondary-level students, history of civil engineering, architectural design, surveying, cost and efficiency analysis, sustainable design, soil testing, site evaluation and layout. Requirements: Project Lead The Way high school teacher.

**ENGR:6437 Concepts of Physical Science with Computer Engineering** 5 s.h.

Field of computer science and software engineering; exploration of pedagogy to learn how engineers and technicians use math, science, and technology to solve engineering problems and benefit people; concerns about social and political consequences of technological change. Requirements: Project Lead The Way high school teacher.

**ENGR:6438 Concepts of Physical Science with Medical Detectives Training** 2 s.h.

Field of medical testing and forensics, exploration of pedagogy; how medical personnel use math, science, and technology to solve problems and benefit people; solving medical mysteries through hands-on projects and labs; how to measure and interpret vital signs; how systems of human body work together to maintain health. Requirements: Project Lead The Way high school or middle school teacher.

**ENGR:6439 Concepts of Physical Science with Engineering Design and Development** 5 s.h.

Experiences from engineering design and development fields; proper paradigm for relating concepts to secondary-level students; team work to design and develop an original solution to a technical problem by applying engineering design process; research to choose, validate, and justify a technical problem; teams design, build, and test solutions, then present and defend original solution to an outside panel; developed by Project Lead The Way.

**ENGR:6440 Concepts in Physical Science with Environmental Sustainability Applications 1,5 s.h.**

Investigation and design of solutions in response to real-world challenges related to clean and abundant drinking water, food supply issues, and renewable energy; proper paradigm for relating these concepts to secondary level students; application of knowledge through hands-on activities and simulations. Requirements: Project Lead The Way teacher.

**ENGR:6450 Concepts in Physical Science with K-5 STEM Launch Applications 1-2 s.h.**

Introduction to Project Lead the Way (PLTW) launch curriculum; 24 modules (K-5 grade level) that align to Common Core State Standards for math and English language arts, Next Generation Science Standards, and other national and state standards; 10-hour modules presented in pairs that combine to create a thematic unit; flexibility of teachers and schools to introduce modules that they want, when they want, and at the grade level they want; proper paradigm for relating these concepts to elementary (K-5) students, training other elementary teachers. Requirements: Project Lead The Way teacher.

**ENGR:6451 Concepts in Physical Science with Introduction to Computer Science 2-3 s.h.**

Preparation for teaching beginning computer science course; creation of simple applications for mobile devices using MIT App Inventor; impact of computing on society, application of computing across career paths, skill building and awareness of digital citizenship and cybersecurity; transfer of programming skills gained in MIT App Inventor to text-based programming in Python to create strategy games; proper paradigm for relating these concepts to secondary students.

**ENGR:6462 Concepts in Computer Science A Applications 5 s.h.**

Developing computational thinking skills through the medium of Android App development for mobile platforms; utilize industry-standard tools such as Android Studio, Java programming language, XML, and device emulators; students collaborate to create original solutions to problems of their own choosing by designing and implementing user interfaces and Web-based databases; course curriculum is a college board-approved implementation of AP CS A; focus on the proper paradigm for relating these concepts to secondary level students. Requirements: consent of UI Project Lead The Way director.

**ENGR:6470 Concepts in Principles of Biomedical Science Applications 5 s.h.**

Introductory course of the Project Lead The Way Biomedical Science program; students explore concepts of biology and medicine to determine factors that led to the death of a fictional person; students examine autopsy reports, investigate medical history, and explore medical treatments that might have prolonged the person's life; activities and projects introduce students to human physiology, basic biology, medicine, and research processes while allowing them to design their own experiments to solve problems; course also stresses the proper paradigm for relating these concepts to secondary level students. Requirements: consent of UI Project Lead The Way director.

**ENGR:7270 Engineering Ethics 1 s.h.**

Introduction to practical issues associated with being a responsible scientist; topics in responsible conduct of research in engineering and the sciences using case studies, presentations, and discussions with visiting speakers; conforms to mandates set by the Office of the Vice President for Research and the Graduate College to train graduate students and postdoctoral scholars/fellows in responsible conduct of research. Requirements: first-year graduate standing in College of Engineering.

**ENGR:7604 Engineering Ethics for Post Docs 0 s.h.**

Introduction to practical issues associated with being a responsible scientist; topics in responsible conduct of research in engineering and the sciences using case studies, presentations, and discussions with visiting speakers; conforms to mandates set by the Office of the Vice President for Research and the Graduate College to train graduate students and postdoctoral scholars/fellows in responsible conduct of research. Requirements: new postdoctoral research scholar/fellow in College of Engineering.