ENGINEERING (ENGR)

Discover, search, courses (https://catalog.luc.edu/course-search/)!

ENGR 100 Engineering Design Fundamentals (1 Credit Hour)
Restricted to students transferring into Engineering Science. This course provides an introduction to engineering design for students transferring into Engineering Science, who have completed an external Engineering Graphics course. Major topics include engineering estimation, 2k factorial design, teamwork, engineering ethics, and requirement specifications.
Outcomes:
Demonstration of proficiency in engineering design

ENGR 101 Introduction to Engineering Design (4 Credit Hours)
Restricted to School of Engineering students. This course is the first of four engineering design courses in the Engineering Science curriculum. Major topics in this course include engineering estimation, three dimensional computer-aided design, 2k factorial design, teamwork, engineering ethics, requirement specifications, and design iteration.
Outcomes:
1) Demonstration of proficiency in engineering design; 2) Application of teamwork principles to an open-ended design project

ENGR 102 Engineering Science Freshman Seminar (1 Credit Hour)
This seminar offers a shared learning experience with an assignment of a service project and exposure to Industrial Advisory Board members and Loyola administrators and faculty. In addition to providing intellectual enhancement to the program, these seminars give us a time and place to regularly interact. This class is restricted to Engineering Science freshman.
Outcomes:
Encourage bonding through a service project, stimulate thoughtful interaction, provide connections with the faculty, and connect to the broader industry community

ENGR 201 Experiential Engineering (3 Credit Hours)
Pre-requisites: COMP 170 and (PHYS 112K or PHYS 122) (each with minimum C-); Corequisite: CHEM 171
This course introduces students to environmental, biomedical and computer engineering-based sensors and signal analysis techniques. Major topics in this course include an introduction to common biomedical sensors, electronics, signals, sampling, analog-to-digital conversion, c programming, microcontroller system architectures, and microcontroller programming.
Outcomes:
Provide an experiential environment to learn about instrumentation and sensors in biomedical, computer and environmental engineering; Introduce complex devices and systems to understand, measure and analyze signals

ENGR 311 Engineering Systems I (3 Credit Hours)
Pre-requisites: ENGR 201 with a minimum grade of C-; Restricted to Applied Mathematics and Engineering Science majors; Concurrent enrollment in MATH 266 (Engineering Science majors only)
ENGR 311 covers the fundamentals of signal and system analysis, focusing on representations of discrete-time and continuous-time signals and representations of linear, time-invariant systems. Major topics in this course include convolution, Fourier series, Fourier Transform, and unit impulse and unit step functions. Applications are drawn broadly from engineering and physics.
Outcomes:
Understand basic concepts of discrete and continuous time signals; Employ Fourier analysis to analyze simple LTI systems; Proficiently use MATLAB as a numerical analysis tool

ENGR 312 Engineering Systems II (3 Credit Hours)
Pre-requisites: ENGR 311, ENGR 321, (MATH 264 or MATH 266), and COMP 170
Introduces numerical methods and control systems theory. Students are exposed to root finding, numerical integration and differentiation, numerical solutions to ODEs, curve fitting and regression techniques, classical control system theory methods (Laplace transforms and transfer functions, root locus design, Routh-Hurwitz stability analysis, Bode and Nyquist plots) and the state variable method (controllability and observability). Employ the state variable method.
Outcomes:
Understand the concepts of numerical methods, their strengths and weaknesses; Use MATLAB as a numerical analysis tool; Apply Laplace transforms and transfer functions

ENGR 313 Engineering Systems III (3 Credit Hours)
Pre-requisites: ENGR 312 with a minimum grade of C-; Restricted to Applied Math and Engineering Science majors
This course is an introduction to discrete-time signal processing and system identification. Major topics include the z-transform, infinite/finite impulse response filters, discrete/fast Fourier transform, models of linear time-invariant systems, and parameter estimation methods.
Outcomes:
Reinforce fundamental knowledge of signal processing concepts; Execute discrete-time signal processing techniques; Solve real-world problems through use of modeling, prediction, and estimation methods

ENGR 321 Electronic Circuits & Devices (2 Credit Hours)
Pre-requisites: PHYS 112K or PHYS 122 (minimum C-); Corequisites: ENGR 311 and (MATH 266 or MATH 264)
This course is an introduction to electronic circuits and devices. Major topics in this course include an introduction to Ohm's Law, Kirchhoff's Current Law, Kirchhoff's Voltage Law, Nodal and Loop analysis, Thevenin's and Norton's Theorems, and alternating current steady-state analysis.
Outcomes:
Define and explain the terminology associated with linear circuit theory; Identify and solve linear circuits utilizing the most appropriate method for the analysis

ENGR 322 Chemical & Thermal Processes (3 Credit Hours)
Pre-requisites: (CHEM 171 or CHEM 102), (PHYS 111 or PHYS 121), (PHYS 112K or PHYS 122), and MATH 162 (each with minimum C-)
This course provides an introduction to basic chemical and thermal processes. Major topics include open and closed systems, control volumes, microscopic vs. macroscopic, mass and energy balances, first and second laws of thermodynamics, entropy balance, exergy balance, thermodynamic cycles, thermodynamic property relations, gas laws, and chemical thermodynamics.
Outcomes:
Describe engineering systems and cycles using mass and energy conservation laws, quantify chemical and thermodynamic properties of pure substances, and analyze thermodynamics cycles and processes

ENGR 323 Digital Electronic & Computer Engineering (2 Credit Hours)
Pre-requisites: (PHYS 112K or PHYS 122) and COMP 170 (each with minimum C-); Corequisite: ENGR 324L
This course is an introduction to digital design. Major topics in this course include, but is not limited to, binary conversions, logic gates, combinational logic design, sequential logic design, microprocessor architecture, and an introduction to hardware description languages.
Outcomes:
Understand the fundamental building blocks of digital systems; Understand and apply knowledge in the implementation and design of digital circuits

ENGR 324 Mechanics (3 Credit Hours)
Pre-requisites: (PHYS 111 or PHYS 121), (PHYS 112K or PHYS 122), and (MATH 264 or MATH 266) (each with minimum C-)
Mechanics covers the fundamentals of modeling continuous media. Major topics include stress, strain, and constitutive relations; elements of tensor analysis; basic applications of solid and fluid mechanics; and application of conservation laws to control volumes.
Outcomes:
Construct free-body diagrams to undertake structural analysis; Apply the laws of conservation to solve engineering problems

ENGR 324L Core Engineering Lab (1 Credit Hour)
Pre-requisites: ENGR majors only; Corequisites: ENGR 322, ENGR 323, and ENGR 324
This lab course enables students to experiment with concepts learned in concurrently taken core engineering courses ENGR 322, ENGR 323, and ENGR 324.
Outcomes:
Understand, apply and create an assembly-based program for ARM-based microprocessors; Apply Thermodynamic and Flow principles in an experimental context

ENGR 325 Materials Engineering (3 Credit Hours)
Pre-requisites: ENGR 322 and ENGR 324 (minimum of C-)
This course introduces concepts related to the structure, properties, and processing of materials commonly used in engineering applications. Major topics include material structure, bonding, crystalline and non-crystalline structures, imperfections, properties of metals, metal alloys, ceramics and polymers, phase transformation, and material failures.
Outcomes:
Describe the microscale structure of metals, ceramics, polymers, and composites; quantify and describe relationships among structure, processing, and properties; understand the role of material selection in contemporary engineering design applications

ENGR 341 Medical Device Systems (3 Credit Hours)
Pre-requisites: MATH 266, ENGR 321, ENGR 323, ENGR 324, BIOL 101, and CHEM 171; ENGR majors only; Corequisites: ENGR 325, ENGR 341L, and ENGR 313
The relevant physiology, clinical need, history, and system descriptions of eighteen fundamental medical devices are discussed and analyzed. Students are also introduced to several medical device systems, including medical instruments, electrical stimulators, and combination products. These topics provide a foundational background for medical device product development and regulation.
Outcomes:
Understand and analyze the clinical need and common subsystems underlying eighteen fundamental medical devices; Evaluate the battery requirements for commonly implantable medical devices

ENGR 341L Medical Device Systems Laboratory (1 Credit Hour)
Introduction to the graphical user interface, data acquisition, and sensors of common medical devices. The lab experiments are synchronized with the presentation of medical device topics in ENGR 341. Students also create a software application for a Sponsor from the School of Nursing. Restricted to Engineering Science majors. Concurrent enrollment in ENGR 341. Apply FDA design control principles for creation of a nursing software application and accompanying requirement and design specifications.
Outcomes:
Use common medical devices subsystems

ENGR 342 Medical Device Software Development I (3 Credit Hours)
Pre-requisites: ENGR 341 and ENGR 341L, each with a minimum grade of C-
This is the second semester of a three-semester Specialty course series for students specializing in Biomedical Engineering. During the first four weeks, students increase their programming skills through exposure to recurrence solving, sorting, and data structures. They then learn how design and verify medical device software using model-based engineering. Restricted to Engineering Science majors. Concurrent enrollment in ENGR 381.
Outcomes:
Design a medical device through model-based engineering concepts

ENGR 343 Medical Device Software Development II (3 Credit Hours)
Pre-requisites: Restricted to Engineering Science majors
This is the third semester of a three-semester Specialty course series for students specializing in Biomedical Engineering. During four weeks, students increase their programming skills through exposure to advanced data structures and graph algorithms. Separately, software issues that the Food and Drug Administration considers during medical device submissions are highlighted. ENGR 342 with a minimum grade of C-, concurrent enrollment in ENGR 391.
Outcomes:
Analyze software issues that the FDA considers during medical device submissions; Create user interface and cybersecurity code, according to Requirements Specifications provided by the instructor

ENGR 351 Electronic Circuit Analysis and Design (3 Credit Hours)
Pre-requisites: ENGR 201, ENGR 312, and ENGR 321 (each with minimum of C-); Corequisite: ENGR 351L
A course for engineering science students (computer engineering) that introduces advanced topics in the design and analysis of analog and digital electronic circuits. Areas of emphasis include an introduction to semiconductor physics, diodes, BJT transistors, CMOS devices, advanced operational amplifier circuits and frequency response fundamentals.
Outcomes:
Understand and apply fundamental concepts of semiconductor physics; Understand and apply complex models to analyze analog and digital microelectronic circuits

ENGR 351L Circuit Design Laboratory (1 Credit Hour)
Co-requisites: ENGR 351
A lab for engineering science students (in the computer engineering specialization) to provide a first experience working with semiconductor devices (such as diodes, BJTs, MOSFETs, and Operational Amplifiers) for the design, creation and analysis of microelectronics using lab instruments.
Outcomes:
Identify integrated circuit design issues and develop applicable solutions; Apply advanced principles in analog circuit design, creation and analysis

ENGR 352 Methods and Algorithms for Computer Engineers (3 Credit Hours)
Pre-requisites: ENGR 351 and ENGR 351L (each with minimum of C-)
ENGR 352 is the second semester course of a three-semester Specialty course series for students specializing in Computer Engineering. The areas of emphasis are the analysis of the methods and algorithms used in computer engineering. The course includes hands-on experiments and a design project related to the computing performance and efficiency improvement of engineering systems
Outcomes:
Evaluate the design and implementation of methods and algorithms in computer engineering; Analyze the performance, efficiency and computational complexities of algorithms using the time-and-space tradeoff

ENGR 353 Programmable Systems (3 Credit Hours)
Pre-requisites: ENGR 352 (minimum C-)
ENGR 353 is the third semester course of a three-semester Specialty course series for students specializing in Computer Engineering. The course consists of an introduction to programmable logic controllers, relays, timers, counters, shift registers, human-machine interfaces and programmable embedded systems. The course includes hands-on experiments and a design project to evaluate the performance and efficiency of programmable systems, related safety issues and hardware troubleshooting for control and automation systems.
Outcomes:
Evaluate the performance and efficiency of programmable controllers, embedded systems and processors; Design modern engineering tools to integrate hardware and software components, and input-output devices used in industries

ENGR 361 Fundamentals of Environmental Engineering (3 Credit Hours)
Pre-requisites: MATH 266, ENGR 322, ENGR 324, and ENGR 325 (each with minimum C-); ENGR majors only; Corequisite: ENGR 361L
This is the first of three Specialization courses in Environmental Engineering. Topics include aquatic chemistry, chemical thermodynamics and kinetics, environmental soil and biogeochemistry, environmental organic chemistry, surface and groundwater hydrology, atmospheric processes, and fate and transport modeling of contaminants in natural and engineered systems.
Outcomes:
Apply principles of environmental engineering to describe and quantify key physical, biological and chemical phenomena in natural and engineered systems

ENGR 361L Fundamentals of Environmental Engineering Lab (1 Credit Hour)
Pre-requisites: ENGR majors only; Corequisite: ENGR 361
This laboratory course introduces students to the analytical techniques such as mass spectrometry and titration, relevant to environmental engineering practice. This course emphasizes the design of field sampling campaigns of water and soil environments and the statistical data analysis of experimentally estimated water and soil parameters.
Outcomes:
Quantify fundamental environmental parameters with emphasis on water quality; Design and conduct a field sampling campaign

ENGR 362 Water & Wastewater Engineering (3 Credit Hours)
Pre-requisites: MATH 266, ENGR 324, and CHEM 171 (each with minimum C-)
Theoretical and conceptual design of systems for treating municipal wastewater and drinking water which include reactor theory, process kinetics, and models. Physical, chemical, and biological processes are presented, including sedimentation, filtration, biological treatment, disinfection, and sludge processing. Re-use of water and waste products are also covered.
Outcomes:
Undertake calculations related to unit processes and undertake the required calculations to design a municipal water and wastewater treatment facility

ENGR 363 Contemporary Environmental Engineering Challenges (3 Credit Hours)
Pre-requisites: MATH 266 and ENGR 324 (minimum C-)
This is the third semester of a three-semester Specialty course series for students specializing in Environmental Engineering. Overview of engineering solutions to present day environmental issues. Technologies focused on the mitigation and adaptation to climate change, the modeling and design of best management practices Overview of engineering solutions to present day environmental issues. Technologies focused on the mitigation and adaptation to climate change, the modeling and design of best management practices for stormwater management, an exploration of conventional and renewable energy technologies and the design of green infrastructure.
Outcomes:
Make aware of present and future environmental challenges; Understand the current methods being employed to tackle current environmental issues

ENGR 381 Biomedical Engineering Capstone Design I (4 Credit Hours)
Pre-requisites: Restricted to Engineering Science majors; ENGR 341
A major design experience based on the knowledge and skills acquired in earlier course work and incorporating appropriate engineering standards and multiple realistic constraints. Each group is assigned an industry-sponsored medical device software problem to solve. Each week, a medical device product development or regulation topic is also introduced.
Outcomes:
ABET Student Outcome (2): An ability to apply engineering design to produce medical device solutions that meet specified needs with consideration for public health, safety, welfare, and other factors

ENGR 382 Computer Engineering Capstone Design I (4 Credit Hours)
Pre-requisites: Restricted to Engineering Science majors; ENGR 351
First part of the team-based Capstone Design series for Computer Engineering students. Students focus on the design of an industry-sponsored project with practical, economic, and ethical constraints. They learn the fundamentals of product development, quality, reliability, ethics and project management as it relates to the field of computer engineering.
Outcomes:
ABET Student Outcome (2): An ability to apply engineering design to produce microelectronic solutions that meet specified needs with consideration for public health, safety, welfare, and other factors

ENGR 383 Environmental Engineering Capstone Design I (4 Credit Hours)
Pre-requisites: MATH 266, ENGR 324, and ENGR 322 (each with minimum C-); ENGR majors only
A major design experience based on the knowledge and skills acquired in earlier course work and incorporating engineering standards and multiple realistic constraints. Each group is assigned an environmental engineering industry-sponsored design problem to solve. During the semester, specific environmental design and regulation case studies will be introduced.
Outcomes:
ABET Student Outcome (2): An ability to apply engineering design to produce environmental engineering solution that meet specified needs with consideration for public health, safety, environmental and other factors

ENGR 391 Biomedical Engineering Capstone Design II (3 Credit Hours)
Pre-requisites: Restricted to Engineering Science majors; ENGR 381 during the same academic year, ENGR 342, concurrent enrollment in ENGR 343
Second semester of a major design experience based on knowledge and skills acquired in earlier course work and incorporating appropriate engineering standards and multiple realistic constraints. Each group continues work on the industry-sponsored medical device projects assigned in ENGR 381. Medical device product development or regulation topics are also introduced.
This course satisfies the Engaged Learning requirement.
Outcomes:
ABET Student Outcome (2): An ability to apply engineering design to produce medical device solutions that meet specified needs with consideration for public health, safety, welfare, and other factors

ENGR 392 Computer Engineering Capstone Design II (3 Credit Hours)
Pre-requisites: Restricted to Engineering Science majors; ENGR 382 during the same academic year, ENGR 352, concurrent enrollment in ENGR 353
Second semester of a major design experience based on knowledge and skills acquired in earlier course work and incorporating appropriate engineering standards and multiple realistic constraints. Each group continues work on the industry-sponsored design projects assigned in ENGR 382. Computer engineering or professional development topics are also introduced.
This course satisfies the Engaged Learning requirement.
Outcomes:
ABET Student Outcome (2): An ability to apply engineering design to produce computer engineering solutions that meet specified needs with consideration for public health, safety, welfare, and other factors

ENGR 393 Environmental Engineering Capstone Design II (3 Credit Hours)
Pre-requisites: ENGR 383 (minimum C-)
Second semester of a major design experience based on knowledge and skills acquired in earlier course work and incorporating appropriate engineering standards and multiple realistic constraints. Each group continues work on the industry-sponsored design projects assigned in ENGR 383. Environmental engineering or professional development topics are also introduced. ENGR majors only.
This course satisfies the Engaged Learning requirement.
Outcomes:
ABET Student Outcome (2): An ability to apply engineering design to produce environmental engineering solutions that meet specified needs with consideration for public health, safety, welfare, and other factors

ENGR 398 Independent Study (1-3 Credit Hours)
The course enables independent study of selected topics in Biomedical, Computer, and Environmental Engineering, under the supervision of a faculty member. It may be repeated for credit. Restricted to Engineering Science majors. Permission of Director.
Outcomes:
Application of engineering science concepts, and analysis of Biomedical, Computer, or Environmental Engineering systems