

ENGINEERING (ENGR)

ENGR 101 Introduction to Engineering1 Credit

Exploration of engineering as a field. Includes general characteristics of the profession, training required for various engineering degrees, industries in which engineers practice, and tools for academic and professional success in engineering, including the basics of report generation and the licensure process. Ethics and societal issues related to engineering will also be introduced.

Terms Typically Offered: Fall.

ENGR 125 Computer-Aided Design and Fabrication3 Credits

Introduces engineering design graphics. Includes learning a contemporary computer-aided design (CAD) software application and relevant engineering graphics concepts, such as orthographic projection, sections, engineering drawing practices, geometric dimensioning and tolerancing, and an introduction to manufacturing methods. Entails a final design project using rapid prototyping.

ENGR 140 First-Year Engineering Project3 Credits

Introduction to the application of mathematic and scientific skills in interdisciplinary engineering projects. Includes elements of teamwork, project management, engineering design and prototyping, and project documentation.

Prerequisites: MATH 119; or MATH 119A and MATH 119B.

Terms Typically Offered: Spring.

ENGR 196 Topics:1-3 Credits

Course may be taken multiple times up to maximum of 15 credit hours.

ENGR 224 Materials Science2 Credits

Structure, properties, and processing of metallic, polymeric, ceramic, and composite materials. Perfect and imperfect solids; phase equilibria; transformation kinetics; mechanical behavior; material degradation.

Includes both materials science and materials engineering components.
Prerequisites: CHEM 151/CHEM 151L or CHEM 131/CHEM 131L; and PHYS 131/PHYS 131L.

Corequisites: ENGR 224L.

Terms Typically Offered: Fall, Spring.

ENGR 224L Materials Science Laboratory1 Credit

Hands-on application of topics learned in lecture. Includes mechanical testing, determination of material properties, thermal processing, and technical reporting. Lab component for ENGR 224.

Prerequisites: CHEM 151/CHEM 151L or CHEM 131/CHEM 131L; and PHYS 131/PHYS 131L.

Corequisites: ENGR 224.

Terms Typically Offered: Fall, Spring.

Fees: Yes.

ENGR 225 Introduction to Manufacturing3 Credits

Principles, processes, and problems associated with the conversion of engineered materials into useful goods. Fundamentals of geometric specification, casting, machining, plastic deformation, bulk deformation, joining processes, and processes for plastics, ceramics, and composites.

Prerequisites: ENGR 224.

Terms Typically Offered: Fall.

Fees: Yes.

ENGR 261 Statics and Structures3 Credits

Covers statics of particles, equivalent force systems, rigid bodies, equilibrium of rigid bodies in two and three dimensions, analysis of truss and frame structures, uniaxially-loaded members, deformation and stress, distributed force systems, friction. Lectures and homework assignments involve computer work and hands-on laboratory work documented by written reports.

Prerequisites: MATH 136 or MATH 152, and PHYS 131/PHYS 131L.

ENGR 263 Mechanics of Solids3 Credits

Covers shear force and bending moment, torsion, stresses in beams, deflection of beams, matrix analysis of frame structures, analysis of stress and strain in 2-D and 3-D (field equations, transformations), energy methods, stress concentrations, and columns. Lectures and homework assignments involve computer work and hands-on laboratory work documented by written reports.

Prerequisites: ENGR 261.

ENGR 305 Engineering Economics & Ethics2 Credits

Applications of economics and ethics for mechanical engineers. Topics include cost concepts and design economics, money-time relationships, and comparison of alternatives. Engineering ethics includes personal vs. professional ethics, ethical problem-solving techniques, rights and responsibilities of engineers, and whistle-blowing.

Prerequisites: ENGR 101, ENGR 140; and MATH 135 or MATH 151.

Terms Typically Offered: Fall.

ENGR 312 Engineering Thermodynamics3 Credits

An introductory course in thermodynamics, the science of heat energy conversion. Develops understanding of energy, heat, work, efficiency, and ideal thermodynamic cycles. Teaches first and second laws of thermodynamics and perfect gas law.

Prerequisites: MATH 136 or MATH 152, and PHYS 131/PHYS 131L.

ENGR 317 Fundamentals of Circuits and Electronics2 Credits

Introduction to resistive circuits, capacitors, inductors, transient analysis, sine waves, AC circuit analysis, resonance, and transformers.

Prerequisites: MATH 136 or MATH 152, and PHYS 131/PHYS 131L.

Corequisites: ENGR 317L.

ENGR 317L Fundamentals of Circuits and Electronics Laboratory1 Credit

Lab component required for ENGR 317.

Prerequisites: MATH 136 or MATH 152, and PHYS 131/PHYS 131L.

Corequisites: ENGR 317.

Fees: Yes.

ENGR 321 Fluid Mechanics3 Credits

Covers fluid properties, laws of fluid statics and fluid dynamics, measurement of flow, viscous flow, laminar and turbulent flow, flow in ducts, forces due to fluid motion, and fluid machinery.

Prerequisites: MATH 152 or MATH 136; PHYS 131/PHYS 131L, and ENGR 261.

Terms Typically Offered: Fall.

ENGR 325 Component Design3 Credits

Knowledge and skills developed in preceding courses are extended and applied to design and selection of machine elements and machines. Attention is given to functional requirements, methods of manufacture, choice of materials and economic factors.

Prerequisites: ENGR 224 and ENGR 263.

ENGR 329 Bicycle Design and Frame-Building3 Credits

Engineering and artistic execution of designing and building a bicycle frame. Fundamentals of bicycle dynamics, handling, and sizing. Material properties and selection. Discussion of relevant standards covering bicycle frame and fork testing. Fabrication skills necessary to construct a custom bicycle frame will be developed.

Prerequisites: ENGR 125 and ENGR 263.

Terms Typically Offered: Spring.

ENGR 333 Lean Principles3 Credits

Overview of the structure and tools of the Lean production system. Students will learn how Lean can be applied to various industries and even outside of the factory, in settings such as health care, finance, IT, and engineering.

Prerequisites: ENGR 225.

Terms Typically Offered: Spring.

ENGR 336 Heat and Power3 Credits

Discussion of major modes of heat transfer. Includes steady and transient conduction, internal and external convection, and radiation with emphasis on industrial applications. Heat exchanger and boiler analysis and related codes and standards discussed.

Prerequisites: ENGR 312 and ENGR 321.

Fees: Yes.

ENGR 343 Dynamics3 Credits

Kinematics of particles and rigid bodies. Kinetics of particles and rigid bodies in plane motion, including Newton's second law, work and energy, impulse and momentum.

Prerequisites: ENGR 261.

ENGR 345 Engineering Integration I3 Credits

First course in a design sequence integrating concepts from the mechanical engineering technology curriculum. Emphasis on laboratory experience and the design, analysis, and testing of mechanical systems. Team project work on "design-and-build" projects will require manufacture of mechanical systems and/or electronic circuits.

Prerequisites: ENGR 224, ENGR 263, MAMT 106, and CSCI 130.

Fees: Yes.

ENGR 353 Exploring Entrepreneur Opportunities3 Credits

Introduction to innovation and opportunity recognition, including development of business ideas, business model validation and business feasibility analysis.

Equivalent Course(s): ENTR 343

ENGR 385 Engineering Integration II3 Credits

Second course in a design sequence integrating concepts from the mechanical engineering technology curriculum. Emphasis on laboratory experience and the design, analysis, and testing of mechanical systems. Team project work on "design-and-build" projects will require manufacture of mechanical systems and/or electronic circuits.

Prerequisites: ENGR 345.

Fees: Yes.

ENGR 395 Independent Study1-3 Credits

Course may be taken multiple times up to maximum of 6 credit hours.

ENGR 396 Topics1-3 Credits

Course may be taken multiple times up to maximum of 15 credit hours.

ENGR 397 Structured Research1-3 Credits**ENGR 399 Internship1-12 Credits**

Course may be taken multiple times up to maximum of 15 credit hours.

ENGR 401 Professionalism Seminar1 Credit

Preparation for a career in the engineering profession. Includes professionalism, ethics, competitive job application materials, jobs and internships, and current engineering issues.

Prerequisites: Junior standing or higher.

Terms Typically Offered: Fall.

ENGR 425 Advanced Manufacturing3 Credits

Use of cutting edge materials and emerging capabilities that utilize the coordination of information, automation, computation, software, sensing, and networking. Includes discussion of product data management, flexible manufacturing, manufacturability, and product life-cycle management.

Prerequisites: ENGR 225, ENGR 305, and STAT 305.

Terms Typically Offered: Spring.

Fees: Yes.

ENGR 427 Engineering Measurements2 Credits

Methods of experimentation and data analysis. Specific skills used in planning an experiment, applying sound procedures, keeping proper records, and communicating results orally, with posters and in written reports developed.

Prerequisites: ENGL 325, ENGR 263, ENGR 317, and STAT 305.

Fees: Yes.

ENGR 435 Industrial Controls3 Credits

Fundamentals of control of manufacturing processes. Applications of relay logic, input/output devices, and programmable logic controllers (PLC). Design of complete control circuits, selection of components, and cost estimation. PLC programming for discrete event control and for analog applications.

Prerequisites: ENGR 317.

ENGR 436 Fluid & Electric Power Systems3 Credits

A mechanical approach to industrial power systems. Applications emphasize the selection and function of hardware and interfacing of hydraulic, pneumatic and electric systems with mechanical, fluidic and electrical/electronic controls. Topics covered include transformers, motors, generators, motor controls, and protective devices.

Prerequisites: ENGR 321 and ENGR 435.

ENGR 445 MET Design Project I3 Credits

First of a two-course comprehensive group capstone design experience, focusing on the design proposal. This sequence applies material from prior course work, along with concepts of project management, problem definition; determining design requirements, design optimization, engineering analysis, proof-of-concept prototype, and CAD drawings.

Prerequisites: ENGR 140, ENGR 225, ENGR 312, ENGR 317, ENGR 317L, ENGR 321, ENGR 325, ENGR 385, MAMT 102, and ENGL 325.

Terms Typically Offered: Fall.

ENGR 446 Writing for Design Projects1 Credit

Communication of engineering designs to technical and non-technical audiences. Development of skills to document a problem and describe a design and its evaluation against design criteria. Design reports are created to describe senior design projects. Other course elements include composing technical and non-technical documents that meet the needs of particular audiences, as well as clear, concise, and correct writing.

Corequisites: ENGR 485.

Terms Typically Offered: Spring.

ENGR 455 Fluid Power Systems3 Credits

Coverage of the fundamentals of hydraulic and pneumatic systems and their components, fluid power circuit design, analysis, and troubleshooting for industrial applications, introduction to electro-pneumatics.

Prerequisites: ENGR 321.

Fees: Yes.

ENGR 460 Energy Systems3 Credits

Discussion of conventional, alternative and renewable energy systems, such as wind, solar, clean coal, and geothermal. Challenging energy problems relevant to the industry presented and analyzed.

Prerequisites: ENGR 312 and ENGR 321.

Fees: Yes.

ENGR 465 Electric Power Systems3 Credits

Basic understanding of electric power systems; generation, transmission, distribution and consumption. Review of AC circuit analysis in single and three phase systems using time domain and phasor representation.

Includes magnetic circuits, transformers and renewable energy generation from photovoltaic cells. Introduces electromechanical energy conversion from experiments with induction and synchronous motors/ generators, and includes photovoltaic panels.

Prerequisites: ENGR 317.

Fees: Yes.

ENGR 481 Thermal-Fluid Systems Analysis Using CFD3 Credits

Presentation of advanced computer simulation tools for analysis of thermal-fluid problems (fluid mechanics, thermodynamics, and heat transfer). Fundamentals of CFD (computational fluid dynamics) such as grid generation, solution techniques and convergence, modeling and simulation, and analysis of results for representative industrial problems discussed.

Prerequisites: CSCI 130 and ENGR 336.

ENGR 485 MET Design Project II3 Credits

Second part of a two-course capstone design experience. Refinement of prototype, design optimization, fabrication, testing and evaluation. Students orally present the final design, prepare a written report and operation manual for the product.

Prerequisites: ENGR 445.

ENGR 495 Independent Study1-4 Credits

Course may be taken multiple times up to maximum of 6 credit hours.

ENGR 496 Topics1-3 Credits

Course may be taken multiple times up to maximum of 15 credit hours.

ENGR 497 Structured Research1-3 Credits

Engineering research under the direct guidance of a faculty member. Designed for junior and senior level students.

Prerequisites: Permission of instructor.