

*Lower Division***ENGR 160 Engineering Orientation (1)**

An introduction to the various areas within the engineering discipline. Description of engineering curricula and career opportunities within each of the various areas. Academic advising for engineering programs. Primarily for students planning to major in one of the fields of engineering. Offered on a credit, no-credit basis only. One hour lecture/discussion.

ENGR 161 Introduction to Engineering Design (2)

Introduces students to real-life engineering projects. Students design, build, tests and present engineering projects designed to solve specified problems within given constraints. Primarily for students planning to major in one of the fields of engineering. Two hours of lecture/discussion.

ENGR 162 Introduction to Engineering Computing (2)

Introduces the solution of engineering problems using spreadsheets, a numerical computing environment, and computer-aided design. Two hours of lecture/discussion. Prerequisite or corequisite: MATH 201 or 231.

ENGR 207 Electric Circuits (5)

Circuit laws and analysis of DC and AC circuits. Physical properties, electrical characteristics and circuits of discrete and integrated electrical and electronic devices. Design and construction of circuits with instrumentation applications. Three hours lecture/discussion and two three-hour laboratories per week. Prerequisites: PHYS 222 and MATH 202 or 232 and MATH 222 or CMPS 221 or ENGR 162 (MATH 203 or 233 recommended).

ENGR 240 Analytic Mechanics, Statics (5)

Fundamental principles of force systems acting on particles and rigid bodies in static equilibrium. Applications to structural and mechanical problems, both two-dimensional and three-dimensional. Five hours lecture/discussion. Prerequisites: PHYS 221, Prerequisite or corequisite: MATH 202 or 232.

ENGR 241 Analytic Mechanics, Dynamics (5)

Topics include vector representation of kinematics and kinematics of particles; Newton's laws of motion; force-mass-acceleration, work-energy, and impulse-momentum methods; kinematics of systems of particles; kinematics and kinetics of rigid bodies. Five hours lecture/discussion per week. Prerequisites: ENGR 240.

ENGR 243 Mechanics of Materials (5)

This course covers stress and strain and mechanical properties of materials. The axial load, torsion, bending and transverse shear; combined loadings; stress transformation; pressure vessels, deflection of beams and shafts; and buckling of columns are reviewed as well. Five hours lecture/discussion per week. Prerequisites: ENGR 240.

ENGR 270 Introduction to CAD in Engineering (3)

Use of computer-aided design software, such as AutoCAD, in engineering. CAD concepts including drawing setups, commands and system variables, layers and object properties, 2-dimensional entity creation, coordinate systems, creating objects, drawing with precision, plotting, and editing methods are applied to a variety of engineering applications. Two hours lecture/discussion and three hours laboratory per week.

ENGR 271 Intermediate CAD in Engineering (3)

Intermediate topics in computer-aided design using AutoCAD. Introduction to 3-dimensional drawing and modeling with engineering applications, adding text to drawings, creating dimensions, using blocks and external references, managing content with Autocad Design Center, creating a layout to plot, plotting your drawings, working with raster images, creating compound documents with OLE, and using other file formats. Two hours lecture/discussion and three hours laboratory per week. Prerequisite: ENGR 270.

ENGR 244 Properties of Materials (5)

Structure of matter. Physical and mechanical properties of materials including metals, polymers, ceramics, composites, and electronic materials. Equilibrium diagrams. Materials selection, corrosion phenomena. Heat treatment, cold deformation, brittle-ductile fracture behavior. Three hours lecture/discussion, two three-hour laboratories. Prerequisites: MATH 201, PHYS 221, CHEM 211 and 211L.

*Upper Division***ENGR 300 Engineering Modeling and Analysis (5)**

Formulation of mathematical models for engineering systems; applying mass, momentum, and energy balances to derive governing differential equations; solution of differential equations and eigenvalue problems typically encountered within an engineering context; solving equations with the use of spreadsheets and other numerical computing environments such as Matlab; fitting linear and nonlinear models to experimental data; concepts in probability and statistics. Four hours lecture/discussion and one three-hour laboratory per week. Prerequisites: CMPS 221 or ENGR 162, PHYS 222.

ENGR 301 Numerical Methods and Applications in Engineering (5)

Formulation and solution of mathematical models for engineering systems, continuation from ENGR 300. Numerical methods including: interpolation and polynomial approximation, numerical differentiation and integration, numerical solution of ordinary differential equations. Advanced methods in a numerical computing environment and computer-aided design. Four hours lecture/discussion and one three-hour laboratory per week. Prerequisite: ENGR 300.

ENGR 307 Principles of Electronics (5)

Circuit laws, theorems, equivalent circuits. Physical properties, electrical characteristics and circuits of electrical and electronic devices, discrete and integrated. Design and construction of analog and digital circuits with instrumentation applications. Three hours lecture/discussion and two three-hour laboratories per week. Prerequisites: ENGR 207.

ENGR 310 Thermodynamics (4)

Properties of working fluids and fundamental relations for processes involving the transfer of energy. First and second laws of thermodynamics, irreversibility and availability. Four hour lecture/discussion per week. Prerequisites: PHYS 222.

ENGR 320 Fluid Mechanics (5)

Hydrostatics and fluid dynamics. Viscous flow, boundary layer concepts, lift and drag, laminar and turbulent flow, compressible flow. Experiments involving flow measurement and control, conservation equations, pressure and velocity distributions, dimension analysis for lift and drag. Four hours lecture/discussion, one three hour laboratory. Prerequisites: ENGR 300, 310.

ENGR 330 Heat Transfer (4)

Introduces the analysis of steady and transient heat conduction, forced and natural convection, radiation heat transfer, and design of heat exchangers. Analytical and numerical methods in heat transfer and fluid mechanics. Topics include heat conduction and convection, gaseous radiation, boiling and condensation, general aspects of phase change, mass transfer principles, multimode heat transfer and the simulation of thermal fields, and the heat transfer process. Four hours lecture/discussion per week. Prerequisites: ENGR 320.

ENGR 340 Soil and Water Resource Management (4)

Soil and water management systems and practices including hydrology, surface drainage, open channels, and erosion, subsurface drainage, impoundments and irrigation. Four hours lecture/discussion per week. Prerequisites: ENGR 240. Prerequisite or corequisite: ENGR 300 or consent of instructor.

ENGR 341 Engineering Principles of Agricultural Machines (3)

Application of machine systems to agricultural production and biological processing. Functional design and analysis of equipment. This course is designed to provide a broad foundation for understanding machine system. Machine systems are an integral part of many agricultural operations from field production to post-harvest processing, storage, transportation, and bio-based processing. Three hours lecture/discussion per week. Prerequisite or corequisite: ENGR 240 or consent of the instructor.

ENGR 342 Bioprocess Engineering (4)

Engineering principles, processes and techniques for using biological agents such as cells, enzymes or antibodies for the production of chemicals, food, biofuels and pharmaceuticals, and waste treatment. The course includes stoichiometry and kinetics of reactions that employ biological agents; design, analysis and operation of reactors; and product recovery and purification. Four hours lecture/discussion per week. Prerequisites: ENGR 240, CHEM 211, 211L or consent of the instructor.

ENGR 351 Fundamentals and Transport in Petroleum Engineering (5)

Introduction to fundamental concepts in petroleum engineering. Topics include the origin, migration and accumulation of petroleum, properties of reservoir rocks and fluids. Introduces petroleum exploration, reservoir engineering, drilling technology, well completion, and production engineering. Five hours lecture/discussion per week. Prerequisites: CHEM 211, 211L, PHYS 221, and MATH 202 or 232, or consent of the instructor.

ENGR 401 Senior Laboratory (1)

Experimental evaluation and analysis of the performance of energy systems, such as heat exchangers, pumps, internal combustion engines, and refrigerators. Three hours of laboratory per week. Prerequisite or corequisite: ENGR 330.

ENGR 405 Machine Design (5)

This course is an introduction to the principles of mechanical design. Methods for determining static, fatigue, and surface failure are presented. Analysis and selection of machine components such as shafts, keys, couplings, bearings, gears, springs, power screws, and fasteners is covered. Five hours lecture/discussion per week. Prerequisites: ENGR 241, 243, 300.

ENGR 410 Power Systems Analysis (4)

Fundamentals, power transformers, transmission lines, power flow, fault calculations, power system controls. Unbalanced networks, symmetric and unsymmetrical faults, transient transmission line modeling, system protection. Four hours lecture/discussion per week. Prerequisite: ENGR 207.

ENGR 420 Operations Research (4)

Introduction to deterministic optimization modeling and algorithms in operations research. Emphasis on formulation and solution of linear programs, networks flows, and integer programs. Introduction to probabilistic models in operations research. Emphasis on Markov chains, Poisson processes, and their application to queueing systems. Four hours lecture/discussion per week. Prerequisites: ENGR 300.

ENGR 422 Project Management (4)

Projects are unique, strategically important, complex endeavors with definite beginning and ending dates. The course develops the skills required to manage the component processes of a project throughout its life cycle: scope, time and sequencing, cost, quality, human resources, communications, risk, procurement, and project integration management. The project life cycle encompasses development of the initiative out of strategic planning activities, articulation of project goals and objectives, planning project components and their integration, execution and control, project close out, and follow-up activities. Four hours lecture/discussion per week. Prerequisites: Senior standing in Engineering Sciences.

ENGR 424 Quality Management (4)

An overview of management literature relating to quality planning, quality control, quality assurance, and quality improvement. A consideration of the core principles and methods common to most quality improvement programs and their relationship to management principles. Comparison of prevalent quality improvement programs such as ISO9004: 2008, SixSigma, and TQM and the Malcolm Baldrige Standards. Case studies. Four hours lecture/discussion per week. Prerequisites: Senior standing in Engineering Sciences.

ENGR 426 Economics of Engineering Design (4)

Cost measurement and control in engineering studies. Basic accounting concepts, income measurement, and valuation problems. Manufacturing cost control and standard cost systems. Capital investment, engineering alternatives, and equipment replacement studies. Four hours lecture/discussion per week. Prerequisites: MATH 201 or 231.

ENGR 440 Biological Systems Applications (4)

Principles of heat and mass transfer in the context of biological (biomedical/bioprocessing/bioenvironmental) systems. Physical understanding of transport processes and simple reaction rates with application to examples from plant, animal, and human biology. Four hours lecture/discussion per week. Prerequisites: CHEM 211, 211L and BIOL 100, 103, 201, 202, or 203. Prerequisite or corequisite: ENGR 320 or consent of the instructor.

ENGR 441 Environmental Engineering (4)

An introduction to environmental engineering, including: water usage and conservation; water chemistry including pH and alkalinity relationships, solubility and phase equilibria; environmental biology; fate and transport of contaminants in lakes, streams and groundwater; design and analysis of mechanical, physicochemical and biochemical water and wastewater treatment processes. Three hours lecture/discussion and one three hour laboratory per week. Prerequisites: CHEM 211, 211L and BIOL 100, 103, 201, 202, or 203. Prerequisite or corequisite: ENGR 320 or consent of the instructor.

ENGR 442 Food and Bioprocess Engineering Unit Operations (4)

Principles of the engineering design, testing and analysis of unit processing operations employed in the food and bioprocess industries, such as sterilization, pasteurization, freezing/refrigeration, drying, evaporation, and fermentation, along with physical, chemical and phase separations. Design and analysis of thermal, freezing, evaporation, dehydration; and mechanical, chemical and phase separations processes as governed by reaction kinetics and rheology of food and biological materials. Three hours lecture/discussion and one three hour laboratory per week. Prerequisites: CHEM 211, 211L, BIOL 100, 103, 201, 202, or 203, or consent of the instructor. Prerequisite or corequisite: ENGR 330.

ENGR 452 Petroleum Production Engineering (4)

Covers topics in modern petroleum production engineering, including production technologies, production equipment, equipment design and optimization, well completion, tubing design, well performance evaluation (productivity index), inflow performance relationships (IPR), artificial lift and surface facilities. Four hours lecture/discussion per week. Prerequisite: ENGR 351 or consent of the instructor.

ENGR 453 Reservoir Engineering (5)

Fundamental equations of fluid flow through porous media, reservoir material balances, aquifer influx, well testing, and decline curve analysis. Methods for forecasting reservoir performance are covered using analytical models. Five hours lecture/discussion per week. Prerequisites: MATH 203 or 233, and ENGR 351, or consent of the instructor.

ENGR 454 Drilling Engineering and Completion Technology (5)

Fundamentals of drilling equipment, engineering design calculations, wellbore diagrams, drilling fluids, cement calculations, and casing design. Additional topics such as directional drilling as well as completion technologies are covered using practical examples and field applications as applied in the oil and natural gas well drilling operations. Four hours lecture/discussion and one three-hour laboratory per week. Prerequisites: ENGR 244, and 351, or consent of the instructor.

ENGR 477 Special Topics in Engineering Sciences (1-4)

This course will often be used to supplement other courses with additional work at a more advanced level. May be repeated in different topics. Prerequisite: Permission of instructor.

ENGR 490A Senior Design Project A (2)

Selection and initiation of an engineering design project under faculty supervision. Collaborative projects with local industry partners are encouraged. Projects are presented in a formal report and in a formal presentation. Two hours lecture/discussion per week. Prerequisite: ENGR 240, Prerequisite or corequisite: ENGR 330.

ENGR 490B Senior Design Project B (2)

Project under faculty supervision. Collaborative projects with local industry partners are encouraged. Projects are presented in a formal report and in a formal presentation. This course is a continuation of ENGR 490A. Two hours lecture/discussion per week. Prerequisite: ENGR 490A.

ENGR 490C Senior Design Project C (2)

Completion of a project under faculty supervision. Collaborative projects with local industry partners are encouraged. Projects are presented in a formal report and in a formal presentation. This course is a continuation of ENGR 490B. Two hours lecture/discussion per week. Prerequisite: ENGR 490B.