ME 250. Materials Engineering  3 credit hours
Introduces the basic principles behind materials science and engineering. Structure and properties of materials relevant to practicing engineers are looked at along with crystal structure and imperfections in metals. Studies diffusion mechanical properties, failure mechanisms, phase equilibrium diagrams and heat treatment principles for steels, cast irons, and other metal alloys. Provides the scientific foundation for an understanding of the relationships among material properties, structure and performance for the classes of engineering solids (metals and alloys, polymers, ceramics, semiconductors, etc.). Includes study of corrosion, atomic structure, mechanical properties, failure theories, fatigue, creep, cold working, heat treating, alloying, and nondestructive and other material testing. Students are expected to gain an understanding of these materials, processing techniques, their properties, and how they are applied in the industry. Prerequisites: CHEM 211, MATH 242.

ME 251. Materials Engineering Laboratory  1 credit hour
Experimental study and macroscopic mechanical response of ceramics, metals, polymers and composite materials, with an introduction to the underlying microstructural processes during deformation and fracture. The laboratory is designed to introduce students to some of the most common materials testing and characterization methods. Topics include optical metallography, tensile and compression testing, hardness testing, impact testing, fatigue testing, heat treating, scanning electron microscopy, plastic injection molding, melting and casting. Corequisite: ME 250.

ME 281. Noncredit Internship  0 credit hours
Complements and enhances the student's academic program by providing an opportunity to apply and acquire knowledge in a workplace environment as an intern. Prerequisite: departmental consent.

ME 325. Numerical Methods for Engineers  3 credit hours
Provides the basic numerical methods to understand, analyze and design the various engineering systems. Includes linear systems of equations, least square problems, eigenvalue problems, and singular value problems, and ordinary differential equations. Students learn not only basic principles of numerical analysis, but also practical applications to the various numerical problems through commercially available computer software, e.g., MS Excel and MATLAB. Prerequisites: MATH 243 and PHYS 313.

ME 335. Dynamics for Mechanical Engineers  3 credit hours
Kinematics and kinetics of particles in space and rigid bodies in plane motion. Applications of the principles of Newton's laws, work-energy, impulse-momentum, and conservation laws to solve mechanical systems with prismatic joints, revolute joints, cylindrical joints, and rolling joints. Lectures and projects on modeling and simulation of mechanical systems using multibody dynamic software. Prerequisites: AE 223 and MATH 344.

ME 339. Design of Machinery  3 credit hours
Introduces engineering design process; synthesis and analysis of machinery and machines. Kinematic (position, velocity and acceleration) and inverse dynamic analysis of planar mechanisms by analytical, graphical and computer methods. Design of linkages for motion, path and function generation; cam design. Computer-aided engineering approach in mechanical design; projects on practical engineering designs for machinery. Prerequisite: IME 222. Corequisite: ME 335.

ME 350. Selected Topics in Mechanical Engineering  1-3 credit hours
New or special topics presented on sufficient demand. Repeatable for credit when subject material warrants. Prerequisites: as published or departmental consent.

ME 398. Thermodynamics I  3 credit hours
An introduction to the terminology and analysis techniques specific to thermodynamics centered around a study of the first and second laws of thermodynamics. Prerequisites: MATH 243, PHYS 313.

ME 398H. Thermodynamics I - Honors  3 credit hours
An introduction to the terminology and analysis techniques specific to thermodynamics centered around a study of the first and second laws of thermodynamics. Honors section. Prerequisites: MATH 243, PHYS 313.

ME 439. Mechanical Engineering Design I  3 credit hours
Covers the basics of machine design, including the design process, engineering mechanics, deformations and stress analysis, failure prevention under static and variable loading conditions, design of mechanical components, and selection of materials and mechanical components from standard tables and handbooks. It offers a practical approach to the design subject through a wide range of real-world applications and examples. Prerequisites: ME 250, ME 251, AE 333, MATH 555.

ME 450. Selected Topics in Mechanical Engineering  1-3 credit hours
New or special topics presented on sufficient demand. Repeatable for credit when subject material warrants. Prerequisite: departmental consent.

ME 469. Energy Conversion  3 credit hours
Energy conversion principles and their implementation in engineering devices including thermal, mechanical, nuclear and direct energy conversion processes. Prerequisite: ME 398.

ME 481A. Cooperative Education  1-3 credit hours
Introduction to engineering practice by working in industry in an engineering-related job. Provides planned professional experience designed to complement and enhance the student's academic program. Individualized programs must be formulated in consultation with, and approved by, appropriate faculty sponsors and cooperative education coordinators. Intended for students who will be working full time on their co-op assignments and need not be enrolled in any other course. May be repeated. Graded Cr/NCr. Prerequisites: junior standing and approval by the appropriate faculty sponsor.

ME 481I. Noncredit Internship  0 credit hours
Complements and enhances the student's academic program by providing an opportunity to apply and acquire knowledge in a workplace environment as an intern. Prerequisite: departmental consent.

ME 481N. Internship  1 credit hours
Complements and enhances the student's academic program by providing an opportunity to apply and acquire knowledge in a workplace environment as an intern. Graded Cr/NCr. Prerequisite: departmental consent.

ME 481P. Cooperative Education  1 credit hour
Introduction to engineering practice by working in industry in an engineering-related job. Provides planned professional experience designed to complement and enhance the student's academic program. Individualized programs must be formulated in consultation with, and approved by, appropriate faculty sponsors and cooperative education coordinators. Intended for students who will be working part time on their co-op assignments and be currently enrolled in courses leading to a mechanical engineering degree. May be repeated. Graded Cr/NCr.
Prerequisites: junior standing and approval by the appropriate faculty sponsor.

ME 502. Thermodynamics II 3 credit hours
Continuation of ME 398, emphasizing cycle analysis, thermodynamic property relationships and psychrometrics, with an introduction to combustion processes and chemical thermodynamics. For undergraduate students only. Prerequisite: ME 398.

ME 521. Fluid Mechanics 3 credit hours
The definition of a fluid and the concept of a continuum. Stress and strain in a Newtonian fluid. Description and classification of fluid motions. Hydrostatic pressure and forces on submerged surfaces. Reynolds Transport Theorem and integral analysis of conservation laws. Introduction to differential analysis of fluid motion. Dimensional analysis and similitude. Study of flow in closed conduits: pressure drop in fully developed viscous flow. The boundary layer concept and lift and drag forces on immersed bodies. For undergraduate students only. Prerequisites: ME 335, 398, MATH 555; all with a minimum grade of C (2.000).

ME 522. Heat Transfer 3 credit hours
Introduction to the three modes of heat transfer in the context of the laws of thermodynamics; the heat equation and its application to steady conduction in one- and two-dimensions as well as to unsteady one-dimensional conduction; the thermal boundary layer, Reynolds Analogy, and the problem of convection; free and forced convection in internal and external flows; boiling and condensation; thermal radiation. Emphasizes problem solving using analytical methods approximate solutions, analogies, empirical correlations, and numerical methods. For undergraduate students only. Prerequisites: ME 325, ME 521 and PHYS 314; each with a minimum grade of C (2.000).

ME 533. Mechanical Engineering Laboratory 3 credit hours
2 Classroom hours; 3 Lab hours. Introduces the basics of engineering measurements. Discusses related theory, followed by applications in such areas as strain, sound, temperature and pressure measurements. Format includes lectures, recitation (presenting the concept of the experiment to be performed and the required data analysis), and laboratories. Analyzes the data obtained from measuring systems set up and operated in the laboratory to demonstrate and reinforce fundamental concepts of engineering mechanics. For undergraduate students only. Prerequisites: EE 282, AE 333, ME 325, ENGL 102, COMM 111, PHYS 315; Corequisite: ME 522.

ME 541. Mechanical Engineering Design II 3 credit hours
Principles of mechanical design, emphasizing practice in the application of many mechanical design elements: shafts, bearings, gears, brakes, clutches, thread fasteners, etc. Includes machine elements design, materials election, fatigue, stress concentration, statistical concepts and cost standardization. Innovative practical applications demanding integration of machine elements into a practical device. For undergraduate students only. Prerequisites: ME 339 and ME 439.

ME 581. Introduction to Corrosion 3 credit hours
Presents information about basic corrosion processes, underlying principles of corrosion formations, and general protection methods. Studies basic corrosion and corrosion mechanisms, importance of corrosion, coating systems, and how the materials are protected from the corrosion formations. Concerns fundamental theory of the thermodynamics and kinetics of the corrosion process of metals and alloys as well as polymer materials both in atmosphere and water solutions. Focuses on electrochemical aspects and the influences of the properties of the metals and their oxides on the corrosion behavior, which is exemplified by different corrosion types. Existing corrosion protection strategies, including surface treatments and coatings are described and choice of material is discussed from a corrosion point of view. Prerequisites: ME 250 and ME 398; or instructor’s consent.

ME 602. Engineering for the Environment 3 credit hours
Engineering for the environment, air, water and noise pollution, and handling of hazardous wastes. Covers briefly the main pollutants, their major sources, their effects and their attainment levels set by the U.S. Environmental Protection Agency. Emphasizes engineering systems for pollution control. Prerequisites: ME 398, AE 223, IME 255, or departmental consent.

ME 631. Heat Exchanger Design 3 credit hours
Covers analytical models for forced convection through tubes and over surfaces, experimental correlations for the Nusselt number and pressure drop; design of single and multiple pass shell and tube heat exchangers; compact baffled, direct contact, plat and fluidized bed heat exchangers, radiators, recuperators and regenerators. Prerequisites: ME 521 and 522, or equivalent.

ME 633. Mechanical Engineering Systems Laboratory 3 credit hours
2 Classroom hours; 3 Lab hours. Selected experiments illustrate the methodology of experimentation as applied to mechanical and thermal systems. Experiments include the measurement of performance of typical systems and evaluation of physical properties and parameters of systems. Group design and construction of an experiment is an important part of the course. Team and individual efforts are stressed as are written and oral communication skills. For undergraduate students only. Prerequisites: ME 522, ME 533.

ME 637. Computer-Aided Engineering 3 credit hours
2 Classroom hours; 3 Lab hours. Integrates computer-aided design, finite element analysis, kinematics analysis, heat transfer analysis and other considerations for design of mechanical components and systems. Provides a blend of theory and practice. Prerequisites: ME 339 and ME 439, or equivalent.

ME 639. Applications of Finite Element Methods in Mechanical Engineering 3 credit hours
2 Classroom hours; 3 Lab hours. Introduces the finite element method (FEM) as a powerful and general tool for solving differential equations arising from modeling practical engineering problems. Finite element solutions to one- and two-dimensional mechanical engineering problems in mechanical systems, heat transfer, fluid mechanics and vibrations. Includes Galerkin's and variational finite element models. Introduces commercial finite element computer tools such as ANSYS. Prerequisites: ME 325, ME 339 and ME 439; Corequisite: ME 522 or instructor's consent.

ME 644. Design of HVAC Systems 3 credit hours
Analysis and design of heating, ventilating and air-conditioning systems based on psychometrics, thermodynamics and heat transfer fundamentals with focus on advanced duct design for composite building, cooling load calculations and thermal-issues based psychometric. Focuses on design procedures for space air-conditioning, and heating and cooling loads in buildings. Prerequisites: ME 521, 522; or instructor's consent.

ME 650. Selected Topics in Mechanical Engineering 1-3 credit hours
New or special topics are presented on sufficient demand. Repeatable for credit when subject material warrants. Prerequisite: departmental consent.

ME 651. Biomaterials 3 credit hours
Introduction to biomaterials and biotechnology for both undergraduate and graduate students focusing on biomaterials (e.g., metals and alloys, composites, polymers and ceramics), biodevices, basic fabrication
and characterization techniques, and their general properties and applications. Prerequisites: ME 250, ME 251; or instructor's consent.

**ME 659. Mechanical Control Systems  3 credit hours**
Cross-listed as EE 684. Modeling and simulation of dynamic systems. Theory and analysis of the dynamic behavior of control systems, based on the laws of physics and linear mathematics. Concerns classical methods of feedback control systems and design. Prerequisites: (1) EE 282 and MATH 555, or (2) EE 383.

**ME 660. Polymer Materials and Engineering  3 credit hours**
Introduces the basic science and engineering of polymer materials. Provides the scientific foundation for an understanding of the relationships among material structures and properties of different types of polymer materials (thermoplastics, thermosets, synthetic fibers and rubbers, etc.) for various applications from consumer electronics to aviation industry. An understanding of these materials, processing techniques, their properties, and how they are applied in the industry. Prerequisite: ME 250 or CHEM 211.

**ME 662. Senior Capstone Design  3 credit hours**
1 Classroom hour; 6 Lab hours. A culminating course that allows students nearing graduation to combine the knowledge and skills acquired in their program and apply them to a major project or assignment. An exercise in the practice of mechanical engineering for undergraduate students in their graduating semester; students engage in a comprehensive design project requiring the integration of knowledge gained in prerequisite engineering, science and design courses. Team effort and both oral and written presentations are a part of the experience. For undergraduate students only. Prerequisites: ME 339, ME 439, ME 522. Corequisites: ME 633, ME 659.

**ME 664. Introduction to Fatigue and Fracture  3 credit hours**
Deals with the primary analytical methods used to quantify fatigue damage. These are the stress life approach, strain life approach and the fracture mechanics approach. Prerequisite: ME 439.

**ME 665. Selection of Materials for Design and Manufacturing  3 credit hours**
Focuses on the selection of engineering materials to meet product and manufacturing requirements. Solution to various product and manufacturing problems by appropriate selection of materials is illustrated through the use of numerous examples and case studies. Prerequisite: ME 439.

**ME 667. Mechanical Properties of Materials  3 credit hours**
Major focus on deformation mechanisms and on crystal defects that significantly affect mechanical properties. Also covers plasticity theory, yield criteria for multi-axial states of stress, fracture mechanics and fracture toughness. Includes some review of basic mechanics of materials and elasticity as needed. Prerequisite: ME 439.

**ME 669. Acoustics  3 credit hours**
Introduces the fundamentals of acoustics including the study of simple harmonic systems, acoustic waves, transmission phenomena, environmental and architectural acoustics. Foundations of 3D elasticity, fluid and elastic wave equations, elastic and plastic waves in rods and beams, waves in plates, and dynamics and acoustics of cylindrical shells, acoustic fluids effects such as radiation and scattering by submerged plates and shells, and interaction between structural elements. Response of plates and shells to high-intensity loads, dynamic plasticity and fracture, and structural damage caused by impulsive and impact loads. Prerequisites: MATH 555, ME 335 or instructor's consent.

**ME 670. Introduction to Nanotechnology  3 credit hours**
Introduction to the underlying principles and applications of the field of nanotechnology and nanoscience. Covers basic principles of nanotechnology, nanomaterials and associated technologies and provides a background of the understanding, motivation, implementation, impact, future, and implications of nanotechnology. Focuses on processing techniques of nanoparticles, nanofibers/wires, nanotubes, nanofilms and nanocomposites using physical, chemical and physicochemical techniques, as well as their characterizations and potential commercial applications. An understanding of nanomaterials, fabrication and characterization techniques, and how they are applied in nanodevice fabrication. Material covered includes nanofabrication technology (how one achieves the nanometer length scale, from “bottom up” to “top down” technologies), the interdisciplinary nature of nanotechnology and nanoscience (including areas of chemistry, material science, physics and molecular biology), examples of nanoscience phenomena (the crossover from bulk to quantum mechanical properties), and applications (from integrated circuits, quantum computing, MEMS and bioengineering). Prerequisites: ME 250 and ME 398; or instructor's consent.

**ME 672. Manufacturing of Composites  3 credit hours**
2 classroom hours; 3 laboratory hours. Provides the basis for understanding and use of composite materials in various engineering applications such as space and aerospace structures. Different classes of composite materials, the characteristics of their constituents, an introduction to micromechanics of composites, commonly used composite manufacturing techniques in detail, along with their capabilities and limitations, characterization methods, degradation, joining, tooling, machining, and recycling of composites is discussed. Contains laboratory modules designed to provide hands-on experience to emphasize the practical aspects of the topics covered. Prerequisites: ME 250, ME 251, AE 333; or instructor's consent.

**ME 673. Recovery of Engineering Materials  3 credit hours**
Introduces basic standards in recycling and reusing processes of different materials and the importance of recycling for the economy, health and environmental aspects. Focuses on basic separation techniques of various recyclable materials, recycled products reprocessing, as well as characterizations and potential commercial applications in different industries. Undergraduate and graduate students are expected to gain an understanding of recycling processes, recycled materials and applications. Prerequisites: ME 250, ME 398 and IME 255; or instructor’s consent.

**ME 678. Studies in Mechanical Engineering  1-3 credit hours**
Arranged individual, independent study in specialized content areas in mechanical engineering under the supervision of a faculty member. Requires written report or other suitable documentation of work for departmental records. Three (3) hours maximum technical elective credit. Not for graduate credit. Prerequisite: departmental consent.

**ME 682. Engineering Applications of Computational Fluid Dynamics and Heat Transfer  3 credit hours**
Reviews the basic laws of fluid flow and heat transfer including the Navier-Stokes equations. Applications include a CFD software emphasizing the finite volume method and introducing turbulence modeling. Additional topics include grid generation and benchmarking exercises as well as open-ended projects. Prerequisites: ME 325 (or AE 227) and ME 522 (or AE 424) with a minimum grade of C in each, or instructor's consent.

**ME 702. Energy and Sustainability  3 credit hours**
Introduction to sustainability in a world of increasing population with more energy intensive lifestyles and diminishing resources; anthropogenic global climate change and the engineer's responsibilities; a critical look at our ecological footprint; survey of alternative sources with special emphasis on wind and solar energy; life cycle analysis (LCA) of engineered products; the electric grid; emissions from various transportation modes, and alternative. Consists of traditional lectures,
ME 709. Injury Biomechanics 3 credit hours
Offers insight into the trauma problem and methods used to quantify and reduce it. Research methods used in injury biomechanics and their limitations are discussed including tests with human volunteers, cadavers, animals, mechanical crash test dummies and computer models. Provides a basic understanding of injury mechanisms and tolerances for the different body parts, including head, spine, thorax and extremities. Presents both automotive and aircraft impact safety regulations on occupant protection and related biomechanical limits. Students are exposed to and gain experience in using mathematical/numerical/computer models for injury biomechanics. Prerequisite: instructor's consent.

ME 719. Basic Combustion Theory 3 credit hours
Introduction to the fundamental principles of combustion processes. Examines the chemistry and physics of combustion phenomena, that is, detonation and flames, explosion and ignition processes. Prerequisites: CHEM 211, ME 502.

ME 728. Advanced Electronic Materials 3 credit hours
Focuses on electronic materials which are fundamental and critical to performances and applications of electronic devices. Structure-property and property-relationships of different types of electronic materials are discussed. High level knowledge of electronic material structures, properties and applications of electronic materials, and basic principles for material design for electronics. Prerequisites: ME 250 or PHYS 313; or instructor's consent.

ME 729. Computer-Aided Analysis of Mechanical Systems 3 credit hours
Modeling and analysis of planar motion for multibody mechanical systems including automatic generation of governing equations for kinematic and dynamic analysis, as well as computational methods and numerical solutions of governing equations. Computer applications. Open-ended student projects on engineering applications such as mechanisms design and vehicle dynamics. Technical elective course for mechanical engineering students. Prerequisites: ME 335, 339, MATH 555; or instructor's consent.

ME 730. Modeling of Engineering Systems 3 credit hours
Provides rigorous understanding of physics and engineering mathematics in order to model practical scientific and engineering problems in fluid mechanics, heat transfer, solid mechanic, and vibrations. Focuses on analytical approaches and introduces computational methods for modeling engineering systems using computer codes. Prerequisites: MATH 555 and ME 325, or departmental consent.

ME 731. Advanced Heat Exchanger Design 3 credit hours
Topics cover advanced design of fluidized bed, heat pipe, and high-temperature heat exchangers. Design experience through individual projects. Prerequisites: ME 521, ME 522.

ME 737. Robotics and Control 3 credit hours
A systems engineering approach to robotic science and technology. Fundamentals of manipulators, sensors, actuator, end-effectors and product design for automation. Includes kinematics, trajectory planning, control, programming of manipulator and simulation, along with introduction to artificial intelligence and computer vision. Prerequisite: ME 659 or equivalent.

ME 739. Advanced Machine Design 3 credit hours
A broad coverage of principles of mechanical analysis and design of machine elements. Emphasizes dynamic system modeling, prediction of natural frequencies and forced response, effect of support flexibility, failure theories used in design and fatigue life prediction. Typical mechanical systems studied are gears, bearings, shafts, rotating machinery and many types of spring-mass systems. Uses fundamentals learned in mechanics, strength of materials and thermal sciences to understand mechanical system modeling, analysis and design. Prerequisite: ME 541 or instructor's consent.
ME 753. Advanced Materials for Energy Systems 3 credit hours
Introduces the advanced materials and fundamental principles behind the energy systems and devices. Focuses on advanced materials (e.g., metals and alloys, composites, polymers, ceramics and semiconductors) at micro- and nanosize, novel energy conversion systems and devices, fabrication and characterization techniques and their general properties and applications. Efficiencies of most energy systems are limited by materials engineering and reliability of these systems. Covers the application of scientific and engineering principles for materials used in energy systems. Equips students with knowledge and skills that enable them to solve a wide range of energy materials technology and engineering problems to minimize operational risks and maximize process reliability, and ensure a more sustainable future. Students gain an understanding of these advanced materials and devices, importance of them, and how they are applied in energy related technologies and future developments. Prerequisites: ME 250, ME 398, ME 469 or ME 522 (either one of ME 469 or ME 522); or instructor's consent.

ME 755. Intermediate Thermodynamics 3 credit hours
Laws of thermodynamics, introduction to statistical concepts of thermodynamics, thermodynamic properties, chemical thermodynamics, Maxwell's relations. Prerequisite: ME 502 or departmental consent.

ME 758. Nonlinear Controls of Electro-Mechanical Systems 3 credit hours
Standard first nonlinear controls course. Covers stability, feedback linearization (robotic, mechanical, electro-mechanical system applications), differentially-flat systems (with rotor-craft position tracking applications), back-stepping control-design methods (electro-mechanical, robotic and rotor-craft applications), MIMO systems, normal form, zero dynamics, and adaptive control of robotic systems. EE 792, Linear Systems, while not a prerequisite, is helpful. Prerequisite: ME 659 or EE 684; or equivalent.

ME 759. Neural Networks for Control 3 credit hours
Introduces specific neural network architectures used for dynamic system modeling and intelligent control. Includes theory of feed-forward, recurrent, and Hopfield networks; applications in robotics, aircraft and vehicle guidance, chemical processes, and optimal control. Prerequisite: ME 659 or departmental consent.

ME 760. Fracture Mechanics 3 credit hours
Covers fracture mechanics in metals, ceramics, polymers and composites. Suitable for graduate and undergraduate study in metallurgy and materials, mechanical engineering, civil engineering and aerospace engineering where a combined materials-fracture mechanics approach is stressed. Prerequisite: ME 439 or instructor's consent.

ME 762. Polymeric Composite Materials 3 credit hours
Designed to provide students with an understanding and knowledge about polymeric composite materials. The characteristics of various reinforcements and polymeric matrices are presented and their processing techniques, capabilities and limitations are highlighted. In addition, various methods for manufacturing of polymeric composites along with their capabilities are discussed. Characterization techniques, test methods, assembly, and joining of polymeric composites are presented. Prerequisites: ME 250, ME 251, AE 333, ME 439, and MATH 555; or instructor's consent.

ME 764. Thermodynamics of Solids 3 credit hours
Presents basic thermodynamic concepts which form the working tools throughout the course. Emphasizes the interpretation of certain types of phase diagrams — not upon the use of thermodynamics to assist phase diagram construction but upon the use of phase diagrams to obtain thermodynamic quantities. Also, the thermodynamics of defects and defect interactions in metals, ceramics, polymers, elemental semiconductors, and compounds. Prerequisites: ME 250 and 398 or departmental consent.

ME 766. SEM and EDAX 3 credit hours
Introduces Scanning Electron Microscopy (SEM), a powerful tool in materials science and engineering which can be used to analyze structural defects in materials. Discusses both the theory and experimental methods, as well as the application of these methods. Prerequisite: ME 250 or departmental consent.

ME 767. X-Ray Diffraction 3 credit hours
Theory of X-ray diffraction, experimental methods, and their applications which can include determination of the crystal structure of materials, chemical analysis, stress and strain measurements, study of phase equilibria, measurement of particle size, and determination of the orientation of a single crystal. Prerequisites: ME 250 and AE 333 or departmental consent.

ME 769. Impact Dynamics 3 credit hours
Classical methods are presented to analyze mechanical components and structures for impact response. Impact methods include stereo mechanics, contact mechanics, impulse-momentum, stress-wave, energy method and plastic impact. Finite element analysis (FEA) modeling of impact events are examined and applied to classical methods. Material properties evaluation for impact conditions, design techniques for impact and shock mitigation, and an introduction to crashworthiness are also presented. Course goals are to understand characteristics such as loading, stresses, deflections, contact forces and material response to impact events. Prerequisite: ME 439 or instructor's consent.

ME 781. Cooperative Education 2-8 credit hours
A work-related placement with a supervised professional experience to complement and enhance the student's academic program. Intended for master's level or doctoral students in mechanical engineering. Repeatable for credit. May not be used to satisfy degree requirements. Graded Cr/NCr. Prerequisites: ME 781A. Cooperative Education 1 credit hour
Introduces the student to professional practice by working in industry in an academically-related job and provides a planned professional experience designed to complement and enhance the student's academic program. Individualized programs must be formulated in consultation with, and approved by, appropriate faculty sponsors and cooperative education coordinators. Intended for students who will be working full time on their co-op assignment and need not be enrolled in any other course. Graded Cr/NCr unless student has received permission before enrolling for course to be used as an elective. Repeatable. Prerequisite: approval by the appropriate faculty sponsor.

ME 781P. Cooperative Education 1 credit hour
Introduces the student to professional practice by working in industry in an academically-related job and provides a planned professional experience designed to complement and enhance the student's academic program. Individualized programs must be formulated in consultation with, and approved by, appropriate faculty sponsors and cooperative
education coordinators. Students must enroll concurrently in a minimum of 6 hours of coursework including this course in addition to a minimum of 20 hours per week at their co-op assignment. Graded Cr/NCr unless student has received permission before enrolling for course to be used as an elective. Repeatable. Prerequisite: approval by the appropriate faculty sponsor.