

Mechanical Engineering (ME)

ME 118. Energy for Sustainable Society. 3 hours.

Focuses on how energy systems work today and how they can work in a decarbonized sustainable future, while still meeting the critical energy needs of global developed and developing societies. Course Information: Same as IE 118. *Individual and Society course.*

ME 205. Introduction to Thermodynamics. 3 hours.

Principles of energy transport and work; properties of substances and equations of state; first and second laws of thermodynamics; applications to mechanical cycles and systems. Course Information: Prerequisite(s): PHYS 141 and MATH 181.

ME 210. Engineering Dynamics. 3 hours.

Dynamics of particles and rigid bodies. Introduction to Linear Algebra. Kinematics in different coordinate systems, coordinate transformations. Kinetics: Newton's second law, work energy relations, impulse-momentum relations, impact problems. Course Information: Prerequisite(s): CME 201.

ME 211. Fluid Mechanics I. 4 hours.

Fluid properties. Dimensional analysis. Statics and kinematics. Conservation equations. Inviscid and incompressible flows. Bernoulli's equation. Integral momentum theorems. Viscous flows. Boundary layer theories. Compressible Flows. Course Information: Prerequisite(s): PHYS 141 and MATH 220. Class Schedule Information: To be properly registered, students must enroll in one Laboratory and one Lecture-Discussion.

ME 250. Introduction to Engineering Design and Graphics. 3 hours.

Engineering design process, modeling, analysis. Product dissection, prototyping. Technical communication, AutoCAD, engineering graphics software, 3-D views, multiview projection, dimensioning and tolerancing, standards. Team design project. Course Information: Prerequisite(s): Eligibility to register for ENGL 160. Class Schedule Information: To be properly registered, students must enroll in one Laboratory and one Lecture.

ME 261. Materials for Manufacturing. 2 hours.

Introductory-level course in materials engineering to familiarize students with relationships between processing, structure and properties of materials used to manufacture devices. Course Information: Same as CME 261. Credit is not given for ME 261 if the student has credit for CME 260. Prerequisite(s): CHEM 122 and CHEM 123 and PHYS 141 and MATH 181.

ME 293. Special Problems. 1-4 hours.

Special problems, readings or research under close supervision of a faculty member in the area of engineering graphics. Course Information: May be repeated. Prerequisite(s): Consent of the instructor.

ME 308. Mechanical Vibrations. 3 hours.

Free and forced vibrations of damped linear single and multiple degree of freedom systems. Approximate methods, instrumentation, and applications. Course Information: Same as CME 359. Prerequisite(s): CS 109; and ME 210; and MATH 220.

ME 312. Dynamic Systems and Control. 3 hours.

Dynamics of linear systems. Modeling of mechanical, electrical, fluid, and thermal systems. Analysis and design of feedback control systems. Analytical, computer and experimental solution methods. Time and frequency domain techniques. Course Information: Same as IE 312. Prerequisite(s): CS 109 and ECE 210 and MATH 220; and sophomore standing or above; or approval of the department.

ME 318. Fluid Mechanics II. 3 hours.

Conservation equations for fluid mechanics, inviscid ideal flows, viscous flow solutions of Navier-Stokes equations, pipe flows and boundary flows, compressible flow, computer solutions and applications. Course Information: Prerequisite(s): ME 211.

ME 320. Mechanisms and Dynamics of Machinery. 3 or 4 hours.

Kinematic analysis and synthesis of mechanisms; linkages, cams, spur gears, gear trains. Dynamic forces in machines; bearing reactions, balancing, flywheel design, friction, efficiency. Course Information: Prerequisite(s): ME 210.

ME 321. Heat Transfer. 4 hours.

Modes of heat transfer, material properties, one- and two-dimensional conduction. Extended surfaces. Forced and free convection. Heat exchangers. Radiation. Shape factors. Laboratories in conduction, convection, and radiation. Course Information: Prerequisite(s): ME 205 and credit or concurrent enrollment in ME 211. Class Schedule Information: To be properly registered, students must enroll in one Laboratory and one Lecture-Discussion.

ME 325. Intermediate Thermodynamics. 3 hours.

In-depth study of thermodynamic principles, thermodynamics of state, vapor and gas power cycles, refrigeration cycles, thermodynamics of nonreacting and reacting mixtures, internal combustion engines, and thermodynamics of equilibrium. Course Information: Prerequisite(s): ME 205 and credit or concurrent registration in ME 211.

ME 328. Numerical Methods in Mechanical Engineering. 3 hours.

Introduction to numerical solution methods for problems in mechanical engineering. Example problems include heat transfer, fluid mechanics, thermodynamics, mechanical vibrations, dynamics, stress analysis, and other related problems. Course Information: Previously listed as ME 428. Extensive computer use required. Prerequisite(s): CS 109 and Credit or concurrent registration in MATH 310. Open only to juniors and seniors.

ME 341. Experimental Methods in Mechanical Engineering. 3 hours.

Introduction to the theory and practice of experimental methods, measurement techniques, instrumentation, data acquisition and data analysis in mechanical and thermal-fluid systems. Experiments and reports. Course Information: Prerequisite(s): CME 203; and ME 211. Class Schedule Information: To be properly registered, students must enroll in one Laboratory and one Lecture.

ME 347. Introduction to Computer-Aided Design. 3 hours.

Conventional and computer-assisted methods in design. Geometric manipulation. Computer-aided modeling with curves, surfaces, and solids. Design with finite-element analysis. Course Information: Previously listed as ME 447. Extensive computer use required. Prerequisite(s): MATH 220 and CME 203 and ME 250. Recommended background: Credit in MATH 310. Class Schedule Information: To be properly registered, students must enroll in one Laboratory-Discussion and one Lecture.

ME 370. Mechanical Engineering Design. 3 hours.

Mechanical design concepts, failure prevention under static and variable loading, application of engineering mechanics and materials to analysis, selection and design of mechanical elements such as shafts, fasteners, springs, bearings, and gears. Course Information: Prerequisite(s): CME 203 and ME 250. Recommended background: ME 230.

ME 380. Manufacturing Process Principles. 3 hours.

Introduction to basic manufacturing processes such as casting, bulk deformation, sheet metal forming, metal cutting. Interaction between materials, design and manufacturing method. Economics of manufacturing. Course Information: Same as IE 380. Prerequisite(s): CME 203.

ME 391. Mechanical Engineering Practicum. 1 hour.

Provides students with the opportunity to apply the skills and knowledge gained in previous engineering courses within a professional, working environment. Course Information: Satisfactory/Unsatisfactory grading only. May be repeated. A maximum of 1 hour awarded toward degree requirements. Prerequisite(s): Approval of the Department.

ME 392. Undergraduate Research. 1-3 hours.

Research under close supervision of a faculty member. Course Information: May be repeated to a maximum of 6 hours. Prerequisite(s): Consent of the head of the department.

ME 394. Senior Capstone Design. 4 hours.

Systematic approach to the design process. Creative problem solving. Design methodology and engineering principles applied to open-ended design problems with inherent breadth and innovation. Course Information: Same as IE 394. Credit is not given for ME 394 if the student has credit for ME 396 or IE 396. Prerequisite(s): Senior standing or above; or approval of the department.

ME 396. Senior Design I. 3 hours.

Systematic approach to the design process. Creative problem solving. Design methodology and engineering principles applied to open-ended design problems with inherent breadth and innovation. Course Information: Same as IE 396. Credit is not given for ME 396 if the student has credit in IE 444 or ME 444 or IE 445 or ME 445. Prerequisite(s): ME 347 and IE 201; or IE 345 and IE 201. Open only to seniors. Class Schedule Information: To be properly registered, students must enroll in one Laboratory and one Lecture-Discussion.

ME 397. Senior Design II. 2 or 3 hours.

The systematic approach to the design process; creative problem solving; design methodology and engineering principles learned in ME 396 are applied to complete the Senior Design project. Course Information: Same as IE 397. Credit is not given for ME 397 if the student has credit for IE 444 or ME 444 or IE 445 or ME 445. Prerequisite(s): ME 396; or IE 396; and senior standing or above. Requires concurrent registration in ME 499 or IE 499.

ME 401. Applied Stress Analysis I. 3 or 4 hours.

Complex bending and torsion, curved flexural members, energy methods in design, theories of failure. Course Information: 3 undergraduate hours. 4 graduate hours. Prerequisite(s): CME 203.

ME 408. Intermediate Vibration Theory. 3 or 4 hours.

Free and forced vibrations of multi-degree of freedom linear systems. Lagrangian dynamics, matrix, approximate and numerical methods. Course Information: 3 undergraduate hours. 4 graduate hours. Prerequisite(s): ME 308.

ME 409. Advanced Kinematics I. 3 or 4 hours.

Kinematic synthesis of planar linkages. Higher-order, precision point and approximate synthesis. Unified treatment of position, function, and path-angle problems. Consideration of branching and rotatability. Course Information: 3 undergraduate hours. 4 graduate hours. Prerequisite(s): ME 320.

ME 410. Automation and Robotics Applications. 3 or 4 hours.

Basic pneumatic and hydraulic systems. Design of sequential control circuits and ladder diagrams. Robot kinematics and dynamics. Robot design. Trajectory planning. Applications and demonstrations. Course Information: 3 undergraduate hours. 4 graduate hours. Prerequisite(s): ME 210.

ME 411. Mechatronics I. 0-4 hours.

Elements of mechatronic systems, sensors, actuators, microcontrollers, modeling, hardware in the loop simulations, real time software, Electromechanical systems laboratory experiments. Course Information: Same as IE 411. 3 undergraduate hours. 4 graduate hours. Extensive computer use required. Prerequisite(s): Senior standing or above; or approval of the department. Class Schedule Information: To be properly registered, students must enroll in one Laboratory and one Lecture.

ME 412. Dynamic Systems Analysis I. 3 or 4 hours.

Classical control theory, concept of feedback, laplace transform, transfer functions, control system characteristics, root locus, frequency response, compensator design. Course Information: Same as IE 412. 3 undergraduate hours. 4 graduate hours. Prerequisite(s): ME 308.

ME 413. Dynamics of Mechanical Systems. 3 or 4 hours.

Degrees of freedom, generalized coordinates, principle of virtual work. D'Alembert's Principle, Lagrange's Equation, Hamilton's Principle. Equations of motion and Newton-Euler equations for rigid bodies. Course Information: 3 undergraduate hours. 4 graduate hours. Prerequisite(s): ME 320.

ME 414. Theory of Gearing and Applications. 3 or 4 hours.

Classification of gear drives. Geometry of plane and spatial gears. Analysis and synthesis of gears with approximate meshing. Applications to spur, helical, worm and bevel gear drives. Course Information: 3 undergraduate hours. 4 graduate hours. Prerequisite(s): ME 320.

ME 415. Propulsion Theory. 3 or 4 hours.

Thermodynamics and fluid mechanics of air-breathing engines, performance of rockets; chemical and nuclear rockets. Course Information: 3 undergraduate hours. 4 graduate hours. Prerequisite(s): ME 419 or the equivalent.

ME 416. Railroad Vehicle Dynamics. 3 or 4 hours.

Introduces analytical and computational methods used for the computer aided dynamic and stability analysis of railroad vehicle systems. Course Information: 3 undergraduate hours. 4 graduate hours. Prerequisite(s): ME 413; or consent of the instructor.

ME 417. Intermediate Fluid Mechanics. 3 or 4 hours.

Development of conservation equations for Newtonian-fluids; continuity, Navier-Stokes and energy equations. Some exact and approximate solutions of highly viscous, viscous and inviscid flows. Boundary layer flows, jets and wakes. Course Information: 3 undergraduate hours. 4 graduate hours. Prerequisite(s): ME 321.

ME 418. Transport Phenomena in Nanotechnology. 3 or 4 hours.

Free surface flows, rheologically complex liquids, colloidal suspensions, emulsions, Brownian motion, flows in micro- and nanochannels, and multiple applications. Course Information: 3 undergraduate hours. 4 graduate hours. Prerequisite(s): ME 325 and ME 211.

ME 419. Compressible Flow Theory. 3 or 4 hours.

Conservation laws, one-dimensional flows. Normal and oblique shock waves, Prandtl-Meyer expansion, flow over airfoils. Applications to nozzles, shock-tubes, wind-tunnels. Flow with friction and heat addition or loss. Course Information: 3 undergraduate hours. 4 graduate hours. Prerequisite(s): ME 321.

ME 421. Intermediate Heat Transfer. 3 or 4 hours.

Topics in conduction, convection and radiation with emphasis on exact solutions: extended surfaces, internal and external flows, surface radiation, combined modes of heat transfer and selected topics. Course Information: 3 undergraduate hours. 4 graduate hours. Prerequisite(s): ME 321 or consent of the instructor.

ME 422. Heating, Ventilation and Air Conditioning. 3 or 4 hours.

Refrigeration systems and heat-pump, mass transfer in humidification, solar heat transfer in buildings, heating and cooling loads, air-conditioning computer project. Course Information: 3 undergraduate hours. 4 graduate hours. Prerequisite(s): ME 321.

ME 423. Heat Exchangers. 3 or 4 hours.

Classification; heat transfer and pressure drop analysis, flow distribution, transient performance, surface selection and geometrical properties, codes and standards. Course Information: 3 undergraduate hours. 4 graduate hours. Prerequisite(s): ME 211 and ME 321.

ME 424. Energy Management Solutions for Industry: Theory and Practice. 3 or 4 hours.

Emphasis on real world applications including: understanding utility billing and identifying costs; identifying and quantifying energy savings opportunities at industrial facilities; determining investment payback scenarios and considerations. Course Information: 3 undergraduate hours. 4 graduate hours. Extensive computer use required. Field work required. Extensive use of Microsoft Excel. Prerequisite(s): Junior standing or above.

ME 425. Second Law Analysis in Energy Engineering. 3 or 4 hours.

Fundamentals: lost available work. Entropy generation minimization, optimal thermal design of: heat transfer augmentation devices, thermal energy storage, cryogenics, heat exchangers, thermal insulations, solar collectors. Course Information: 3 undergraduate hours. 4 graduate hours. Prerequisite(s): ME 321.

ME 426. Applied Combustion. 3 or 4 hours.

Topics in combustion, providing both a theoretical and applied understanding of combustion processes as they relate to furnaces. Internal and external combustion engines; pollutant formation. Course Information: 3 undergraduate hours. 4 graduate hours. Prerequisite(s): ME 325.

ME 427. Solar Engineering. 3 or 4 hours.

Applications; solar geometry and intensities; applied heat transfer topics; flat plate and concentrating collectors; energy storage; analysis of heating and cooling systems. Course Information: 3 undergraduate hours. 4 graduate hours. Prerequisite(s): ME 321 or consent of the instructor.

ME 428. Numerical Methods in Mechanical Engineering. 3 or 4 hours.

Introduction to numerical solution methods for problems in mechanical engineering. Example problems include heat transfer, fluid mechanics, thermodynamics, mechanical vibrations, dynamics, stress analysis, and other related problems. Course Information: 3 undergraduate hours. 4 graduate hours. Prerequisite(s): CS 109. Open only to juniors and seniors.

ME 429. Internal Combustion Engines. 3 or 4 hours.

Introduction to engine types, characteristics and performance. Combustion processes in spark and compression ignition engines; combustion abnormalities. Analysis of intake, exhaust and fuel system. Course Information: 3 undergraduate hours. 4 graduate hours. Prerequisite(s): ME 325.

ME 433. Non-Equilibrium Thermal Processes. 3 or 4 hours.

Molecular engineering. Non-equilibrium statistical mechanics. Distribution functions. Molecular excitation and de-excitation. Ionization and dissociation. Laser engineering. Non-equilibrium chemical kinetics. Surface processes. Chemisorption and physisorption. Course Information: 3 undergraduate hours. 4 graduate hours. Prerequisite(s): ME 325 or consent of the instructor.

ME 441. Optical Methods in Mechanical Engineering. 0-4 hours.

Optical measurement techniques in solid mechanics and thermal-fluid engineering. Fundamentals of optics. Use of holography, interferometry, LDV, lasers, light scattering, diffraction, and other relevant techniques. Course Information: 3 undergraduate hours. 4 graduate hours. Prerequisite(s): Senior standing or consent of the instructor. Class Schedule Information: To be properly registered, students must enroll in one Laboratory and one Lecture-Discussion.

ME 444. Interdisciplinary Product Development I. 3 or 4 hours.

Systematic approach to the design process. Creative problem solving. Cross-functional teams (w/students from other departments/colleges) research and apply new product concepts to open-ended design problems. Course Information: Same as IE 444. 3 undergraduate hours. 4 graduate hours. Credit for ME 444 is not given if the student has credit in ME 396 or ME 397 or IE 396 or IE 397. Year-long (with IE/ME 445) project course. Prerequisite(s): ME 347 and IE 201; or IE 345 and IE 201; and senior standing or above; and consent of the instructor.

ME 445. Interdisciplinary Product Development 2. 4 hours.

Systematic approach to the design process. Creative problem solving. Cross-functional teams (w/students from other departments/colleges) research and apply new product concepts to open-ended design problems. Focus on solutions to the opportunities. Course Information: Same as IE 445. Credit is not given for ME 445 if the student has credit in ME 396 or ME 397 or IE 396 or IE 397. Year-long (with IE/ME 444) project course. Prerequisite(s): IE 444 or ME 444; and senior standing or above; and consent of the instructor.

ME 449. Microdevices and Micromachining Technology. 0-5 hours.

Microfabrication techniques for microsensors, microstructures, and microdevices. Selected examples of physical/chemical sensors and actuators. Simulation experiments. Course Information: Same as ECE 449. 4 undergraduate hours. 5 graduate hours. Laboratory. Prerequisite(s): ECE 347; or consent of the instructor. Class Schedule Information: To be properly registered, students must enroll in one Laboratory and one Lecture-Discussion.

ME 450. Air Pollution Engineering. 3 or 4 hours.

Environmental aspects of combustion processes, pollutant formation. Control of pollutants and particulates. Air quality control. Fundamentals of combustion. Course Information: Same as CHE 450. 3 undergraduate hours. 4 graduate hours. Prerequisite(s): ME 321 or consent of the instructor.

ME 464. Virtual Automation. 0-4 hours.

Fundamentals of manufacturing and automation modeling using CAD/CAM and computer-integrated manufacturing methods; concepts of virtual manufacturing; industrial robots and automated factory models within virtual environments. Course Information: Same as IE 464. 3 undergraduate hours. 4 graduate hours. Prerequisite(s): CS 107 or CS 108. Class Schedule Information: To be properly registered, students must enroll in one Lecture-Discussion, and one Laboratory.

ME 468. Virtual Manufacturing. 3 or 4 hours.

Virtual reality applications in manufacturing systems design, manufacturing applications of networked virtual reality, virtual reality modeling of occupational safety engineering. Course Information: Same as IE 468. 3 undergraduate hours. 4 graduate hours. Prerequisite(s): CS 107 or CS 108.

ME 481. Additive Manufacturing Process. 3 or 4 hours.

Covers aspects of additive manufacturing. The types that are covered are generic process, design, vat photopolymerization, extrusion based, jetting, direct writing, 3D bio-printing, powder bed fusion, slicing, and data representation. Course Information: Same as IE 481. 3 undergraduate hours. 4 graduate hours. Recommended background: Manufacturing Processes.

ME 494. Special Topics in Mechanical Engineering. 3 or 4 hours.

Particular topics vary from term to term depending on the interests of the students and the specialties of the instructor. Course Information: 3 undergraduate hours. 4 graduate hours. May be repeated. Prerequisite(s): Consent of the instructor.

ME 496. Undergraduate Senior Design Thesis I. 0-8 hours.

Introduction to the principles and practice of product design: specifications, evaluation of design alternatives, technical reports, and oral presentations, through independent design projects. Course Information: Same as IE 496. Credit only given to nondegree students. No graduation credit given to students enrolled in Engineering. Extensive computer use required. Field trips required at a nominal fee. Prerequisite(s): Consent of the instructor.

ME 497. Undergraduate Senior Design Thesis II. 0-8 hours.

Introduction to engineering design and research methods: design tools, product conception and development, simulation, prototyping, technical reports and presentations, literature survey and undergraduate thesis. Course Information: Same as IE 497. Credit only given to nondegree students. No graduation credit given to students enrolled in Engineering. Extensive computer use required. Field trips required at a nominal fee. Prerequisite(s): Consent of the instructor.

ME 499. Professional Development Seminar. 0 hours.

Students are provided general information about their role as UIC MIE alumni in society and the role of the University in their future careers. Students provide evaluations of their educational experience in the MIE department. Course Information: Same as IE 499. Satisfactory/Unsatisfactory grading only. Prerequisite(s): Open only to seniors; and approval of the department. Must be taken in the student's last semester of study.