

MECHANICAL ENGINEERING

At the undergraduate level, the Department of Mechanical Engineering offers an ABET-accredited Bachelor of Science in Mechanical Engineering. Additional information is available in that program's section of this catalogue.

REGULATIONS

Students pursuing the Bachelor of Science in Mechanical Engineering are subject to the Academic Standards in CEMS outlined in this catalogue.

Students may apply no more than 4 credits graded D, D+ or D- in any engineering (BME, CEE, CMPE, EE, ENGR or ME) course toward the degree.

In order to earn the Bachelor of Science in Mechanical Engineering, students must achieve a minimum 2.00 GPA in all Engineering (BME, CEE, CMPE, EMGT, ENGR, EE, ME), Mathematics, Statistics, Physics, Chemistry and Computer Science coursework.

MAJORS

MECHANICAL ENGINEERING MAJORS

Mechanical Engineering B.S.ME.

MINORS

MECHANICAL ENGINEERING MINORS AND UNDERGRADUATE CERTIFICATES

Sustainable Energy Engineering - Undergraduate Certificate

Autonomy and Robotics - Undergraduate Certificate

GRADUATE

See the online Graduate Catalogue for more information.

Courses

ME 1010. First-Year Design Experience. 0 or 2 Credits.

Project-based. Introduction to the engineering profession and design. Hands-on experiences that emphasize interdisciplinary teamwork, technical communications, and project design methodologies.

ME 1020. Engineering Shop Experience. 0 or 1 Credits.

Introduction to the machine shop and fabrication lab environments; shop safety; proper use of essential shop tools; machining techniques. Prerequisite: ENGR 1020.

ME 1120. Dynamics. 3 Credits.

Kinematics and kinetics of particles and rigid bodies in two and three dimensions. Computer-aided analysis. Prerequisite: CEE 1100, MATH 2248.

ME 1140. Mechanics of Solids. 3 Credits.

Stress, strain, temperature relationships, torsion, bending stresses and deflections. Columns, joints, thin-walled cylinders. Combined stresses and Mohr's circle. Prerequisites: CEE 1100 with a grade of C- or better or CEE 1150 with a grade of C- or better. Cross-listed with: CEE 2100.

ME 1210. Thermodynamics. 3 Credits.

Principles of engineering thermodynamics; work, heat, and phase change; energy conservation in closed and open systems; thermodynamic cycles; entropy and the second law. Prerequisites: MATH 1248 or MATH 1242, PHYS 1500 or PHYS 1600, CHEM 1400.

ME 1220. Applied Thermodynamics. 3 Credits.

Analysis of isentropic processes, gas, vapor and combined power cycles; refrigeration/heat pump cycles; relationships for ideal and real gases; gas mixtures and psychrometric applications. Prerequisite: ME 1210 with a C- minimum. Catamount Core: SU.

ME 1310. Intro to Robotics and Coding. 1 Credit.

Introduction to computational engineering for data science and robotics in python. Prerequisite: CS 1210.

ME 1510. Computational Mech Engr Lab. 1 Credit.

Introduction to finite element analysis, solid modeling, and stress-strain analysis with post-processing techniques. Prerequisite: CEE 1100. Co-requisite: ME 1140 or CEE 2100.

ME 1990. Special Topics. 1-18 Credits.

See Schedule of Courses for specific titles. One to three hours with Instructor approval.

ME 1991. Internship. 1-3 Credits.

On-site supervised work experience combined with a structured academic learning plan directed by a faculty member or a faculty-staff team in which a faculty member is the instructor of record, for which academic credit is awarded. Offered at department discretion.

ME 1993. Independent Study. 1-18 Credits.

ME 2110. Materials Engineering. 3 Credits.

Atomic structure, crystalline structure, mechanical properties and testing of materials, phase equilibria, processing of metals, polymers, and ceramics. Prerequisite: ME 1140.

ME 2111. Materials and Mechanics Lab. 0 or 2 Credits.

Experimentation, engineering measurements, and data analysis in solid mechanics. Instrumentation for dynamic measurements. Photoelasticity. Mechanical testing and heat treatments of engineering materials. Prerequisite: ME 1140. Pre/Co-requisite: ME 2110.

ME 2120. System Dynamics. 3 Credits.

Project-based. Modeling of systems with mechanical, electrical, fluid, and thermal elements. Linear systems analysis. Response of vibratory and feedback systems. Computer simulation. Prerequisite: ME 1120. Co-requisite: MATH 2522 or MATH 2544.

ME 2230. Fluid Mechanics. 3 Credits.

Fluid pressure distributions; integral control volume systems; differential relations for a fluid particle; dimensional similarity; viscous flow in ducts; boundary layer flows; inviscid incompressible flows. Prerequisites: ME 1120, ME 1140 or CEE 2100, ME 1210, MATH 3201.

ME 2231. Thermo-Fluid Lab. 0 or 2 Credits.

Engineering measurements, data analysis and theory of experimentation. Experiments with fluids and material testing machines and instrumentation for dynamic measurements. Prerequisites: ME 1120, ME 1140 or CEE 2100, ME 1210, MATH 3201. Co-requisite: ME 2230.

ME 2240. Heat and Mass Transfer. 3 Credits.

One- and two-dimensional steady and unsteady thermal conduction; natural and forced internal and external convection; thermal radiation; heat exchangers; boiling and condensation heat transfer; mass transfer; heat and mass transfer in the context of global citizenship. Prerequisite: ME 2230. Catamount Core: GC1.

ME 2310. Design of Elements. 3 Credits.

Mechanical fatigue criteria, fatigue analysis and design of springs, bolted/welded joints, gearing, shafts, bearings, power transmission. Computer-aided design and analysis. Prerequisite: Junior standing; ME 1140.

ME 2910. Senior Thesis. 3 Credits.

Investigation of a research or design project under supervision of assigned staff member culminating in acceptable thesis. Prerequisite: Senior standing; department permission.

ME 2990. Special Topics. 1-18 Credits.

See Schedule of Courses for specific titles. Prerequisite: Senior standing in Civil or Mechanical Engineering.

ME 2991. Internship. 1-18 Credits.

On-site supervised work experience combined with a structured academic learning plan directed by a faculty member or a faculty-staff team in which a faculty member is the instructor of record, for which academic credit is awarded. Offered at department discretion.

ME 2993. Independent Study. 1-18 Credits.

A course which is tailored to fit the interests of a specific student, which occurs outside the traditional classroom/laboratory setting under the supervision of a faculty member, for which credit is awarded. Offered at department discretion.

ME 2994. Teaching Assistantship. 1-3 Credits.

Undergraduate student service as a teaching assistant, usually in an introductory level course in the discipline, for which credit is awarded. Offered at department discretion.

ME 2995. Undergraduate Research. 1-18 Credits.

Undergraduate student work on individual or small team research projects under the supervision of a faculty member, for which credit is awarded. Offered at department discretion.

ME 2996. College Honors. 1-6 Credits.

Honors studies leading to a thesis.

ME 3060. Integrated Product Dev. 3 Credits.

Project-based course focusing on the entire product life cycle. Team dynamics, process and product design, quality, materials, management, and environmentally-conscious manufacturing. Prerequisite: Senior standing. Cross-listed with: BUS 3360. Catamount Core: QR.

ME 3170. Structural Dynamics. 3 Credits.

Vibrations, matrices, earthquake engineering, stability and wave propagation. Prerequisites: Senior/Graduate standing in Engineering or physical sciences, or Instructor permission. Cross-listed with: CEE 3720.

ME 3230. Incompressible Flow. 3 Credits.

Intermediate treatment of incompressible fluid flow; Navier-Stokes equations; two-dimensional potential flows; wing theory; vorticity and vortex structures; laminar and turbulent boundary layers. Prerequisites: ME 2230 or equivalent.

ME 3250. Compressible Flow. 3 Credits.

Theory of compressible flow. Normal and oblique shocks; expansion waves; unsteady wave motion; method of characteristics; linearized external flows; conical and 3D flows. Prerequisite: ME 2230 or equivalent.

ME 3260. Renewable Energy Harvesting. 3 Credits.

Covers the engineering fundamentals of different renewable energy technologies, including wind power, tidal power, solar power, biomass, hydropower, etc. Focus placed on the mathematical derivation and application of small scale vibration energy harvesting technologies. Prerequisite: ME 2230 or CEE 3600.

ME 3271. Air Breathing Propulsion. 3 Credits.

Presents a study on air-breathing propulsion systems. Initial focus will be on various types of engine systems, real and ideal parametric cycle analysis, and individual internal component performance. Will then move to contemporary propulsion topics and research that push aerospace systems to new flight envelopes. Prerequisites: ME 2240, ME 3250.

ME 3310. Machinery Analysis & Synthesis. 3 Credits.

Kinematic and kinetic analysis of two- and three-dimensional machines; kinematic synthesis, electromechanical and servo mechanisms; application to robotic mechanisms. Prerequisite: Senior standing in ME.

ME 3320. Control Systems. 3 Credits.

Analysis and design of continuous and discrete-time control systems; stability, signal flow, performance criteria, classical and state variable methods, simulation design tools, computer-based realizations. Credit not given for more than one of the courses EE 3515, ME 3320. Prerequisites: EE 3150 or ME 2120. Cross-listed with: EE 5530.

ME 3330. Mechanical Vibrations. 3 Credits.

Analysis, measurement, and control of mechanical vibrations; SDOF, MDOF, and rotating systems, forced, free, and random vibrations. Prerequisite: ME 2120 or Senior/Graduate standing in engineering or physical sciences.

ME 3390. Modern Manufacturing Processes. 3 Credits.

Product development, product design, concurrent engineering, rapid prototyping, semiconductor manufacturing, metal and plastic products manufacturing, EDM, ECM, laser, ultrasonic and high energy forming methods, biotechnology. Prerequisite: Junior standing in Mechanical Engineering.

ME 3410. Biomaterials Engineering. 3 Credits.

A materials science and engineering approach is used to explore the structure-function relationships of natural and bio-inspired materials for various engineering applications. The emphasis is on mechanical design and function. The medical applications of biomaterials will be discussed. Prerequisite: ME 2110 or BME 3600. Cross-listed with: BME 3410.

ME 3460. Biomechanics of Human Motion. 3 Credits.

Biomechanics of Human Motion will describe the typical processes—from small scale protein interactions to large scale joint torques—that result in human locomotion. Clinical problems and athletic performance will be discussed. Students will learn about musculoskeletal tissues related to force generation/transmission and will perform kinematic/kinetic analyses. Prerequisites: BME 2000 or ME 1120. Pre/Co-requisites: ME 2110 or ME 2120 or BME 3000. Cross-listed with: BME 3460.

ME 3480. Biomechanics: Tissue Engr. 3 Credits.

Solid biomechanics including structure, function and mechanical properties of biological tissues. Tissue engineering involving cell mechanics, scaffold materials, and signaling. Current literature topics are covered. Prerequisites: ME 2110 or BME 3600. Cross-listed with: BME 3480.

ME 3530. Computational Fluids Engr. 0 or 3 Credits.

Project-based. Computational methods for solving the Navier-Stokes equations and combined thermo-fluid flows; finite-differences and finite-volume techniques; use of standard commercial CFD software. Prerequisite: ME 2230 or equivalent.

ME 3820. Seminar. 1 Credit.

Presentation and discussion of advanced mechanical engineering problems and current developments. Prerequisite: Senior/Graduate engineering enrollment.

ME 3899. Cooperative Ed Experience. 12 Credits.

On-site, full-time, supervised work experience that satisfies the educational objectives defined by the Department of Mechanical Engineering co-op program. Prerequisite: Senior standing.

ME 3990. Special Topics. 1-18 Credits.

Content is dictated by expanding professional interest in newly developing, or recently developed, technical areas in which there is particular need or opportunity. Prerequisite: Senior/Graduate standing.

ME 3991. Internship. 1-18 Credits.

On-site supervised work experience combined with a structured academic learning plan directed by a faculty member or a faculty-staff team in which a faculty member is the instructor of record, for which academic credit is awarded. Offered at department discretion.

ME 3993. Independent Study. 1-18 Credits.

A course which is tailored to fit the interests of a specific student, which occurs outside the traditional classroom/laboratory setting under the supervision of a faculty member, for which credit is awarded. Offered at department discretion.

ME 3994. Teaching Assistantship. 1-3 Credits.

Undergraduate student service as a teaching assistant, usually in an introductory level course in the discipline, for which credit is awarded. Offered at department discretion.

ME 3995. Undergraduate Research. 1-18 Credits.

Undergraduate student work on individual or small team research projects under the supervision of a faculty member, for which credit is awarded. Offered at department discretion.

ME 4010. Capstone Design I. 3 Credits.

Project-based course. Multidisciplinary teams apply their knowledge to design, analyze, build and test a functional prototype that meets client's requirements and solves unique problems. Teams follow engineering design and project management processes such as periodic reports, presentations, meetings, reviews and demonstrations using standard industry tools. Prerequisite: Senior standing in Mechanical or Biomedical Engineering or Instructor permission. Cross-listed with: EE 4100.

ME 4020. Capstone Design II. 0 or 3 Credits.

Project-based course. Multidisciplinary teams apply their knowledge to design, analyze, build and test a functional prototype that meets client's requirements and solves their problems. Teams follow engineering design and project management processes such as periodic reports, presentations, meetings, reviews and demonstrations using standard industry tools. Prerequisite: ME 4010. Cross-listed with: EE 4200.

ME 4990. Special Topics. 1-18 Credits.

See Schedule of Courses for specific titles.