

# MECHANICAL ENGINEERING (ME)

## ME 2015. Introduction to Computing for Mechanical Engineers. (1 Credit)

Basic programming logic using programming languages common in industry. Application of programming to mechanical engineering problems.

CSE 1010.

View Classes (<https://catalog.uconn.edu/course-search/?details&code=ME%202015>)

## ME 2016. Introduction to Computational Fluid Dynamics. (1 Credit)

Basic operation of Computational Fluid Dynamics software. Emphasis on evaluation and analysis of the solutions in the context of practical problems.

View Classes (<https://catalog.uconn.edu/course-search/?details&code=ME%202016>)

## ME 2017. Introduction to Finite Element Analysis. (1 Credit)

Practice-oriented introduction to Finite Element Analysis for computational simulation of the behavior of continuous mechanical systems. Emphasis on the use of software for the analysis workflow, and on evaluation of the solution for practical problems.

View Classes (<https://catalog.uconn.edu/course-search/?details&code=ME%202017>)

## ME 2120. Applied Mechanics II. (3 Credits)

(Also offered as CE 2120.) Fundamentals of dynamics using vector methods. Rectilinear and curvilinear motion, translation, rotation, plane motion; work, energy, and power; impulse and momentum. CE 2110; MATH 2110Q or MATH 2130Q. May not be taken for credit after PHYS 3101.

View Classes (<https://catalog.uconn.edu/course-search/?details&code=ME%202120>)

## ME 2140. Computer-Aided Design and Manufacturing. (3 Credits)

Basic Computer-Aided Design (CAD) software. Isometric/Orthogonal views and geometric tolerancing exercises will be conducted by hand and with CAD software. General manufacturing techniques. Introduction to CNC principles and GCODE.

View Classes (<https://catalog.uconn.edu/course-search/?details&code=ME%202140>)

## ME 2193. International Study. (1-6 Credits)

Special engineering topics taken in an international study program. May count toward the major with consent of the advisor and approved plan of study.

May be repeated for a total of 6 credits

View Classes (<https://catalog.uconn.edu/course-search/?details&code=ME%202193>)

## ME 2233. Thermodynamic Principles. (3 Credits)

Introduction to the First and Second Laws of Thermodynamics. Thermodynamic properties of pure substances and ideal gases. Analysis of ideal and real processes - including turbines, pumps, heat exchangers, and compressors.

CHEM 1127Q or both CHEM 1124Q and CHEM 1125Q; PHYS 1401Q or PHYS 1501Q; MATH 2110Q, which may be taken concurrently. May not be taken out of sequence after passing ME 3232, 3242, or 3250.

View Classes (<https://catalog.uconn.edu/course-search/?details&code=ME%202233>)

## ME 2234. Applied Thermodynamics. (3 Credits)

Thermodynamic first and second law analysis of vapor and gas cycles, property relations for simple pure substances, properties of ideal gas mixtures, psychrometry, fundamentals of combustion thermodynamics, application of thermodynamics in the design of thermal engineering systems.

ME 2233 or CHEG 2111. May not be taken out of sequence after passing ME 3232 or 3276.

View Classes (<https://catalog.uconn.edu/course-search/?details&code=ME%202234>)

## ME 3130. Advanced Engineering Mathematics. (3 Credits)

Linear algebra, systems of linear equations, eigenvalues, vector calculus and integral theorems, series solutions to ordinary differential equations, Laplace and Fourier transforms, solution to partial differential equations. The course stresses on the application of mathematics and methods to solve engineering problems rather than derivation of mathematical theorems. Applications include structural analysis, vibration, control systems, heat transfer, and fluid dynamics.

MATH 2410Q; ME 2015.

View Classes (<https://catalog.uconn.edu/course-search/?details&code=ME%203130>)

## ME 3161. Introduction to Robotics. (3 Credits)

(Also offered as ECE 3161.) Fundamentals of mathematical modeling of robots commonly found in industrial and household domains. History of robots with multidisciplinary applications, robot classifications, coordinate frame transformations, modeling rigid body motions, forward and inverse kinematics, velocity kinematics. Course includes project work.

Corequisite: MATH 2210; Recommended preparation: ECE 1401 and either ECE 3101 or ME 3253 or ME 3254 or BME 3400.

View Classes (<https://catalog.uconn.edu/course-search/?details&code=ME%203161>)

## ME 3162. Robot Motion Planning. (3 Credits)

(Also offered as ECE 3162.) The fundamentals of motion planning of robots. Topics include sensing systems for obstacle avoidance and environment mapping, robot localization, shortest path planning using potential field-based, grid-based and sampling-based methods, coverage path planning using cellular decomposition, spanning trees and potential fields, deep neural networks and their application to path planning, motion planning under constraints, adaptive planning in changing environments. Course includes project work.

Open only to students in the College of Engineering. Corequisite: MATH 2210Q. Recommended preparation: ECE/ME 3161; ECE 1401, 3411; CSE 2050, 3500; and either ECE 3101 or ME 3253 or 3254.

View Classes (<https://catalog.uconn.edu/course-search/?details&code=ME%203162>)

## ME 3163. Robot Control and Dynamics. (3 Credits)

(Also offered as ECE 3163.) Basic concepts of robot manipulator modeling and control including joint space and task space control, Euler-Lagrange dynamics, independent joint control, whole robot manipulator control, robot control using visual feedback, robot control with trajectory planner. The course will include robot controller implementation via a course project and practical examples throughout the course.

ECE/ME 3161; ECE 3111 or ME 3253 or ME 3254; open only to students in the School of Engineering.

View Classes (<https://catalog.uconn.edu/course-search/?details&code=ME%203163>)

**ME 3193. International Study. (1-6 Credits)**

Special engineering topics taken in an International study program. May count toward the major with consent of the advisor and approved plan of study.

May be repeated for a total of 6 credits

View Classes (<https://catalog.uconn.edu/course-search/?details&code=ME%203193>)

**ME 3214. Dynamics of Particles and Rigid Bodies. (3 Credits)**

Kinematics and dynamics of particles. Motion relative to translating and rotating observers; inertial reference systems; central forces and orbits. Kinematics and dynamics of groups of particles and rigid bodies. Lagrangian description of motion.

CE 2120.

View Classes (<https://catalog.uconn.edu/course-search/?details&code=ME%203214>)

**ME 3217. Metal Cutting Principles. (3 Credits)**

Examination of metal cutting processes including turning, shaping, drilling, grinding. Mechanics of two and three dimensional cutting. Principles and mechanisms of wear. Tool materials. Theoretical prediction of surface finish. Chemistry of cutting fluids. Laboratory period includes operation of machine tools. Experimental determination of cutting energies forces, stresses and strains. The interrelationship between these and practical metal cutting conditions.

CE 3110, which may be taken concurrently.

View Classes (<https://catalog.uconn.edu/course-search/?details&code=ME%203217>)

**ME 3220. Mechanical Vibrations. (3 Credits)**

Free and forced vibrations, with damping, of linear systems with one and two degrees of freedom. Transient vibrations. Vibration isolation. Rigid rotor balancing. Elements of Laplace transforms.

ME 3253; MATH 2110Q and 2410Q; CE 2120. May not be taken out of sequence after passing ME 3232.

View Classes (<https://catalog.uconn.edu/course-search/?details&code=ME%203220>)

**ME 3221. Manufacturing Automation. (3 Credits)**

Introduction to Computer Integrated Manufacturing (CIM). Fundamentals of automated manufacturing; Computer Numerical Control (CNC); production economics and optimization of production systems. Instructor consent.

View Classes (<https://catalog.uconn.edu/course-search/?details&code=ME%203221>)

**ME 3222. Production Engineering. (3 Credits)**

Introduction to the modern techniques of Production Systems including the Decision-Making Process, Economic Analysis, Demand Forecasting, Production and Process Design and Optimization, Production Scheduling, and Statistical Quality Control.

Instructor consent.

View Classes (<https://catalog.uconn.edu/course-search/?details&code=ME%203222>)

**ME 3224. Analysis and Design of Mechanisms. (3 Credits)**

Application of kinematics in the analysis and synthesis of mechanisms.

Type and dimensional design of linkages, cams and gears based on motion requirements and kinetostatic force transmission, in contrast to the strength requirements. Graphical, analytical and computer methods in analysis and design of mechanisms. Design considerations in mechanism synthesis. Design project.

MATH 2110Q and 2410Q; CE 2110.

View Classes (<https://catalog.uconn.edu/course-search/?details&code=ME%203224>)

**ME 3225. Computer-Aided Design, Modeling, and Graphics. (3 Credits)**

Introduction to computer-aided graphics, modeling and design.

Applications of graphics software and hardware with mini- and micro-computer systems. Interactive computer graphic techniques. Extensive laboratory study of wire-frame and raster computer graphics. Static and dynamic graphic presentation methods.

CSE 1010 or 1100; CE 3110; MATH 2110Q.

View Classes (<https://catalog.uconn.edu/course-search/?details&code=ME%203225>)

**ME 3227. Design of Machine Elements. (3 Credits)**

Application of the fundamentals of engineering mechanics, materials and manufacturing to the design and analysis of machine elements.

CE 3110.

View Classes (<https://catalog.uconn.edu/course-search/?details&code=ME%203227>)

**ME 3228. Introduction to Fatigue in Mechanical Design. (3 Credits)**

Design calculation methods for fatigue life of engineering components.

Crack initiation and crack propagation fatigue lives; introduction to current literature in the field. Emphasis on finite life prediction by strain life methods.

CE 3110. Not open to students who have passed ME 5431.

View Classes (<https://catalog.uconn.edu/course-search/?details&code=ME%203228>)

**ME 3230. Biosolid Mechanics. (3 Credits)**

Contemporary topics on applications of nonlinear solid mechanics to modeling of biological tissues and design of biomedical devices. Study of the theoretical aspects of nonlinear solid mechanics including kinematics, stretch, stress and hyperelastic material models along with review of current literature. Stress analysis of soft biological tissues, tissue functions and disorders, and interventional device design. The modern techniques pertinent to mechanical testing, computational modeling and simulation of soft biological tissue behaviors will also be discussed. Students are expected to review literature and actively participate in classroom discussion.

CE 3110.

View Classes (<https://catalog.uconn.edu/course-search/?details&code=ME%203230>)

**ME 3232. Automotive Engineering. (3 Credits)**

Applied course in automotive systems and components, including topics on engine thermodynamics, combustion process, solid mechanics of components, suspension geometry and dynamics; includes a team project in designing a system or a component of a typical collegiate FSAE car.

ME 2233, 2234, 3220; CE 2110, 2120.

View Classes (<https://catalog.uconn.edu/course-search/?details&code=ME%203232>)

**ME 3239. Combustion for Energy Conversion. (3 Credits)**

Introduction to combustion processes and chemical kinetics. Mechanism of the formation of pollutants such as nitrogen oxides, carbon monoxide, soot, and unburned hydrocarbons in stationary and vehicular power plants.

ME 2234.

View Classes (<https://catalog.uconn.edu/course-search/?details&code=ME%203239>)

**ME 3242. Heat Transfer. (3 Credits)**

Fundamentals of conduction, convection, and radiation heat transfer. Application of the general laws of heat transfer, and heat exchange to a wide variety of practical problems. The analytical, numerical, and graphical solution of one, two, and three dimensional problems. ME 2233 and 3250.

View Classes (<https://catalog.uconn.edu/course-search/?details&code=ME%203242>)

**ME 3250. Fluid Dynamics I. (3 Credits)**

Laws of conservation of mass, momentum, and energy in fluid systems, fluid statics, dimensional analysis, incompressible, inviscid and viscous flows, steady and unsteady flows, internal and external flows.

ME 2232E or ME 2233; MATH 2110Q; MATH 2410Q. Corequisite: Math 2410Q. May not be taken for credit after passing CE/ENVE 3120. May not be taken out of sequence after passing ME 3242, 3251, 3270, 3275, 3276, 3280, or 4972.

View Classes (<https://catalog.uconn.edu/course-search/?details&code=ME%203250>)

**ME 3251. Fluid Dynamics II. (3 Credits)**

One-dimensional compressible flow with applications to propulsion systems and gas-dynamic testing devices. Flows with friction and heat addition. Normal and oblique shock waves. Prandtl-Meyer flow. Selected topics in liquid flow.

ME 3250 or CE 3120.

View Classes (<https://catalog.uconn.edu/course-search/?details&code=ME%203251>)

**ME 3253. Linear Systems Theory. (3 Credits)**

Review of ODE Solutions, mathematical modeling of dynamic systems, linearization of nonlinear behavior, Laplace domain representation of dynamics, transfer functions, block diagram algebra, signal-flow graphs, Mason's rule, transient analysis of system response, convolution integral, Duhamel's integral, Green's function, stability of linear systems, Routh-Hurwitz method, root locus, frequency response, Bode and polar representations, introduction to feedback systems.

CE 2120; MATH 2410Q. May not be taken out of sequence after passing ME 3220.

View Classes (<https://catalog.uconn.edu/course-search/?details&code=ME%203253>)

**ME 3254. Linear Systems Theory. (3 Credits)**

Introduction to block diagram algebra, signal-flow graphs, Mason's rule, transient analysis of system response, convolution integral, Duhamel's integral, Green's function, stability of linear systems, Routh-Hurwitz method, root locus, frequency response, Bode and polar representations, introduction to feedback systems.

ME 3130.

View Classes (<https://catalog.uconn.edu/course-search/?details&code=ME%203254>)

**ME 3255. Computational Mechanics. (3 Credits)**

Topics include elementary numerical analysis, finite differences, initial value problems, ordinary and partial differential equations and finite element techniques. Applications include structural analysis, heat transfer, and fluid flow.

MATH 2410Q and CE 3110.

View Classes (<https://catalog.uconn.edu/course-search/?details&code=ME%203255>)

**ME 3256W. Data-Driven Decisions and Technical Communications. (3 Credits)**

Integration of Monte Carlo analysis—a powerful probabilistic modeling technique—with technical communication. How to effectively communicate results from Monte Carlo methods for both technical and non-technical audiences. Probability modeling, Monte Carlo simulation, statistical analysis, and the creation of technical reports and presentations.

CSE 1010; ENGL 1007 or 1010 or 1011 or 2011.

View Classes (<https://catalog.uconn.edu/course-search/?details&code=ME%203256W>)

**ME 3262. Applied Measurements and Data Analysis. (3 Credits)**

Introduction to the design and behavior of common sensors, highlighting their proper use and physical limitations. Hands-on laboratory experiences include measurements in energy conversion, solid mechanics, dynamics, and fluid and thermal sciences, as well as application of statistical methods to analysis of experimental data. ECE 2000 and ME 2233, both of which may be concurrent. Cannot be taken after passing ME 4973.

View Classes (<https://catalog.uconn.edu/course-search/?details&code=ME%203262>)

**ME 3263. Introduction to Sensors and Data Analysis. (3 Credits)**

Introduction to the design and behavior of common sensors, highlighting their proper use and physical limitations. In the lab, each type of sensor is used in a practical engineering problem, with data being taken via data acquisition software. Data analysis techniques, including Gaussian statistics, uncertainty analysis, frequency domain studies, are also covered and used on the acquired data.

ME 2233; PHYS 1230 or PHYS 1402Q or PHYS 1502Q or PHYS 1530; CE 2110.

View Classes (<https://catalog.uconn.edu/course-search/?details&code=ME%203263>)

**ME 3264. Applied Measurements Laboratory. (3 Credits)**

Application of fundamental measurement techniques developed in ME 3263 to various mechanical systems and processes. Hands-on laboratory experiences include measurements in energy conversion, solid mechanics, dynamics, and fluid and thermal sciences, as well as statistical methods to analysis of experimental data.

ME 3263 and ME 2234.

View Classes (<https://catalog.uconn.edu/course-search/?details&code=ME%203264>)

**ME 3266. Principles of Optimum Design. (3 Credits)**

Application of mathematical optimization concepts to the numerical solution of engineering design problems. Heuristic methods for the solution of optimization problems for which efficient gradient-based solution methods cannot be used. When and how to cast a design problem into an optimization problem, choosing an appropriate algorithm to solve it, how to interpret the results of the optimization, and how to diagnose problems when things go wrong.

View Classes (<https://catalog.uconn.edu/course-search/?details&code=ME%203266>)

**ME 3270. Fuel Cells. (3 Credits)**

Advanced course on fuel cells as an alternative energy conversion technology. Subjects covered include: thermodynamics and electrochemistry of fuel cells, operating principles, types of fuel cells, overview of intermediate/high temperature fuel cells, polymer electrolyte fuel cells and direct methanol fuel cells.

ME 2233 and 3250.

View Classes (<https://catalog.uconn.edu/course-search/?details&code=ME%203270>)

**ME 3275. Introduction to Computational Fluid Dynamics. (3 Credits)**

Computational fluid dynamics (CFD) based on pressure-based finite volume methods. Topics covered include: integral derivations of governing equations of fluid flow, finite volume discretization of diffusion and convection equations, pressure-velocity coupling algorithms based on SIMPLE method for flow field solutions and finite volume solutions of unsteady problems. The course also covers iterative and non-iterative solution methods for large systems of linear equations, as well as methods for verification and validation of computational solutions.

ME 3242, 3250.

View Classes (<https://catalog.uconn.edu/course-search/?details&code=ME%203275>)

**ME 3276. Propulsion. (3 Credits)**

Physical and chemical concepts of basic importance in modern propulsion systems, including rockets and air-breathing engines. Topics of interest include energy sources of propulsion, performance criteria, one-dimensional gas dynamics, chemical thermodynamics, deflagration, detonation, rocket flight performance, rocket staging, chemical rockets, electric propulsion, turboprop, turbofan, turbojet, ramjet, scramjet, cycle analysis, solar sails, etc.

ME 2234 and 3250.

View Classes (<https://catalog.uconn.edu/course-search/?details&code=ME%203276>)

**ME 3279. Honors Research. (3 Credits)**

May be used to convert independent research into course credit that may be applied toward the Honors Program requirements and will count as a technical elective. As part of the course, students will be involved in research programs of their choice in areas of emerging technologies. Research work will be directed by a Mechanical Engineering faculty member who serves as the research advisor for the course. Will typically involve collaborative efforts with graduate students and other researchers, and will provide significant independent problem solving experience to supplement the classroom experience obtained from traditional coursework.

Open to Honors students.

**Grading Basis:** Honors Credit

View Classes (<https://catalog.uconn.edu/course-search/?details&code=ME%203279>)

**ME 3280. Turbines and Centrifugal Machinery. (3 Credits)**

Review of fundamental fluids and thermodynamics. Introduction to compressible flow concepts. Theory, design and performance of centrifugal and axial flow machinery including turbines, blowers, fans, compressors, superchargers, pumps, fluid couplings and torque converters. A detailed study of the mechanics of the transfer of energy between a fluid and a rotor. Preparation for practical design of turbomachinery.

ME 3250.

View Classes (<https://catalog.uconn.edu/course-search/?details&code=ME%203280>)

**ME 3285. Sustainable Energy Sources and Systems. (3 Credits)**

Topics include current energy sources and usage, environmental pollution from use of fossil fuels, nuclear energy, biomass energy, geothermal energy resources and usage, hydroelectric, solar, wind and tidal energy conversion principles, hydrogen generation and usage in electrochemical devices, energy economics and effects of energy pricing on economically viable energy options.

ME 2234 and 3250 (which may be taken concurrently).

View Classes (<https://catalog.uconn.edu/course-search/?details&code=ME%203285>)

**ME 3295. Special Topics in Mechanical Engineering. (1-3 Credits)**

A classroom course on special topics as announced.

Prerequisites and recommended preparation vary.

May be repeated for credit

View Classes (<https://catalog.uconn.edu/course-search/?details&code=ME%203295>)

**ME 3296. Independent Research in Mechanical Engineering. (1-4 Credits)**

Designed primarily for students who wish to pursue academic research in a research group affiliated with Mechanical Engineering. The program of study is to be approved by the head of the department or director of undergraduate studies and by the instructor before registration is completed.

Instructor consent; open to Juniors or higher.

May be repeated for a total of 9 credits

View Classes (<https://catalog.uconn.edu/course-search/?details&code=ME%203296>)

**ME 3299. Problems in Mechanical Engineering. (1-4 Credits)**

Designed primarily for students who wish to pursue a special line of study or investigation. The program of study is to be approved by the head of the department or director of undergraduate studies and by the instructor before registration is completed.

Open only to juniors and seniors in mechanical engineering.

May be repeated for a total of 9 credits

View Classes (<https://catalog.uconn.edu/course-search/?details&code=ME%203299>)

**ME 3396. Honors Research. (1-4 Credits)**

May be used to convert independent research into course credit that may be applied toward the Honors Program requirements and will count as a technical elective. As part of the course, students will be involved in research programs of their choice in areas of emerging technologies. Research work will be directed by a Mechanical Engineering faculty member who serves as the research advisor for the course. Will typically involve collaborative efforts with graduate students and other researchers, and will provide significant independent problem solving experience to supplement the classroom experience obtained from traditional coursework.

Instructor consent; open to juniors or higher.

**Grading Basis:** Honors Credit

View Classes (<https://catalog.uconn.edu/course-search/?details&code=ME%203396>)

**ME 3970. Junior Design. (3 Credits)**

Principles of design are introduced. Fundamentals of project management, risk analysis, scheduling are covered. Effective technical presentation and writing techniques are introduced. Students conduct a design project through the semester.

ME 2140.

View Classes (<https://catalog.uconn.edu/course-search/?details&code=ME%203970>)

**ME 4161. Robotics Systems Laboratory. (3 Credits)**

(Also offered as ECE 4161.) Hands on introduction to autonomous robotics emphasizing the synergy between hardware (microprocessors, sensors, actuators), technology (optimization, control system, machine learning) and systems (integration, programming) to achieve perception, action, and behavior in real-world environment. Students will be able to apply principles of robot modeling, planning and control to the real-world platforms.

ECE/ME 3162; open only to students in the College of Engineering.

Corequisite: ECE/ME 3163.

View Classes (<https://catalog.uconn.edu/course-search/?details&code=ME%204161>)

**ME 4972. Senior Design Project I. (3 Credits)**

The first part of the senior design experience. It will cover topics on design process, planning, and costs. Design for manufacture and assembly will be covered. Both oral and written reports are required.

ME 3250; ME 3227, which may be taken concurrently. May not be taken out of sequence after passing ME 4973.

View Classes (<https://catalog.uconn.edu/course-search/?details&code=ME%204972>)

**ME 4973W. Senior Design Project II. (3 Credits)**

Projects which have started in the previous semester will be completed.

The project analysis, design, and manufacture stages will take place.

Both written and oral reports will be required.

ME 3260 or 3264, 3262 or 3263, and 4972; ENGL 1007 or 1010 or 1011 or 2011.

**Skill Codes:** Writing Competency

View Classes (<https://catalog.uconn.edu/course-search/?details&code=ME%204973W>)

**ME 4975. Senior Design Project I. (3 Credits)**

The first part of the senior design experience. It will cover topics on design process, planning, and costs. Design for manufacture and assembly will be covered. Both oral and written reports are required.

ME 3227 and 3970. May not be taken out of sequence after passing ME 4976.

View Classes (<https://catalog.uconn.edu/course-search/?details&code=ME%204975>)

**ME 4976. Senior Design Project II. (3 Credits)**

Projects which have started in the previous semester will be completed.

The project analysis, design, and manufacture stages will take place.

Both written and oral reports will be required.

ME 3262 and 4975.

View Classes (<https://catalog.uconn.edu/course-search/?details&code=ME%204976>)