MECHANICAL ENGINEERING

https://me.calpoly.edu (https://me.calpoly.edu/)

Mission Statement

To empower graduates with ethical and technical skills, fully prepared to contribute to industry, government, and academia. We prepare individuals for responsible practice in the art and science of mechanical engineering through a comprehensive undergraduate curriculum that emphasizes hands-on, collaborative experiences and embodies a Learn-By-Doing philosophy.

Program Educational Objectives

A mechanical engineering alumnus will:

1. Research, design, develop, test, evaluate, or implement engineering solutions to problems that are of a complexity encountered in professional practice.
2. Communicate and perform as an effective engineering professional in both individual and team-based project environments.
3. Recognize and determine the ethical implications and societal impacts of engineering solutions.
4. Continuously improve through lifelong learning.

Program Description

The profession of mechanical engineering is directed toward the design, manufacture, and system integration of a very wide variety of equipment ranging from manufacturing machinery and power generation equipment to consumer goods. Of central concern to mechanical engineers is the sound application of basic principles of solid mechanics, fluid mechanics and thermal sciences in the design, manufacture, and application of this equipment. Mechanical Engineering graduates obtain employment primarily with manufacturers, energy companies, consultants, and government agencies. Types of work performed by graduates include product design, mechanical design, testing, engineering management, engineering sales, design of manufacturing systems, and development of maintenance procedures. Mechanical Engineering graduates also often enhance their careers through graduate study in engineering, and some students also study engineering to build a scientific and technical foundation as a prelude to enrollment in medical, law, and business schools.

The focus of the Cal Poly Mechanical Engineering program is on education based on our "learn by doing" educational philosophy. Thus, the curriculum includes a large number of hands-on laboratories, integration of design throughout, and a senior project requirement for all students. Students are enrolled in engineering laboratories in all years of the curriculum. The program is accredited by the Engineering Accreditation Commission of ABET (https://www.abet.org/).

The Mechanical Engineering Department is the home of the Donald E. Bently Center for Engineering Innovation. The center provides support for faculty, students, and visiting scholars for the advancement of research, education, and practice in mechanical engineering. A $6 million endowment to fund three professorships supports the center.

Upper division students in the **General Curriculum** can choose professional elective courses from such courses as turbomachinery, robotics, mechatronics, composite materials, rotor dynamics, advanced mechanics, solar systems, internal combustion engines, heat and mass transfer, and courses emphasizing the petroleum, air conditioning, ventilating, and refrigeration industries. Students in the **Mechatronics Concentration** are prepared for professional practice in the design of “intelligent” products for use in factory automation, robotics, hybrid vehicles, alternative energy, and many other fields. The **HVAC&R Concentration** prepares students for careers in the heating, ventilating, air-conditioning and refrigeration (HVAC&R) industry, with a focus on the design of mechanical systems for commercial and industrial buildings. **Manufacturing Concentration** students focus on fabrication processes, preparing them for careers designing or manufacturing a wide variety of consumer and industrial products. The **Energy Resources Concentration** prepares students for careers in renewable and nonrenewable energy companies producing electrical power, with the focus on the design, manufacture, and system integration of power and fuel plants.

There are several organized student clubs associated with the Mechanical Engineering Department, including national honor societies and student chapters of professional societies. Each of these clubs offers students active programs and leadership activities.

Undergraduate Programs

- Mechanical Engineering (BS) (Solano Campus) (https://catalog.calpoly.edu/engineering/mechanical-engineering-bs-solano/)
- Mechanical Engineering (BS)(San Luis Obispo Campus) (https://catalog.calpoly.edu/engineering/mechanical/mechanical-engineering-bs/)

Graduate Programs

- Mechanical Engineering (MS) (https://catalog.calpoly.edu/engineering/mechanical/mechanical-engineering-ms/)

ME Courses

ME 1125 Introduction to Mechanical Engineering (1 unit)
Term Typically Offered: F, SP
Prerequisite: Mechanical Engineering major.

Design, analysis, testing and examination of mechanical engineering systems. Career opportunities, ethics, engineering social justice, and Mechanical Engineering curriculum and concentrations. Goal setting, degree planning, time management, growth mindset, effective learning strategies, and personal development. Intended for first-year Mechanical Engineering students. 1 laboratory. Formerly ME 128.

ME 1148 Engineering Design Communication (2 units)
Term Typically Offered: F, SP
Corequisite: IME 143 or IME 1143.

Communication of designs for manufacturing using points, lines, and planes in space. Pictorials, orthographic projection, section views, and auxiliary views. Computer-aided design (CAD) to create parts and assemblies. Dimensioned drawings for part fabrication. Fits and tolerances. 1 lecture, 1 laboratory. Formerly ME 129.

ME 2204 Introduction to Mechanics of Materials (2 units)
Term Typically Offered: TBD
Prerequisite: Consent of instructor.

Estimate stresses, strains, and deformations associated with axial, torsional, and flexural loading of bars, shafts, and beams. Analysis of elementary determinate and indeterminate mechanical and structural systems. Intended for new transfer students. Not open to students with credit in ENGR 2211. Course may be offered in classroom-based, online, or hybrid format. 2 lectures.

ME 2205 Engineering Career Preparation (1 unit)
Term Typically Offered: F

Offered at Solano Campus. Preparation and development of skills for establishing an engineering career. Resume and cover letter development, job search tools and utilization, developing networking skills, establishing interview skills. 1 lecture. Formerly ME 205 at Cal Maritime.

ME 2210 Engineering Statics (2 units)
Term Typically Offered: TBD
Prerequisite: MATH 241 or MATH 1262; and PHYS 141 or PHYS 1141.

Analysis of forces on engineering structures in equilibrium. Properties of forces, moments, couples, and resultants. Equilibrium conditions, friction, centroids, area moments of inertia. Not open to students with credit in ENGR 2211. Course may be offered in classroom-based, online, or hybrid format. 2 lectures. Formerly HNRS/ME 211.

ME 2212 Engineering Dynamics (3 units)
Term Typically Offered: F, SP, SU
Prerequisite: one of the following: ARCE 223, ARCE 2211, ENGR 2211, ME 211, or ME 2210.

Analysis of motions of particles and rigid bodies encountered in engineering. Kinematic relationships using both translating and rotating coordinate systems, relative motion, Newton's second law, work and energy, impulse and momentum, and 3D kinematics. Further development of mathematical modeling and problem solving. Course maybe offered in classroom-based or hybrid format. 3 lectures. Crosslisted as HNRS/ME 2212. Formerly HNRS 214/ME 212.

ME 2220 Computer Aided Engineering (2 units)
Term Typically Offered: F, SP

Offered at Solano Campus. Virtual product development and fundamentals of parametric design and solid modeling using advanced engineering software tools. Complex component design, assembly design and the development of working drawings. Participate in Team Design/Reverse Engineering Projects. 2 lectures. Formerly ME 220 at Cal Maritime.

ME 2225 Introduction to Mechanical Engineering for Transfers (1 unit)
Term Typically Offered: F
Prerequisite: Junior standing and Mechanical Engineering major.

Design, analysis, testing, and dissection of mechanical engineering systems. Career opportunities, ethics, engineering social justice, mechanical engineering curriculum and concentrations. Transfer student success-oriented goal setting, degree planning, time management, growth mindset, effective learning strategies, and personal development. Intended for new transfer students in the Mechanical Engineering major. 1 laboratory. Formerly ME 264.

ME 2230 Engineering Materials (3 units)
Term Typically Offered: F
Prerequisite: CHE 110 or CHE 1110; and CHE 110L or CHE 1110L.

Offered at Solano Campus. Examination of the properties of materials from the atomic level through the molecular levels, looking at crystal structure. Emphasis is on metals, but nonmetals are discussed. Mechanical properties, creep, fatigue, corrosion, and failure characteristics. Phase Diagrams and thermal processing are also studied. Applying material properties in design. 3 lectures. Formerly ME 230 at Cal Maritime.

ME 2232 Engineering Statics (3 units)
Term Typically Offered: F
Prerequisite: PHY 200 or PHY 2200.

Offered at Solano Campus. Analysis of particles and rigid bodies at rest, using vector methods. Concepts of forces, moments, and equivalent force systems, calculation and use of centroids, equilibrium of rigid bodies, force analysis of trusses, frames, and machines, internal forces in structural members, and friction. 3 lectures. Formerly ME 232 at Cal Maritime.

ME 2240 Applied Programming for Mechanical Engineering (1 unit)
Term Typically Offered: F, SP

Introduction to applied programming for mechanical engineering. Algorithms, selection structures and loops, and data visualization. Projects and assignments will apply programming to solve engineering problems. Not open to students with credit in CSC 231 or CSC 1031. 1 laboratory.

ME 2241 Engineering Thermodynamics (3 units)
Term Typically Offered: SP
Prerequisite: PHY 200 or PHY 2200.

Offered at Solano Campus. Basic principles of thermodynamics and their applications to engineering processes and cycles. First and second laws and the application of these laws to thermodynamic systems, with emphasis on power and refrigeration cycles. 3 lectures. Formerly ME 240 at Cal Maritime.

ME 2248 Design Using Solid Modeling (1 unit)
Term Typically Offered: F, SP
Prerequisite: One of the following: ME 129, ME 130, ME 228, or ME 1148.

Part and system, or assembly design solid modeling using current software. Techniques of advanced communication including weld symbols, threaded fasteners, dimensioning, and tolerancing. Create design layouts and part models with varied configurations and dynamic assembly models. 1 laboratory. Formerly ME 251.

ME 2270 Special Topics (1-4 units)
Term Typically Offered: TBD
Prerequisite: Consent of instructor.

Directed group study of special topics. The Class Schedule will list topic selected. Repeatable up to 8 units. Course may be offered in classroom-based, online, or hybrid format. 1 to 4 lectures. Formerly ME 270.

ME 2271 Special Laboratory (1-2 units)
Term Typically Offered: TBD
Prerequisite: Consent of instructor.

Directed group laboratory study of special topics. The Class Schedule will list topic selected. Repeatable up to 4 units. 1 to 2 laboratories. Formerly ME 271.

ME 3234 Design Thinking and Creativity (3 units)
Term Typically Offered: F, SP, SU
2026-28 or later: Upper-Div GE Area 4
2020-26 catalogs: Upper-Div GE Area D
Prerequisite: Junior standing; completion of GE Area 1 with grades of C- or better (GE Area A for the 2020-26 catalogs); completion of GE Area 2 with a grade of C- or better (GE Area B4 for the 2020-26 catalogs); and completion of one lower-division course in GE Area 4 (GE Areas D1 or D2 for the 2020-26 catalogs).

Conceptual engineering design with emphasis on problem definition, iterative prototyping, and testing through stakeholder feedback. Free-hand sketching to communicate design ideas. Design theories and accompanying practices. Professional engineering skills such as teamwork and communication through engagement in design challenges. 3 lectures. Fulfills GE Upper-Division 4 (GE Area Upper-Division D for students on the 2020-26 catalogs).

ME 3236 Engineering Measurement and Data Analysis (3 units)
Term Typically Offered: F, SP
2026-28 or later: Upper-Div GE Area 2/5
2020-26 catalogs: Upper-Div GE Area B
Prerequisite: Junior standing or Mechanical Engineering major; completion of GE Area 1 with grades of C- or better (GE Area A for the 2020-26 catalogs); CHEM 124 or CHEM 1120; MATH 141 or MATH 1261; PHYS 141 or PHYS 1141; and one of the following: CSC 101, CSC 231, CSC 232, CSC 1001, CSC 1031, CSC 1032, or ME 2240.

Introduction to laboratory practice, measurement, analysis and professional reporting of experiments. Statistics applied to engineering measurement and design. Measurement of common thermal and mechanical properties. 2 lectures, 1 laboratory. Fulfills GE Areas Upper-Division 2 or Upper-Division 5 (GE Area Upper-Division B for students on the 2020-26 catalogs).

ME 3302 Thermodynamics (3 units)
Term Typically Offered: F, SP, SU
Prerequisite: CHEM 124 or CHEM 1120; ENGR 2211; and MATH 241 or MATH 2263.

The First and Second Laws of Thermodynamics applied to engineering systems. Vapor, gas, power, refrigeration, and heat pump cycles are analyzed using energy and entropy balances. Thermodynamic property evaluation including psychrometrics. Course may be offered in classroom-based, online, or hybrid format. 3 lectures. Formerly ME 303.

ME 3305 Mechatronics I (4 units)
Term Typically Offered: F, SP
Prerequisite: EE 2115 and ME 2240.

Introduction to microcontrollers and programming in assembly language and high-level language. Techniques for real-time interfacing in embedded applications. Laboratory exercises involve real-time interfacing of microcontrollers to external sensors and actuators. 3 lectures, 1 laboratory. Formerly ME 305.

ME 3313 Intermediate Dynamics (2 units)
Term Typically Offered: F, SP
Prerequisite: One of the following: ENGR 2212, ME 212, or ME 2212. Corequisite: MATH 244 or MATH 2341.

Continued study of engineering dynamics. Additional analysis of planar motion of rigid bodies with particular attention to rotating reference frames. Three-dimensional kinematics, inertia tensor, and three-dimensional kinetics of rigid bodies. 2 lectures. Formerly ME 326.

ME 3315 Energy Conversion (3 units)
Term Typically Offered: F, SP
Prerequisite: One of the following: ME 302, ME 303, or ME 3302.

Engineering aspects of energy sources, conversion, and storage. Fossil fuel systems, nuclear, geothermal, wind, solar, ocean, fuel cells, and magnetohydrodynamic generators. 3 lectures. Formerly ME 415.

ME 3317 Vibrations and System Modeling (4 units)
Term Typically Offered: F, SP
Prerequisite: EE 2115 and EE 2115L, or EE 2328; MATH 244 or MATH 2341; and ME 212 or ME 2212.

Mathematical modeling of vibratory and other dynamic systems. The free and forced response of single and multiple degrees of freedom systems, and the study of dynamic behaviors of systems through laboratory experiments and simulations. Gain hands-on experience with vibration measurement equipment. 3 lectures, 1 laboratory.

ME 3318 Mechanical Vibrations (3 units)
Term Typically Offered: TBD
Prerequisite: EE 2115 and EE 2115L or EE 145 or EE 2328; MATH 244 or MATH 2341; ME 212 or ME 2212.

Modeling and analysis of vibrating mechanical systems. Vibration response of single and multiple degree of freedom systems. Experimental and simulation studies of the dynamic behavior of structures and machines. Instrumentation methods utilized in field and laboratory. 2 lectures, 1 laboratory. Formerly ME 318.

ME 3319 Introduction to System Dynamics (4 units)
Term Typically Offered: F, SP
Prerequisite: EE 2115; MATH 244 or MATH 2341; ME 212 or ME 2212; and ME 2240.

Unified approach for mathematical modeling and numerical analysis of dynamic physical systems that store energy in multiple domains. Emphasis on developing lumped-parameter linear models from primitive elements in a systematic manner. 3 lectures, 1 laboratory. Formerly ME 322.

ME 3328 Design for Strength and Stiffness (4 units)
Term Typically Offered: F, SP
Prerequisite: ENGR 2211; and one of the following: IME 1140, ME 129, or ME 1148.

Analyzing stress and strain from axial, bending, transverse, and torsional loads. Fluctuating stresses and stress concentrations. Designing shafts and machine parts by stress and deflection. Modern industrial practices using finite element analysis and computational tools. 3 lectures, 1 laboratory. Formerly ME 328.

ME 3329 Mechanical Systems Design (3 units)
Term Typically Offered: F, SP
Prerequisite: One of the following: ENGR 2212, ME 212, or ME 2212; and ME 328 or ME 3328. Corequisite: One of the following: BMED 212, BMED 2212, ME 251, or ME 2248.

Design of mechanical systems using machine components such as threaded fasteners, gears, bearings, clutches, and motors. Decision modeling based on economic technical feasibility. 2 lectures, 1 laboratory. Formerly ME 329.

ME 3330 Engineering Dynamics (3 units)
Term Typically Offered: SP
Prerequisite: ME 232 or ME 2232; and MTH 212 or MTH 2212.

Offered at Solano Campus. Analysis of particles and rigid bodies in motion using vector methods, calculus, and analytical geometry. Kinematic analysis of motion and relative motion, kinetic analysis of forces and motion, rotation and translation of rigid bodies, work-energy methods, and impulse-momentum methods. 3 lectures. Formerly ME 330 at Cal Maritime.

ME 3332 Mechanics of Materials (3 units)
Term Typically Offered: F
Prerequisite: ME 230 or ME 2230; ME 232 or ME 2232; and MTH 212 or MTH 2212.

Offered at Solano Campus. Application of stress and strain in design and analysis of simple structural members under load. Stresses and deformations in members with a single load in tension, torsion, shear or bending moment are analyzed, followed by the transformation of stresses and effects of combined loads. Analysis of statically indeterminate structures is also included. 3 lectures. Formerly ME 332 at Cal Maritime.

ME 3339 Material/Mechanical Laboratory (2 units)
Term Typically Offered: TBD
Prerequisite: ME 332 or ME 3332; and ME 360 or ME 3360. Concurrent: ME 339L or 3339L.

Offered at Solano Campus. Principles and applications of materials science, solid mechanics, and dynamics learned through experimental inquiry. Design a series of experimental studies involving material and structural response to loading, including structural failure. Studies will then be conducted and analyzed, with the results reported in both written and oral presentations. 2 lectures. Formerly ME 339 at Cal Maritime.

ME 3339L Material/Mechanical Lab Lab (0 units)
Term Typically Offered: TBD
CR/NC
Concurrent: ME 339 or 3339.

Offered at Solano Campus. Material/Mechanical Lab Lab. Credit/No Credit grading only. Formerly ME 339L at Cal Maritime.

ME 3340 Engineering Fluid Mechanics (3 units)
Term Typically Offered: F
Prerequisite: ME 232 or ME 2232; and MTH 212 or MTH 2212.

Offered at Solano Campus. Theory and fundamental principles of incompressible fluid flows. Hydrostatic fluids, continuity, linear momentum, Bernoulli equations for control volumes, dimensional analysis, viscous duct flows, boundary layer flows, centrifugal and axial flow pumps, and pump performance curves and similarity rules. 3 lectures. Formerly ME 340 at Cal Maritime.

ME 3341 Fluid Mechanics (3 units)
Term Typically Offered: F, SP, SU
Prerequisite: One of the following: ENGR 2212, ME 212, or ME 2212; MATH 241 or MATH 2263; and MATH 244 or MATH 2341.

Fluid properties and statics. Conservation equations in integral and differential form. Dimensional analysis. Internal (pipe flow) viscous flows and external viscous flows including boundary layers, drag, and lift. Compressible flow. 3 lectures. Formerly ME 341.

ME 3342 Fluid Mechanics Laboratory (1 unit)
Term Typically Offered: F, SP, SU
Prerequisite: ME 236 or ME 3236. Corequisite: ME 341 or ME 3341.

Fluid mechanics laboratory measurements and analysis of velocity, pressure, forces, and machine performance using a variety of experimental apparatus including wind tunnels, turbomachines, and piping systems. Incompressible and compressible flows. 1 laboratory.

ME 3343 Heat Transfer (4 units)
Term Typically Offered: F, SP
Prerequisite: ME 236 or ME 3236; ME 303 or ME 3302; and ME 341 or ME 3341.

Basic principles of heat transfer by conduction, convection, and radiation. Laboratory experiments to characterize thermodynamic material properties, energy conversion processes, thermodynamic cycles, and performance of heat transfer equipment. 3 lectures, 1 laboratory. Formerly ME 343.

ME 3344 Heat Transfer (3 units)
Term Typically Offered: SP
Prerequisite: One of the following: ME 240, ME 2241, ET 344, or ET 3344; and ME 340 or ME 3340.

Offered at Solano Campus. Fundamental mechanisms of the transfer of energy in the form of heat, including conduction, convection, and radiation. Steady and transient conduction, free and forced convection, radiation, and heat exchanger analysis and design. 3 lectures. Formerly ME 344 at Cal Maritime.

ME 3349 Fluid/Thermal Laboratory (2 units)
Term Typically Offered: TBD
Prerequisite: ME 344 or ME 3344; and ME 360 or ME 3360. Concurrent: ME 349L or 3349L.

Offered at Solano Campus. Principles and applications of fluid mechanics. Thermodynamics and heat transfer through a series of laboratory experiments. Experiments to demonstrate fluid flow measurements, the first and second laws of thermodynamics, conduction and convection heat transfer, heat exchanger analyses and performance, and gas turbine and gasoline engine cycles. Acquisition and statistical analyses of experimental data, and professional laboratory reports are also included. 2 lectures. Formerly ME 349 at Cal Maritime.

ME 3349L Fluid/Thermal Lab Laboratory (0 units)
Term Typically Offered: TBD
CR/NC
Concurrent: ME 349 or ME 3349.

Offered at Solano Campus. Thermodynamics and heat transfer through a series of laboratory experiments. Credit/No Credit grading only. Formerly ME 349L at Cal Maritime.

ME 3350 Electromechanical Machinery (3 units)
Term Typically Offered: F
Prerequisite: ENG 250 or ENG 2250; and ENG 250L or ENG 2250L. Concurrent: ME 350L or ME 3350L.

Offered at Solano Campus. Fundamentals of magnetism, magnetic circuits, and transformers. Principles and operation of series, shunt, compound DC generators and motors. Single-phase and three-phase AC generators, synchronous and induction AC motors, DC and AC motor controllers, and stepper motors. System protective devices and safety. Formerly ME 350 at Cal Maritime.

ME 3350L Electromechanical Machinery Laboratory (1 unit)
Term Typically Offered: F
Prerequisite: ENG 250 or ENG 2250; and ENG 250L or ENG 2250L. Concurrent: ME 350 or ME 3350.

Offered at Solano Campus. Supports instruction and theory of Electromechanical Machinery using hands-on motor operation and analysis. 1 laboratory. Formerly ME 350L at Cal Maritime.

ME 3355 Introduction to Sustainable Energy Usage in Buildings (3 units)
Term Typically Offered: SP
Prerequisite: PHYS 141 or PHYS 1141. Recommended: ME 303 or ME 3302.

Sustainable energy usage in buildings, human comfort, and indoor air quality. Introduction to mechanical heating, ventilation, air conditioning, and refrigeration (HVAC&R) system design. Course may be offered in classroom-based, online, or hybrid format. 2 lectures, 1 laboratory. Formerly ME 359.

ME 3360 Instrumentation and Measurement Systems (2 units)
Term Typically Offered: F
Prerequisite: ENG 210 or ENG 2210; ENG 250 or ENG 2250; and ENG 250L or ENG 2250L. Concurrent: ME 360L or ME 3360L.

Offered at Solano Campus. Measurement techniques for mechanical testing: types of signals, dynamic response of measurement systems, frequency response, uncertainty analysis, types of instruments, basic input circuits, signal conditioning, computer based data acquisition, sampling, A/D conversion, time and frequency analysis, statistical analysis of data. 2 lectures. Formerly ME 360 at Cal Maritime.

ME 3360L Instrumentation and Measurement Systems Laboratory (1 unit)
Term Typically Offered: F
Prerequisite: ENG 210 or ENG 2210; ENG 250 or ENG 2250; and ENG 250L or ENG 2250L. Concurrent: ME 360 or ME 3360.

Offered at Solano Campus. Data acquisition using a PC and LabView. Construction and use of basic input circuits. Use of signal conditioning to improve the quality of measurements. Calibration and use of common instruments, including strain gauges, thermocouples, photovoltaic cells, RTDs, and accelerometers. Examination of the dynamic response of instruments. Time domain and frequency domain analysis of data. Presentation of data. Uncertainty estimates of measured data. Output of control signals. 1 laboratory. Formerly ME 360L at Cal Maritime.

ME 3392 Mechanical Design (3 units)
Term Typically Offered: SP
Prerequisite: ME 332 or ME 3332.

Offered at Solano Campus. General overview of fundamentals on applied loads, material properties, stress and stains, stress concentrations, static as well as dynamic failure theories, and some tribiological considerations. Relate these fundamentals to various machine elements, such as columns, thin and thick-walled cylinders, shafting and associated parts, bearings, gears fasteners and power screws, springs, brakes and clutches, and flexible machine elements. Design project from the text will be assigned. 3 lectures. Formerly ME 392 at Cal Maritime.

ME 3394 Fluid/Thermal Design (3 units)
Term Typically Offered: TBD
Prerequisite: ME 344 or ME 3344.

Offered at Solano Campus. Analysis and design aspects of fluid and thermal systems. Instruction in piping systems, with the economics of pipe size selection and the sizing of pumps for systems, as well as double pipe, shell and tube, and cross flow heat exchangers: configuration, selection, analysis, and design. 3 lectures. Formerly ME 394 at Cal Maritime.

ME 3395 Special Topics (1-3 units)
Term Typically Offered: F, SP
Prerequisite: Consent of instructor.

Offered at Solano Campus. Special topic courses are intended to enables each department to offer an elective course of study when faculty scholarship activities, the expertise of visiting faculty, or off-campus educational programs may afford a unique and worthwhile learning experience. 1 to 3 lectures. Formerly ME 395 at Cal Maritime.

ME 4305 Mechatronics II (3 units)
Term Typically Offered: F, SP
Prerequisite: ME 305 or ME 3305, and ME 329 or ME 3329 (can be taken concurrently); or one of the following: CPE 316, CPE/EE 329, CPE 3160, or EE 3329.

Microcontroller applications in machine control and product design. Applied electronics. Drive technology. Transducers and electromechanical systems. Real-time programming. Mechatronics design methodology. 2 lectures, 1 laboratory. Formerly ME 405.

ME 4361 Fundamentals of Fire Protection Engineering (4 units)
Term Typically Offered: F
Prerequisite: Junior standing; completion of GE Area 1 with grades of C- or better (GE Area A for the 2020-26 catalogs); completion of GE Area 2 with a grade of C- or better (GE Area B4 for the 2020-26 catalogs); and completion of GE Area 5 (GE Areas B1 to B3 for the 2020-26 catalogs).

Fundamental physical and design principles of fire protection engineering. Fire safety strategy, egress, human behavior, fire dynamics, smoke control, alarm and detection, suppression, structural behavior, failure analysis, and engineering ethics. Course may be offered in classroom-based or online format. 3 lectures, 1 laboratory. Formerly ME 361.

ME 4380 Composites Manufacturing, Machining, and Testing (3 units)
Term Typically Offered: SP
Prerequisite: Completion of GE Area 2 with a grade of C- or better (GE Area B4 for the 2020-26 catalogs). Recommended: Machine Shop Red Tag.

Reinforcing fibers and matrix materials both synthetic and natural. Composite material molding and forming processes, hand layup, autoclave, compression molding, filament winding, vacuum infusion, and tooling design. Post-processing, machining, sandwich panel, tension, compression, and three-point bend testing. 1 lecture, 2 laboratories. Replaced ME 161.

ME 4400 Special Problems for Advanced Undergraduates (1-4 units)
Term Typically Offered: F, SP
Prerequisite: Consent of instructor.

Individual investigation, research, studies, or surveys of selected problems. Repeatable up to 8 units. Formerly ME 400.

ME 4401 Advanced Strength of Materials (3 units)
Term Typically Offered: F
Prerequisite: ME 328 or ME 3328.

Advanced strength of materials and theory of elasticity. Behavior of disks, plates, shells, and pressure vessels. Shear, torsion, unsymmetrical bending, and shear centers in beams. Energy methods. Numerical methods. 2 lectures, 1 laboratory. Formerly ME 401.

ME 4402 Orthopedic Biomechanics (3 units)
Term Typically Offered: F
Prerequisite: ME 328 or ME 3328.

Biomechanical analysis of the musculoskeletal system. Emphasis on the use of statics, dynamics, strength of materials, viscoelasticity, and poroelasticity to analyze the mechanical loads acting on human joints, the mechanical properties of tissues, and the design of artificial joints. Course may be offered in classroom-based or hybrid format. 2 lectures, 1 laboratory. Formerly ME 402.

ME 4403 Access by Design: Introduction to Rehabilitation Engineering (3 units)
Term Typically Offered: SP
Prerequisite: One of the following: BMED 212, BMED 2212, ME 234, or ME 3234; and one of the following: ENGR 2212, ME 212, or ME 2212.

Project-based course. Design and analysis of systems to assist people with disabilities. Workplace assistance, mobility aids, educational accommodations, assistive technology and adaptive sports. Universal design, empathy in design, the Americans with Disabilities Act, and the social model of disability. Course may be offered in classroom-based or hybrid format. 2 lectures, 1 laboratory. Formerly ME 403.

ME 4404 Applied Finite Element Analysis (3 units)
Term Typically Offered: F, SP
Prerequisite: One of the following: BMED 410, BMED 3410, CE 352, CE 3352, ME 328, or ME 3328.

Finite element solutions to engineering elastostatic problems using commercial finite element code. Practical modeling assignments. 2 lectures, 1 laboratory. Crosslisted as BMED/CE/ME 4404. Formerly BMED/CE/ME 404.

ME 4405 Fundamentals of Engineering Exam Seminar (1 unit)
Term Typically Offered: F
Prerequisite: ME 330 or ME 3330; ME 332 or ME 3332; ME 340 or ME 3340; and ME 360 or ME 3360.

Offered at Solano Campus. Preparation for the Fundamentals of Engineering Exam (Mechanical) through the coverage of the topic areas covered by the exam. 1 lecture. Formerly ME 405 at Cal Maritime.

ME 4409 Interdisciplinary Projects in Biomechanics (3 units)
Term Typically Offered: SP
Prerequisite: One of the following: BMED 410, BMED 3410, KINE 403, KINE 4403, ME 212, or ME 2212.

Examination of human motion biomechanics. Experimental and analytical methods in motion analysis. Rigid body dynamics. Protocols for protection of human subjects in research. Hypothesis-driven research. Interdisciplinary teams. Proposal development. Written/oral communication to a scientific audience. 1 lecture, 2 activities. Crosslisted as BMED/KINE/ME 4409. Formerly BMED/KINE/ME 409.

ME 4416 Ground Vehicle Dynamics and Design (3 units)
Term Typically Offered: F
Prerequisite: ME 3317.

Design of ground vehicles including turning and longitudinal dynamics, handling characteristics, tire mechanics, powertrain, traction, braking, and suspension. Laboratory focus on applications of concepts introduced in lecture. Project focus on team-based research topic, modeling, and presentation of results. 2 lectures, 1 laboratory. Formerly ME 416.

ME 4417 Mechanical Controls and Implementations (3 units)
Term Typically Offered: F, SP
Prerequisite: ME 3317.

Automated controller development, experimental measurement, and modeling of mechanical systems. Analysis of control strategies' impact on dynamics, closed-loop system design, and implementation using embedded computing hardware. Not open to students with credit in ME 419 or ME 4419. 2 lectures, 1 laboratory. Formerly ME 418.

ME 4419 Advanced Control Systems (3 units)
Term Typically Offered: F, SP
Prerequisite: ME 322 or ME 3319; and ME 236 or ME 3236.

Modeling and control of physical systems. Design mechanical, hydraulic and electrical feedback control systems using time response, transfer function, frequency response, state space, and computer simulation to design and analyze real-world applications. Address state feedback, observability, controllability of multi-input, and multi-output systems. Not open to students with credit in ME 418 or ME 4417. 2 lectures, 1 laboratory. Formerly ME 419.

ME 4423 Robotics: Fundamentals and Applications (4 units)
Term Typically Offered: SP
Prerequisite: One of the following: ENGR 2212, ME 212, or ME 2212; and one of the following: CSC 231, CSC 232, CSC 1001L, CSC 1031, CSC 1032, or ME 2240.

Introduction to robots and their types. Spatial descriptions and transformations. Forward and inverse kinematics. Velocities and static forces. Robot dynamics. Path planning. Actuation and sensing. Control techniques. Advanced topics of modern robotics. 3 lectures, 1 laboratory. Formerly ME 423.

ME 4429 Manufacturing Processes Laboratory (1 unit)
Term Typically Offered: SP
Prerequisite: EPO 215 or EPO 2215; and ME 220 or ME 2220. Concurrent: ME 490 or ME 4490.

Offered at Solano Campus. Principles of manufacturing processes in the areas of metal removal, forming, joining, casting, and fundamentals of numerical control. Study of manufacturing includes design aspects, material considerations, review of latest methods, and numerical controlled machining utilizing computer graphics and solid modeling. 1 laboratory. Formerly ME 429 at Cal Maritime.

ME 4430 Mechanical Vibrations (3 units)
Term Typically Offered: F
Prerequisite: ME 330 or ME 3330; and MTH 215 or MTH 2215.

Offered at Solano Campus. Analysis of mechanical systems undergoing vibration. Free response of vibrating systems, response to harmonic excitation, response to general excitation, analysis of multi-degree of freedom systems using matrix methods, and techniques to suppress vibration. In addition, a series of laboratory experiments are done to demonstrate the theory learned in class. Formerly ME 430 at Cal Maritime.

ME 4432 Machinery Design (3 units)
Term Typically Offered: SP
Prerequisite: ME 330 or ME 3330; and ME 332 or ME 3332.

Offered at Solano Campus. The kinematics of mechanisms is introduced. Position, velocity, and acceleration analysis of mechanisms are discussed, along with linkage synthesis. Dynamics of machinery, mechanism design, cam design, gear train design, force analysis of mechanisms, and engine dynamics. Design, animate, analyze, and optimize complex three-dimensional mechanisms using virtual prototyping tools for mechanism design and analysis. 3 lectures. Formerly ME 432 at Cal Maritime.

ME 4434 Micro/Nano Fabrication (2 units)
Term Typically Offered: SP
Prerequisite: One of the following: BMED 420, BMED 2420, MATE 210, MATE 1210, MATE 1220, EE 306, or EE 3306.

Fabrication science and technology for creating micro and nano scale devices. Unit operations including oxidation, diffusion, ion implantation, etching, chemical and physical vapor deposition, and photolithography. Analyze process physics to design proper steps for electronic/photonic device fabrication. 2 lectures. Crosslisted as BMED/MATE/ME 4434. Formerly BMED 434/EE 423/MATE 430.

ME 4435 Micro/Nano Fabrication Laboratory (1 unit)
Term Typically Offered: SP
Corequisite: BMED 434/EE 423/MATE 430 or BMED/MATE/ME 4434.

Application of basic operations involved in microfabrication: cleanroom protocol, oxidation, diffusion, photolithography, etching, and sputtering. Student teams explore process development through fabrication and testing of microscale silicon devices. 1 laboratory. Crosslisted as BMED/MATE/ME 4435. Formerly BMED 435/EE 473/MATE 435.

ME 4436 Mechatronic System Design (2 units)
Term Typically Offered: SP
Prerequisite: ENG 250 or ENG 2250; ME 330 or ME 3330. Concurrent: ME 436L or ME 4436L.

Offered at Solano Campus. Introduction to a multidisciplinary field that combines electronics, control systems, mechanical design and simulation. Simulation and design of mechatronic systems with sensors, electronic controllers and mechanical actuators. Selection and mathematical modeling of system elements including common sensors, actuators and various electronic controllers. 2 lectures. Formerly ME 436 at Cal Maritime.

ME 4436L Mechatronic System Design Laboratory (1 unit)
Term Typically Offered: SP
Prerequisite: ENG 250 or ENG 2250; ME 330 or ME 3330. Concurrent: ME 436 or ME 4436.

Offered at Solano Campus. Laboratory supporting Mechatronic System Design. 1 laboratory. Formerly ME 436L at Cal Maritime.

ME 4437 Nuclear Energy Power Generation (3 units)
Term Typically Offered: TBD
Prerequisite: ME 303 or ME 3302.

Nuclear physics and reactor theory. Operation of a nuclear electric generation station. Next generation nuclear reactors. Nuclear fusion and other nuclear energy applications. Field trip may be required. Not open to students with credit in ME 439 or ME 4439. 3 lectures. Formerly ME 437.

ME 4438 Nuclear Power Plant Design and Operation (3 units)
Term Typically Offered: TBD
Prerequisite: ME 303 or ME 3302.

Principal elements of boiling and pressurized water reactor power systems. Reactor physics, thermodynamics, and heat transfer, including basic reactor physics, reactor heat generation, reactor plant systems, support systems, and reactor safety. Field trip may be required. Not open to students with credit in ME 439 or ME 4439. 3 lectures. Formerly ME 438.

ME 4439 Nuclear Energy Resources (4 units)
Term Typically Offered: SP
Prerequisite: ME 303 or ME 3302.

Principal elements and operation of nuclear reactor power systems, including overview of nuclear physics, reactor physics, nuclear fusion, propulsion and space applications, fuel cycle, nuclear reactor safety, and review of nuclear accidents. Field trip may be required. Not open to students with credit in ME 437 or ME 4437. 4 lectures. Formerly ME 439.

ME 4440 Thermal System Design (3 units)
Term Typically Offered: F, SP
Prerequisite: ME 3342; and ME 343 or ME 3343.

Design of thermal systems. Engineering economics, thermal component sizing, turbomachinery, simulation, and optimization techniques applied to the design and performance analysis of thermal systems. 3 lectures. Formerly ME 448.

ME 4441 Single-Track Vehicle Design (3 units)
Term Typically Offered: SP
Prerequisite: ME 329 or ME 3329. Recommended: ME 326 or ME 3313.

Design of single-track vehicles, including turning and longitudinal dynamics, handling characteristics, ergonomics and human power, strength and stiffness considerations, traction, braking, and suspension. Laboratory focus on designing a single-track vehicle, including fabrication of a handling prototype. 2 lectures, 1 laboratory. Formerly ME 441.

ME 4442 Design of Machinery (3 units)
Term Typically Offered: SP
Prerequisite: One of the following: ME 212, ME 2212, or ENGR 2212; and ME 2240 or an equivalent computer science course.

Graphical and analytical syntheses of mechanisms and machines. Analytical study of displacements, velocities, accelerations, and dynamic forces necessary for the design of machinery. Creative design projects using software simulation tools. 2 lectures, 1 laboratory. Formerly ME 442.

ME 4443 Turbomachinery (1 unit)
Term Typically Offered: SP
Prerequisite: ME 303 or ME 3302; and ME 341 or ME 3341.

Performance characteristics of various types of turbomachines. Criteria for proper selection of type and main dimensions. Stresses velocity diagrams, Euler head, and specific speed as applied to various machines. Introduction to seals, bearings, rotordynamics, and computational fluid dynamics. Half-semester course. Course may be offered in classroom-based or hybrid format. 1 unit. Formerly ME 443.

ME 4444 Design and Analysis of Internal Combustion Engines (4 units)
Term Typically Offered: SP
Prerequisite: ME 303 or ME 3302.

Application of design parameters to the various cycles of internal combustion engines. Aspects of the combustion processes. Emission regulation effects on engine design. Static and dynamic loading. 3 lectures, 1 laboratory. Formerly ME 444.

ME 4445 Advanced Fluid Mechanics and Thermodynamics (3 units)
Term Typically Offered: SP
Prerequisite: One of the following: ME 240, ME 2241, ET 344 or ET 3344; and ME 340 or ME 3340.

Offered at Solano Campus. Advanced topics in gas dynamics, including compressible flow analysis of converging-diverging nozzles, normal and oblique shock waves, compressible duct flow with friction; and advanced topics in thermodynamics, including irreversibility, availability, and second-law analysis of thermodynamic systems, gas and vapor mixtures, chemical reactions, and thermodynamics of propulsion systems with applications. 3 lectures. Formerly ME 440 at Cal Maritime.

ME 4446 Heating, Ventilating, and Air Conditioning (3 units)
Term Typically Offered: SP
Prerequisite: One of the following: ME 240, ME 2241, ET 344 or ET 3344; and ME 340 or ME 3340.

Offered at Solano Campus. Analysis and design of air conditioning systems for industrial and commercial applications. Psychometrics, heating and cooling loads, HVAC systems and controls, infiltration, ventilation, fan performance, and duct design. 3 lectures. Formerly ME 442 at Cal Maritime.

ME 4447 Energy Systems Design (3 units)
Term Typically Offered: F
Prerequisite: ME 344 or ME 3344.

Offered at Solano Campus. Application of fundamentals of thermodynamics, fluid mechanics, heat transfer in design, analysis, and selection of power production systems, auxiliary power units, and heat exchange systems. Economic evaluation and preliminary cost of estimation of energy systems. 3 lectures. Formerly ME 444 at Cal Maritime.

ME 4450 Solar Thermal Power Systems (3 units)
Term Typically Offered: F
Prerequisite: ME 343 or ME 3343. Recommended: ME 415 or ME 3315.

High and intermediate temperature systems for conversion of solar energy to mechanical power and heat. Thermal energy storage and total thermal energy system design. 3 lectures. Formerly ME 450.

ME 4451 Engineering, Design, and Social Justice (3 units)
Term Typically Offered: SP
Prerequisite: Senior standing. Recommended: ME 234 or ME 3234; and completion of USCP.

Explores the intersection of engineering design theories and efforts for social justice and equity. Critiques dominant engineering mindsets, examines design practices, and articulates ways engineers can develop equity-mindedness in problem-solving. 3 lectures. Formerly ME 451.

ME 4452 Machine Learning in Mechanical Engineering (4 units)
Term Typically Offered: F
Prerequisite: MATH 244 or MATH 2341; one of the following: ME 322, ME 3317, or ME 3319; and ME 236 or ME 3236.

Applications of machine learning in mechanical engineering. Optimization, fault detection, system identification, and control. Neural networks, machine vision, deep reinforcement learning, and other current topics in machine learning. 3 lectures, 1 laboratory.

ME 4455 Building Energy Performance and Modeling (3 units)
Term Typically Offered: SP

Study of building energy assessment principles, protocols for existing commercial buildings, and practices of building energy modeling. Energy metric comparison, analysis, and energy auditing. Simulate energy use of buildings. Methods to reduce energy consumption of buildings. Course may be offered in classroom-based or hybrid format. 3 lectures. Prerequisite ME 303 or ME 3302. Formerly ME 454.

ME 4456 HVAC&R Air and Water Distribution for Sustainable Building Environments (3 units)
Term Typically Offered: F
Prerequisite: ME 341 or ME 3341.

Design of air and water distribution systems as applied to Heating, Ventilation, Air-Conditioning and Refrigeration (HVAC&R) Systems for buildings, including theories and applications of systems, components and relative energy usage in creating sustainable indoor environments. Course may be offered in classroom-based or online format. 2 lectures, 1 laboratory. Formerly ME 456.

ME 4457 Environmentally Efficient and Sustainable Refrigeration Systems (3 units)
Term Typically Offered: F
Prerequisite: ME 303 or ME 3302.

Basic engineering principles of refrigeration processes with an emphasis on sustainability, including vapor compression cycles, multi-pressure systems, heat exchangers, compressors, expansion devices, product cooling and freezing load, and refrigerant selection. 2 lectures, 1 laboratory. Formerly ME 457.

ME 4459 Automatic Feedback Control (3 units)
Term Typically Offered: SP
Prerequisite: ME 360 or ME 3360; ME 360L or ME 3360L; and MTH 215 or MTH 2215. Concurrent: ME 460L or ME 4459L.

Offered at Solano Campus. Dynamic system modeling for various types of engineering systems. Analysis of dynamic systems using Laplace transform and state space methods. Open and closed loop stability. Design of feedback controllers using root-locus and frequency response techniques. Extensive use of MATLAB for analysis and simulation. 3 lectures. Formerly ME 460 at Cal Maritime.

ME 4459L Automatic Feedback Control Laboratory (1 unit)
Term Typically Offered: TBD
Prerequisite: ME 360 or ME 3360; ME 360L or ME 3360L; and MTH 215 or MTH 2215. Concurrent: ME 460 or ME 4459.

Offered at Solano Campus. Supports instruction and theory of ME 460 using MATLAB modeling and simulation. Hands-on lab and case studies are performed. 1 laboratory. Formerly ME 460L at Cal Maritime.

ME 4460 Senior Design Project I (2 units)
Term Typically Offered: F, SP
Prerequisite: Senior standing; IME 143 or IME 1143; ME 234 or ME 3234; and ME 329 or ME 3329. Corequisite: One of the following: ME 322, ME 3317, or ME 3319; and ME 343 or ME 3343.

First semester of a two-semester team project designing solutions for an engineering design challenge, including problem definition, concept generation, feasibility, and detailed design and analysis. Professional skills, including communication, teamwork, and project management. 2 laboratories. Formerly ME 428.

ME 4461 Senior Design Project II (2 units)
Term Typically Offered: F, SP
Prerequisite: ME 428 or ME 4460.

Completion of a two-semester team design project. Product realization, including material procurement, prototyping, and testing. Professional skills, including communication, teamwork, project management, and ethics. 2 laboratories. Formerly ME 429.

ME 4462 Experimental Methods in Mechanical Engineering (1 unit)
Term Typically Offered: F
Prerequisite: ENG 112 or ENG 1112; ME 332 or ME 3332; ME 340 or ME 3340; and ME 360 or ME 3360. Concurrent: ME 462L or ME 4462L.

Offered at Solano Campus. Principles and applications of experiments in fluid mechanics, material science, mechanics, and thermodynamics. Technical communication, both oral and written, of the entire experimental process. 1 lecture. Formerly ME 462 at Cal Maritime.

ME 4462L Experimental Methods in Mechanical Engineering Laboratory (1 unit)
Term Typically Offered: F
Prerequisite: ENG 112 or ENG 1112; ME 332 or ME 3332; ME 340 or ME 3340; and ME 360 or ME 3360. Concurrent: ME 462 or ME 4462.

Offered at Solano Campus. Laboratory supporting Experimental Methods in Mechanical Engineering. 1 activity. Formerly ME 462L at Cal Maritime.

ME 4465 HVAC&R Senior Design Project I (2 units)
Term Typically Offered: F
Prerequisite: Senior standing. Corequisite: ME 343 or ME 3343; and ME 456 or ME 4456.

First semester of a two-semester sequence. Team projects designing sustainable heating, ventilating, air-conditioning, and refrigeration (HVAC&R) systems. New developments, policies, and practices in the HVAC&R industry. Ethics for engineers. 1 lecture, 1 laboratory. Formerly ME 459.

ME 4466 HVAC&R Senior Design Project II (2 units)
Term Typically Offered: SP
Prerequisite: ME 459 or ME 4465.

Continuation of senior project. Team project designing sustainable heating, ventilating, air-conditioning and refrigeration (HVAC&R) systems. 2 laboratories. Formerly ME 460.

ME 4470 Special Advanced Topics (1-4 units)
Term Typically Offered: F, SP
Prerequisite: Consent of instructor.

Directed group study of special topics for advanced students. The Class Schedule will list topic selected. Repeatable up to 8 units. Course may be offered in classroom-based, online, or hybrid format. 1 to 4 lectures. Formerly ME 470.

ME 4471 Special Advanced Laboratory (1-2 units)
Term Typically Offered: F, SP
Prerequisite: Consent of instructor.

Directed group laboratory study of special topics for advanced students. The Class Schedule will list topic selected. Repeatable up to 4 units. 1 to 2 laboratories. Formerly ME 471.

ME 4480 Composite Materials Analysis and Design (3 units)
Term Typically Offered: F
Prerequisite: One of the following: AERO 331, AERO 3331, ME 328, or ME 3328. Recommended: ME 4380.

Behavior of unidirectional fiber composites. Properties of short-fiber composites and orthotropic lamina. Analysis of laminated composites. Strength and hygrothermal behavior of composite materials, sandwich structure, and structural optimization using Finite Element Analysis. Course may be offered in classroom-based, online, or hybrid format. 2 lectures, 1 laboratory. Formerly ME 412.

ME 4485 Cooperative Education Experience (2-12 units)
Term Typically Offered: TBD
CR/NC
Prerequisite: Sophomore standing and consent of instructor.

Work experience in business, industry, government, and other areas of student career interest. Positions are paid and usually require relocation and registration in course for one to two consecutive semesters. Formal report and evaluation by work supervisor required. Credit/No Credit grading only. Repeatable up to 12 units. Formerly ME 493.

ME 4488 Wind Power Engineering (3 units)
Term Typically Offered: F
Prerequisite: ME 341 or ME 3341.

Engineering aspects of wind power systems including mechanical design, support structure design, aerodynamic analysis, wind field analysis, system concepts and analysis, and economics. Field trip may be required. 3 lectures. Formerly ME 488.

ME 4490 Engineering Design Process (3 units)
Term Typically Offered: SP
2026-28 or later catalog: GE Area 1C
2020-26 catalogs: GE Area A1
Prerequisite: ENG 112 or ENG 1112; ME 332 or ME 3332; ME 340 or ME 3340; and ME 360 or ME 3360.

Offered at Solano Campus. Introduction to the engineering design processes. Identifying objectives and constraints, generating concepts, background research including finding appropriate engineering standards, application of analytical and numerical models for design, evaluating design alternatives, and communication of work to a wide range of audiences. 3 lectures. Fulfills GE Area 1C (GE Area A1 for students on the 2020-26 catalogs). Formerly ME 490 at Cal Maritime.

ME 4492 Project Design I (2 units)
Term Typically Offered: F
Prerequisite: ME 490 or ME 4490. Concurrent: ME 492L or ME 4492L.

Offered at Solano Campus. First of two courses taken sequentially in the application of engineering design principles. Study and application of techniques including problem definition, concept generation, and decision making. Practice of skills including written and oral communication, teamwork, ethics, and demonstrating societal and/or environmental responsibility. 2 lectures. Formerly ME 492 at Cal Maritime.

ME 4492L Project Design I Lab (1 unit)
Term Typically Offered: F
Prerequisite: ME 490 or ME 4490. Concurrent: ME 492 or ME 4492.

Offered at Solano Campus. group laboratory with technical advisors for projects in Project Design I. 1 laboratory. Formerly ME 492L at Cal Maritime.

ME 4494 Project Design II (2 units)
Term Typically Offered: SP
Prerequisite: ME 492 or ME 4492. Concurrent: ME 494L or ME 4494L.

Offered at Solano Campus. Second of two courses taken sequentially in the application of engineering design principles. Study and application of techniques including prototyping and testing. Practice of skills including written and oral communication, teamwork, ethics, and demonstrating societal and/or environmental responsibility. 2 lectures. Formerly ME 494 at Cal Maritime.

ME 4494L Project Design II Lab (1 unit)
Term Typically Offered: SP
Prerequisite: ME 492 or ME 4492. Concurrent: ME 494 or ME 4494.

Offered at Solano Campus. Directed group laboratory with technical advisors for projects in Project Design II. 1 laboratory. Formerly ME 494L at Cal Maritime.

ME 4495 Cooperative Education Experience (12 units)
Term Typically Offered: TBD
CR/NC
Prerequisite: Sophomore standing and consent of instructor.

Work experience in business, industry, government, and other areas of student career interest. Positions are paid and usually require relocation and registration in course for one to two consecutive semesters. A more fully developed formal report and evaluation by work supervisor required. Credit/No Credit grading only. Repeatable up to 24 units. Formerly ME 495.

ME 5305 Mechatronics III (3 units)
Term Typically Offered: F
Prerequisite: Graduate standing.

Application of principles of high-level design to mechanical control system implementation. Design printed circuit boards as system components. Use modified state transition logic in conjunction with object-oriented programming as design methodology. Real-time programming for control of mechanical systems. 2 lectures, 1 laboratory. Formerly ME 507.

ME 5500 Individual Study (1-4 units)
Term Typically Offered: F, SP
Prerequisite: Consent of department chair, graduate advisor, and consent of instructor.

Advanced study planned and completed under the direction of a member of the department faculty. Enrollment by petition. Repeatable up to 8 units. Formerly ME 500.

ME 5501 Continuum Mechanics and Elasticity (3 units)
Term Typically Offered: F
Prerequisite: Graduate standing.

Introduction to continuum mechanics. Kinematics, stress, and balance laws. Constitutive theory for isotropic and anisotropic solids and viscous fluids. Applications including design of beams and pressure vessels, stress concentrations, fiber-reinforced composites, and non-homogeneous biological materials. Course may be offered in classroom-based or hybrid format. 3 lectures. Crosslisted as CE 5511/ME 5501. Formerly CE 511/ME 501.

ME 5503 Inelastic Stress Analysis (3 units)
Term Typically Offered: SP
Prerequisite: One of the following: CE 511, CE 5511, ME 501, or ME 5501.

Perfectly plastic and work hardening materials. Von Mises and Tresca yield, isotropic and kinematic hardening flow rules, and boundary-value problems. Finite elasticity, including kinematics, Cauchy- and Green-elasticity, invariance, constraints, Neo-Hookean and Mooney-Rivlin materials, experimental approaches, anisotropic and fiber reinforced materials, boundary-value problems, stability and strain energy convexity, and viscoelasticity. Course may be offered in classroom-based or hybrid format. 3 lectures. Crosslisted as CE 5513/ME 5503. Formerly CE 513/ME 503.

ME 5504 Finite Element Analysis of Continua (4 units)
Term Typically Offered: SP
Prerequisite: One of the following: BMED/CE/ME 404, BMED/CE/ME 4404, CE 501, CE 5502, AERO 431, or AERO 4431.

Finite element theory and application with a focus on numerical implementation. Strong and weak forms, variational theorems, displacement based methods, mixed methods, viscoelasticity and plasticity type formulations, augmented Lagrangian formulations, transient and modal analysis, and finite deformation. 3 lectures, 1 laboratory. Crosslisted as AERO/BMED/CE/ME 5504. Formerly CE/ME 504.

ME 5506 System Dynamics (3 units)
Term Typically Offered: SP
Prerequisite: Graduate standing.

Unified approach for mathematical modeling and analysis of dynamic physical systems which may store energy in multiple energy domains. Emphasis on developing lumped-parameter linear system models from a set of primitive elements in a systematic manner. 3 lectures. Formerly ME 506.

ME 5517 Advanced Vibrations (3 units)
Term Typically Offered: F
Prerequisite: One of the following: ME 318, ME 3317, or ME 3318; or graduate standing.

Vibration of complex engineering systems. Inertia and stiffness matrices. Natural frequencies and normal modes. Approximate solutions and computer techniques. Response to transient and periodic inputs. 2 lectures, 1 laboratory. Formerly ME 517.

ME 5518 Machinery Vibration and Rotor Dynamics (3 units)
Term Typically Offered: SP
Prerequisite: Graduate standing.

Vibrations of rotating machinery. Modeling of structural rotor dynamic phenomena induced by shaft flexibility and bearings. Laboratory measurement of rotor dynamic response and interpretation of machinery diagnostic information. Practical research projects. 2 lectures, 1 laboratory. Formerly ME 518.

ME 5540 Viscous Flow (3 units)
Term Typically Offered: F
Prerequisite: ME 341 or ME 3341; or graduate standing.

Introduction to tensor calculus, development of Reynolds' Transport Theory, special forms of governing equations of fluid motion, and classical solutions to the Navier-Stokes equations. 3 lectures. Formerly ME 540.

ME 5541 Advanced Thermodynamics (3 units)
Term Typically Offered: F
Prerequisite: ME 448 or ME 4440; or graduate standing.

Selected modern applications of thermodynamics that may include equilibrium and kinetics as applied to combustion and air pollution, analysis and evaluation of techniques used to predict properties of gases and liquids, improvement of modern thermodynamic cycles by second law analysis. 3 lectures. Formerly ME 541.

ME 5542 Dynamics and Thermodynamics of Compressible Flow (3 units)
Term Typically Offered: SP
Prerequisite: ME 303 or ME 3302; and ME 341 or ME 3341; or graduate standing.

Control volume analysis of fluid-thermo equations for one-dimensional, compressible flow involving area change, normal shocks, friction, and heat transfer. Two-dimensional supersonic flow, including linearization, method of characteristics, and oblique shocks. One-dimensional constant area, unsteady flow. 3 lectures. Formerly ME 542.

ME 5552 Conduction and Radiation Heat Transfer (3 units)
Term Typically Offered: F
Prerequisite: ME 343 or ME 3343; or graduate standing.

Advanced principles of conduction and radiation heat transfer. Classical solution techniques to problems in conduction and radiation. 3 lectures. Formerly ME 552.

ME 5553 Convective Heat Transfer (3 units)
Term Typically Offered: SP
Prerequisite: ME 3342; and ME 343 or ME 3343; or graduate standing.

Advanced principles of convective heat transfer. Classical solution techniques to problems in convection. 3 lectures. Formerly ME 553.

ME 5554 Computational Heat Transfer (3 units)
Term Typically Offered: SP
Prerequisite: ME 341 or ME 3341; and ME 343 or ME 3343; or graduate standing. Recommended: MATH 418 or MATH 4352.

Numerical solutions of classical, industrial, and experimental problems with conduction, convection, and radiation heat transfer. 2 lectures, 1 laboratory. Formerly ME 554.

ME 5563 Graduate Seminar (1 unit)
Term Typically Offered: F
CR/NC
Prerequisite: Graduate standing in Mechanical Engineering.

Current developments in mechanical engineering are presented by guest speakers. Participation is by graduate students, faculty, and guests. Credit/No Credit grading only. 1 seminar. Formerly ME 563.

ME 5570 Special Advanced Topics (1-4 units)
Term Typically Offered: TBD
Prerequisite: Graduate standing and consent of instructor.

Directed group study of special topics for advanced students. The Class Schedule will list topic selected. Repeatable up to 8 units. Course may be offered in classroom-based, online, or hybrid format. 1 to 4 lectures. Formerly ME 570.

ME 5571 Special Advanced Laboratory (1-2 units)
Term Typically Offered: TBD
Prerequisite: Graduate standing and consent of instructor.

Directed group laboratory study of special topics for advanced students. The Class Schedule will list topic selected. Repeatable up to 4 units. 1 to 2 laboratories. Formerly ME 571.

ME 5579 Fluid Power Control (3 units)
Term Typically Offered: TBD
Prerequisite: one of the following: ME 419, ME 4417, or ME 4419; or graduate standing.

Design, analysis, and control of fluid power systems. Analysis of fluid power system components such as pumps, valves, and actuators. Dynamic system modeling, analysis of system response, stability, and controller design. Computer simulation and laboratory experimentation. 2 lectures, 1 laboratory. Formerly ME 579.

ME 5580 Failure Analysis of Advanced Composite Materials (3 units)
Term Typically Offered: F
Prerequisite: One of the following: AERO 331, AERO 3331, ME 328, or ME 3328; or graduate standing. Recommended: One of the following: ME 161, ME 412, ME 4380, or ME 4480.

Behavior of advanced composite structures, failure analysis, and damage development. Plate and beam, buckling, impact, vibration of laminated plates, and sandwich structures. Fatigue behavior and optimum design of pressure vessels. Hygrothermal fatigue and residual stresses. Course may be offered in classroom-based, online, or hybrid format. 2 lectures, 1 laboratory.

ME 5597 Comprehensive Examination (0 units)
Term Typically Offered: F, SP
CR/NC
Prerequisite: Graduate standing and consent of instructor.

For the course option for the Master of Science degree in Mechanical Engineering, students must enroll in this course during the semester they take the culminating exam to meet the degree requirements. Credit/No Credit grading only.

ME 5599 Thesis (1-6 units)
Term Typically Offered: F, SP
Prerequisite: Graduate standing and consent of instructor.

Individual research or activity under faculty supervision as a requirement for the master's degree, culminating in a written report/thesis. Repeatable up to 6 units. Formerly ME 599.