Mechanical Engineering (MEC ENG)

Courses

MEC ENG 24 Freshman Seminars 1 Unit
The Berkeley Seminar Program has been designed to provide new students with the opportunity to explore an intellectual topic with a faculty member in a small-seminar setting. Berkeley Seminars are offered in all campus departments, and topics vary from department to department and semester to semester.
Rules & Requirements

Repeat rules: Course may be repeated for credit as topic varies. Course may be repeated for credit when topic changes.

Hours & Format

Fall and/or spring: 15 weeks - 1 hour of seminar per week

Additional Details

Subject/Course Level: Mechanical Engineering/Undergraduate

Grading/Final exam status: The grading option will be decided by the instructor when the class is offered. Final exam required.

MEC ENG 40 Thermodynamics 3 Units
This course introduces the fundamentals of energy storage, thermophysical properties of liquids and gases, and the basic principles of thermodynamics which are then applied to various areas of engineering related to energy conversion and air conditioning.
Rules & Requirements

Prerequisites: Chemistry 1A, Engineering 7, Mathematics 1B, and PHYSICS 7B (http://guide.berkeley.edu/search/?P=PHYSICS%207B)

Credit Restrictions: Students will receive no credit for 40 after taking 105B.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 1 hour of discussion per week

Summer: 10 weeks - 4.5 hours of lecture and 1.5 hours of discussion per week

Additional Details

Subject/Course Level: Mechanical Engineering/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

MEC ENG C85 Introduction to Solid Mechanics 3 Units
A review of equilibrium for particles and rigid bodies. Application to truss structures. The concepts of deformation, strain, and stress. Equilibrium equations for a continuum. Elements of the theory of linear elasticity. The states of plane stress and plane strain. Solution of elementary elasticity problems (beam bending, torsion of circular bars). Euler buckling in elastic beams.
Rules & Requirements

Prerequisites: Mathematics 53 and 54 (may be taken concurrently); PHYSICS 7A (http://guide.berkeley.edu/search/?P=PHYSICS%207A)

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 1 hour of discussion per week

Summer:
6 weeks - 7.5 hours of lecture and 2.5 hours of discussion per week
10 weeks - 4.5 hours of lecture and 1.5 hours of discussion per week

Additional Details

Subject/Course Level: Mechanical Engineering/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructors: Armero, Papadopoulos, Zohdi

Also listed as: CIV ENG C30

MEC ENG W85 Introduction to Solid Mechanics 3 Units
A review of equilibrium for particles and rigid bodies. Application to truss structures. The concepts of deformation, strain, and stress. Equilibrium equations for a continuum. Elements of the theory of linear elasticity. The states of plane stress and plane strain. Solution of elementary elasticity problems (beam bending, torsion of circular bars). Euler buckling in elastic beams.
Objectives Outcomes

Course Objectives: To learn statics and mechanics of materials

Student Learning Outcomes: - Correctly draw free-body
- Apply the equations of equilibrium to two and three-dimensional solids
- Understand the concepts of stress and strain
- Ability to calculate deflections in engineered systems
- Solve simple boundary value problems in linear elastostatics (tension, torsion, beam bending)

Rules & Requirements

Prerequisites: Mathematics 53 and 54 (may be taken concurrently); PHYSICS 7A (http://guide.berkeley.edu/search/?P=PHYSICS%207A)

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of web-based lecture and 1 hour of web-based discussion per week

Summer:
6 weeks - 7.5 hours of web-based lecture and 2.5 hours of web-based discussion per week
8 weeks - 6 hours of web-based lecture and 2 hours of web-based discussion per week
10 weeks - 4.5 hours of web-based lecture and 1.5 hours of web-based discussion per week

Online: This is an online course.

Additional Details

Subject/Course Level: Mechanical Engineering/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructors: Govindjee, Sanjay

Also listed as: CIV ENG W30

MEC ENG 98 Supervised Independent Group Studies 1 - 4 Units
Organized group study on various topics under the sponsorship and direction of a member of the Mechanical Engineering faculty.
Rules & Requirements

Prerequisites: Consent of instructor

Repeat rules: Course may be repeated for credit. Course may be repeated for credit when topic changes.

Hours & Format

Fall and/or spring: 15 weeks - 1-4 hours of directed group study per week

Summer: 10 weeks - 1.5-6 hours of directed group study per week

Additional Details

Subject/Course Level: Mechanical Engineering/Undergraduate

Grading/Final exam status: Offered for pass/not pass grade only. Final exam not required.

MEC ENG 101 Introduction to Lean Manufacturing Systems 3 Units
Fundamentals of lean manufacturing systems including manufacturing fundamentals, unit operations and manufacturing line considerations for work in process (WIP), manufacturing lead time (MLT), economics, quality monitoring; high mix/low volume (HMLV) systems fundamentals including just in time (JIT), kanban, buffers and line balancing; class project/case studies for design and analysis of competitive manufacturing systems.

Objectives Outcomes

Course Objectives: This course will enable students to analyze manufacturing lines in order to understand the production process and improve production efficiency. The course provides practical knowledge and skills that can be applied in industry, covering the complete manufacturing system from production planning to quality control. Students are given a chance to practice and implement what they learn during lectures by conducting projects with local or global manufacturing companies.

Student Learning Outcomes: Students will understand the whole scope of manufacturing systems from production planning to quality control, which can be helpful to set up manufacturing lines for various products. Students will be capable of identifying sources of manufacturing problems by analyzing the production line and produce multi-level solutions to optimize manufacturing efficiency.

Rules & Requirements

Prerequisites: Completion of all lower division requirements for an engineering major, or consent of instructor

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 1 hour of discussion per week

Summer: 6 weeks - 7.5 hours of lecture and 3 hours of discussion per week

Additional Details

Subject/Course Level: Mechanical Engineering/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructors: Dornfeld, McMains

MEC ENG 102A Introduction to Mechanical Systems for Mechatronics 4 Units
The objectives of this course are to introduce students to modern experimental techniques for mechanical engineering, and to improve students' written and oral communication skills. Students will be provided exposure to, and experience with, a variety of sensors used in mechatronic systems including sensors to measure temperature, displacement, velocity, acceleration and strain. The role of error and uncertainty in measurements and analysis will be examined. Students will also be provided exposure to, and experience with, using commercial software for data acquisition and analysis. The role and limitations of spectral analysis of digital data will be discussed.

Objectives Outcomes

Course Objectives: Introduce students to modern experimental techniques for mechanical engineering; provide exposure to and experience with a variety of sensors used in mechatronic systems, including sensors to measure temperature, displacement, velocity, acceleration and strain; examine the role of error and uncertainty in measurements and analysis; exposure to and experience in using commercial software for data acquisition and analysis; discuss the role and limitations of spectral analysis of digital data; provide experience in working in a team in all aspects of the laboratory exercises, including set-up, data collection, analysis and report writing.

Student Learning Outcomes: By the end of this course, students should: Know how to use, what can be measured with, and what the limitations are of the basic instruments found in the laboratory: oscilloscope, multimeter, counter/timer, analog-to-digital converter; know how to write a summary laboratory report; understand the relevance of uncertainty in measurements, and the propagation of uncertainty in calculations involving measurements; understand the physics behind the instruments and systems used in the laboratory; know how to program effectively using LabVIEW for data acquisition and analysis; understand the use of spectral analysis for characterizing the dynamic response of an instrument or of a system.

Rules & Requirements

Prerequisites: Engineering 10 and 28, ENGLISH R1A (http://guide.berkeley.edu/search/?P=ENGLISH%20R1A) or equivalent course, Mechanical Engineering C85/Civil and Environmental Engineering C30 and Electrical Engineering 40 or 100

Hours & Format

Fall and/or spring: 15 weeks - 2 hours of lecture and 3 hours of laboratory per week

Additional Details

Subject/Course Level: Mechanical Engineering/Undergraduate

Grading/Final exam status: Letter grade. Final exam not required.

MEC ENG 102B Mechatronics Design 4 Units
Introduction to design and realization of mechatronics systems. Micro computer architectures. Basic computer IO devices. Embedded microprocessor systems and control, IO programming such as analogue to digital converters, PWM, serial and parallel outputs. Electrical components such as power supplies, operational amplifiers, transformers and filters. Shielding and grounding. Design of electric, hydraulic and pneumatic actuators. Design of sensors. Design of power transmission systems. Kinematics and dynamics of robotics devices. Basic feedback design to create robustness and performance.
Objectives Outcomes

Course Objectives: Introduce students to design and design techniques of mechatronics systems; provide guidelines to and experience with design of variety of sensors and actuators; design experience in programming microcomputers and various IO devices; exposure to and design experience in synthesis of mechanical power transfer components; understanding the role of dynamics and kinematics of robotic devices in design of mechatronics systems; exposure to and design experience in synthesis of feedback systems; provide experience in working in a team to design a prototype mechatronics device.

Student Learning Outcomes: By the end of this course, students should: Know how to set up micro computers and interface them with various devices; know how to understand the microcomputers architectures, IO devices and be able to program them effectively; understand the design of actuators and sensors; know how to do shielding and grounding for various mechatronics projects, know how to create feedback systems, know the role of dynamics and kinematics of robotic devices in design and control of mechatronics systems; know how to design mechanical components such as transmissions, bearings, shafts, and fasteners.

Rules & Requirements

Prerequisites: ENG 28 and EE 40 or EE 100

Credit Restrictions: Students will receive no credit for Mechanical Engineering 102B after completing Mechanical Engineering 105B.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 3 hours of laboratory per week

Additional Details

Subject/Course Level: Mechanical Engineering/Undergraduate

Grading/Final exam status: Letter grade. Final exam not required.

MEC ENG 104 Engineering Mechanics II 3 Units
This course is an introduction to the dynamics of particles and rigid bodies. The material, based on a Newtonian formulation of the governing equations, is illustrated with numerous examples ranging from one-dimensional motion of a single particle to planar motions of rigid bodies and systems of rigid bodies.
Rules & Requirements

Prerequisites: C85 and Engineering 7

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 1 hour of discussion per week

Summer: 10 weeks - 4.5 hours of lecture and 1.5 hours of discussion per week

Additional Details

Subject/Course Level: Mechanical Engineering/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

MEC ENG 106 Fluid Mechanics 3 Units
This course introduces the fundamentals and techniques of fluid mechanics with the aim of describing and controlling engineering flows.
Rules & Requirements

Prerequisites: C85 and 104 (104 may be taken concurrently)

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 1 hour of discussion per week

Summer: 10 weeks - 4.5 hours of lecture and 1.5 hours of discussion per week

Additional Details

Subject/Course Level: Mechanical Engineering/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

MEC ENG 107 Mechanical Engineering Laboratory 3 Units
Experimental investigation of engineering systems and of phenomena of interest to mechanical engineers. Design and planning of experiments. Analysis of data and reporting of experimental results.
Rules & Requirements

Prerequisites: 102A; senior standing

Hours & Format

Fall and/or spring: 15 weeks - 2 hours of lecture and 3 hours of laboratory per week

Additional Details

Subject/Course Level: Mechanical Engineering/Undergraduate

Grading/Final exam status: Letter grade. Final exam not required.

MEC ENG 108 Mechanical Behavior of Engineering Materials 4 Units
This course covers elastic and plastic deformation under static and dynamic loads. Failure by yielding, fracture, fatigue, wear, and environmental factors are also examined. Topics include engineering materials, heat treatment, structure-property relationships, elastic deformation and multiaxial loading, plastic deformation and yield criteria, dislocation plasticity and strengthening mechanisms, creep, stress concentration effects, fracture, fatigue, and contact deformation.
Rules & Requirements

Prerequisites: C85

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture, 1 hour of discussion, and 4 hours of laboratory per week

Summer: 10 weeks - 4.5 hours of lecture, 1.5 hours of discussion, and 6 hours of laboratory per week

Additional Details

Subject/Course Level: Mechanical Engineering/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

MEC ENG 109 Heat Transfer 3 Units
This course covers transport processes of mass, momentum, and energy from a macroscopic view with emphasis both on understanding why matter behaves as it does and on developing practical problem solving skills. The course is divided into four parts: introduction, conduction, convection, and radiation.
Rules & Requirements

Prerequisites: 40 and 106

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 1 hour of discussion per week

Summer:
8 weeks - 5.5 hours of lecture and 1.5 hours of discussion per week
10 weeks - 4.5 hours of lecture and 1.5 hours of discussion per week

Additional Details

Subject/Course Level: Mechanical Engineering/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

MEC ENG 110 Introduction to Product Development 3 Units
Provides project-based learning experience in innovative new product development, with a focus on mechanical engineering systems. Design concepts and techniques are introduced, and the student’s design ability is developed in a design or feasibility study chosen to emphasize ingenuity and provide wide coverage of engineering topics. Relevant software will be integrated into studio sessions, including solid modeling and environmental life cycle analysis. Design optimization and social, economic, and political implications are included. All product ideas will be evaluated against the "triple bottom line": economic, societal, and environmental. Both individual and group oral presentations are made, and participation in a final tradeshow type presentation is required.
Rules & Requirements

Prerequisites: Junior or higher standing

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Summer: 10 weeks - 4.5 hours of lecture per week

Additional Details

Subject/Course Level: Mechanical Engineering/Undergraduate

Grading/Final exam status: Letter grade. Final exam not required.

MEC ENG C115 Molecular Biomechanics and Mechanobiology of the Cell 4 Units
This course applies methods of statistical continuum mechanics to subcellar biomechanical phenomena ranging from nanoscale (molecular) to microscale (whole cell and cell population) biological processes at the interface of mechanics, biology, and chemistry.
Objectives Outcomes

Course Objectives: This course, which is open to senior undergraduate students or graduate students in diverse disciplines ranging from engineering to biology to chemistry and physics, is aimed at exposing students to subcellular biomechanical phenomena spanning scales from molecules to the whole cell.

Student Learning Outcomes: The students will develop tools and skills to (1) understand and analyze subcelluar biomechanics and transport phenomena, and (2) ultimately apply these skills to novel biological and biomedical applications

Rules & Requirements

Prerequisites: MATH 54 (http://guide.berkeley.edu/search/?P=MATH%2054); PHYSICS 7A (http://guide.berkeley.edu/search/?P=PHYSICS%207A); BioE102 or MEC85 or instructor's consent

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 1 hour of discussion per week

Additional Details

Subject/Course Level: Mechanical Engineering/Undergraduate

Grading/Final exam status: Letter grade. Alternative to final exam.

Instructor: Mofrad

Also listed as: BIO ENG C112

MEC ENG C117 Structural Aspects of Biomaterials 4 Units
This course covers the structure and mechanical functions of load bearing tissues and their replacements. Natural and synthetic load-bearing biomaterials for clinical applications are reviewed. Biocompatibility of biomaterials and host response to structural implants are examined. Quantitative treatment of biomechanical issues and constitutive relationships of tissues are covered in order to design biomaterial replacements for structural function. Material selection for load bearing applications including reconstructive surgery, orthopedics, dentistry, and cardiology are addressed. Mechanical design for longevity including topics of fatigue, wear, and fracture are reviewed. Case studies that examine failures of devices are presented. This course includes a teaching/design laboratory component that involves design analysis of medical devices and outreach teaching to the public community. Several problem-based projects are utilized throughout the semester for design analysis. In addition to technical content, this course involves rigorous technical writing assignments, oral communication skill development and teamwork.
Rules & Requirements

Prerequisites: BIOLOGY 1A (http://guide.berkeley.edu/search/?P=BIOLOGY%201A), Engineering 45, Civil and Environmental Engineering 130 or 130N or Bioengineering 102, and Engineering 190

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 2 hours of laboratory per week

Additional Details

Subject/Course Level: Mechanical Engineering/Undergraduate

Grading/Final exam status: Letter grade. Final exam not required.

Instructor: Pruitt

Also listed as: BIO ENG C117

MEC ENG 118 Introduction to Nanotechnology and Nanoscience 3 Units
This course introduces engineering students (juniors and seniors) to the field of nanotechnology and nanoscience. The course has two components: (1) Formal lectures. Students receive a set of formal lectures introducing them to the field of nanotechnology and nanoscience. The material covered includes nanofabrication technology (how one achieves the nanometer length scale, from "bottom up" to "top down" technologies), the interdisciplinary nature of nanotechnology and nanoscience (including areas of chemistry, material science, physics, and molecular biology), examples of nanoscience phenomena (the crossover from bulk to quantum mechanical properties), and applications (from integrated circuits, quantum computing, MEMS, and bioengineering). (2) Projects. Students are asked to read and present a variety of current journal papers to the class and lead a discussion on the various works.
Rules & Requirements

Prerequisites: Chemistry 1A and PHYSICS 7B (http://guide.berkeley.edu/search/?P=PHYSICS%207B). PHYSICS 7C (http://guide.berkeley.edu/search/?P=PHYSICS%207C) and Engineering 45 (or the equivalent) recommended

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mechanical Engineering/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructors: Lin, Sohn

MEC ENG 119 Introduction to MEMS (Microelectromechanical Systems) 3 Units
Fundamentals of microelectromechanical systems including design, fabrication of microstructures; surface-micromachining, bulk-micromachining, LIGA, and other micro machining processes; fabrication principles of integrated circuit device and their applications for making MEMS devices; high-aspect-ratio microstructures; scaling issues in the micro scale (heat transfer, fluid mechanics and solid mechanics); device design, analysis, and mask layout.
Rules & Requirements

Prerequisites: Electrical Engineering 100, PHYSICS 7B (http://guide.berkeley.edu/search/?P=PHYSICS%207B)

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mechanical Engineering/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

MEC ENG 120 Computational Biomechanics Across Multiple Scales 3 Units
This course applies the methods of computational modeling and continuum mechanics to biomedical phenomena spanning various length scales ranging from molecular to cellular to tissue and organ levels. The course is intended for upper level undergraduate students who have been exposed to undergraduate continuum mechanics (statics and strength of materials.)
Rules & Requirements

Prerequisites: Mechanical Engineering C85

Hours & Format

Fall and/or spring: 15 weeks - 2 hours of lecture and 3 hours of laboratory per week

Additional Details

Subject/Course Level: Mechanical Engineering/Undergraduate

Grading/Final exam status: Letter grade. Final exam not required.

Instructor: Mofrad

MEC ENG 122 Processing of Materials in Manufacturing 3 Units
Fundamentals of manufacturing processes (metal forming, forging, metal cutting, welding, joining, and casting); selection of metals, plastics, and other materials relative to the design and choice of manufacturing processes; geometric dimensioning and tolerancing of all processes.
Rules & Requirements

Prerequisites: Mechanical Engineering 108 and Mechanical Engineering C85/Civil Engineering C30

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 1 hour of discussion per week

Additional Details

Subject/Course Level: Mechanical Engineering/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

MEC ENG 127 Composite Materials--Analysis, Design, Manufacture 3 Units
Properties and microstructure of high-strength fiber materials (glass, carbon, polymer, ceramic fibers) and matrix materials (polymer, metal, ceramic, and carbon matrices). Specific strength and stiffness of high-performance composites. Stress, strain and stiffness transformations. Elastic properties of a single orthotropic ply. Laminated plate theory. Failure criteria. Short fiber composites. Manufacturing processes. Sandwich panels. Joints. Design of composite structures and components. Sustainability and recycling. Laboratory sessions on manufacturing processes and testing. Assigned class design projects on design and manufacturing of composites.
Rules & Requirements

Prerequisites: Civil and Environmental Engineering 130 or 130N or equivalent course in mechanics of materials; Engineering 36 and 45

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mechanical Engineering/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructor: Dharan

MEC ENG 128 Computer-Aided Mechanical Design 3 Units
Introduction to design (not drafting) via computers. Using MATLAB and other Finite Element software, students will be introduced to a variety of mechanical design techniques and apply those techniques to the design of beams, automobile engine components, planar machine elements, linkages, and flexure hinges. These techniques include ad-hoc methods, exhaustive numeration, grid studies, and informal optimizations.
Rules & Requirements

Prerequisites: Engineering 28, and Mathematics 53, 54, or consent of instructor

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 1 hour of discussion per week

Additional Details

Subject/Course Level: Mechanical Engineering/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructor: Lin

MEC ENG 130 Design of Planar Machinery 3 Units
Synthesis, analysis, and design of planar machines. Kinematic structure, graphical, analytical, and numerical analysis and synthesis. Linkages, cams, reciprocating engines, gear trains, and flywheels.
Rules & Requirements

Prerequisites: 104

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 1 hour of laboratory per week

Additional Details

Subject/Course Level: Mechanical Engineering/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructor: Youssefi

MEC ENG 131 Vehicle Dynamics and Control 3 Units
Physical understanding of automotive vehicle dynamics including simple lateral, longitudinal, and ride quality models. An overview of active safety systems will be introduced including the basic concepts and terminology, the state-of-the-art development, and basic principles of systems such as ABS, traction control, dynamic stability control, and roll stability control. Passive, semi-active, and active suspension systems will be analyzed. Concepts of autonomous vehicle technology including drive-by-wire and steer-by-wire systems, adaptive cruise control, and lane keeping systems. Upon completion of this course, students should be able to follow the literature on these subjects and perform independent design, research, and development work in this field.
Rules & Requirements

Prerequisites: Engineering 7, MATH 53 (http://guide.berkeley.edu/search/?P=MATH%2053) and 54, and PHYSICS 7A (http://guide.berkeley.edu/search/?P=PHYSICS%207A)-7B

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 1 hour of discussion per week

Additional Details

Subject/Course Level: Mechanical Engineering/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructor: Hedrick

MEC ENG 132 Dynamic Systems and Feedback 3 Units
Physical understanding of dynamics and feedback. Linear feedback control of dynamic systems. Mathematical tools for analysis and design. Stability. Modeling systems with differential equations. Linearization. Solution to linear, time-invariant differential equations.
Rules & Requirements

Prerequisites: MATH 53 (http://guide.berkeley.edu/search/?P=MATH%2053), 54, PHYSICS 7A (http://guide.berkeley.edu/search/?P=PHYSICS%207A)-7B

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 1 hour of laboratory per week

Summer: 10 weeks - 4.5 hours of lecture and 1.5 hours of laboratory per week

Additional Details

Subject/Course Level: Mechanical Engineering/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

MEC ENG 133 Mechanical Vibrations 3 Units
An introduction to the theory of mechanical vibrations including topics of harmonic motion, resonance, transient and random excitation, applications of Fourier analysis and convolution methods. Multidegree of freedom discrete systems including principal mode, principal coordinates and Rayleigh's principle.
Rules & Requirements

Prerequisites: 104

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mechanical Engineering/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructor: Tongue

MEC ENG C134 Feedback Control Systems 4 Units
Analysis and synthesis of linear feedback control systems in transform and time domains. Control system design by root locus, frequency response, and state space methods. Applications to electro-mechanical and mechatronics systems.
Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture, 1 hour of discussion, and 3 hours of laboratory per week

Additional Details

Subject/Course Level: Mechanical Engineering/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Also listed as: EL ENG C128

MEC ENG 135 Design of Microprocessor-Based Mechanical Systems 4 Units
This course provides preparation for the conceptual design and prototyping of mechanical systems that use microprocessors to control machine activities, acquire and analyze data, and interact with operators. The architecture of microprocessors is related to problems in mechanical systems through study of systems, including electro-mechanical components, thermal components and a variety of instruments. Laboratory exercises lead through studies of different levels of software.
Rules & Requirements

Prerequisites: Engineering 7

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 3 hours of laboratory per week

Summer: 10 weeks - 4.5 hours of lecture and 4.5 hours of laboratory per week

Additional Details

Subject/Course Level: Mechanical Engineering/Undergraduate

Grading/Final exam status: Letter grade. Final exam not required.

Instructor: Kazerooni

MEC ENG 138 Introduction to Micro/Nano Mechanical Systems Laboratory 3 Units
This hands-on laboratory course focuses on the mechanical engineering principles that underlie the design, fabricaton, and operation of micro/nanoscale mechanical systems, including devices made by nanowire/nanotube syntheses; photolithography/soft lithography; and molding processes. Each laboratory will have different focuses for basic understanding of MEMS/NEMS systems from prototype constructions to experimental testings using mechanical, electrical, or optical techniques.
Rules & Requirements

Prerequisites: Electrical Engineering 100, Mechanical Engineering 106, PHYSICS 7B (http://guide.berkeley.edu/search/?P=PHYSICS%207B)

Credit Restrictions: Students will receive no credit for Mechanical Engineering 238 after taking Mechanical Engineering 138.

Hours & Format

Fall and/or spring: 15 weeks - 2 hours of lecture and 3 hours of laboratory per week

Additional Details

Subject/Course Level: Mechanical Engineering/Undergraduate

Grading/Final exam status: Letter grade. Final exam not required.

MEC ENG 140 Combustion Processes 3 Units
Fundamentals of combustion, flame structure, flame speed, flammability, ignition, stirred reaction, kinetics and nonequilibrium processes, pollutant formation. Application to engines, energy production and fire safety.
Rules & Requirements

Prerequisites: 40, 106, and 109 (106 and 109 may be taken concurrently)

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 1 hour of laboratory per week

Additional Details

Subject/Course Level: Mechanical Engineering/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructors: Fernandez-Pello, Chen

MEC ENG 146 Energy Conversion Principles 3 Units
This course covers the fundamental principles of energy conversion processes, followed by development of theoretical and computational tools that can be used to analyze energy conversion processes. The course also introduces the use of modern computational methods to model energy conversion performance characteristics of devices and systems. Performance features, sources of inefficiencies, and optimal design strategies are explored for a variety of applications, which may include conventional combustion based and Rankine power systems, energy systems for space applications, solar, wind, wave, thermoelectric, and geothermal energy systems.
Rules & Requirements

Prerequisites: 40, 106, and 109 (106 and 109 may be taken concurrently)

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 1 hour of discussion per week

Additional Details

Subject/Course Level: Mechanical Engineering/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructor: Carey

MEC ENG 150A Solar-Powered Vehicles: Analysis, Design and Fabrication 3 Units
This course addresses all aspects of design, analysis, construction and economics of solar-powered vehicles. It begins with an examination of the fundamentals of photovoltaic solar power generation, and the capabilities and limitations that exist when using this form of renewable energy. The efficiency of energy conversion and storage will be evaluated across an entire system, from the solar energy that is available to the mechanical power that is ultimately produced. The structural and dynamic stability, as well as the aerodynamics, of vehicles will be studied. Safety and economic concerns will also be considered. Students will work in teams to design, build and test a functioning single-person vehicle capable of street use.
Objectives Outcomes

Course Objectives: This course provides a structured environment within which students can participate in a substantial engineering project from start to finish. It provides the opportunity for students to engage deeply in the analysis, design and construction of a functioning vehicle powered by a renewable source. Through participation in this course, students should strengthen their understanding of how their engineering education can be used to address the multidisciplinary problems with creativity, imagination, confidence and responsibility. Students will recognize the importance of effective communication in effectively addressing such problems.

Student Learning Outcomes: This course will strengthen students' abilities: to apply knowledge of mathematics, science, and engineering to real projects; to design a component or process that is part of a larger system; to function on multi-disciplinary teams; to identify, formulate, and solve engineering problems; to communicate effectively; to understand the impact of engineering solutions in a context beyond the classroom; to appreciate the importance of engaging in life-long learning and understanding contemporary issues; and to recognize and use the techniques, skills, and modern engineering tools necessary for successful project completion.

Rules & Requirements

Prerequisites: MATH 54 (http://guide.berkeley.edu/search/?P=MATH%2054), PHYSICS 7A (http://guide.berkeley.edu/search/?P=PHYSICS%207A); Upper division status in engineering

Hours & Format

Fall and/or spring: 15 weeks - 2 hours of lecture and 3 hours of laboratory per week

Summer: 10 weeks - 3 hours of lecture and 4.5 hours of laboratory per week

Additional Details

Subject/Course Level: Mechanical Engineering/Undergraduate

Grading/Final exam status: Letter grade. Alternative to final exam.

MEC ENG 151 Advanced Heat Transfer 3 Units
Basic principles of heat transfer and their application. Subject areas include steady-state and transient system analyses for conduction, free and forced convection, boiling, condensation and thermal radiation.
Rules & Requirements

Prerequisites: 40, 106, and 109 (106 and 109 may be taken concurrently)

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mechanical Engineering/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

MEC ENG 163 Engineering Aerodynamics 3 Units
Introduction to the lift, drag, and moment of two-dimensional airfoils, three-dimensional wings, and the complete airplane. Calculations of the performance and stability of airplanes in subsonic flight.
Rules & Requirements

Prerequisites: 106

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mechanical Engineering/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructor: Savas

MEC ENG 164 Marine Statics and Structures 3 Units
Terminology and definition of hull forms, conditions of static equilibrium and stability of floating submerged bodies. Effects of damage on stability. Structural loads and response. Box girder theory. Isotropic and orthotropic plate bending and bucking.
Rules & Requirements

Prerequisites: Civil and Environmental Engineering 130 or 130N or consent of instructor

Credit Restrictions: Students will receive no credit for 164 after taking C164/Ocean Engineering C164; 2 units after taking 151.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mechanical Engineering/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructor: Mansour

Formerly known as: C164

MEC ENG 165 Ocean-Environment Mechanics 3 Units
Ocean environment. Physical properties and characteristics of the oceans. Global conservation laws. Surface-waves generation. Gravity-wave mechanics, kinematics, and dynamics. Design consideration of ocean vehicles and systems. Model-testing techniques. Prediction of resistance and response in waves--physical modeling and computer models.
Rules & Requirements

Prerequisites: 106 or Civil and Environmental Engineering 100

Credit Restrictions: Students will receive no credit for 165 after taking C165/Ocean Engineering C165.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 1 hour of discussion per week

Additional Details

Subject/Course Level: Mechanical Engineering/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructor: Yeung

Formerly known as: C165

MEC ENG 167 Microscale Fluid Mechanics 3 Units
Phenomena of physical, technological, and biological significance in flows of gases and liquids at the microscale. The course begins with familiar equations of Newtonian fluid mechanics, then proceeds to the study of essentially 1-D flows in confined geometries with the lubrication equations. Next is a study of the flow of thin films spreading under gravity or surface tension gradients. Lubrication theory of compressible gases leads to consideration of air bearings. Two- and 3-D flows are treated with Stokes' equations. Less familiar physical phenomena of significance and utility at the microscale are then considered: intermolecular forces in liquids, slip, diffusion and bubbles as active agents. A review of relevant aspects of electricity and magnetism precedes a study of electrowetting and electrokinetically driven liquid flows.
Rules & Requirements

Prerequisites: 40, 106, 109, (106 and 109 may be taken concurrently) PHYSICS 7B (http://guide.berkeley.edu/search/?P=PHYSICS%207B) or equivalent

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mechanical Engineering/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructors: Morris, Szeri

MEC ENG 168 Mechanics of Offshore Systems 3 Units
This course covers major aspects of offshore engineering including ocean environment, loads on offshore structures, cables and mooring, underwater acoustics and arctic operations.
Objectives Outcomes

Course Objectives: To provide a basic to intermediate level of treatment of engineering systems that operate in coastal, offshore, and arctic environment. Students will acquire an understanding of the unique and essential character of the marine fields and the analysis tools to handle the engineering aspects of them.

Student Learning Outcomes: (a) an ability to apply knowledge of mathematics, science, and engineering
(c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
(d) an ability to function on multi-disciplinary teams
(e) an ability to identify, formulate, and solve engineering problems
(j) a knowledge of contemporary issues
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Rules & Requirements

Prerequisites: Mechanical Engineering 106 and Mechanical Engineering C85 (or Civil Engineering C30). Mechanical Engineering 165 is recommended

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 1 hour of discussion per week

Additional Details

Subject/Course Level: Mechanical Engineering/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructor: Alam

MEC ENG 170 Engineering Mechanics III 3 Units
This course builds upon material learned in 104, examining the dynamics of particles and rigid bodies moving in three dimensions. Topics include non-fixed axis rotations of rigid bodies, Euler angles and parameters, kinematics of rigid bodies, and the Newton-Euler equations of motion for rigid bodies. The course material will be illustrated with real-world examples such as gyroscopes, spinning tops, vehicles, and satellites. Applications of the material range from vehicle navigation to celestial mechanics, numerical simulations, and animations.
Rules & Requirements

Prerequisites: 104 or consent of instructor

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mechanical Engineering/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructors: O’Reilly, Tongue

MEC ENG 171 Dynamics of Charged Particulate Systems: Modeling, Theory and Computation 3 Units
Introduction to the dynamics of small-scale charged particle systems.
Rules & Requirements

Prerequisites: 104 or equivalent

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mechanical Engineering/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructor: Zohdi

MEC ENG 173 Fundamentals of Acoustics 3 Units
Plane and spherical sound waves. Sound intensity. Propagation in tubes and horns. Resonators. Standing waves. Radiation from oscillating surface. Reciprocity. Reverberation and diffusion. Electro-acoustic loud speaker and microphone problems. Environmental and architectural acoustics. Noise measurement and control. Effects on man.
Rules & Requirements

Prerequisites: 104

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mechanical Engineering/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

MEC ENG 175 Intermediate Dynamics 3 Units
This course introduces and investigates Lagrange's equations of motion for particles and rigid bodies. The subject matter is particularly relevant to applications comprised of interconnected and constrained discrete mechanical components. The material is illustrated with numerous examples. These range from one-dimensional motion of a single particle to three-dimensional motions of rigid bodies and systems of rigid bodies.
Rules & Requirements

Prerequisites: 104 or equivalent

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 1 hour of discussion per week

Additional Details

Subject/Course Level: Mechanical Engineering/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

MEC ENG C176 Orthopedic Biomechanics 4 Units
Statics, dynamics, optimization theory, composite beam theory, beam-on-elastic foundation theory, Hertz contact theory, and materials behavior. Forces and moments acting on human joints; composition and mechanical behavior of orthopedic biomaterials; design/analysis of artificial joint, spine, and fracture fixation prostheses; musculoskeletal tissues including bone, cartilage, tendon, ligament, and muscle; osteoporosis and fracture-risk predication of bones; and bone adaptation. MATLAB-based project to integrate the course material.
Rules & Requirements

Prerequisites: Civil and Environmental Engineering 130 or 130N

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 1 hour of discussion per week

Additional Details

Subject/Course Level: Mechanical Engineering/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructor: Keaveny

Also listed as: BIO ENG C119

MEC ENG C180 Engineering Analysis Using the Finite Element Method 3 Units
This is an introductory course on the finite element method and is intended for seniors in engineering and applied science disciplines. The course covers the basic topics of finite element technology, including domain discretization, polynomial interpolation, application of boundary conditions, assembly of global arrays, and solution of the resulting algebraic systems. Finite element formulations for several important field equations are introduced using both direct and integral approaches. Particular emphasis is placed on computer simulation and analysis of realistic engineering problems from solid and fluid mechanics, heat transfer, and electromagnetism. The course uses FEMLAB, a multiphysics MATLAB-based finite element program that possesses a wide array of modeling capabilities and is ideally suited for instruction. Assignments will involve both paper- and computer-based exercises. Computer-based assignments will emphasize the practical aspects of finite element model construction and analysis.
Rules & Requirements

Prerequisites: Engineering 7 or 77 or Computer Science 61A; Mathematics 53 and 54; senior status in engineering or applied science

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 2 hours of laboratory per week

Additional Details

Subject/Course Level: Mechanical Engineering/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Also listed as: CIV ENG C133

MEC ENG 185 Introduction to Continuum Mechanics 3 Units
Kinematics of deformation, the concept of stress, conservation of mass and balance of linear momentum, angular momentum and energy. Mechanical constitutive equations for ideal fluid, linear elastic solid.
Rules & Requirements

Prerequisites: PHYSICS 7A (http://guide.berkeley.edu/search/?P=PHYSICS%207A); Mathematics 53, 54

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 1 hour of discussion per week

Additional Details

Subject/Course Level: Mechanical Engineering/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

MEC ENG 190A Rapid Prototyping of Mechanical Systems 2 Units
Design, optimization, rapid prototyping, assembly, test and evaluation of mechanical components and sub-systems used in mechanical systems.
Rules & Requirements

Prerequisites: Engineering 10

Hours & Format

Fall and/or spring: 15 weeks - 1 hour of lecture and 3 hours of laboratory per week

Additional Details

Subject/Course Level: Mechanical Engineering/Undergraduate

Grading/Final exam status: Letter grade. Final exam not required.

Instructor: Pisano

MEC ENG 190K Professional Communication for Mechanical Engineers 1 Unit
The course emphasizes understanding of and performance in professional speaking situations, including presentations, meetings, interviews, and informal business conversations. It emphasizes collaborative projects with distance partners. It combines theory and practice, integrating extensive speaking practice and individual critiques from instructor and students. The purpose is to advance students' ability to collaborate and communicate effectively in a variety of professional environments.
Hours & Format

Fall and/or spring: 15 weeks - 1 hour of lecture per week

Additional Details

Subject/Course Level: Mechanical Engineering/Undergraduate

Grading/Final exam status: Letter grade. Final exam not required.

MEC ENG 190L Practical Control System Design: A Systematic Loopshaping Approach 1 Unit
After a review of basic loopshaping, we introduce the loopshaping design methodology of McFarlane and Glover, and learn how to use it effectively. The remainder of the course studies the mathematics underlying the new method (one of the most prevalent advanced techniques used in industry) justifying its validity.
Rules & Requirements

Prerequisites: 132 or Electrical Engineering 128 (El Engineering 20 may suffice) or similar introductory experience regarding feedback control systems

Hours & Format

Fall and/or spring: 15 weeks - 1 hour of lecture per week

Additional Details

Subject/Course Level: Mechanical Engineering/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructor: Packard

MEC ENG 190M Model Predictive Control 1 Unit
Basics on optimization and polyhedra manipulation. Analysis and design of constrained predictive controllers for linear and nonlinear systems.
Rules & Requirements

Prerequisites: 132

Hours & Format

Fall and/or spring: 15 weeks - 1 hour of lecture per week

Additional Details

Subject/Course Level: Mechanical Engineering/Undergraduate

Grading/Final exam status: Letter grade. Final exam not required.

Instructor: Borrelli

MEC ENG 190Y Practical Control System Design: A Systematic Optimization Approach 1 Unit
The Youla-parametrization of all stabilizing controllers allows certain time-domain and frequency-domain closed-loop design objectives to be cast as convex optimizations, and solved reliably using off-the-shelf numerical optimization codes. This course covers the Youla parametrization, basic elements of convex optimization, and finally control design using these techniques.
Rules & Requirements

Prerequisites: 132 or Electrical Engineering 128 (EE 20 may suffice) or similar introductory experience regarding feedback control systems

Hours & Format

Fall and/or spring: 15 weeks - 1 hour of lecture per week

Additional Details

Subject/Course Level: Mechanical Engineering/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructor: Packard

MEC ENG 191AC Cases and Conflicts in Engineering Ethics 3 Units
Engineering is challenged by issues of security, poverty and under-development, and environmental sustainability. These issues intersect with those of race, class, and culture in U.S. society. This course focuses on engineering ethics case studies as they apply to issues of workplace diversity, sustainable practices, economic impacts on neighborhoods and nations, and issues of security and identity. The goal of this course is to broaden the understanding of engineering ethics from individual and business-based practices to those affecting communities and nations. This class cannot be used to satisfy any Engineering requirement (technical electives, engineering units, or courses).
Hours & Format

Summer: 8 weeks - 6 hours of lecture per week

Additional Details

Subject/Course Level: Mechanical Engineering/Undergraduate

Grading/Final exam status: Letter grade. Final exam not required.

MEC ENG 191K Professional Communication 3 Units
This course is designed to enhance students' written and oral communication skills. Written work consists of informal documents--correspondence, internal reports, and reviews--and formal work--proposals, conference papers, journal articles, and websites. Presentations consist of informal and formal reports, including job and media interviews, phone interviews, conference calls, video conferences, progress reports, sales pitches, and feasibility studies.
Rules & Requirements

Prerequisites: ENGLISH R1A (http://guide.berkeley.edu/search/?P=ENGLISH%20R1A)-R1B or equivalent

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Summer:
6 weeks - 8 hours of lecture per week
8 weeks - 5.5 hours of lecture per week

Additional Details

Subject/Course Level: Mechanical Engineering/Undergraduate

Grading/Final exam status: Letter grade. Final exam not required.

MEC ENG H194 Honors Undergraduate Research 2 - 4 Units
Final report required. Students who have completed a satisfactory number of advanced courses may pursue original research under the direction of one of the members of the faculty. A maximum of three units of H194 may be used to fulfill technical elective requirements in the Mechanical Engineering program (unlike 198 or 199, which do not satisfy technical elective requirements). Students can use a maximum of three units of graded research units (H194 or 196) towards their technical elective requirement.
Rules & Requirements

Prerequisites: 3.3 cumulative GPA or higher, consent of instructor and adviser, and senior standing

Repeat rules: Course may be repeated for credit. Course may be repeated for credit when topic changes.

Hours & Format

Fall and/or spring: 15 weeks - 2-4 hours of independent study per week

Summer:
6 weeks - 1-5 hours of independent study per week
8 weeks - 4-8 hours of independent study per week

Additional Details

Subject/Course Level: Mechanical Engineering/Undergraduate

Grading/Final exam status: Letter grade. Final exam not required.

MEC ENG 196 Undergraduate Research 2 - 4 Units
Students who have completed a satisfactory number of advanced courses may pursue original research under the direction of one of the members of the staff. A maximum of three units of 196 may be used to fulfill technical elective requirements in the Mechanical Engineering program (unlike 198 or 199, which do not satisfy technical elective requirements). Students can use a maximum of three units of graded research units (H194 or 196) towards their technical elective requirement. Final report required.
Rules & Requirements

Prerequisites: Consent of instructor and adviser; junior or senior standing

Repeat rules: Course may be repeated for credit. Course may be repeated for credit when topic changes.

Hours & Format

Fall and/or spring: 15 weeks - 2-4 hours of independent study per week

Summer:
6 weeks - 5-10 hours of independent study per week
8 weeks - 4-8 hours of independent study per week

Additional Details

Subject/Course Level: Mechanical Engineering/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

MEC ENG 197 Undergraduate Engineering Field Studies 1 - 4 Units
Supervised experience relative to specific aspects of practice in engineering. Under guidance of a faculty member, the student will work in industry, primarily in an internship setting or another type of short-time status. Emphasis is to attain practical experience in the field.
Objectives Outcomes

Student Learning Outcomes: (h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
(j) a knowledge of contemporary issues
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Rules & Requirements

Repeat rules: Course may be repeated for credit when topic changes.

Hours & Format

Fall and/or spring: 15 weeks - 3-12 hours of internship per week

Summer:
6 weeks - 8-30 hours of internship per week
10 weeks - 5-18 hours of internship per week

Additional Details

Subject/Course Level: Mechanical Engineering/Undergraduate

Grading/Final exam status: Offered for pass/not pass grade only. Final exam not required.

MEC ENG 198 Directed Group Studies for Advanced Undergraduates 1 - 4 Units
Group study of a selected topic or topics in Mechanical Engineering. Credit for 198 or 199 courses combined may not exceed 4 units in any single term. See College for other restrictions.
Rules & Requirements

Prerequisites: Upper division standing and good academic standing

Repeat rules: Course may be repeated for credit. Course may be repeated for credit when topic changes.

Hours & Format

Fall and/or spring: 15 weeks - 1-4 hours of directed group study per week

Summer: 10 weeks - 1.5-6 hours of directed group study per week

Additional Details

Subject/Course Level: Mechanical Engineering/Undergraduate

Grading/Final exam status: Offered for pass/not pass grade only. Final exam not required.

MEC ENG 199 Supervised Independent Study 1 - 4 Units
Supervised independent study. Enrollment restrictions apply; see the introduction to Courses and Curricula section of this catalog.
Rules & Requirements

Prerequisites: Consent of instructor and major adviser

Repeat rules: Course may be repeated for credit. Course may be repeated for credit when topic changes.

Hours & Format

Fall and/or spring: 15 weeks - 1-4 hours of independent study per week

Summer:
6 weeks - 1-5 hours of independent study per week
8 weeks - 1-4 hours of independent study per week

Additional Details

Subject/Course Level: Mechanical Engineering/Undergraduate

Grading/Final exam status: Offered for pass/not pass grade only. Final exam not required.

MEC ENG C200 Design, Evaluate, and Scale Development Technologies 3 Units
This required course for the Designated Emphasis in Development Engineering will include projects and case studies, many related to projects at UC Berkeley, such as those associated with the Development Impact Labs (DIL). Student teams will work with preliminary data to define the problem. They will then collect and analyze interview and survey data from potential users and begin to design a solution. Students will explore how to use novel monitoring technologies and “big data” for product improvement and evaluation. The student teams will use the case studies (with improvements based on user feedback and data analysis) to develop a plan for scaling and evaluation with a rigorous controlled trial.
Objectives Outcomes

Course Objectives: Students will use multiple qualitative and quantitative methods to learn about user needs, to come up with new concepts and solutions, and to understand how new products and services achieve or fail to achieve their goals in a development setting.

Student Learning Outcomes: Students will be able to apply the skills to current challenges in development engineering
Students will develop a set of skills that will allow them to flourish in a climate of complex problem solving and design challenges in development engineering
Students will learn how to learn from users using qualitative and quantitative tools including surveys, interviews, new monitoring technologies, statistical analyses and experimental designs
Students will learn to participate in and lead innovation and creativity in collaborative settings

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mechanical Engineering/Graduate

Grading: Letter grade.

Instructors: Agogino, Levine

Also listed as: DEV ENG C200

MEC ENG C201 Modeling and Simulation of Advanced Manufacturing Processes 3 Units
This course provides the student with a modern introduction to the basic industrial practices, modeling techniques, theoretical background, and computational methods to treat classical and cutting edge manufacturing processes in a coherent and self-consistent manner.
Objectives Outcomes

Course Objectives: An introduction to modeling and simulation of modern manufacturing processes.

Rules & Requirements

Prerequisites: An undergraduate course in strength of materials or 122

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 1 hour of discussion per week

Additional Details

Subject/Course Level: Mechanical Engineering/Graduate

Grading: Letter grade.

Instructor: Zohdi

Also listed as: MAT SCI C286

MEC ENG C202 Computational Design of Multifunctional/Multiphysical Composite Materials 3 Units
The course is self-contained and is designed in an interdisciplinary manner for graduate students in engineering, materials science, physics, and applied mathematics who are interested in methods to accelerate the laboratory analysis and design of new materials. Examples draw primarily from various mechanical, thermal, diffusive, and electromagnetic applications.
Rules & Requirements

Prerequisites: An undergraduate degree in the applied sciences or engineering

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mechanical Engineering/Graduate

Grading: Letter grade.

Instructor: Zohdi

Also listed as: MAT SCI C287

MEC ENG 204 Advanced Manufacturing Systems Analysis, AMS 3 Units
This course is designed to prepare students for technical leadership in industry. The objective is to provide insight and understanding on the main concepts and practices involved in analyzing, managing systems to deliver high quality, cost effectiveness and sustainable advantages.
The impact of this class on the Mechanical Engineering program includes delivering core production concepts and advanced skills that blend vision and advanced manufacturing elements. This course is highly recommended for students on the Product Design track in Mechanical Engineering’s Master of Engineering program.
Objectives Outcomes

Course Objectives: The objective of this course is to ensure that our students:

a. Gain solid foundations on the analysis of Advanced Manufacturing Systems Analysis (AMS), including flow analysis concepts, frameworks and methodologies.
b. Understand and apply sustainable engineering practices.
c. Put into practice decision-making activities based on solid academic rigor, quantitative tools and simulation models oriented for AMS
d. Align their AMS to a company’s strategy to deliver business advantage.

Rules & Requirements

Prerequisites: This course is open to graduate students, with priority given to students in Mechanical Engineering’s Master of Engineering program

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mechanical Engineering/Graduate

Grading: Letter grade.

MEC ENG C210 Advanced Orthopedic Biomechanics 4 Units
Students will learn the application of engineering concepts including statics, dynamics, optimization theory, composite beam theory, beam-on-elastic foundation theory, Hertz contact theory, and materials behavior. Topics will include forces and moments acting on human joints; composition and mechanical behavior of orthopedic biomaterials; design/analysis of artificial joint, spine, and fracture fixation prostheses; musculoskeletal tissues including bone, cartilage, tendon, ligament, and muscle; osteoporosis and fracture-risk predication of bones; and bone adaptation. Students will be challenged in a MATLAB-based project to integrate the course material in an attempt to gain insight into contemporary design/analysis/problems.
Objectives Outcomes

Course Objectives: The purpose of this course is twofold:
• to learn the fundamental concepts of orthopaedic biomechanics;
• to enhance skills in mechanical engineering and bioengineering by analyzing the mechanical behavior of various complex biomedical problems.

Student Learning Outcomes: Working knowledge of various engineering concepts such as composite beam theory, beam-on-elastic-foundation theory, Hertz contact theory and MATLAB-based optimization design analysis. Understanding of basic concepts in orthopaedic biomechanics and the ability to apply the appropriate engineering concepts to solve realistic biomechanical problems, knowing clearly the assumptions involved.

Rules & Requirements

Prerequisites: ME C85/CE C30 or Bio Eng 102; concurrent enrollment OK. Proficiency in MatLab or equivalent. Prior knowledge of biology or anatomy is not assumed

Credit Restrictions: Students will not receive credit for this course if they have taken ME C176/Bio E C119.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture, 1 hour of discussion, and 1 hour of laboratory per week

Additional Details

Subject/Course Level: Mechanical Engineering/Graduate

Grading: Letter grade.

Instructors: O'Connell, Keaveny

Also listed as: BIO ENG C209

MEC ENG 211 The Cell as a Machine 3 Units
This course offers a modular and systems mechanobiology (or "machine") perspective of the cell. Two vitally important components of the cell machinery will be studied in depth: (1) the integrin-mediated focal adhesions system that enables the cell to adhere to, and communicate mechano-chemical signals with, the extracellular environment, and (2) the nuclear pore complex, a multi-protein gateway for traffic in and out of the nucleus that regulates gene expression and affects protein synthesis.
Rules & Requirements

Prerequisites: Mathematics 54; PHYSICS 7A (http://guide.berkeley.edu/search/?P=PHYSICS%207A); graduate standing

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 1 hour of discussion per week

Additional Details

Subject/Course Level: Mechanical Engineering/Graduate

Grading: Letter grade.

Instructor: Mofrad

MEC ENG C212 Heat and Mass Transport in Biomedical Engineering 3 Units
Fundamental processes of heat and mass transport in biological systems; organic molecules, cells, biological organs, whole animals. Derivation of mathematical models and discussion of experimental procedures. Applications to biomedical engineering.
Rules & Requirements

Prerequisites: 106 and 109 (106 and 109 may be taken concurrently)

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mechanical Engineering/Graduate

Grading: Letter grade.

Formerly known as: Mechanical Engineering 212

Also listed as: BIO ENG C212

MEC ENG C213 Fluid Mechanics of Biological Systems 3 Units
Fluid mechanical aspects of various physiological systems, the circulatory, respiratory, and renal systems. Motion in large and small blood vessels. Pulsatile and peristaltic flows. Other biofluidmechanical flows: the ear, eye, etc. Instrumentation for fluid measurements in biological systems and for medical diagnosis and applications. Artificial devices for replacement of organs and/or functions, e.g. blood oxygenators, kidney dialysis machines, artificial hearts/circulatory assist devices.
Rules & Requirements

Prerequisites: 106 or equivalent; 265A or consent of instructor

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mechanical Engineering/Graduate

Grading: Letter grade.

Instructors: Berger, Liepmann

Also listed as: BIO ENG C213

MEC ENG C214 Advanced Tissue Mechanics 3 Units
The goal of this course is to provide a foundation for characterizing and understanding the mechanical behavior of load-bearing tissues. A variety of mechanics topics will be introduced, including anisotropic elasticity and failure, cellular solid theory, biphasic theory, and quasi-linear viscoelasticity (QLV) theory. Building from this theoretical basis, we will explore the constitutive behavior of a wide variety of biological tissues. After taking this course, students should have sufficient background to independently study the mechanical behavior of most biological tissues. Formal discussion section will include a seminar series with external speakers.
Rules & Requirements

Prerequisites: 102A, 176, 185; graduate standing or consent of instructor

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 1 hour of discussion per week

Additional Details

Subject/Course Level: Mechanical Engineering/Graduate

Grading: Letter grade.

Also listed as: BIO ENG C214

MEC ENG C215 Advanced Structural Aspects of Biomaterials 4 Units
This course covers the structure and mechanical functions of load bearing tissues and their replacements. Biocompatibility of biomaterials and host response to structural implants are examined. Quantitative treatment of biomechanical issues and constitutive relationships of materials are covered in order to design implants for structural function. Material selection for load bearing applications including reconstructive surgery, orthopedics, dentistry, and cardiology are addressed.
Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 2 hours of laboratory per week

Additional Details

Subject/Course Level: Mechanical Engineering/Graduate

Grading: Letter grade.

Also listed as: BIO ENG C222

MEC ENG C216 Molecular Biomechanics and Mechanobiology of the Cell 4 Units
This course develops and applies scaling laws and the methods of continuum and statistical mechanics to understand micro- and nano-scale mechanobiological phenomena involved in the living cell with particular attention the nucleus and the cytoskelton as well as the interactions of the cell with the extracellular matrix and how these interactions may cause changes in cell architecture and biology, consequently leading to functional adaptation or pathological conditions.
Objectives Outcomes

Course Objectives: This course, which is open to graduate students in diverse disciplines ranging from engineering to biology to chemistry and physics, is aimed at exposing students to subcellular biomechanical phenomena spanning scales from molecules to the whole cell.

Student Learning Outcomes: The students will develop tools and skills to (1) understand and analyze subcelluar biomechanics and transport phenomena, and (2) ultimately apply these skills to novel biological and biomedical applications.

Rules & Requirements

Prerequisites: MATH 54 (http://guide.berkeley.edu/search/?P=MATH%2054); PHYSICS 7A (http://guide.berkeley.edu/search/?P=PHYSICS%207A); BioE 102 or ME C85 or instructor’s consent

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 1 hour of discussion per week

Additional Details

Subject/Course Level: Mechanical Engineering/Graduate

Grading: Letter grade.

Instructor: Mofrad

Also listed as: BIO ENG C215

MEC ENG C217 Biomimetic Engineering -- Engineering from Biology 3 Units
Study of nature's solutions to specific problems with the aim of determining appropriate engineering analogs. Morphology, scaling, and design in organisms applied to engineering structures. Mechanical principles in nature and their application to engineering devices. Mechanical behavior of biological materials as governed by underlying microstructure, with the potential for synthesis into engineered materials. Trade-offs between redundancy and efficiency. Students will work in teams on projects where they will take examples of designs, concepts, and models from biology and determine their potential in specific engineering applications.

Rules & Requirements

Prerequisites: Graduate standing in engineering or consent of instructor

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mechanical Engineering/Graduate

Grading: Letter grade.

Instructor: Dharan

Also listed as: BIO ENG C217/INTEGBI C217

MEC ENG C218 Introduction to MEMS Design 4 Units
Physics, fabrication, and design of micro-electromechanical systems (MEMS). Micro and nanofabrication processes, including silicon surface and bulk micromachining and non-silicon micromachining. Integration strategies and assembly processes. Microsensor and microactuator devices: electrostatic, piezoresistive, piezoelectric, thermal, magnetic transduction. Electronic position-sensing circuits and electrical and mechanical noise. CAD for MEMS. Design project is required.

Rules & Requirements

Prerequisites: Graduate standing in engineering or science; undergraduates with consent of instructor

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 1 hour of discussion per week

Additional Details

Subject/Course Level: Mechanical Engineering/Graduate

Grading: Letter grade.

Instructors: Nguyen, Pister

Also listed as: EL ENG C247B

MEC ENG C219 Parametric and Optimal Design of MEMS 3 Units
Parametric design and optimal design of MEMS. Emphasis on design, not fabrication. Analytic solution of MEMS design problems to determine the dimensions of MEMS structures for specified function. Trade-off of various performance requirements despite conflicting design requirements. Structures include flexure systems, accelerometers, and rate sensors.

Rules & Requirements

Prerequisites: Graduate standing or consent of instructor

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mechanical Engineering/Graduate

Grading: Letter grade.

Instructors: Lin, Pisano

Formerly known as: 219

Also listed as: EL ENG C246

MEC ENG 220 Precision Manufacturing 3 Units
Introduction to precision engineering for manufacturing. Emphasis on design and performance of precision machinery for manufacturing. Topics include machine tool elements and structure, sources of error (thermal, static, dynamic, process related), precision machining processes and process models (diamond turning and abrasive (fixed and free) processes), sensors for process monitoring and control, metrology, actuators, machine design case studies and examples of precision component manufacture.

Rules & Requirements

Prerequisites: 101, 102B, or consent of instructor

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mechanical Engineering/Graduate

Grading: Letter grade.

Instructor: Dornfeld

MEC ENG C223 Polymer Engineering 3 Units
A survey of the structure and mechanical properties of advanced engineering polymers. Topics include rubber elasticity, viscoelasticity, mechanical properties, yielding, deformation, and fracture mechanisms of various classes of polymers. The course will discuss degradation schemes of polymers and long-term performance issues. The class will include polymer applications in bioengineering and medicine.
Rules & Requirements

Prerequisites: Civil Engineering 130, Engineering 45

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 1 hour of discussion per week

Additional Details

Subject/Course Level: Mechanical Engineering/Graduate

Grading: Letter grade.

Also listed as: BIO ENG C223

MEC ENG 224 Mechanical Behavior of Engineering Materials 3 Units
This course covers elastic and plastic deformation under static and dynamic loads. Prediction and prevention of failure by yielding, fracture, fatigue, creep, corrosion, and wear. Basic elasticity and plasticity theories are discussed.
Rules & Requirements

Prerequisites: Civil and Environmental Engineering 130 or 130N; Engineering 45

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 1 hour of discussion per week

Additional Details

Subject/Course Level: Mechanical Engineering/Graduate

Grading: Letter grade.

MEC ENG C225 Deformation and Fracture of Engineering Materials 4 Units
This course covers deformation and fracture behavior of engineering materials for both monotonic and cyclic loading conditions.
Rules & Requirements

Prerequisites: Civil Engineering 130, Engineering 45

Hours & Format

Fall and/or spring: 15 weeks - 4 hours of lecture per week

Additional Details

Subject/Course Level: Mechanical Engineering/Graduate

Grading: Letter grade.

Instructors: Ritchie, Pruitt, Komvopoulos

Also listed as: MAT SCI C212

MEC ENG 226 Tribology 3 Units
Surface interactions. Fundamentals of contact mechanics. Friction theories. Types of measurement of wear. Response of materials to surface tractions. Plastic deformation, void/crack nucleation and crack propagation. Delamination wear. Microstructural effects in wear processes. Mechanics of layered media. Solid film and boundary liquid film lubrication. Friction and wear of polymers and fiber-reinforced polymeric composites. Brief introduction to metal cutting and tool wear mechanisms.
Rules & Requirements

Prerequisites: 102B, 104, 108

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mechanical Engineering/Graduate

Grading: Letter grade.

Instructor: Komvopoulos

MEC ENG 227 Mechanical Behavior of Composite Materials 3 Units
Response of composite materials (fiber and particulate-reinforced materials) to static, cyclic, creep and thermomechanical loading. Manufacturing process-induced variability, and residual stresses. Fatigue behavior,fracture mechanics and damage development. Role of the reinforcement-matrix interface in mechanical behavior. Environmental effects. Dimensional stability and thermal fatigue. Application to polymer, metal, ceramic, and carbon matrix composites.
Rules & Requirements

Prerequisites: Graduate standing or consent of instructor

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mechanical Engineering/Graduate

Grading: Letter grade.

Instructor: Dharan

MEC ENG 229 Design of Basic Electro-Mechanical Devices 3 Units
Fundamental principles of magnetics, electro-magnetics, and magnetic materials as applied to design and operation of electro-mechanical devices. Type of device to be used in a particular application and dimensions of parts for the overall design will be discussed. Typical applications covered will be linear and rotary actuators, stepper motors, AC motors, and DC brush and brushless motors. A design project is required.

Rules & Requirements

Prerequisites: EECS 100, graduate standing or consent of instructor

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mechanical Engineering/Graduate

Grading: Letter grade.

MEC ENG 230 Real-Time Applications of Mini and Micro Computers 4 Units
Mini and micro computers, operating in real time, have become ubiquitous components in engineering systems. The purpose of this course is to build competence in the engineering use of such systems through lectures stressing small computer structure, programming, and output/input operation, and through laboratory work with mini and micro computer systems.

Rules & Requirements

Prerequisites: Graduate standing in engineering or consent of instructor for advanced undergraduates

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 3 hours of laboratory per week

Additional Details

Subject/Course Level: Mechanical Engineering/Graduate

Grading: Letter grade.

MEC ENG C231A Experiential Advanced Control Design I 3 Units
Experience-based learning in the design of SISO and MIMO feedback controllers for linear systems. The student will master skills needed to apply linear control design and analysis tools to classical and modern control problems. In particular, the participant will be exposed to and develop expertise in two key control design technologies: frequency-domain control synthesis and time-domain optimization-based approach.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 2 hours of laboratory per week

Additional Details

Subject/Course Level: Mechanical Engineering/Graduate

Grading: Letter grade.

Also listed as: EL ENG C220B

MEC ENG C231B Experiential Advanced Control Design II 3 Units
Experience-based learning in the design, analysis, and verification of automatic control systems. The course emphasizes the use of computer-aided design techniques through case studies and design tasks. The student will master skills needed to apply advanced model-based control analysis, design, and estimation to a variety of industrial applications. The role of these specific design methodologies within the larger endeavor of control design is also addressed.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 2 hours of laboratory per week

Additional Details

Subject/Course Level: Mechanical Engineering/Graduate

Grading: Letter grade.

Also listed as: EL ENG C220C

MEC ENG C232 Advanced Control Systems I 3 Units
Input-output and state space representation of linear continuous and discrete time dynamic systems. Controllability, observability, and stability. Modeling and identification. Design and analysis of single and multi-variable feedback control systems in transform and time domain. State observer. Feedforward/preview control. Application to engineering systems.

Rules & Requirements

Repeat rules: Students will receive no credit for Electrical Engineering C220A after taking Mechanical Engineering 232. Course may be repeated for credit when topic changes.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 1 hour of discussion per week

Additional Details

Subject/Course Level: Mechanical Engineering/Graduate

Grading: Letter grade.

Instructors: Borrelli, Horowitz, Tomizuka, Tomlin

Also listed as: EL ENG C220A

MEC ENG 233 Advanced Control Systems II 3 Units
Linear Quadratic Optimal Control, Stochastic State Estimation, Linear Quadratic Gaussian Problem, Loop Transfer Recovery, Adaptive Control and Model Reference Adaptive Systems, Self Tuning Regulators, Repetitive Control, Application to engineering systems.

Rules & Requirements

Prerequisites: 232

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 1 hour of discussion per week

Additional Details

Subject/Course Level: Mechanical Engineering/Graduate

Grading: Letter grade.

Instructors: Tomizuka, Horowitz

MEC ENG 234 Multivariable Control System Design 3 Units
Analysis and synthesis techniques for multi-input (MIMO) control systems. Emphasis is on the effect that model uncertainty has on the design process.

Rules & Requirements

Prerequisites: 232 or EECS 221A, as well as firm foundation in classical control

Credit Restrictions: Students may not take 234 for credit if they have taken 291C.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mechanical Engineering/Graduate

Grading: Letter grade.

Instructors: Packard, Poolla

Formerly known as: 291C

MEC ENG 235 Design of Microprocessor-Based Mechanical Systems 4 Units
This course provides preparation for the conceptual design and prototyping of mechanical systems that use microprocessors to control machine activities, acquire and analyze data, and interact with operators. The architecture of microprocessors is related to problems in mechanical systems through study of systems, including electro-mechanical components, thermal components, and a variety of instruments. Laboratory exercises lead through studies of different levels of software.

Rules & Requirements

Prerequisites: 132, or C134/Electrical Engineering and Computer Science C128, or any basic undergraduate course in controls

Repeat rules: Students will receive no credit for 235 after taking 135. Course may be repeated for credit when topic changes.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 3 hours of laboratory per week

Summer: 10 weeks - 4.5 hours of lecture and 4.5 hours of laboratory per week

Additional Details

Subject/Course Level: Mechanical Engineering/Graduate

Grading: Letter grade.

MEC ENG C236 Control and Optimization of Distributed Parameters Systems 3 Units
Distributed systems and PDE models of physical phenomena (propagation of waves, network traffic, water distribution, fluid mechanics, electromagnetism, blood vessels, beams, road pavement, structures, etc.). Fundamental solution methods for PDEs: separation of variables, self-similar solutions, characteristics, numerical methods, spectral methods. Stability analysis. Adjoint-based optimization. Lyapunov stabilization. Differential flatness. Viability control. Hamilton-Jacobi-based control.

Rules & Requirements

Prerequisites: Engineering 77, Mathematics 54 (or equivalent), or consent of instructor

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mechanical Engineering/Graduate

Grading: Letter grade.

Also listed as: CIV ENG C291F/EL ENG C291

MEC ENG 237 Control of Nonlinear Dynamic Systems 3 Units
Fundamental properties of nonlinear systems. Stability of nonlinear systems. Controller Design via Lyapunov methods. Equivalent Linearization methods including limit cycle prediction.
Rules & Requirements

Prerequisites: 232

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 1 hour of discussion per week

Additional Details

Subject/Course Level: Mechanical Engineering/Graduate

Grading: Letter grade.

Instructor: Hedrick

MEC ENG 238 Advanced Micro/Nano Mechanical Systems Laboratory 3 Units
This hands-on laboratory course focuses on the mechanical engineering principles that underlie the design, fabricaton, and operation of micro/nanoscale mechanical systems, including devices made by nanowire/nanotube syntheses; photolithography/soft lithography; and molding processes. Each laboratory will have different focuses for basic understanding of MEMS/NEMS systems from prototype constructions to experimental testings using mechanical, electrical, or optical techniques.
Rules & Requirements

Prerequisites: Electrical Engineering 100, Mechanical Engineering 106, PHYSICS 7B (http://guide.berkeley.edu/search/?P=PHYSICS%207B)

Credit Restrictions: Students will receive no credit for Mechanical Engineering 238 after taking Mechanical Engineering 138.

Hours & Format

Fall and/or spring: 15 weeks - 2 hours of lecture and 3 hours of laboratory per week

Additional Details

Subject/Course Level: Mechanical Engineering/Graduate

Grading: Letter grade.

MEC ENG 239 Advanced Design and Automation 4 Units
This course will provide students with a solid understanding of smart products and the use of embedded microcomputers in products and machines. The course has two components: 1.) Formal lectures. Students receive a set of formal lectures on the design of smart machines and products that use embedded microcomputers. The materials cover machine components, actuators, sensors, basic electronic devices, embedded microprocessor systems and control, power transfer components, and mechanism design. 2.) Projects. Students will design and construct prototype products that use embedded microcomputers.
Rules & Requirements

Prerequisites: Graduate standing in engineering or science and one course in Control

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 3 hours of laboratory per week

Additional Details

Subject/Course Level: Mechanical Engineering/Graduate

Grading: Letter grade.

Instructor: Kazerooni

MEC ENG 240A Advanced Marine Structures I 3 Units
This course introduces a probabilistic description of ocean waves and wave loads acting on marine structures. These topics are followed with discussion of structural strength and reliability analysis.
Rules & Requirements

Prerequisites: Graduate standing; Statistics 25 or equivalent

Credit Restrictions: Students will receive no credit for 240A after taking C240A/Ocean Engineering C240A.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mechanical Engineering/Graduate

Grading: Letter grade.

Instructor: Mansour

Formerly known as: C240A

MEC ENG 240B Advanced Marine Structures II 3 Units
This course is concerned with the structural response of marine structures to environmental loads. Overall response of the structure as well as the behavior of its members under lateral and compressive loads are discussed.
Rules & Requirements

Prerequisites: Consent of instructor

Credit Restrictions: Students will receive no credit for 240B after taking C240B/Ocean Engineering C240B.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mechanical Engineering/Graduate

Grading: Letter grade.

Instructor: Mansour

Formerly known as: C240B

MEC ENG 241A Marine Hydrodynamics I 3 Units
Navier-Stokes Equations. Boundary-layer theory, laminar, and turbulent. Frictional resistance. Boundary layer over water surface. Separated flow modeling. Steady and unsteady flow. Momentum theorems. Three-dimensional water-wave theory. Formulation of wave resistance of ships. Michell's solution. Wave patterns. Applications.
Rules & Requirements

Prerequisites: Engineering 165 recommended or graduate standing

Credit Restrictions: Students will receive no credit for 241A after taking C241A/Ocean Engineering C241A.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mechanical Engineering/Graduate

Grading: Letter grade.

Instructor: Yeung

Formerly known as: C241A

MEC ENG 241B Marine Hydrodynamics II 3 Units
Momentum analysis for bodies moving in a fluid. Added-mass theory. Matched asymptotic slender-body theory. Small bodies in a current. Theory of motion of floating bodies with and without forward speed. Radiation and diffraction potentials. Wave forces. Hydro-elasticity formulation. Memory effects in time domain. Second-order effects. Impact hydrodynamics.
Rules & Requirements

Prerequisites: 260A or 241A recommended

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mechanical Engineering/Graduate

Grading: Letter grade.

Instructor: Yeung

Formerly known as: Naval Architecture 241B

MEC ENG 243 Advanced Methods in Free-Surface Flows 3 Units
Analytical and numerical methods in free-surface problems. Elements of inviscid external lifting and nonlifting flows. Analytical solutions in special coordinates systems. Integral-equation methods: formulations and implementations. Multiple-bodies interaction problems. Free-surface Green functions in two and three dimensions. Hybrid integral-equation methods. Finite-element formulations. Variational forms in time-harmonic flows. Finite-difference forms, stability, and accuracy. Boundary-fitted coordinates methods. Unsteady linearized wave-body interaction in time domain. Nonlinear breaking waves calculations. Particle dynamics. Extensive hands-on experience of microcomputers and/or workstations in developing solution.
Rules & Requirements

Prerequisites: 260A or Civil Engineering 200; 241B recommended

Credit Restrictions: Students will receive no credit for 243 after taking C243/Ocean Engineering C243.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mechanical Engineering/Graduate

Grading: Letter grade.

Instructor: Yeung

Formerly known as: C243

MEC ENG 245 Oceanic and Atmospheric Waves 3 Units
Covers dynamics of wave propagation in the ocean and the atmosphere. Specifically, formulation and properties of waves over the surface of a homogenous fluid, interfacial waves in a two-/multi-layer density stratified fluid, and internal waves in a continuous stratification will be discussed.
Rules & Requirements

Prerequisites: Mechanical Engineering 241A or 241B or 260A or Civil and Environmental Engineering 200A or equivalent courses

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 1 hour of discussion per week

Additional Details

Subject/Course Level: Mechanical Engineering/Graduate

Grading: Letter grade.

MEC ENG 246 Advanced Energy Conversion Principles 3 Units
Covers the fundamental principles of energy conversion processes, followed by development of theoretical and computational tools that can be used to analyze energy conversion processes. Also introduces the use of modern computational methods to model energy conversion performance characteristics of devices and systems. Performance features, sources of inefficiencies, and optimal design strategies are explored for a variety of applications.
Rules & Requirements

Prerequisites: Engineering 7, Mechanical Engineering 40, Mechanical Engineering 106, and Mechanical Engineering 109 or their equivalents

Credit Restrictions: Students will receive no credit for Mechanical Engineering 246 after taking Mechanical Engineering 146.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 1 hour of discussion per week

Additional Details

Subject/Course Level: Mechanical Engineering/Graduate

Grading: Letter grade.

Instructor: Carey

MEC ENG 251 Heat Conduction 3 Units
Analytical and numerical methods for the determination of the conduction of heat in solids.
Rules & Requirements

Prerequisites: 151; Engineering 230A

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mechanical Engineering/Graduate

Grading: Letter grade.

MEC ENG 252 Heat Convection 3 Units
The transport of heat in fluids in motion; free and forced convection in laminar and turbulent flow over surfaces and within ducts.
Rules & Requirements

Prerequisites: 151, 265A; Engineering 230A

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mechanical Engineering/Graduate

Grading: Letter grade.

Instructor: Greif

MEC ENG 253 Thermal Radiation 3 Units
Thermal radiation properties of gases, liquids, and solids; the calculation of radiant energy transfer.
Rules & Requirements

Prerequisites: 151

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mechanical Engineering/Graduate

Grading: Letter grade.

Instructors: Grigoropoulos, Majumdar

MEC ENG 254 Thermodynamics I 3 Units
Axiomatic formulation of macroscopic equilibrium thermodynamics. Quantum mechanical description of atomic and molecular structure. Statistical-mechanical evaluation of thermodynamic properties of gases, liquids, and solids. Elementary kinetic theory of gases and evaluation of transport properties.
Rules & Requirements

Prerequisites: 40

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mechanical Engineering/Graduate

Grading: Letter grade.

Instructor: Carey

MEC ENG 255 Advanced Combustion Processes 3 Units
Fundamentals of combustion, flame structure, flame speed, flammability, ignition, stirred reaction, kinetics and nonequilibrium processes, pollutant formation. Application to engines, energy production, and fire safety.
Objectives Outcomes

Course Objectives: The course provides an introduction to the subject of combustion, covering a broad range of topics important to the fields of energy conversion, engines, pollution and fires. It consists of classroom lectures and laboratory demonstration. It treats the fundamental processes occurring in combustion systems and emphasizes on technological-problem solving skills. The laboratory demonstrations provide practical experience with real combustion systems. The course also uses computer programs to aid the students in the calculations and analysis, especially in thermodynamics and chemical kinetics.

Student Learning Outcomes: Upon completion of the course, students shall be able to:
Understand and calculate the stoichiometry, adiabatic flame temperature and heat of combustion of a fuel and oxidizer mixture. Understand the role of elementary and global reactions. Calculate reaction rates. Know how to use computer codes (e.g. Cantera) to solve combustion problems. Understand and calculate the ignition characteristics of a fuel and oxidizer mixture: flammability limits, self-ignition. Understand and calculate the structure and properties of a premixed flame: propagation speed, thickness, quenching distance, and minimum ignition energy. Understand and calculate the structure and properties of a diffusion flame: height, lift-off distance and blow-off limit. Understand the formation of pollutants from hydrocarbon combustion. Understand the operation of practical systems, specifically, furnaces and boilers, spark ignition and diesel internal combustion engines, and gas turbines.

Rules & Requirements

Prerequisites: ME 40, ME 106, and ME 109 (or their equivalents)

Credit Restrictions: Students will receive no credit for this course if they have taken ME 140.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 1 hour of laboratory per week

Additional Details

Subject/Course Level: Mechanical Engineering/Graduate

Grading: Letter grade.

Instructors: Chen, Fernandez-Pello

MEC ENG 256 Combustion 3 Units
Combustion modeling. Multicomponent conservation equations with reactions. Laminar and turbulent deflagrations. Rankine-Hugoniot relations. Diffusion flames. Boundary layer combustion, ignition, and stability.
Rules & Requirements

Prerequisites: 40, 106, and 109 (106 and 109 may be taken concurrently). 140 is recommended

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mechanical Engineering/Graduate

Grading: Letter grade.

Instructor: Dibble

MEC ENG 257 Advanced Combustion 3 Units
Critical analyses of combustion phenomenon. Conservation relations applied to reacting systems. Reactions are treated by both asymptotic and numerical methods. Real hydrocarbon kinetics are used; where available reduced kinetic mechanics are introduced. Flame propagation theory and experiments are discussed in detail for both laminar and turbulent flows.
Rules & Requirements

Prerequisites: 256

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mechanical Engineering/Graduate

Grading: Letter grade.

MEC ENG 258 Heat Transfer with Phase Change 3 Units
Heat transfer associated with phase change processes. Topics include thermodynamics of phase change, evaporation, condensation, nucleation and bubble growth, two phase flow, convective boiling and condensation, melting and solidification.
Rules & Requirements

Prerequisites: 151

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mechanical Engineering/Graduate

Grading: Letter grade.

Instructor: Carey

MEC ENG 259 Microscale Thermophysics and Heat Transfer 3 Units
This course introduces advanced statistical thermodynamics, nonequilibrium thermodynamics, and kinetic theory concepts used to analyze thermophysics of microscale systems and explores applications in which microscale transport plays an important role.
Rules & Requirements

Prerequisites: 151, 254, or consent of instructor

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mechanical Engineering/Graduate

Grading: Letter grade.

Instructors: Carey, Majumdar

MEC ENG 260A Advanced Fluid Mechanics I 3 Units
Introduces the foundations of fluid mechanics. Exact flow solutions are used to develop a physical insight of the fluid flow phenomena. Rigorous derivation of the equations of motion. Incompressible and compressible potential flows. Canonical viscous flows.
Rules & Requirements

Prerequisites: 106; 185 (strongly recommended) or consent of instructor

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 1 hour of discussion per week

Additional Details

Subject/Course Level: Mechanical Engineering/Graduate

Grading: Letter grade.

MEC ENG 260B Advanced Fluid Mechanics II 3 Units
Develops a working knowledge of fluid mechanics by identifying the essential physical mechanism in complex canonical flow problems which leads to simplified yet accurate formulation. Boundary layers, creeping flows, rotational flows, rotating flows. Stability and transition, introduction to turbulence.
Rules & Requirements

Prerequisites: 260A or consent of instructor

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 1 hour of discussion per week

Additional Details

Subject/Course Level: Mechanical Engineering/Graduate

Grading: Letter grade.

MEC ENG 262 Hydrodynamic Stability and Instability 3 Units
Discussions of linear and nonlinear instabilities in a variety of fluid flows: thermal convection, Rayleigh-Taylor flows, shearing flows, circular and cylindrical Couette flows (i.e., centrifugal instability). Use of the Landau equation, bifurcation diagrams, and energy methods for nonlinear flows.
Rules & Requirements

Prerequisites: 185 and 106, or equivalents

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mechanical Engineering/Graduate

Grading: Letter grade.

Instructor: Marcus

MEC ENG 263 Turbulence 3 Units
Physics of turbulence: Summary of stability and transition. Description of turbulence phenomena. Tools for studying turbulence. Homogeneous turbulence, shear turbulence, rotating turbulence. Summary of engineering models. Discussion of recent advances.
Rules & Requirements

Prerequisites: 260A-260B or equivalent

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mechanical Engineering/Graduate

Grading: Letter grade.

Instructor: Savas

MEC ENG 266 Geophysical and Astrophysical Fluid Dynamics 3 Units
This course examines high-Reynolds number flows, including their stability, their waves, and the influence of rotating and stratification as applied to geophysical and astrophysical fluid dynamics as well as to engineering flows. Examples of problems studies include vortex dynamics in planetary atmospheres and protoplanetary disks, jet streams, and waves (Rossby, Poincare, inertial, internal gravity, and Kelvin) in the ocean and atmosphere.
Rules & Requirements

Prerequisites: Graduate-level standing or consent of instructor

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mechanical Engineering/Graduate

Grading: Letter grade.

Instructor: Marcus

Formerly known as: 260C

MEC ENG C268 Physicochemical Hydrodynamics 3 Units
An introduction to the hydrodynamics of capillarity and wetting. Balance laws and short-range forces. Dimensionless numbers, scaling and lubrication approximation. Rayleigh instability. Marangoni effect. The moving contact line. Wetting and short-range forces. The dynamic contact angle. Dewetting. Coating flows. Effect of surfactants and electric fields. Wetting of rough or porous surfaces. Contact angles for evaporating systems.
Rules & Requirements

Prerequisites: A first graduate course in fluid mechanics sucs as 260A-260B

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mechanical Engineering/Graduate

Grading: Letter grade.

Instructor: Morris

Also listed as: CHM ENG C268

MEC ENG 273 Oscillations in Linear Systems 3 Units
Response of discrete and continuous dynamical systems, damped and undamped, to harmonic and general time-dependent loading. Convolution integrals and Fourier and Laplace Transform methods. Lagrange's equations; Eigensolutions; Orthogonality; generalized coordinates; nonreciprocal and degenerate systems; Rayleigh quotient.
Rules & Requirements

Prerequisites: 104 and 133

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mechanical Engineering/Graduate

Grading: Letter grade.

Instructor: Ma

MEC ENG 274 Random Oscillations of Mechanical Systems 3 Units
Random variables and random processes. Stationary, nonstationary, and ergodic proceses. Analysis of linear and nonlinear, discrete and continuous, mechanical systems under stationary and nonstationary excitations. Vehicle dynamics. Applications to failure analysis. Stochastic estimation and control and their applications to vibratory systems.
Rules & Requirements

Prerequisites: 104 and 133

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mechanical Engineering/Graduate

Grading: Letter grade.

Instructor: Ma

MEC ENG 275 Advanced Dynamics 3 Units
Review of Lagrangian dynamics. Legendre transform and Hamilton's equations, Cyclic coordinates, Canonical transformations, Hamilton-Jacobi theory, integrability. Dynamics of asymmetric systems. Approximation theory. Current topics in analytical dynamics.
Rules & Requirements

Prerequisites: 175

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mechanical Engineering/Graduate

Grading: Letter grade.

MEC ENG 277 Oscillations in Nonlinear Systems 3 Units
Oscillations in nonlinear systems having one or two degrees of freedom. Qualitative and quantitative methods: graphical, iteration, perturbation, and asymptotic methods. Self-excited oscillations, limit cycles, and domains of attraction.
Rules & Requirements

Prerequisites: 175

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mechanical Engineering/Graduate

Grading: Letter grade.

Instructor: Szeri

MEC ENG C279 Statistical Mechanics of Elasticity 3 Units
Introduction to statistical mechanics for engineers interested in the constitutive behavior of matter with a particular interest in continua. Systems of interest will be polymers and crystalline solids. Coverage includes introduction to statistical mechanics, ensembles, phase spaces, partitions functions, free energy, polymer chain statistics, polymer networks, harmonic and quasi-harmonic crystalline solids, limitations of classical methods and quantum mechanical influences.
Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mechanical Engineering/Graduate

Grading: Letter grade.

Instructors: Govindjee, Papadopoulos

Also listed as: CIV ENG C235

MEC ENG 280A Introduction to the Finite Element Method 3 Units
Weighted-residual and variational methods of approximation. Canonical construction of finite element spaces. Formulation of element and global state equations. Applications to linear partial differential equations of interest in engineering and applied science.
Rules & Requirements

Prerequisites: Mathematics 50A-50B; some familiarity with elementary field theories of solid/fluid mechanics and/or thermal science

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 1 hour of discussion per week

Additional Details

Subject/Course Level: Mechanical Engineering/Graduate

Grading: Letter grade.

Instructors: Papadopoulos, Zohdi

Formerly known as: 280

MEC ENG 280B Finite Element Methods in Nonlinear Continua 3 Units
A brief review of continuum mechanics. Consistent linearization of kinematical variables and balance laws. Incremental formulations of the equations of motion. Solution of the nonlinear field equations by Newton's method and its variants. General treatment of constraints. Applications to nonlinear material and kinematical modeling on continua.
Rules & Requirements

Prerequisites: 280A or equivalent; background in continuum mechanics at the level of 185

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mechanical Engineering/Graduate

Grading: Letter grade.

Instructor: Papadopoulos

MEC ENG 281 Methods of Tensor Calculus and Differential Geometry 3 Units
Methods of tensor calculus and classical differential geometry. The tensor concept and the calculus of tensors, the Riemann-Christoffel tensor and its properties, Riemannian and Euclidean spaces. Geometry of a surface, formulas of Weingarten, and equations of Gauss and Codazzi.
Rules & Requirements

Prerequisites: Mathematics 53 and 54

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mechanical Engineering/Graduate

Grading: Letter grade.

MEC ENG 282 Theory of Elasticity 3 Units
Fundamentals and general theorems of the linear theory of elasticity (in three dimensions) and the formulation of static and dynamic boundary value problems. Application to torsion, flexure, and two-dimensional problems of plane strain, generalized plane stress, and bending of plates. Representation of basic field equations in terms of displacement potentials and stress functions. Some basic three-dimensional solutions.
Rules & Requirements

Prerequisites: 185

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mechanical Engineering/Graduate

Grading: Letter grade.

Instructors: Bogy, Steigmann

MEC ENG 283 Wave Propagation in Elastic Media 3 Units
Propagation of mechanical disturbances in unbounded and bounded media. Surface waves, wave reflection and transmission at interfaces and boundaries. Stress waves due to periodic and transient sources. Some additional topics may vary with instructor.

Rules & Requirements

Prerequisites: 185

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mechanical Engineering/Graduate

Grading: Letter grade.

Instructor: Bogy

MEC ENG 284 Nonlinear Theory of Elasticity 3 Units
Fundamentals of nonlinear theory of elasticity. Exact solutions in elastostatics by inverse and semi-inverse methods. The method of successive approximations. Small deformations superposed on finite deformations. Nonlinear oscillations, shocks and acceleration waves, progressive waves and standing waves of finite amplitude, waves in pre-stressed solids.

Rules & Requirements

Prerequisites: 185 and 281

Credit Restrictions: Students will receive no credit for 284 after taking 284A.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mechanical Engineering/Graduate

Grading: Letter grade.

Instructor: Casey

Formerly known as: 284A

MEC ENG 285A Foundations of the Theory of Continuous Media 3 Units
A general development of thermodynamics of deformable media, entropy production, and related entropy inequalities. Thermomechanical response of dissipative media, including those for viscous fluids and nonlinear elastic solids. A discussion of invariance, internal constraints, material symmetry, and other special topics.

Rules & Requirements

Prerequisites: 185

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mechanical Engineering/Graduate

Grading: Letter grade.

Instructor: Casey

Formerly known as: 285

MEC ENG 285B Surfaces of Discontinuity and Inhomogeneities in Deformable Continua 3 Units
Finitely deforming thermo-mechanical media. Moving surfaces of discontinuity. Shock waves and acceleration waves in elastic materials. The Eshelby tensor and Eshelbian mechanics. Fracture. Microstructured continua.

Rules & Requirements

Prerequisites: 185

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mechanical Engineering/Graduate

Grading: Letter grade.

Instructor: Casey

MEC ENG 285C Electrodynamics of Continuous Media 3 Units
This course presents the fundamentals of electromagnetic interactions in deformable continuous media. It develops the background necessary to understand various modern technologies involving MEMS devices, sensors and actuators, plasmas, and a wide range of additional phenomena. The emphasis of this course is on fundamentals, beginning with Maxwell's equations in vacuum, the ether relations and their extension to electromagnetic interactions in materials. The treatment is general within the limits of nonrelativistic physics and accommodates coupling with mechanical and thermal effects. The topics discussed are all developed at a general level including the effects of finite deformations. Various linear models, which are especially useful in applications, are developed through specialization of general theory. This course will be of interest to students in engineering, physics, and applied mathematics.
Rules & Requirements

Prerequisites: A first course in continuum mechanics (such as 185 or Civil Engineering 231.)

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mechanical Engineering/Graduate

Grading: Letter grade.

Instructor: Steigmann

Formerly known as: 284B

MEC ENG 285D Engineering Rheology 3 Units
Rheology is the study of the interaction between forces and the flow/deformation of materials. It deals with aspects of the mechanics of materials that are not covered in the standard curriculum, such as the response of viscoelastic fluids and solids, together with methods for modeling and simulating their response. Such materials exhibit a host of counterintuitive phenomena that call for nonlinear modeling and a close interaction between theory and experiment. This is a special-topics course for graduate students seeking advanced knowledge of these phenomena and associated modeling.
Objectives Outcomes

Course Objectives: To expose students to the theory and methods of modern rheology, including: the mechanics of flow in complex non-Newtonian fluids and the mechanics of viscoelastic solids.

Student Learning Outcomes: Skill in modeling and simulating rheological problems.

Rules & Requirements

Prerequisites: A basic background in continuum mechanics (as covered in ME 185)

Repeat rules: Course may be repeated for credit when topic changes.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mechanical Engineering/Graduate

Grading: Letter grade.

Instructor: Steigmann

MEC ENG 286 Theory of Plasticity 3 Units
Formulation of the theory of plasticity relative to loading surfaces in both strain space and stress space and associated loading criteria. Nonlinear constitutive equations for finitely deformed elastic-plastic materials. Discussion of strain-hardening and special cases. Applications.
Rules & Requirements

Prerequisites: 185

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mechanical Engineering/Graduate

Grading: Letter grade.

Instructors: Casey, Papadopoulos

MEC ENG 288 Theory of Elastic Stability 3 Units
Dynamic stability of elastic bodies. Small motion on finite deformation. Classical treatments of buckling problems. Snapthrough and other global stability problems. Stability theory based upon nonlinear three-dimensional theory of elasticity.
Rules & Requirements

Prerequisites: 185 and 273

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mechanical Engineering/Graduate

Grading: Letter grade.

Instructor: Steigmann

MEC ENG 289 Theory of Shells 3 Units
A direct formulation of a general theory of shells and plates based on the concept of Cosserat (or Directed) surfaces. Nonlinear constitutive equations for finitely deformed elastic shells. Linear theory and a special nonlinear theory with small strain accompanied by large or moderately large rotation. Applications.
Rules & Requirements

Prerequisites: 185 and 281

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mechanical Engineering/Graduate

Grading: Letter grade.

Instructors: Johnson, Steigmann

MEC ENG 290C Topics in Fluid Mechanics 3 Units
Lectures on special topics which will be announced at the beginning of each semester that the course is offered. Topics may include transport and mixing, geophysical fluid dynamics, biofluid dynamics, oceanography, free surface flows, non-Newtonian fluid mechanics, among other possibilities.
Rules & Requirements

Prerequisites: Consent of instructor

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mechanical Engineering/Graduate

Grading: Letter grade.

Instructors: Savas, Yeung

MEC ENG C290S Hybrid Systems and Intelligent Control 3 Units
Analysis of hybrid systems formed by the interaction of continuous time dynamics and discrete-event controllers. Discrete-event systems models and language descriptions. Finite-state machines and automata. Model verification and control of hybrid systems. Signal-to-symbol conversion and logic controllers. Adaptive, neural, and fuzzy-control systems. Applications to robotics and Intelligent Vehicle and Highway Systems (IVHS).
Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mechanical Engineering/Graduate

Grading: Letter grade.

Formerly known as: 291E

Also listed as: EL ENG C291E

MEC ENG C290X Advanced Technical Communication: Proposals, Patents, and Presentations 3 Units
This course will help the advanced Ph.D. student further develop critically important technical communication traits via a series of lectures, interactive workshops, and student projects that will address the structure and creation of effective research papers, technical reports, patents, proposals, business plans, and oral presentations. One key concept will be the emphasis on focus and clarity--achieved through critical thinking regarding objectives and context. Examples will be drawn primarily from health care and bioengineering multidisciplinary applications.
Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mechanical Engineering/Graduate

Grading: Offered for satisfactory/unsatisfactory grade only.

Instructors: Keaveny, Pruitt

Also listed as: BIO ENG C290D

MEC ENG 290D Solid Modeling and CAD/CAM Fundamentals 3 Units
Graduate survey of solid modeling research. Representations and algorithms for 3D solid geometry. Applications in design, analysis, planning, and manufacturing of mechanical parts, including CAD/CAM, reverse engineering, robotics, mold-making, and rapid prototyping.
Objectives Outcomes

Course Objectives: Students will gain experience with critical close reading of primary sources, evaluating and synthesizing the content of research papers. They will design, implement, and analyze a sample of geometric algorithms for applications in Solid Modeling and CAD/CAM.

Student Learning Outcomes: Students will be familiar with seminal research and important solid modeling representations and fundamental geometric algorithms, giving them insight into the capabilities and limitations of commercial solid modeling systems. They will have gained programming experience and skills and an understanding of theoretical and practical concerns as they design, implement, and analyze a sample of geometric algorithms for applications in Solid Modeling and CAD/CAM.

Rules & Requirements

Prerequisites: An introductory programming course; graduate standing or consent of instructor

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mechanical Engineering/Graduate

Grading: Letter grade.

Instructor: McMains

MEC ENG 290G Laser Processing and Diagnostics 3 Units
The course provides a detailed account of laser interactions with materials in the context of advanced materials processing and diagnostics.
Rules & Requirements

Prerequisites: Graduate standing or undergraduate elective upon completion of ME109

Repeat rules: Course may be repeated for credit when topic changes.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mechanical Engineering/Graduate

Grading: Letter grade.

Instructor: Grigoropoulos

MEC ENG 290H Green Product Development: Design for Sustainability 3 Units
The focus of the course is management of innovation processes for sustainable products, from product definition to sustainable manufacturing and financial models. Using a project in which students will be asked to design and develop a product or service focused on sustainability, we will teach processes for collecting customer and user needs data, prioritizing that data, developing a product specification, sketching and building product prototypes, and interacting with the customer/community during product development. The course is intended as a very hands-on experience in the "green" product development process. The course will be a Management of Technology course offered jointly with the College of Engineering and the Haas School of Business. In addition, it will also receive credit towards the new Certificate on Engineering Sustainability and Environmental Management program. We aim to have half MBA students and half Engineering students (with a few other students, such as from the School of Information) in the class. The instructors will facilitate students to form mixed disciplinary reams for the development of their "green" products.
Rules & Requirements

Prerequisites: Graduate standing in Engineering or Information, or consent of instructor

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mechanical Engineering/Graduate

Grading: Letter grade.

Instructors: Agogino, Beckmann

MEC ENG 290I Sustainable Manufacturing 3 Units
Sustainable design, manufacturing, and management as exercised by the enterprise is a poorly understood idea and one that is not intuitively connected to business value or engineering practice. This is especially true for the manufacturing aspects of most enterprises (tools, processes, and systems). This course will provide the basis for understanding (1) what comprises sustainable practices in for-profit enterprises, (2) how to practice and measure continuous improvement using sustainability thinking, techniques, and tools for product and manufacturing process design, and (3) the techniques for and value of effective communication of sustainablilty performance to internal and external audiences. Material in the course will be supplemented by speakers with diverse backgrounds in corporate sustainability, environmental consulting, non-governmental organizations, and academia.

Rules & Requirements

Prerequisites: Graduate standing, or consent of instructor, especially for students not in engineering, business, or other management of technology programs

Repeat rules: Students will receive no credit for 290I after taking Engineering 290C. Course may be repeated for credit when topic changes.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 1 hour of discussion per week

Additional Details

Subject/Course Level: Mechanical Engineering/Graduate

Grading: Letter grade.

Instructor: Dornfeld

MEC ENG 290J Predictive Control for Linear and Hybrid Systems 3 Units
Advanced optimization, polyhedra manipulation, and multiparametric programming. Invariant set theory. Analysis and design of constrained predictive controllers for linear systems. Computational oriented models of hybrid systems. Analysis and design of constrained predictive controllers for hybrid systems.

Rules & Requirements

Prerequisites: 232

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mechanical Engineering/Graduate

Grading: Letter grade.

Instructor: Borrelli

MEC ENG 290KA Innovation through Design Thinking 2 Units
Designed for professionally-oriented graduate students, this course explores key concepts in design innovation based on the human-centered design approach called “design thinking.” Topics covered include human-centered design research, analysis of research to develop design principles, creativity techniques, user needs framing and strategic business modeling.

Objectives Outcomes

Student Learning Outcomes: The primary goal is to provide students with a set of innovation skills that will allow them to flourish in a climate of complex problem solving and design challenges. Students will develop expertise in innovation skills drawn from the fields of critical thinking, design thinking and systems thinking. Students should be able to apply the skills mastered to real world design problems.

Rules & Requirements

Prerequisites: Graduate level standing; Prior design course

Hours & Format

Fall and/or spring: 8 weeks - 4 hours of lecture per week

Additional Details

Subject/Course Level: Mechanical Engineering/Graduate

Grading: Letter grade.

Instructor: Agogino

MEC ENG 290KB Life Cycle Thinking in Engineering Design 1 Unit
How do we design and manufacture greener products, and how do we know if they really are? This class both provides tools for sustainable design innovation and metrics to measure success. Students will use both creative and analytical skills, generating new ideas as well as evaluating designs with screening-level life cycle assessment.
Objectives Outcomes

Course Objectives: The objective of this course is to provide students with the tools to frame, analyze, and redesign their projects in terms of life cycle environmental impacts, to improve the sustainability of their projects.

Student Learning Outcomes: Students can expect to depart the course understanding the practice of basic life cycle assessment, including how to set boundaries, choose functional units, and use LCA software. Students will also learn how to integrate this practice into new product development in the context of the “triple bottom line” – economy, environment and society. Students should be able to apply the skills mastered to real world design and engineering problems.

Rules & Requirements

Prerequisites: Graduate level standing; Prior design course

Hours & Format

Fall and/or spring: 8 weeks - 2 hours of lecture per week

Additional Details

Subject/Course Level: Mechanical Engineering/Graduate

Grading: Letter grade.

Instructor: Agogino

MEC ENG 290L Introduction to Nano-Biology 3 Units
This course introduces graduate students in Mechanical Engineering to the nascent field of Nano-Biology. The course is comprised of both formal lectures and projects. Lectures will include an introduction to both molecular biology (components of cells, protein structure and function, DNA, gene regulation, etc.) and nanotechnology ("bottom up" and "top down" nanotechnologies), an overview of current instrumentation in biology, an in-depth description of the recent integration of molecular biology with nanotechnology (for sensing or labeling purposes, elucidating information on cells, etc.), and an introduction to Systems Biology (design principles of biological circuits). Students will read and present a variety of current journal papers to the class and lead a discussion on the various works.
Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 1 hour of discussion per week

Additional Details

Subject/Course Level: Mechanical Engineering/Graduate

Grading: Letter grade.

Instructor: Sohn

MEC ENG 290M Expert Systems in Mechanical Engineering 3 Units
Introduction to artificial intelligence and decision analysis in mechanical engineering. Fundamentals of analytic design, probability theory, failure analysis, risk assessment, and Bayesian and logical inference. Applications to expert systems in probabilistic mechanical engineering design and failure diagnostics. Use of automated influence diagrams to codify expert knowledge and to evaluate optimal design decisions.
Rules & Requirements

Prerequisites: 102A and 102B or equivalent

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mechanical Engineering/Graduate

Grading: Letter grade.

Instructor: Agogino

MEC ENG 290N System Identification 3 Units
This course is intended to provide a comprehensive treatment of both classical system identification and recent work in control-oriented system identification. Numerical, practical, and theoretical aspects will be covered. Topics treated include time and frequency domain methods, generalized parameter estimation, identification of structured non-linear systems, modeling uncertainty bounding, and state-space methods.
Rules & Requirements

Prerequisites: 232, Electrical Engineering and Computer Sciences 221A or consent of instructor

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mechanical Engineering/Graduate

Grading: Letter grade.

Instructor: Poolla

MEC ENG 290P New Product Development: Design Theory and Methods 3 Units
This course is aimed at developing the interdisciplinary skills required for successful product development in today's competitive marketplace. We expect students to be disciplinary experts in their own field (e.g., engineering, business). By bringing together multiple perspectives, we will learn how product development teams can focus their efforts to quickly create cost-effective products that exceed customers' expectations.
Rules & Requirements

Prerequisites: Graduate standing, consent of instructor

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mechanical Engineering/Graduate

Grading: Letter grade.

Instructor: Agogino

MEC ENG 290Q Dynamic Control of Robotic Manipulators 3 Units
Dynamic and kinematic analysis of robotic manipulators. Sensors (position, velocity, force and vision). Actuators and power transmission lines. Direct drive and indirect drive. Point to point control. Straight and curved path following. Industrial practice in servo control. Applications of optimal linear quadratic control, preview control, nonlinear control, and direct/indirect adaptive controls. Force control and compliance control. Collision avoidance. Utilization of dynamic controls
Rules & Requirements

Prerequisites: 230, 232, or consent of instructor

Hours & Format

Fall and/or spring: 15 weeks - 1-3 hours of lecture per week

Additional Details

Subject/Course Level: Mechanical Engineering/Graduate

Grading: Letter grade.

Instructors: Horowitz, Kazerooni

MEC ENG 290R Topics in Manufacturing 3 Units
Advanced topics in manufacturing research. Topics vary from year to year.
Rules & Requirements

Prerequisites: Consent of instructor

Repeat rules: Course may be repeated for credit as topic varies. Course may be repeated for credit when topic changes.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mechanical Engineering/Graduate

Grading: Letter grade.

Instructors: Dornfeld, McMains, Wright

MEC ENG 290T Plasmonic Materials 3 Units
This course deals with fundamental aspects of plasmonic materials. The electromagnetic responses of those artificially constructed materials will be discussed. Physics of surface plasmons and dispersion engineering will be introduced. Resonant phenomena associated with the negative permittivity and permeability and the left-handed propagation will be presented. Methods of design, fabrication, and characterization of plasmonic materials will be discussed.
Rules & Requirements

Prerequisites: PHYSICS 110A (http://guide.berkeley.edu/search/?P=PHYSICS%20110A) or consent of instructor

Repeat rules: Course may be repeated for credit as topic varies. Course may be repeated for credit when topic changes.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mechanical Engineering/Graduate

Grading: Letter grade.

Instructor: Zhang

MEC ENG 290U Interactive Device Design 3 Units
This course teaches concepts and skills required to design, prototype, and fabricate interactive devices -- that is, physical objects that intelligently respond to user input and enable new types of interactions.
Objectives Outcomes

Course Objectives: To educate students in the hybrid design skills needed for today's electronic products. These combine mechanical devices, electronics, software, sensors, wireless communication and connections to the cloud. Students also learn scale up procedures for volume manufacturing.

Student Learning Outcomes: 3D printed prototypes, learned software, programming and design skills

Rules & Requirements

Prerequisites: Instructor consent

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mechanical Engineering/Graduate

Grading: Letter grade.

Instructors: Hartmann, Wright

MEC ENG 290V Topics in Energy, Climate, and Sustainability 1 Unit
Weekly lecture series featuring guest speakers from academia, industry, government, and civil society. Speakers will address cutting-edge topics involving novel technologies in energy and climate; the production, consumption, and economic exchange of energy resources and commodities; and energy and climate policy. Undergraduate and graduate students welcome.
Objectives Outcomes

Course Objectives: Introduce UC Berkeley students to a variety of perspectives from stakeholders working on the science, technology, economics, and policy of energy and climate issues.

Student Learning Outcomes: Introduce students to interdisciplinary perspectives on energy and climate issues; attract top speakers to campus from academia, industry, government, and civil society; and build community at UC Berkeley around interdisciplinary energy and climate issues.

Rules & Requirements

Repeat rules: Course may be repeated for credit when topic changes.

Hours & Format

Fall and/or spring: 15 weeks - 1 hour of seminar per week

Additional Details

Subject/Course Level: Mechanical Engineering/Graduate

Grading: Offered for satisfactory/unsatisfactory grade only.

Instructors: Wright, Burns, Cullenward

MEC ENG 292A Advanced Special Topics in Bioengineering 1 - 4 Units
The 292 series covers current topics of research interest in bioengineering and biomechanics. The course content may vary semester to semester. Check with the department for current term topics.
Rules & Requirements

Prerequisites: Graduate student standing or consent of instructor

Repeat rules: Course may be repeated for credit when topic changes.

Hours & Format

Fall and/or spring:
6 weeks - 1-3 hours of lecture per week
15 weeks - 1-3 hours of lecture per week

Additional Details

Subject/Course Level: Mechanical Engineering/Graduate

Grading: Letter grade.

Instructor: Faculty

MEC ENG 297 Engineering Field Studies 1 - 12 Units
Supervised experience relative to specific aspects of practice in engineering. Under guidance of a faculty member, the student will work in an internship in industry. Emphasis is to attain practical experience in the field.
Hours & Format

Fall and/or spring: 15 weeks - 1-12 hours of independent study per week

Summer:
6 weeks - 2.5-20 hours of independent study per week
10 weeks - 1.5-18 hours of independent study per week

Additional Details

Subject/Course Level: Mechanical Engineering/Graduate

Grading: Offered for satisfactory/unsatisfactory grade only.

MEC ENG 298 Group Studies, Seminars, or Group Research 1 - 8 Units
Advanced studies in various subjects through special seminars on topics to be selected each year. Informal group studies of special problems, group participation in comprehensive design problems, or group research on complete problems for analysis and experimentation.
Rules & Requirements

Repeat rules: Course may be repeated for credit. Course may be repeated for credit when topic changes.

Hours & Format

Fall and/or spring: 15 weeks - 1-8 hours of independent study per week

Summer: 10 weeks - 1.5-12 hours of independent study per week

Additional Details

Subject/Course Level: Mechanical Engineering/Graduate

Grading: The grading option will be decided by the instructor when the class is offered.

MEC ENG 299 Individual Study or Research 1 - 12 Units
Investigations of advanced problems in mechanical engineering.
Rules & Requirements

Prerequisites: Graduate standing in engineering, physics, or mathematics

Repeat rules: Course may be repeated for credit. Course may be repeated for credit when topic changes.

Hours & Format

Fall and/or spring: 15 weeks - 1-12 hours of independent study per week

Summer:
6 weeks - 1-5 hours of independent study per week
8 weeks - 1-4 hours of independent study per week

Additional Details

Subject/Course Level: Mechanical Engineering/Graduate

Grading: Offered for satisfactory/unsatisfactory grade only.

MEC ENG 375 Teaching of Mechanical Engineering at the University Level 1 - 6 Units
Weekly seminars and discussions on effective teaching methods. Educational objectives. Theories of learning. The lecture and alternative approaches. Use of media resources. Student evaluation. Laboratory instruction. Curricula in mechanical engineering. Practice teaching. This course is open to Teaching Assistants of Mechanical Engineering.
Rules & Requirements

Repeat rules: Course may be repeated for credit. Course may be repeated for credit when topic changes.

Hours & Format

Fall and/or spring: 15 weeks - 1 hour of seminar per week

Additional Details

Subject/Course Level: Mechanical Engineering/Professional course for teachers or prospective teachers

Grading: Offered for satisfactory/unsatisfactory grade only.

Formerly known as: Mechanical Engineering 301