

Mechanical Engineering/ Nuclear Engineering

Bachelor of Science (BS)

The joint major programs are designed for students who wish to undertake study in two areas of engineering in order to qualify for employment in either field or for positions in which competence in two fields is required. These curricula include the core courses from each of the major fields. While they require slightly increased course loads, they can be completed in four years. Both majors are shown on the student's transcript of record.

This program was established to address the interface between the two major fields. It is intended for nuclear engineering students interested in mechanical design and heat transfer as well as for mechanical engineering students who wish to further their knowledge of nuclear radiological systems and processes. Its objective is to provide students with a strong and competitive background in both majors, leading to professional careers in nuclear and radiation-based industries or to graduate study in nuclear engineering and other engineering disciplines or related fields such as medicine and physics.

Admission to the Joint Major

Admission directly to a joint major is closed to freshmen and junior transfer applicants. Students interested in a joint program may apply to change majors during specific times in their academic progress. Please see the College of Engineering joint majors website (<http://engineering.berkeley.edu/academics/majors-minors/joint-majors>) for complete details.

In addition to the University, campus, and college requirements, listed on the College Requirements tab, students must fulfill the below requirements specific to their major program.

General Guidelines

1. All technical courses (courses in engineering, mathematics, chemistry, physics, statistics, biological sciences, and computer science) must be taken for a letter grade.
2. No more than one upper-division course may be used to simultaneously fulfill requirements for a student's major and minor programs.
3. A minimum overall grade point average (GPA) of 2.0 is required for all work undertaken at UC Berkeley.
4. A minimum GPA of 2.0 is required for all technical courses taken in satisfaction of major requirements.

For information regarding residence requirements and unit requirements, please see the College Requirements tab.

For a detailed plan of study by year and semester, please see the Plan of Study tab.

Lower-division Requirements

MATH 1A	Calculus	4
MATH 1B	Calculus	4
MATH 53	Multivariable Calculus	4
MATH 54	Linear Algebra and Differential Equations	4
CHEM 1A & 1AL	General Chemistry and General Chemistry Laboratory ¹	4
or CHEM 4A	General Chemistry and Quantitative Analysis	
PHYSICS 7A	Physics for Scientists and Engineers	4
PHYSICS 7B	Physics for Scientists and Engineers	4
PHYSICS 7C	Physics for Scientists and Engineers	4
ENGIN 7	Introduction to Computer Programming for Scientists and Engineers	4
ENGIN 25	Visualization for Design ²	2
ENGIN 26	Three-Dimensional Modeling for Design ³	2
ENGIN 27	Introduction to Manufacturing and Tolerancing	2
MEC ENG 40	Thermodynamics	3
MEC ENG C85	Introduction to Solid Mechanics	3
EL ENG 40	Introduction to Microelectronic Circuits	4
MEC ENG C85	Introduction to Solid Mechanics	3

¹ CHEM 4A is intended for students majoring in Chemistry or a closely-related field.

² Junior transfer admits are exempt from completing ENGIN 25.

³ Junior transfer admits who have completed the equivalent of ENGIN 28 are exempt from ENGIN 26

Upper-division Requirements

MEC ENG 102A	Introduction to Mechanical Systems for Mechatronics	4
MEC ENG 102B	Mechatronics Design	4
MEC ENG 104	Engineering Mechanics II	3
MEC ENG 106	Fluid Mechanics	3
MEC ENG 107	Mechanical Engineering Laboratory	3
MEC ENG 108	Mechanical Behavior of Engineering Materials	4
MEC ENG 109	Heat Transfer	3
MEC ENG 132	Dynamic Systems and Feedback	3
NUC ENG 100	Introduction to Nuclear Engineering ¹	3
NUC ENG 101	Nuclear Reactions and Radiation	4
NUC ENG 104	Radiation Detection and Nuclear Instrumentation Laboratory	4
NUC ENG 150	Introduction to Nuclear Reactor Theory	4
NUC ENG 170A	Nuclear Design: Design in Nuclear Power Technology and Instrumentation	3

Upper-division Technical Electives: Minimum 12 units

Select 6 units of upper-division NUC ENG courses, in consultation with faculty adviser

Select 6 units of upper-division MEC ENG courses, in consultation with faculty adviser

¹ Junior transfer admits are exempt from completing NUC ENG 100.

Students in the College of Engineering must complete 120 semester units with the following provisions:

1. Completion of the requirements of one Engineering major program (<http://coe.berkeley.edu/students/guide/departments>) of study.
2. A minimum overall grade point average of 2.000 (C average) and a minimum 2.000 grade point average in upper division technical course work required of the major.
3. The final 30 units must be completed in residence in the College of Engineering on the Berkeley campus in two consecutive semesters.
4. All technical courses (math, science & engineering), required of the major or not, must be taken on a letter graded basis (unless they are only offered P/NP).
5. Entering freshman are allowed a maximum of eight semesters to complete their degree requirements. Entering junior transfers are allowed a maximum of four semesters to complete their degree requirements. Summer terms are optional and do not count toward the maximum. Students are responsible for planning and satisfactorily completing all graduation requirements within the maximum allowable semesters.

Humanities and Social Science Requirement

To promote a rich and varied educational experience outside of the technical requirements for each major, the College of Engineering has a Humanities and Social Sciences breadth requirement, which must be completed to graduate. This requirement is built into all the Engineering programs of study. The requirement includes two approved reading and composition courses and four additional approved courses, within which a number of specific conditions must be satisfied.

1. Complete a minimum of six courses (3 units or more) from the approved Humanities/Social Sciences (H/SS) lists (<http://coe.berkeley.edu/hssreq>).
2. Two of the six courses must fulfill the Reading and Composition Requirement. These courses must be taken for a letter grade (C- or better required), and MUST be completed by no later than the end of the sophomore year (4th semester of enrollment). The first half of R&C, the "A" course, must be completed by the end of the freshman year; the second half of R&C, the "B" course, by no later than the end of the sophomore year. For detailed lists of courses that fulfill Reading and Composition requirements, please see the Reading and Composition page (<http://guide.berkeley.edu/archive/2014-15/undergraduate/colleges-schools/engineering/reading-composition-requirement>) in this bulletin.
3. The four additional courses must be chosen from the H/SS comprehensive list. These courses may be taken on a Pass/Not Passed Basis (P/NP).
4. At least two of the six courses must be upper division (courses numbered 100-196).
5. At least two courses must be from the same department and at least one of the two must be upper division. This is called the *Series requirement. AP tests can be combined with a course to complete the series requirement. For example, AP History (any) combined with an upper division History course would satisfy the series requirement
6. One of the six courses must satisfy the campus American Cultures Requirement. For detailed lists of courses that fulfill American Cultures requirements, please see the American Cultures page (<http://guide.berkeley.edu/archive/2014-15/undergraduate/colleges-schools/engineering/american-cultures-requirement>) in this bulletin.

guide.berkeley.edu/archive/2014-15/undergraduate/colleges-schools/engineering/american-cultures-requirement) in this bulletin.

7. A maximum of two exams (Advanced Placement, International Baccalaureate, or A-Level) may be used toward completion of the H/SS requirement. Visit this link (<http://coe.berkeley.edu/exams>)
8. No courses offered by an Engineering department (IEOR, CE, etc.) other than BIOE 100, CS C79, ENGIN 125, ENGIN 130AC, 157AC, ME 191K and ME 191AC may be used to complete H/SS requirements.
9. Courses may fulfill multiple categories. For example, if you complete City and Regional Planning 115 and 118AC that would satisfy the series requirement, the two upper division courses requirement and the American Cultures Requirement.
10. The College of Engineering (COE) uses modified versions of five of the College of Letters and Science (L&S) breadth requirements lists to provide options to our students for completing the Humanities and Social Science requirement. Our requirement is different than that of L & S, so the guidelines posted on the top of each L & S breadth list do NOT apply to COE students.
11. Foreign language courses MAY be used to complete H/SS requirements. L & S does not allow students to use many language courses, so their lists will not include all options open to Engineering students. For a list of language options, visit <http://coe.berkeley.edu/FL>

*NOTE: for the Series Requirement: The purpose of the series requirement is to provide depth of knowledge in a certain area. Therefore, a two-course sequence not in the same department may be approved by petition, in cases in which there is a clear and logical connection between the courses involved.

For more detailed information regarding the courses listed below (e.g., elective information, GPA requirements, etc.), please see the Major Requirements tab.

Freshman				
	Fall	Units	Spring	Units
Chemistry: CHEM 1A & CHEM 1AL, or CHEM 4A		4	PHYSICS 7A	4
MATH 1A		4	ENGIN 7	4
ENGIN 25		2	MATH 1B	4
Reading & Composition course from List A		4	Reading & Composition course from List B	4
Humanities/Social Sciences course		3-4		
		17-18		16
Sophomore				
	Fall	Units	Spring	Units
ENGIN 26		2	MATH 54	4
ENGIN 27		2	MEC ENG 40	3
MATH 53		4	MEC ENG C85	3
PHYSICS 7B		4	PHYSICS 7C	4
Humanities/Social Sciences course		3-4	NUC ENG 100	3
		15-16		17
Junior				
	Fall	Units	Spring	Units
MEC ENG 104		3	EL ENG 40	4
MEC ENG 109		3	MEC ENG 106	3
NUC ENG 101		4	MEC ENG 132	3
MEC ENG 108		4	NUC ENG 150	4

		Humanities/ Social Sciences course	3-4	
		14	17-18	
			Senior	
	Fall	Units	Spring	
MEC ENG 102A		4	MEC ENG 102B	4
Humanities/Social Sciences course		3-4	MEC ENG 107	3
Technical Electives		9	NUC ENG 104	4
			NUC ENG 17C	3
			Technical Elective	3
		16-17		17

Total Units: 129-133

Mechanical Engineering/Nuclear Engineering

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

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

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

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 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 subcellular 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 subcellular biomechanics and transport phenomena, and (2) ultimately apply these skills to novel biological and biomedical applications

Rules & Requirements

Prerequisites: MATH 54; PHYSICS 7A; 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, 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. PHYSICS 7C 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

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 enumeration, 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 and 54, and PHYSICS 7A-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, 54, PHYSICS 7A-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, fabrication, 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

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, PHYSICS 7A; 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 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; 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 (EI 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-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.