

# Mechanical Engineering

The Department of Mechanical Engineering offers three graduate degree programs: the Master of Engineering (MEng), the Master of Science (MS), and the Doctor of Philosophy (PhD).

## Master of Engineering (MEng)

This accelerated Masters of Engineering Program has been designed in collaboration with several other departments in the College of Engineering for the purpose of developing professional leaders who understand the technical, environmental, economic and social issues involved in Mechanical Engineering. It is supported by the College of Engineering's Coleman Fung Institute for Engineering Leadership. For more information about this interdisciplinary program, please see the Fung Institute Website (<http://funginstitute.berkeley.edu>).

As of fall 2013, there are full-time and part-time options for pursuing this program.

## Master of Science (MS)

The majority of students earning a master's degree in our department earn a master of science degree. It can be done in conjunction with a PhD (for the MS/PhD option) or alone, though the vast majority of our students are on the doctoral track. Degrees are granted after completion of programs of study that emphasize the application of the natural sciences to the analysis and solution of engineering problems. Advanced courses in mathematics, chemistry, physics, and the life sciences are normally included in a program that incorporates the engineering systems approach for analysis of problems.

## Doctor of Philosophy (PhD)

This degree can be completed in conjunction with a master of science degree or alone. Degrees are granted after completion of programs of study that emphasize the application of the natural sciences to the analysis and solution of engineering problems. Advanced courses in mathematics, chemistry, physics, and the life sciences are normally included in a program that incorporates the engineering systems approach for analysis of problems.

## Admission to the University

### Minimum Requirements for Admission

The following minimum requirements apply to all graduate programs and will be verified by the Graduate Division:

1. A bachelor's degree or recognized equivalent from an accredited institution;
2. A grade point average of B or better (3.0);
3. If the applicant comes from a country or political entity (e.g., Quebec) where English is not the official language, adequate proficiency in English to do graduate work, as evidenced by a TOEFL score of at least 90 on the iBT test, 570 on the paper-and-pencil test, or an IELTS Band score of at least 7 (note that individual programs may set higher levels for any of these); and
4. Sufficient undergraduate training to do graduate work in the given field.

## Applicants Who Already Hold a Graduate Degree

The Graduate Council views academic degrees not as vocational training certificates, but as evidence of broad training in research methods, independent study, and articulation of learning. Therefore, applicants who already have academic graduate degrees should be able to pursue new subject matter at an advanced level without need to enroll in a related or similar graduate program.

Programs may consider students for an additional academic master's or professional master's degree only if the additional degree is in a distinctly different field.

Applicants admitted to a doctoral program that requires a master's degree to be earned at Berkeley as a prerequisite (even though the applicant already has a master's degree from another institution in the same or a closely allied field of study) will be permitted to undertake the second master's degree, despite the overlap in field.

The Graduate Division will admit students for a second doctoral degree only if they meet the following guidelines:

1. Applicants with doctoral degrees may be admitted for an additional doctoral degree only if that degree program is in a general area of knowledge distinctly different from the field in which they earned their original degree. For example, a physics PhD could be admitted to a doctoral degree program in music or history; however, a student with a doctoral degree in mathematics would not be permitted to add a PhD in statistics.
2. Applicants who hold the PhD degree may be admitted to a professional doctorate or professional master's degree program if there is no duplication of training involved.

Applicants may apply only to one single degree program or one concurrent degree program per admission cycle.

## Required Documents for Applications

1. **Transcripts:** Applicants may upload *unofficial* transcripts with your application for the departmental initial review. *If the applicant is admitted*, then *official* transcripts of all college-level work will be required. Official transcripts must be in sealed envelopes as issued by the school(s) attended. If you have attended Berkeley, upload your unofficial transcript with your application for the departmental initial review. *If you are admitted*, an official transcript with evidence of degree conferral *will not* be required.
2. **Letters of recommendation:** Applicants may request online letters of recommendation through the online application system. Hard copies of recommendation letters must be sent directly to the program, not the Graduate Division.
3. **Evidence of English language proficiency:** All applicants from countries or political entities in which the official language is not English are required to submit official evidence of English language proficiency. This applies to applicants from Bangladesh, Burma, Nepal, India, Pakistan, Latin America, the Middle East, the People's Republic of China, Taiwan, Japan, Korea, Southeast Asia, most European countries, and Quebec (Canada). However, applicants who, at the time of application, have already completed at least one year of full-time academic course work with grades of B or better at a US university may submit an official transcript from the US university to fulfill this requirement. The following courses will not fulfill this requirement:
  - courses in English as a Second Language,
  - courses conducted in a language other than English,

- courses that will be completed after the application is submitted, and
- courses of a non-academic nature.

If applicants have previously been denied admission to Berkeley on the basis of their English language proficiency, they must submit new test scores that meet the current minimum from one of the standardized tests.

## Where to Apply

Visit the Berkeley Graduate Division application page (<http://grad.berkeley.edu/admissions/apply>) .

## Normative Time

Five years or 10 semesters.

### Minimum Number of Units to Complete Degree

Thirty-six semester units.

### Minimum Units Required in Order to Be Registered Each Semester

As a graduate student in ME, each student must enroll in 15 units each semester.

### Maximum Amount of Independent Study Units (298, 299, 300 and Above)

Independent course units are not counted towards the 36 semester units needed to graduate. The maximum of these units you can enroll per semester are listed below.

- 298s: 8 units
- 299s: 12 units
- 300s: 6 units
- 600s: 8 units

### Maximum Number of Courses that Can Be Transferred Towards Degree

Students can transfer up to two courses from another school towards the PhD.

### GSI/ME 300-Level Course Requirement

Each student must either serve as a graduate student instructor (GSI) for at least one semester or have taken a 300-level course on teaching.

### Minimum Grade Point Averages (GPAs)

All students are required to have the following minimum grade point averages:

- 3.5 in Major
- 3.0 in Minors

## Required Emphases

Each student must declare one major area as well as two minors. At least one minor is required to be outside of the department. The minor fields are required to broaden the base of the studies and lend support to the major field as well as the dissertation research.

### Required Number of Courses

- Five courses in your major, all of which must be letter graded.
- Three courses in your First Outside ME Minor (only 1 of these courses can be taken with the Satisfactory/Unsatisfactory option rather than letter graded).
- Two courses in your Inside ME or 2<sup>nd</sup> Outside ME Minor, all of which must be letter graded.
- Two courses to support your major or one minor.

*Please note that 2/3 of the courses counted towards your degree must be letter graded.*

### Preliminary Examination

This written exam covers undergraduate coursework. All students must pass 3 of the 10 exams. One of these exams must be for the student's major field area. Students receive two attempts to pass three exams.

### Qualifying Examination

The intent of the qualifying examination is to ascertain the breadth of the student's comprehension in at least three subject areas related to the major field of study, and to determine whether the student has the ability to think incisively and critically about the theoretical and the practical aspects of these areas. The examination may consider a number of academic points of view and the criteria by which they may be evaluated.

## Advancement to Candidacy

All students must complete the advancement to candidacy application directly after passing their qualifying exam.

### PhD Dissertation

Filing your doctoral dissertation at the Graduate Division is one of the final steps leading to the award of your graduate degree. Your manuscript is a scholarly presentation of the results of the research you conducted. Dissertations are required of all students.

### PhD Candidate Seminar

Each student must present their dissertation findings with at least one member of their dissertation committee present. The seminar must take place prior to the end of the semester in which you receive your degree.

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For more detailed information, please refer to the following pages:

<http://me.berkeley.edu/graduate-student-handbook/chapter-7-phd-doctorate-degree>

<http://grad.berkeley.edu/policy/degrees-policy/>

## Plan II

### Normative Time

One and a half years or three semesters.

### Minimum Number of Units To Complete Degree

Twenty-four semester units.

Course Restriction: Must be either in 200 series or 100 elective upper division series

### Minimum Number of Mechanical Engineering Units

12 Semester Units (must be in 200 series and letter-graded with the exception of the optional 4 units of ME 299 that can be included in the 12).

#### Minimum Units To Be Registered Each Semester

As a graduate student in ME, each student must enroll in 15 Semester units each semester.

#### Maximum Amount of Independent Study Units (298, 299, 300 And Above)

The semester enrollment restrictions for independent study courses are as follows:

- 298s: 8 units
- 299s: 12 units
- 300s: 6 units

Please note that only 4 semester units of 299 can be counted towards the 24 unit total requirement.

#### Minimum Required Number of Units in Major Field Area (E.g. Bioeng, Controls, Etc.)

Twelve semester units from 200 or 100 upper division series.

#### Maximum Number of Units Transferable Towards the Master's Degree

A master's student may transfer up to 4 semester units or 6 quarter units of course work completed as a graduate student at another institution.

### Advancement To Candidacy

If the MS is the student's terminal degree, students should apply for advancement to candidacy in their second semester.

#### Oral Presentation and Final Report

An oral presentation and a written report are required. All committee members are required to be members of the Berkeley Division of the Academic Senate.

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#### For more detailed information, please see the following websites:

<http://me.berkeley.edu/graduate-student-handbook/chapter-5-ms-master-science-degree>  
<http://grad.berkeley.edu/policy/degrees-policy/>

Please note that the requirements above are for the Plan II MS Degree (which the majority of our students choose). If you are interested in the Plan I requirements, please see <http://me.berkeley.edu/graduate-student-handbook/52-master-science-degree-requirements-plan-i>.

### Normative Time

Nine months or two semesters.

#### Minimum Number of Units to Complete Degree

Twenty-five semester units.

Course restriction: must be in 200 series.

#### Minimum Number of Mechanical Engineering Units in Area of Concentration

Twelve semester units (must be in 200 series and letter-graded).

#### Minimum Grade Point Averages (GPAs)

All students are required to have a minimum overall grade point average of 3.0.

#### Minimum Units You Are Required to Take in Order to Be Registered Each Semester

Full time graduate students must enroll in 12 Semester units each semester.

#### Maximum Number of Units Transferable Towards Master's of Engineering Degree

A master of engineering student may petition to transfer up to 4 semester units or 6 quarter units of 200-level courses completed as a graduate student at another UC campus.

### Advancement To Candidacy

Students should apply for advancement to candidacy at the beginning of their second semester.

#### Oral Presentation and Report

An oral presentation and a written report of the capstone project are required by the end of the spring semester as part of the completion of the Engineering 296 series.

### Concentrations

- Advanced Energy Technology
- Experiential Advanced Control Systems Design
- Modeling & Simulation of Physical Processes & Systems
- Product Design

#### Courses Required

Approved individualized study list per student's interest in concentration area, including the courses below:

ENGIN 271	Engineering Leadership I	3
ENGIN 272	Engineering Leadership II	3
ENGIN 296MA	Master of Engineering Capstone Project	2
ENGIN 296MB	Master of Engineering Capstone Project	3
ENGIN 295	Communications for Engineering Leaders ( 1 unit in fall and 1 unit in spring )	1
ENGIN 298A	Group Studies or Seminars (optional, in spring)	1-6
MEC ENG Electives	- approved study list per student's area of concentration. (Advanced Energy Technology; Experiential Advanced Control Systems Design; Modeling and Simulation of Physical Processes and Systems; Product Design)	12

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#### For more detailed information, please refer to the following page:

<http://me.berkeley.edu/graduate-student-handbook/62-master-engineering-degree-requirements>.

## Mechanical Engineering

### MEC ENG C200 Design, Evaluate, and Scale Development Technologies 3 Units

Terms offered: Fall 2017, Fall 2016, Fall 2015

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.

Design, Evaluate, and Scale Development Technologies: Read More [+]

#### 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

Design, Evaluate, and Scale Development Technologies: Read Less [-]

### MEC ENG C201 Modeling and Simulation of Advanced Manufacturing Processes 3 Units

Terms offered: Spring 2018, Spring 2017, Spring 2016

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.

Modeling and Simulation of Advanced Manufacturing Processes: Read More [+]

#### 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

Modeling and Simulation of Advanced Manufacturing Processes: Read Less [-]

## MEC ENG C202 Computational Design of Multifunctional/Multiphysical Composite Materials 3 Units

Terms offered: Spring 2012

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.

Computational Design of Multifunctional/Multiphysical Composite

Materials: [Read More](#) [+]

### Rules & Requirements

**Prerequisites:** An undergraduate degree in the applied sciences or engineering

### Hours & Format

**Fall and/or spring:** 15 weeks - 3-3 hours of lecture and 0-1 hours of discussion per week

### Additional Details

**Subject/Course Level:** Mechanical Engineering/Graduate

**Grading:** Letter grade.

**Instructor:** Zohdi

**Also listed as:** MAT SCI C287

Computational Design of Multifunctional/Multiphysical Composite

Materials: [Read Less](#) [-]

## MEC ENG 204 Advanced Manufacturing Systems Analysis, AMS 3 Units

Terms offered: Spring 2017, Spring 2016, Spring 2015

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.

Advanced Manufacturing Systems Analysis, AMS: [Read More](#) [+]

### Objectives Outcomes

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

- Gain solid foundations on the analysis of Advanced Manufacturing Systems Analysis (AMS), including flow analysis concepts, frameworks and methodologies.
- Understand and apply sustainable engineering practices.
- Put into practice decision-making activities based on solid academic rigor, quantitative tools and simulation models oriented for AMS
- 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.

Advanced Manufacturing Systems Analysis, AMS: [Read Less](#) [-]

## MEC ENG C205 Critical Making 4 Units

Terms offered: Spring 2018, Spring 2017, Spring 2016

Critical Making will operationalize and critique the practice of “making” through both foundational literature and hands on studio culture. As hybrid practitioners, students will develop fluency in readily collaging and incorporating a variety of physical materials and protocols into their practice. Students will envision and create future computational experiences that critically explore social and culturally relevant technological themes. No previous technical knowledge is required to take this course. Class projects involve basic programming, electronic circuitry, and digital fabrication design. Tutorials and instruction will be provided, but students will be expected to develop basic skills in these areas to complete course projects.

Critical Making: Read More [+]

### Hours & Format

**Fall and/or spring:** 15 weeks - 2 hours of lecture and 2 hours of studio per week

### Summer:

6 weeks - 4 hours of lecture and 8 hours of studio per week

8 weeks - 4 hours of lecture and 4 hours of studio per week

10 weeks - 3 hours of lecture and 3 hours of studio per week

### Additional Details

**Subject/Course Level:** Mechanical Engineering/Graduate

**Grading:** Letter grade.

**Formerly known as:** New Media 203

**Also listed as:** NWMEDIA C203

Critical Making: Read Less [-]

## MEC ENG 206 Engineering Design and Prototyping: Pedagogy & Assessment 3 Units

Terms offered: Prior to 2007

This course explores contemporary research in engineering design and prototyping, as well as related cognitive issues in engineering curricular development, pedagogy, and assessment. One recurring theme throughout the course will be the duality between learning and design: design-based research, design as a pedagogy for integrative learning and the role of cognition and the learning sciences in the practice of engineering design. It has been motivated by several reforms: (1) National efforts to better train and educate engineers for the engineering workplace in the 21st Century; to better prepare engineers to face multidisciplinary problems and product design in competitive industries and improve their skills in teamwork and communication.

Engineering Design and Prototyping: Pedagogy & Assessment: Read More [+]

### Objectives Outcomes

**Course Objectives:** This course has been developed to bridge student's previous knowledge of disciplinary research in design and prototyping with engineering education research.

- Provide learners the opportunity to question (usually tacit) assumptions about what engineering is, what the purpose and process of engineering education is, and who gets to be an engineer.
- Understand design as a pedagogy for integrative learning and the role of cognition and the learning sciences in the practice of engineering design and prototyping.
- Provide the participants with an understanding of theories and practices in content, assessment, and pedagogy for teaching engineering design and prototyping.
- Familiarize learners with quantitative and qualitative methodologies for data analysis associated with the assessment of design and prototyping interventions.
- Promote critical thinking and a social construction of knowledge by having face-to-face and online discussions of readings from a variety of sources.

**Student Learning Outcomes:** Students will be able to:

- Identify their own role in shaping engineering and engineering education, and explore paths of connecting their research in Mechanical Engineering (or a related field) educational interests in design and prototyping;
- Think critically, reflectively and holistically about engineering and education;
- Become aware of the theoretical and practical issues of learning, instruction, and assessment as these concern the design of educational environments and technologies;
- Apply design research methods to inform and validate designs involving educational issues.
- Articulate their own view of the design of educational tools and become more confident about their ability to work as an engineer and educational designer.

### 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

Engineering Design and Prototyping: Pedagogy & Assessment: Read



## MEC ENG C210 Advanced Orthopedic Biomechanics 4 Units

Terms offered: Fall 2017, Fall 2016, Fall 2015

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.

Advanced Orthopedic Biomechanics: Read More [+]

### 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

Advanced Orthopedic Biomechanics: Read Less [-]

## MEC ENG 211 The Cell as a Machine 3 Units

Terms offered: Fall 2015, Fall 2013

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.

The Cell as a Machine: Read More [+]

### Rules & Requirements

**Prerequisites:** Mathematics 54; Physics 7A; 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

The Cell as a Machine: Read Less [-]

## MEC ENG C212 Heat and Mass Transport in Biomedical Engineering 3 Units

Terms offered: Spring 2008, Fall 2007, Spring 2006, Spring 2005

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.

Heat and Mass Transport in Biomedical Engineering: Read More [+]

### 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

Heat and Mass Transport in Biomedical Engineering: Read Less [-]

## MEC ENG C213 Fluid Mechanics of Biological Systems 3 Units

Terms offered: Spring 2016, Spring 2014, Spring 2011

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.

Fluid Mechanics of Biological Systems: Read More [\[+\]](#)

### 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

Fluid Mechanics of Biological Systems: Read Less [\[-\]](#)

## MEC ENG C214 Advanced Tissue Mechanics 3 Units

Terms offered: Spring 2018, Spring 2017, Spring 2015

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.

Advanced Tissue Mechanics: Read More [\[+\]](#)

### 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

Advanced Tissue Mechanics: Read Less [\[-\]](#)

## MEC ENG C215 Advanced Structural Aspects of Biomaterials 4 Units

Terms offered: Spring 2018, Spring 2016, Fall 2013

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. Advanced Structural Aspects of Biomaterials: Read More [\[+\]](#)

### Rules & Requirements

**Credit Restrictions:** Students should not receive credit if they've taken ME ME C117 or Bio Eng C117.

### 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 C222

Advanced Structural Aspects of Biomaterials: Read Less [\[-\]](#)



## MEC ENG C216 Molecular Biomechanics and Mechanobiology of the Cell 4 Units

Terms offered: Spring 2016, Spring 2015, Spring 2014

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 cytoskeleton 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.

Molecular Biomechanics and Mechanobiology of the Cell: [Read More](#) [+]

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

### Rules & Requirements

**Prerequisites:** Math 54; Physics 7A; 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

Molecular Biomechanics and Mechanobiology of the Cell: [Read Less](#) [-]

## MEC ENG C217 Biomimetic Engineering -- Engineering from Biology 3 Units

Terms offered: Fall 2017, Spring 2014, Fall 2010

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.

Biomimetic Engineering -- Engineering from Biology: [Read More](#) [+]

### 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

Biomimetic Engineering -- Engineering from Biology: [Read Less](#) [-]

## MEC ENG C218 Introduction to MEMS Design 4 Units

Terms offered: Spring 2018, Spring 2017, Spring 2016

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.

Introduction to MEMS Design: Read More [\[+\]](#)

### 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

Introduction to MEMS Design: Read Less [\[-\]](#)

## MEC ENG C219 Parametric and Optimal Design of MEMS 3 Units

Terms offered: Spring 2013, Spring 2012, Spring 2011

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.

Parametric and Optimal Design of MEMS: Read More [\[+\]](#)

### 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

Parametric and Optimal Design of MEMS: Read Less [\[-\]](#)

## MEC ENG 220 Precision Manufacturing 3 Units

Terms offered: Fall 2015, Fall 2013, Fall 2012

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.

Precision Manufacturing: Read More [\[+\]](#)

### 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

Precision Manufacturing: Read Less [\[-\]](#)

## MEC ENG 221 Graduate Introduction to Lean Manufacturing Systems 3 Units

Terms offered: Spring 2018, Fall 2006, Fall 2004

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.

Graduate Introduction to Lean Manufacturing Systems: Read More [\[+\]](#)

### 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:** Graduate standing in Engineering, or consent of instructor

**Credit Restrictions:** Students will not receive credit for this course after taking ME 101.

### 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:** McMains

Graduate Introduction to Lean Manufacturing Systems: Read Less [\[-\]](#)

## MEC ENG C223 Polymer Engineering 3 Units

Terms offered: Fall 2017, Fall 2015, Fall 2014

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.

Polymer Engineering: Read More [\[+\]](#)

### 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

Polymer Engineering: Read Less [\[-\]](#)

## MEC ENG 224 Mechanical Behavior of Engineering Materials 3 Units

Terms offered: Fall 2016, Fall 2015, Spring 2015

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.

Mechanical Behavior of Engineering Materials: Read More [\[+\]](#)

### 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.

Mechanical Behavior of Engineering Materials: Read Less [\[-\]](#)

## MEC ENG C225 Deformation and Fracture of Engineering Materials 4 Units

Terms offered: Spring 2018, Spring 2016, Spring 2015

This course covers deformation and fracture behavior of engineering materials for both monotonic and cyclic loading conditions.

Deformation and Fracture of Engineering Materials: Read More [\[+\]](#)

### 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

Deformation and Fracture of Engineering Materials: Read Less [\[-\]](#)

## MEC ENG 226 Tribology 3 Units

Terms offered: Fall 2016, Spring 2016, Spring 2013

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.

Tribology: Read More [\[+\]](#)

### 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

Tribology: Read Less [\[-\]](#)

## MEC ENG 227 Mechanical Behavior of Composite Materials 3 Units

Terms offered: Spring 2013, Fall 2010, Fall 2008

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.

Mechanical Behavior of Composite Materials: Read More [\[+\]](#)

### 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

Mechanical Behavior of Composite Materials: Read Less [\[-\]](#)

## MEC ENG 229 Design of Basic Electro-Mechanical Devices 3 Units

Terms offered: Spring 2018, Spring 2017, Spring 2015

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.

Design of Basic Electro-Mechanical Devices: Read More [\[+\]](#)

### 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.

Design of Basic Electro-Mechanical Devices: Read Less [\[-\]](#)

## MEC ENG C231A Experiential Advanced Control Design I 3 Units

Terms offered: Fall 2017, Fall 2016, Fall 2015

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. Experiential Advanced Control Design I: Read More [+]

### 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

Experiential Advanced Control Design I: Read Less [-]

## MEC ENG C231B Experiential Advanced Control Design II 3 Units

Terms offered: Spring 2018, Spring 2017

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.

Experiential Advanced Control Design II: Read More [+]

### 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

Experiential Advanced Control Design II: Read Less [-]

## MEC ENG C232 Advanced Control Systems I 3 Units

Terms offered: Fall 2017, Fall 2016, Fall 2015

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.

Advanced Control Systems I: Read More [+]

### Rules & Requirements

**Repeat rules:** Students will receive no credit for Electrical Engineering C220A after taking Mechanical Engineering 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:** Borrelli, Horowitz, Tomizuka, Tomlin

**Also listed as:** EL ENG C220A

Advanced Control Systems I: Read Less [-]

## MEC ENG 233 Advanced Control Systems II 3 Units

Terms offered: Spring 2018, Spring 2017, Spring 2016

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.

Advanced Control Systems II: Read More [+]

### 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

Advanced Control Systems II: Read Less [-]

## MEC ENG 234 Multivariable Control System Design 3 Units

Terms offered: Fall 2016, Spring 2015, Spring 2011

Analysis and synthesis techniques for multi-input (MIMO) control systems. Emphasis is on the effect that model uncertainty has on the design process.

Multivariable Control System Design: Read More [\[+\]](#)

### Rules & Requirements

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

### 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, Poola

Multivariable Control System Design: Read Less [\[-\]](#)

## MEC ENG 235 Design of Microprocessor-Based Mechanical Systems 4 Units

Terms offered: Spring 2018, Spring 2017, Spring 2016

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.

Design of Microprocessor-Based Mechanical Systems: Read More [\[+\]](#)

### 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.

### 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.

Design of Microprocessor-Based Mechanical Systems: Read Less [\[-\]](#)

## MEC ENG C236 Control and Optimization of Distributed Parameters Systems 3 Units

Terms offered: Fall 2017, Spring 2016, Spring 2015, Spring 2014

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.

Control and Optimization of Distributed Parameters Systems: Read More [\[+\]](#)

### 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

Control and Optimization of Distributed Parameters Systems: Read Less [\[-\]](#)



## MEC ENG 237 Control of Nonlinear Dynamic Systems 3 Units

Terms offered: Spring 2016, Spring 2015, Fall 2013

Fundamental properties of nonlinear systems. Stability of nonlinear systems via Lyapunov's Direct Method. Controllability and observability of nonlinear systems. Controller design of nonlinear systems including feedback linearization and sliding mode control. Design of nonlinear discrete and adaptive controllers. Nonlinear observers and compensators.

Control of Nonlinear Dynamic Systems: [Read More](#) [+]

### Objectives Outcomes

**Course Objectives:** To develop non-simulative/analytical tools to predict the stability and performance of nonlinear systems and to develop an appreciation for the differences between linear and nonlinear systems such as multiple equilibrium points, initial condition dependent stability. To develop controller synthesis methods for nonlinear and uncertain dynamic systems.

**Student Learning Outcomes:** The ability to design, evaluate and implement closed loop controllers for highly nonlinear and uncertain systems.

### Rules & Requirements

**Prerequisites:** ME C232

### Hours & Format

**Fall and/or spring:** 15 weeks - 3-3 hours of lecture and 0-1 hours of discussion per week

### Additional Details

**Subject/Course Level:** Mechanical Engineering/Graduate

**Grading:** Letter grade.

Control of Nonlinear Dynamic Systems: [Read Less](#) [-]

## MEC ENG C237 Nonlinear Systems 3 Units

Terms offered: Spring 2018

Basic graduate course in nonlinear systems. Nonlinear phenomena, planar systems, bifurcations, center manifolds, existence and uniqueness theorems. Lyapunov's direct and indirect methods, Lyapunov-based feedback stabilization. Input-to-state and input-output stability, and dissipativity theory. Computation techniques for nonlinear system analysis and design. Feedback linearization and sliding mode control methods.

Nonlinear Systems: [Read More](#) [+]

### Rules & Requirements

**Prerequisites:** Math 54, or equivalent (undergraduate level Ordinary Differential Equations and Linear Algebra)

### 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:** Arcak, Tomlin, Kameshwar

**Also listed as:** EL ENG C222

Nonlinear Systems: [Read Less](#) [-]

## MEC ENG 238 Advanced Micro/Nano Mechanical Systems Laboratory 3 Units

Terms offered: Spring 2018, Spring 2013

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. Advanced Micro/Nano Mechanical Systems Laboratory: [Read More](#) [+]

### Rules & Requirements

**Prerequisites:** EE 16A or 40, Physics 7B, ME 106, (ME119 or ME118 are highly recommended but not mandatory)

**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.

Advanced Micro/Nano Mechanical Systems Laboratory: [Read Less](#) [-]

## MEC ENG 239 Advanced Design and Automation 4 Units

Terms offered: Fall 2014, Spring 2013, Spring 2011

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. Advanced Design and Automation: Read More [+]

### 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

Advanced Design and Automation: Read Less [-]

## MEC ENG 240A Advanced Marine Structures I 3 Units

Terms offered: Fall 2013, Spring 2013, Spring 2012

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.

Advanced Marine Structures I: Read More [+]

### Rules & Requirements

**Prerequisites:** Graduate standing; Statistics 25 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:** Mansour

Advanced Marine Structures I: Read Less [-]

## MEC ENG 240B Advanced Marine Structures II 3 Units

Terms offered: Spring 2015, Fall 2014, Spring 2014

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.

Advanced Marine Structures II: Read More [+]

### 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.

**Instructor:** Mansour

Advanced Marine Structures II: Read Less [-]

## MEC ENG 241A Marine Hydrodynamics I 3 Units

Terms offered: Fall 2016, Fall 2015, Spring 2014

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.

Marine Hydrodynamics I: Read More [+]

### Objectives Outcomes

**Course Objectives:** To provide students with a sufficient introduction to each of the topics of the course so that he/she will be able to understand the background of current literature in the hydrodynamics of marine vehicles, offshore engineering, and other ocean-related activities.

**Student Learning Outcomes:** Students with ocean- and marine-related interest will develop the necessary theoretical and experimental background to keep up with existing literature and begin research on contemporary topics.

### Rules & Requirements

**Prerequisites:** Mechanical Engineering 165 recommended or graduate standing

### Hours & Format

**Fall and/or spring:** 15 weeks - 3-3 hours of lecture and 0-1 hours of discussion per week

### Additional Details

**Subject/Course Level:** Mechanical Engineering/Graduate

**Grading:** Letter grade.

**Instructor:** Yeung

Marine Hydrodynamics I: Read Less [-]

## MEC ENG 241B Marine Hydrodynamics II 3 Units

Terms offered: Spring 2018, Spring 2017, Spring 2016

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. Ocean-wave energy. Memory effects in time domain. Second-order formulation. Impact hydrodynamics, Hydrofoil theory and lifting surface.

Marine Hydrodynamics II: Read More [+]

### Objectives Outcomes

**Course Objectives:** To provide students with a sufficient introduction to each of the topics of the course so that he/she will be able to understand the background of current literature in the hydrodynamics of marine vehicles, offshore engineering, and renewable ocean energy

**Student Learning Outcomes:** Students with ocean- and marine-related interest will develop the necessary theoretical and experimental background to keep up with existing literature and begin research on contemporary topics.

### Rules & Requirements

**Prerequisites:** 260A or 241A, or CEE 200A recommended

### Hours & Format

**Fall and/or spring:** 15 weeks - 3-3 hours of lecture and 0-1 hours of discussion per week

### Additional Details

**Subject/Course Level:** Mechanical Engineering/Graduate

**Grading:** Letter grade.

**Instructor:** Yeung

Marine Hydrodynamics II: Read Less [-]

## MEC ENG 243 Advanced Methods in Free-Surface Flows 3 Units

Terms offered: Spring 2016, Fall 2012, Spring 2009

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.

Advanced Methods in Free-Surface Flows: Read More [\[+\]](#)

### Objectives Outcomes

**Course Objectives:** To present a relatively broad spectrum of analytical and numerical methods commonly used in tackling wave-body interaction problems. Topics covered include classical techniques in special coordinate systems, modern computational techniques based on boundary-integral, finite-element, and boundary-fitted coordinates methods. Lectures focus on formulations and implementation techniques. Students are given opportunities to implement methods discussed in class on workstations or mainframe.

**Student Learning Outcomes:** Students will be conversant and have abilities to handle fluid-structure interactions problems with free-surface present.

### Rules & Requirements

**Prerequisites:** ME 260A or CEE 200A; ME 241B recommended or with Instructor's permission

### Hours & Format

**Fall and/or spring:** 15 weeks - 3-3 hours of lecture and 0-1 hours of discussion per week

### Additional Details

**Subject/Course Level:** Mechanical Engineering/Graduate

**Grading:** Letter grade.

**Instructor:** Yeung

Advanced Methods in Free-Surface Flows: Read Less [\[-\]](#)

## MEC ENG 245 Oceanic and Atmospheric Waves 3 Units

Terms offered: Spring 2018, Spring 2016, Spring 2015

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.

Oceanic and Atmospheric Waves: Read More [\[+\]](#)

### 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.

Oceanic and Atmospheric Waves: Read Less [\[-\]](#)

## MEC ENG 246 Advanced Energy Conversion Principles 3 Units

Terms offered: Spring 2018, Fall 2016, Spring 2016

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.

Advanced Energy Conversion Principles: Read More [a+]

### Objectives Outcomes

**Course Objectives:** This class provides students with an understanding of the thermophysical principles that govern energy conversion processes of different types, and will introduce them to modern computational methods for modeling the performance of energy conversion processes, devices and systems. This course is a capstone experience for ME students, synthesizing thermodynamics, fluid dynamics, heat transfer and computational analysis tools to facilitate engineering design analysis.

**Student Learning Outcomes:** This course will provide a foundation for design analysis of energy conversion systems encountered in 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 - 3-3 hours of lecture and 0-1 hours of discussion per week

### Additional Details

**Subject/Course Level:** Mechanical Engineering/Graduate

**Grading:** Letter grade.

**Instructor:** Carey

Advanced Energy Conversion Principles: Read Less [-]

## MEC ENG 251 Heat Conduction 3 Units

Terms offered: Spring 2018, Fall 2016, Fall 2015

Analytical and numerical methods for the determination of the conduction of heat in solids.

Heat Conduction: Read More [a+]

### 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.

Heat Conduction: Read Less [-]

## MEC ENG 252 Heat Convection 3 Units

Terms offered: Spring 2017, Spring 2015, Spring 2014

The transport of heat in fluids in motion; free and forced convection in laminar and turbulent flow over surfaces and within ducts.

Heat Convection: Read More [a+]

### 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

Heat Convection: Read Less [-]

## MEC ENG 253 Thermal Radiation 3 Units

Terms offered: Spring 2018, Fall 2015, Fall 2013

Thermal radiation properties of gases, liquids, and solids; the calculation of radiant energy transfer.

Thermal Radiation: Read More [a+]

### 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

Thermal Radiation: Read Less [-]

**MEC ENG 254 Thermodynamics I 3 Units**

Terms offered: Spring 2018, Fall 2016, Fall 2015

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.

Thermodynamics I: Read More [+]

**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

Thermodynamics I: Read Less [-]

**MEC ENG 255 Advanced Combustion Processes 3 Units**

Terms offered: Fall 2016, Fall 2015, Fall 2014

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.

Advanced Combustion Processes: Read More [+]

**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

Advanced Combustion Processes: Read Less [-]



## MEC ENG 256 Combustion 3 Units

Terms offered: Fall 2017, Spring 2015, Spring 2014

Combustion modeling. Multicomponent conservation equations with reactions. Laminar and turbulent deflagrations. Rankine-Hugoniot relations. Diffusion flames. Boundary layer combustion, ignition, and stability.

Combustion: Read More [\[+\]](#)

### Objectives Outcomes

**Course Objectives:** This course provides students a solid foundation in combustion sciences and technologies relevant to current and future energy conversion devices using combustion.

**Student Learning Outcomes:** Students will have the ability to perform critical analyses of current and future reacting systems using analytical and numerical methods. For practical combustion systems with complex geometries, students will have gained sufficient background to further their capabilities of using advanced numerical models.

### Rules & Requirements

**Prerequisites:** ME 40, ME 106, and ME 109 (106 and 109 may be taken concurrently) or their equivalents. ME 140/ME255 is recommended

### Hours & Format

**Fall and/or spring:** 15 weeks - 3-3 hours of lecture and 0-1 hours of discussion per week

### Additional Details

**Subject/Course Level:** Mechanical Engineering/Graduate

**Grading:** Letter grade.

**Instructor:** Chen

Combustion: Read Less [\[-\]](#)

## MEC ENG 257 Advanced Combustion 3 Units

Terms offered: Fall 2016, Fall 2014, Fall 2012

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 mechanisms are introduced. Flame propagation theory and experiments are discussed in detail for both laminar and turbulent flows.

Advanced Combustion: Read More [\[+\]](#)

### 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.

Advanced Combustion: Read Less [\[-\]](#)

## MEC ENG 258 Heat Transfer with Phase Change 3 Units

Terms offered: Spring 2016, Spring 2015, Fall 2013

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.

Heat Transfer with Phase Change: Read More [\[+\]](#)

### 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

Heat Transfer with Phase Change: Read Less [\[-\]](#)

## MEC ENG 259 Microscale Thermophysics and Heat Transfer 3 Units

Terms offered: Fall 2017, Spring 2016, Spring 2014

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.

Microscale Thermophysics and Heat Transfer: Read More [\[+\]](#)

### 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

Microscale Thermophysics and Heat Transfer: Read Less [\[-\]](#)

## MEC ENG 260A Advanced Fluid Mechanics I 3 Units

Terms offered: Fall 2017, Fall 2016, Fall 2015

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.

Advanced Fluid Mechanics I: Read More [+]

### Rules & Requirements

**Prerequisites:** 106; 185 (strongly recommended) 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.

Advanced Fluid Mechanics I: Read Less [-]

## MEC ENG 260B Advanced Fluid Mechanics II 3 Units

Terms offered: Spring 2018, Spring 2017, Spring 2016

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.

Advanced Fluid Mechanics II: Read More [+]

### 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.

Advanced Fluid Mechanics II: Read Less [-]

## MEC ENG 262 Hydrodynamic Stability and Instability 3 Units

Terms offered: Fall 2014, Fall 2012, Spring 2011

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. Hydrodynamic Stability and Instability: Read More [+]

### 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

Hydrodynamic Stability and Instability: Read Less [-]

## MEC ENG 263 Turbulence 3 Units

Terms offered: Spring 2017, Fall 2012, Spring 2010

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.

Turbulence: Read More [+]

### 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

Turbulence: Read Less [-]

## MEC ENG 266 Geophysical and Astrophysical Fluid Dynamics 3 Units

Terms offered: Spring 2015, Spring 2013, Spring 2008

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.

Geophysical and Astrophysical Fluid Dynamics: [Read More](#) [+]

### 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

Geophysical and Astrophysical Fluid Dynamics: [Read Less](#) [-]

## MEC ENG C268 Physicochemical Hydrodynamics 3 Units

Terms offered: Spring 2017, Fall 2013, Fall 2011, Spring 2011

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.

Physicochemical Hydrodynamics: [Read More](#) [+]

### Rules & Requirements

**Prerequisites:** A first graduate course in fluid mechanics such 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

Physicochemical Hydrodynamics: [Read Less](#) [-]

## MEC ENG 273 Oscillations in Linear Systems 3 Units

Terms offered: Fall 2017, Fall 2016, Fall 2015

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's quotient. Oscillations in Linear Systems: [Read More](#) [+]

### Objectives Outcomes

**Course Objectives:** To give a compact, consistent, and reasonably connected account of the theory of linear vibration at the advanced level. A secondary purpose is to survey some topics of contemporary research. Applications will be mentioned whenever feasible.

**Student Learning Outcomes:** Acquired necessary knowledge and scientific maturity to begin research in dynamics and vibration.

### Rules & Requirements

**Prerequisites:** ME 104 and ME 133 or their equivalents

### Hours & Format

**Fall and/or spring:** 15 weeks - 3-3 hours of lecture and 0-1 hours of discussion per week

### Additional Details

**Subject/Course Level:** Mechanical Engineering/Graduate

**Grading:** Letter grade.

**Instructor:** Ma

Oscillations in Linear Systems: [Read Less](#) [-]

## MEC ENG 274 Random Oscillations of Mechanical Systems 3 Units

Terms offered: Spring 2018, Spring 2015, Spring 2011

Random variables and random processes. Stationary, nonstationary, and ergodic processes. 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. Random Oscillations of Mechanical Systems: [Read More](#) [+]

### 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

Random Oscillations of Mechanical Systems: [Read Less](#) [-]

**MEC ENG 275 Advanced Dynamics 3 Units**

Terms offered: Spring 2017, Spring 2015, Spring 2012

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.

Advanced Dynamics: Read More [+]

**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.

Advanced Dynamics: Read Less [-]

**MEC ENG 277 Oscillations in Nonlinear Systems 3 Units**

Terms offered: Spring 2016, Spring 2014, Spring 2012

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.

Oscillations in Nonlinear Systems: Read More [+]

**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

Oscillations in Nonlinear Systems: Read Less [-]

**MEC ENG C278 Adv Designing for the Human Body 3 Units**

Terms offered: Fall 2017

The course provides project-based learning experience in understanding product design, with a focus on the human body as a mechanical machine. Students will learn the design of external devices used to aid or protect the body. Topics will include forces acting on internal materials (e.g., muscles and total replacement devices), forces acting on external materials (e.g., prosthetics and crash pads), design/analysis of devices aimed to improve or fix the human body, muscle adaptation, and soft tissue injury. Weekly laboratory projects will incorporate EMG sensing, force plate analysis, and interpretation of data collection (e.g., MATLAB analysis) to integrate course material to better understand contemporary design/analysis/problems.

Adv Designing for the Human Body: Read More [+]

**Objectives Outcomes**

**Course Objectives:** The purpose of this course is twofold:

- to learn the fundamental concepts of designing devices that interact with the human body;
- to enhance skills in mechanical engineering and bioengineering by analyzing the behavior of various complex biomedical problems;
- To explore the transition of a device or discovery as it goes from "benchtop to bedside".
- Three separate written projects evaluating devices that interact with the body. Projects will focus on 1) biomechanical analysis, 2) FDA regulations and procedures, and 3) design lifecycle.

**Student Learning Outcomes:** Working knowledge of design considerations for creating a device to protect or aid the human body, force transfer and distribution, data analysis, and FDA approval process for new devices. 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. Critical analysis of current literature and technology.

**Rules & Requirements**

**Prerequisites:** Proficiency in MatLab or equivalent. Prior knowledge of biology or anatomy is not assumed

**Credit Restrictions:** There will be no credit given for MEC ENG C178 / BIO ENG C137 after taking MEC ENG 178.<BR/><BR/>

**Hours & Format**

**Fall and/or spring:** 15 weeks - 3-3 hours of lecture and 1-2 hours of laboratory per week

**Additional Details**

**Subject/Course Level:** Mechanical Engineering/Graduate

**Grading:** Letter grade.

**Instructor:** O'Connell

**Also listed as:** BIO ENG C237

Adv Designing for the Human Body: Read Less [-]

## MEC ENG C279 Introduction to Statistical Mechanics for Engineers 3 Units

Terms offered: Spring 2017, Fall 2013, Fall 2012

Introduction to statistical mechanics for engineers. Basics of ensembles, phase spaces, partitions functions, and free energies. Analysis of expectation values and fluctuations in system properties. Applications to the study of elementary gases, phonons in solids, polymer chains and networks, harmonic and quasi-harmonic crystalline solids; limitations of classical methods and quantum mechanical influences; molecular dynamics simulations for solids.

Introduction to Statistical Mechanics for Engineers: Read More [a+]

### Objectives Outcomes

**Course Objectives:** To provide a modern introduction to the application of statistical mechanics for engineering with a particular emphasis on mechanical response.

### Rules & Requirements

**Prerequisites:** CE C231 or MSE C211 or ME 185 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:** Govindjee, Papadopoulos

**Also listed as:** CIV ENG C235

Introduction to Statistical Mechanics for Engineers: Read Less [-]

## MEC ENG 280A Introduction to the Finite Element Method 3 Units

Terms offered: Fall 2017, Fall 2016, Fall 2015

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.

Introduction to the Finite Element Method: Read More [a+]

### 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

Introduction to the Finite Element Method: Read Less [-]

## MEC ENG 280B Finite Element Methods in Nonlinear Continua 3 Units

Terms offered: Spring 2016, Spring 2013, Spring 2009

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.

Finite Element Methods in Nonlinear Continua: Read More [a+]

### 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

Finite Element Methods in Nonlinear Continua: Read Less [-]

## MEC ENG 281 Methods of Tensor Calculus and Differential Geometry 3 Units

Terms offered: Fall 2017, Fall 2015, Spring 2012

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.

Methods of Tensor Calculus and Differential Geometry: Read More [a+]

### 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.

Methods of Tensor Calculus and Differential Geometry: Read Less [-]

**MEC ENG 282 Theory of Elasticity 3 Units**

Terms offered: Spring 2018, Spring 2016, Fall 2014

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. Theory of Elasticity: Read More [+]

**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

Theory of Elasticity: Read Less [-]

**MEC ENG 283 Wave Propagation in Elastic Media 3 Units**

Terms offered: Fall 2013, Fall 2012, Fall 2009

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.

Wave Propagation in Elastic Media: Read More [+]

**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

Wave Propagation in Elastic Media: Read Less [-]

**MEC ENG 284 Nonlinear Theory of Elasticity 3 Units**

Terms offered: Spring 2017, Spring 2014, Spring 2013

Fundamentals of the nonlinear theory of elasticity. Material symmetry. Exact solutions in elastostatics. Internal constraints. Useful strain-energy functions. Uniqueness. Compatibility conditions. Volterra dislocations. The Eshelby tensor. Small deformations superposed on finite deformations. Waves in pre-stressed solids. Stability. Bifurcations and buckling. Acceleration waves. Entropic elasticity.

Nonlinear Theory of Elasticity: Read More [+]

**Objectives Outcomes**

**Course Objectives:** To provide students with a working knowledge of elasticity.

**Student Learning Outcomes:** Ability to embark on modern research in the field.

**Rules & Requirements**

**Prerequisites:** ME 185 or equivalent

**Hours & Format**

**Fall and/or spring:** 15 weeks - 3-3 hours of lecture and 0-1 hours of discussion per week

**Additional Details**

**Subject/Course Level:** Mechanical Engineering/Graduate

**Grading:** Letter grade.

**Instructor:** Casey

Nonlinear Theory of Elasticity: Read Less [-]

**MEC ENG 285A Foundations of the Theory of Continuous Media 3 Units**

Terms offered: Spring 2018, Spring 2016, Spring 2015

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.

Foundations of the Theory of Continuous Media: Read More [+]

**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

Foundations of the Theory of Continuous Media: Read Less [-]



## MEC ENG 285B Surfaces of Discontinuity and Inhomogeneities in Deformable Continua 3 Units

Terms offered: Fall 2011, Spring 2010, Fall 2008

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.

Surfaces of Discontinuity and Inhomogeneities in Deformable Continua:

[Read More](#) [+]

### 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

Surfaces of Discontinuity and Inhomogeneities in Deformable Continua:

[Read Less](#) [-]

## MEC ENG 285C Electrodynamics of Continuous Media 3 Units

Terms offered: Spring 2015, Spring 2013, Spring 2010

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.

Electrodynamics of Continuous Media: [Read More](#) [+]

### 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

Electrodynamics of Continuous Media: [Read Less](#) [-]

## MEC ENG 285D Engineering Rheology 3 Units

Terms offered: Spring 2016, Spring 2014

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.

Engineering Rheology: Read More [ + ]

### 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

Engineering Rheology: Read Less [ - ]

## MEC ENG C285E Mechanics and Physics of Lipid Bilayers 3 Units

Terms offered: Fall 2017

Lipid bilayers constitute the membrane that encloses every animal cell and many of its interior structures, including the nuclear envelope, the organelles and the endoplasmic reticulum. This is a unique course devoted to modern developments in this exceptionally active field of research, ranging from models based on continuum theory to recent developments based on statistical mechanics.

Mechanics and Physics of Lipid Bilayers: Read More [ + ]

### Objectives Outcomes

**Student Learning Outcomes:** To expose students to advanced current work on the mechanics and physics of lipid bilayers (a very active field of current research relevant to biomechanics and biophysics)

### Rules & Requirements

**Prerequisites:** Mechanical Engineering 185 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:** Steigmann

**Also listed as:** CHM ENG C294A

Mechanics and Physics of Lipid Bilayers: Read Less [ - ]

## MEC ENG 286 Theory of Plasticity 3 Units

Terms offered: Spring 2015, Spring 2013, Spring 2010

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.

Theory of Plasticity: Read More [ + ]

Theory of Plasticity: Read More [ + ]

### 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

Theory of Plasticity: Read Less [ - ]

## MEC ENG 288 Theory of Elastic Stability 3 Units

Terms offered: Spring 2009, Fall 2007, Fall 1999

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.

Theory of Elastic Stability: Read More [ + ]

### 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

Theory of Elastic Stability: Read Less [ - ]

## MEC ENG 289 Theory of Shells 3 Units

Terms offered: Spring 2017, Spring 2012, Fall 2007

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.

Theory of Shells: Read More [ + ]

### 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

Theory of Shells: Read Less [ - ]

## MEC ENG 290C Topics in Fluid Mechanics 3 Units

Terms offered: Spring 2015, Fall 2010, Fall 2003

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.

Topics in Fluid Mechanics: Read More [ + ]

### 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

Topics in Fluid Mechanics: Read Less [ - ]

## MEC ENG 290D Solid Modeling and CAD/CAM Fundamentals 3 Units

Terms offered: Fall 2016, Fall 2014, Spring 2008

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. Solid Modeling and CAD/CAM Fundamentals: Read More [+]

### 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

Solid Modeling and CAD/CAM Fundamentals: Read Less [-]

## MEC ENG 290G Laser Processing and Diagnostics 3 Units

Terms offered: Spring 2018, Fall 2015, Spring 2013

The course provides a detailed account of laser interactions with materials in the context of advanced materials processing and diagnostics.

Laser Processing and Diagnostics: Read More [+]

### 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

Laser Processing and Diagnostics: Read Less [-]

## MEC ENG 290H Green Product Development: Design for Sustainability 3 Units

Terms offered: Spring 2017, Spring 2013, Spring 2011

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 teams for the development of their "green" products.

Green Product Development: Design for Sustainability: Read More [ + ]

### 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

Green Product Development: Design for Sustainability: Read Less [ - ]

## MEC ENG 290I Sustainable Manufacturing 3 Units

Terms offered: Spring 2016, Spring 2015, Spring 2014

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 sustainability 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.

Sustainable Manufacturing: Read More [ + ]

### 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.

### 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

Sustainable Manufacturing: Read Less [ - ]

## MEC ENG 290J Predictive Control for Linear and Hybrid Systems 3 Units

Terms offered: Spring 2016, Fall 2014, Spring 2013

Advanced optimization, polyhedra manipulation, and multiparametric programming. Invariant set theory. Analysis and design of constrained predictive controllers for linear and nonlinear systems. Computational oriented models of hybrid systems. Analysis and design of constrained predictive controllers for hybrid systems.

Predictive Control for Linear and Hybrid Systems: Read More [\[+\]](#)

### Objectives Outcomes

**Course Objectives:** The course is designed for graduate students who want to expand their knowledge on optimization-based control design. 50% will be focusing on advanced theory. 50% on applications.

**Student Learning Outcomes:** At the end of the course, the students will write a theoretical paper on MPC and will design an experiment where the theory is implemented.

### Rules & Requirements

**Prerequisites:** ME C232 and ME C231A

### 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

Predictive Control for Linear and Hybrid Systems: Read Less [\[-\]](#)

## MEC ENG 290KA Innovation through Design Thinking 2 Units

Terms offered: Fall 2017, Fall 2016, Fall 2015

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.

Innovation through Design Thinking: Read More [\[+\]](#)

### 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

Innovation through Design Thinking: Read Less [\[-\]](#)



## MEC ENG 290KB Life Cycle Thinking in Engineering Design 1 Unit

Terms offered: Fall 2017, Fall 2016, Fall 2015

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.

Life Cycle Thinking in Engineering Design: [Read More](#) [+]

### 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

Life Cycle Thinking in Engineering Design: [Read Less](#) [-]

## MEC ENG 290L Introduction to Nano-Biology 3 Units

Terms offered: Spring 2017, Spring 2016, Fall 2013

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).

Introduction to Nano-Biology: [Read More](#) [+]

### Objectives Outcomes

**Course Objectives:** The course introduces engineering students to the interplay between Nanotechnology and Biology and serves to 1) broaden the areas of research that students might not have necessarily considered, 2) expose students to cutting-edge research, and 3) develop analytical skills.

**Student Learning Outcomes:** Students should be able to critique methods and techniques that researchers have used to study and probe biological systems at the nano-scale. They will learn how to write research proposals and how to give an effective presentation. Through the research proposals, students will learn about the scientific-research process: formulating the problem, determining the appropriate experimental methods, interpreting the results, and arriving at a conclusion. Through presentations, students will gain valuable experience in public speaking and learn the process by which they would have to propose a research problem, be it in academia or industry.

### Hours & Format

**Fall and/or spring:** 15 weeks - 3-3 hours of lecture and 0-1 hours of discussion per week

### Additional Details

**Subject/Course Level:** Mechanical Engineering/Graduate

**Grading:** Letter grade.

**Instructor:** Sohn

Introduction to Nano-Biology: [Read Less](#) [-]

## MEC ENG 290M Expert Systems in Mechanical Engineering 3 Units

Terms offered: Fall 2005, Fall 2003, Spring 1999

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.

Expert Systems in Mechanical Engineering: Read More [\[+\]](#)

### 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

Expert Systems in Mechanical Engineering: Read Less [\[-\]](#)

## MEC ENG 290N System Identification 3 Units

Terms offered: Fall 2010, Fall 2008, Spring 2007

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.

System Identification: Read More [\[+\]](#)

### 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:** Poola

System Identification: Read Less [\[-\]](#)

## MEC ENG 290P New Product Development: Design Theory and Methods 3 Units

Terms offered: Fall 2015, Fall 2013, Fall 2012

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.

New Product Development: Design Theory and Methods: Read More [\[+\]](#)

### Objectives Outcomes

**Course Objectives:** Students can expect to depart the semester understanding new product development processes as well as useful tools, techniques and organizational structures that support new product development practice.

**Student Learning Outcomes:** Students can expect to depart the semester understanding new product development processes as well as useful tools, techniques and organizational structures that support new product development practice in the context of the "triple bottom line" – economy, environment and society.

### Rules & Requirements

**Prerequisites:** Graduate standing, consent of instructor

### Hours & Format

**Fall and/or spring:** 15 weeks - 3-3 hours of lecture and 0-1 hours of voluntary per week

### Additional Details

**Subject/Course Level:** Mechanical Engineering/Graduate

**Grading:** Letter grade.

**Instructor:** Agogino

New Product Development: Design Theory and Methods: Read Less [\[-\]](#)

## MEC ENG 290Q Dynamic Control of Robotic Manipulators 3 Units

Terms offered: Fall 2008, Spring 2007, Fall 2001

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

Dynamic Control of Robotic Manipulators: Read More [+]

### 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

Dynamic Control of Robotic Manipulators: Read Less [-]

## MEC ENG 290R Topics in Manufacturing 3 Units

Terms offered: Fall 2017, Spring 2016, Fall 2014

Advanced topics in manufacturing research. Topics vary from year to year.

Topics in Manufacturing: Read More [+]

### 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

Topics in Manufacturing: Read Less [-]

## MEC ENG 290T Plasmonic Materials 3 Units

Terms offered: Fall 2017, Fall 2014, Spring 2013

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.

Plasmonic Materials: Read More [+]

### Rules & Requirements

**Prerequisites:** Physics 110A 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

Plasmonic Materials: Read Less [-]

## MEC ENG 290U Interactive Device Design 4 Units

Terms offered: Fall 2017, Fall 2016, Fall 2015

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. Interactive Device Design: Read More [+]

### 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

Interactive Device Design: Read Less [-]

## MEC ENG 290V Topics in Energy, Climate, and Sustainability 1 Unit

Terms offered: Prior to 2007

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.

Topics in Energy, Climate, and Sustainability: [Read More](#) [+]

### 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

Topics in Energy, Climate, and Sustainability: [Read Less](#) [-]

## MEC ENG C290S Hybrid Systems and Intelligent Control 3 Units

Terms offered: Spring 2018, Spring 2016, Spring 2014

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).

Hybrid Systems and Intelligent Control: [Read More](#) [+]

### 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

Hybrid Systems and Intelligent Control: [Read Less](#) [-]

## MEC ENG C290X Advanced Technical Communication: Proposals, Patents, and Presentations 3 Units

Terms offered: Spring 2018, Spring 2016, Spring 2012, Spring 2011

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.

Advanced Technical Communication: Proposals, Patents, and Presentations: [Read More](#) [+]

### 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

Advanced Technical Communication: Proposals, Patents, and Presentations: [Read Less](#) [-]

## MEC ENG 292A Advanced Special Topics in Bioengineering 1 - 4 Units

Terms offered: Fall 2017, Spring 2017, Spring 2015

This 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.

Advanced Special Topics in Bioengineering: Read More [\[+\]](#)

### 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 - 2.5-10 hours of lecture per week

8 weeks - 2-7.5 hours of lecture per week

10 weeks - 1.5-6 hours of lecture per week

15 weeks - 1-4 hours of lecture per week

### Additional Details

**Subject/Course Level:** Mechanical Engineering/Graduate

**Grading:** Letter grade.

**Instructor:** Faculty

Advanced Special Topics in Bioengineering: Read Less [\[-\]](#)

## MEC ENG 292B Advanced Special Topics in Controls 1 - 4 Units

Terms offered: Spring 2018, Fall 2017, Spring 2017

This series covers current topics of research interest in controls.

The course content may vary semester to semester. Check with the department for current term topics.

Advanced Special Topics in Controls: Read More [\[+\]](#)

### Objectives Outcomes

**Course Objectives:** Varies with course.

**Student Learning Outcomes:** Varies with course.

### Rules & Requirements

**Prerequisites:** Graduate standing or consent of instructor

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

### Hours & Format

#### Fall and/or spring:

6 weeks - 2.5-10 hours of lecture per week

8 weeks - 2-7.5 hours of lecture per week

10 weeks - 1.5-6 hours of lecture per week

15 weeks - 1-4 hours of lecture per week

### Additional Details

**Subject/Course Level:** Mechanical Engineering/Graduate

**Grading:** Letter grade.

Advanced Special Topics in Controls: Read Less [\[-\]](#)

## MEC ENG 292C Advanced Special Topics in Design 1 - 4 Units

Terms offered: Spring 2018, Fall 2017, Fall 2016

This series covers current topics of research interest in design. The course content may vary semester to semester. Check with the department for current term topics.

Advanced Special Topics in Design: Read More [\[+\]](#)

### Objectives Outcomes

**Course Objectives:** Varies with course.

**Student Learning Outcomes:** Varies with course.

### 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 - 2.5-10 hours of lecture per week

8 weeks - 2-7.5 hours of lecture per week

10 weeks - 1.5-6 hours of lecture per week

15 weeks - 1-4 hours of lecture per week

### Additional Details

**Subject/Course Level:** Mechanical Engineering/Graduate

**Grading:** Letter grade.

Advanced Special Topics in Design: Read Less [\[-\]](#)

## MEC ENG 292D Advanced Special Topics in Dynamics 1 - 4 Units

Terms offered: Prior to 2007

This series covers current topics of research interest in dynamics.

The course content may vary semester to semester. Check with the department for current term topics.

Advanced Special Topics in Dynamics: Read More [+]

### Objectives Outcomes

**Course Objectives:** Varies with course.

**Student Learning Outcomes:** Varies with course.

### 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 - 2.5-10 hours of lecture per week

8 weeks - 2-7.5 hours of lecture per week

10 weeks - 1.5-6 hours of lecture per week

15 weeks - 1-4 hours of lecture per week

### Additional Details

**Subject/Course Level:** Mechanical Engineering/Graduate

**Grading:** Letter grade.

Advanced Special Topics in Dynamics: Read Less [-]

## MEC ENG 292E Advanced Special Topics in Energy Science and Technology 1 - 4 Units

Terms offered: Fall 2017, Spring 2017

This 292 series covers current topics of research interest in energy

science and technology. The course content may vary semester to semester. Check with the department for current term topics.

Advanced Special Topics in Energy Science and Technology: Read More [+]

### Objectives Outcomes

**Course Objectives:** Varies with course.

**Student Learning Outcomes:** Varies with course.

### 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 - 2.5-10 hours of lecture per week

8 weeks - 2-7.5 hours of lecture per week

10 weeks - 1.5-6 hours of lecture per week

15 weeks - 1-4 hours of lecture per week

### Additional Details

**Subject/Course Level:** Mechanical Engineering/Graduate

**Grading:** Letter grade.

Advanced Special Topics in Energy Science and Technology: Read Less [-]



## MEC ENG 292F Advanced Special Topics in Fluids 1 - 4 Units

Terms offered: Prior to 2007

This 292 series covers current topics of research interest in fluids.

The course content may vary semester to semester. Check with the department for current term topics.

Advanced Special Topics in Fluids: [Read More](#) [+]

### Objectives Outcomes

**Course Objectives:** Varies with course.

**Student Learning Outcomes:** Varies with course.

### 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 - 2.5-10 hours of lecture per week

8 weeks - 2-7.5 hours of lecture per week

10 weeks - 1.5-6 hours of lecture per week

15 weeks - 1-4 hours of lecture per week

### Additional Details

**Subject/Course Level:** Mechanical Engineering/Graduate

**Grading:** Letter grade.

Advanced Special Topics in Fluids: [Read Less](#) [-]

## MEC ENG 292G Advanced Special Topics in Manufacturing 1 - 4 Units

Terms offered: Prior to 2007

This 292 series covers current topics of research interest in

manufacturing. The course content may vary semester to semester.

Check with the department for current term topics.

Advanced Special Topics in Manufacturing: [Read More](#) [+]

### Objectives Outcomes

**Course Objectives:** Varies with course.

**Student Learning Outcomes:** Varies with course.

### 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 - 2.5-10 hours of lecture per week

8 weeks - 2-7.5 hours of lecture per week

10 weeks - 1.5-6 hours of lecture per week

15 weeks - 1-4 hours of lecture per week

### Additional Details

**Subject/Course Level:** Mechanical Engineering/Graduate

**Grading:** Letter grade.

Advanced Special Topics in Manufacturing: [Read Less](#) [-]

## MEC ENG 292H Advanced Special Topics in Materials 1 - 4 Units

Terms offered: Prior to 2007

This 292 series covers current topics of research interest in materials. The course content may vary semester to semester. Check with the department for current term topics.

Advanced Special Topics in Materials: Read More [\[+\]](#)

### Objectives Outcomes

**Course Objectives:** Varies with course.

**Student Learning Outcomes:** Varies with course.

### 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 - 2.5-10 hours of lecture per week  
 8 weeks - 2-7.5 hours of lecture per week  
 10 weeks - 1.5-6 hours of lecture per week  
 15 weeks - 1-4 hours of lecture per week

### Additional Details

**Subject/Course Level:** Mechanical Engineering/Graduate

**Grading:** Letter grade.

Advanced Special Topics in Materials: Read Less [\[-\]](#)

## MEC ENG 292I Advanced Special Topics in Mechanics 1 - 4 Units

Terms offered: Prior to 2007

This series covers current topics of research interest in mechanics. The course content may vary semester to semester. Check with the department for current term topics.

Advanced Special Topics in Mechanics: Read More [\[+\]](#)

### Objectives Outcomes

**Course Objectives:** Varies with course.

**Student Learning Outcomes:** Varies with course.

### 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 - 2.5-10 hours of lecture per week  
 8 weeks - 2-7.5 hours of lecture per week  
 10 weeks - 1.5-6 hours of lecture per week  
 15 weeks - 1-4 hours of lecture per week

### Additional Details

**Subject/Course Level:** Mechanical Engineering/Graduate

**Grading:** Letter grade.

Advanced Special Topics in Mechanics: Read Less [\[-\]](#)

## MEC ENG 292J Advanced Special Topics in MEMS/Nano 1 - 4 Units

Terms offered: Spring 2018

This 292 series covers current topics of research interest in MEMS/nano.

The course content may vary semester to semester. Check with the department for current term topics.

Advanced Special Topics in MEMS/Nano: [Read More](#) [+]

### Objectives Outcomes

**Course Objectives:** Varies with course.

**Student Learning Outcomes:** Varies with course.

### 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 - 2.5-10 hours of lecture per week

8 weeks - 2-7.5 hours of lecture per week

10 weeks - 1.5-6 hours of lecture per week

15 weeks - 1-4 hours of lecture per week

### Additional Details

**Subject/Course Level:** Mechanical Engineering/Graduate

**Grading:** Letter grade.

Advanced Special Topics in MEMS/Nano: [Read Less](#) [-]

## MEC ENG 292K Advanced Special Topics in Ocean Engineering 1 - 4 Units

Terms offered: Prior to 2007

This series covers current topics of research interest in ocean engineering. The course content may vary semester to semester. Check with the department for current term topics.

Advanced Special Topics in Ocean Engineering: [Read More](#) [+]

### Objectives Outcomes

**Course Objectives:** Varies with course.

**Student Learning Outcomes:** Varies with course.

### 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 - 2.5-10 hours of lecture per week

8 weeks - 2-7.5 hours of lecture per week

10 weeks - 1.5-6 hours of lecture per week

15 weeks - 1-4 hours of lecture per week

### Additional Details

**Subject/Course Level:** Mechanical Engineering/Graduate

**Grading:** Letter grade.

Advanced Special Topics in Ocean Engineering: [Read Less](#) [-]

## MEC ENG 297 Engineering Field Studies 1 - 12 Units

Terms offered: Spring 2017, Fall 2016, Spring 2016

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.

Engineering Field Studies: [Read More](#) [+]

### 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.

Engineering Field Studies: [Read Less](#) [-]

## MEC ENG 298 Group Studies, Seminars, or Group Research 1 - 8 Units

Terms offered: Spring 2018, Fall 2017, Spring 2017

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.

Group Studies, Seminars, or Group Research: Read More [\[+\]](#)

### Rules & Requirements

**Repeat rules:** Course may be repeated for credit.

### 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:** Offered for satisfactory/unsatisfactory grade only.

Group Studies, Seminars, or Group Research: Read Less [\[-\]](#)

## MEC ENG 299 Individual Study or Research 1 - 12 Units

Terms offered: Spring 2018, Fall 2017, Spring 2017

Investigations of advanced problems in mechanical engineering.

Individual Study or Research: Read More [\[+\]](#)

### Rules & Requirements

**Prerequisites:** Graduate standing in engineering, physics, or mathematics

**Repeat rules:** Course may be repeated for credit.

### 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.

Individual Study or Research: Read Less [\[-\]](#)

## MEC ENG 375 Teaching of Mechanical Engineering at the University Level 1 - 6 Units

Terms offered: Spring 2018, Fall 2017, Spring 2017

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.

Teaching of Mechanical Engineering at the University Level: Read More [\[+\]](#)

### Rules & Requirements

**Repeat rules:** Course may be repeated for credit.

### 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

Teaching of Mechanical Engineering at the University Level: Read Less [\[-\]](#)