

# Mechanical Engineering/ Nuclear Engineering

## Bachelor of Science (BS)

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

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

## Admission to the Joint Major

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

In addition to the University, campus, and college requirements, students must fulfill the below requirements specific to their major program.

## General Guidelines

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

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

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

## Lower Division Requirements

MATH 1A	Calculus	4
MATH 1B	Calculus	4
MATH 53	Multivariable Calculus	4
MATH 54	Linear Algebra and Differential Equations	4

CHEM 1A & 1AL	General Chemistry and General Chemistry Laboratory <sup>1</sup>	4
or CHEM 4A	General Chemistry and Quantitative Analysis	
PHYSICS 7A	Physics for Scientists and Engineers	4
PHYSICS 7B	Physics for Scientists and Engineers	4
PHYSICS 7C	Physics for Scientists and Engineers	4
ENGIN 7	Introduction to Computer Programming for Scientists and Engineers	4
ENGIN 25	Visualization for Design	2
ENGIN 26	Three-Dimensional Modeling for Design	2
ENGIN 27	Introduction to Manufacturing and Tolerancing	2
EL ENG 16A	Designing Information Devices and Systems I	4
or EL ENG 49	Electronics for the Internet of Things	
MEC ENG 40	Thermodynamics	3
MEC ENG C85/ CIV ENG C30	Introduction to Solid Mechanics	3

- <sup>1</sup> CHEM 4A is intended for students majoring in chemistry or a closely-related field.

## Upper Division Requirements

MEC ENG 102A	Introduction to Mechanical Systems for Mechatronics	4
MEC ENG 102B	Mechatronics Design	4
MEC ENG 104	Engineering Mechanics II	3
MEC ENG 106	Fluid Mechanics	3
MEC ENG 107	Mechanical Engineering Laboratory	3
MEC ENG 108	Mechanical Behavior of Engineering Materials	4
MEC ENG 109	Heat Transfer	3
MEC ENG 132	Dynamic Systems and Feedback	3
NUC ENG 100	Introduction to Nuclear Engineering	3
NUC ENG 101	Nuclear Reactions and Radiation	4
NUC ENG 104	Radiation Detection and Nuclear Instrumentation Laboratory	4
NUC ENG 150	Introduction to Nuclear Reactor Theory	4
NUC ENG 170A	Nuclear Design: Design in Nuclear Power Technology and Instrumentation	3
Ethics requirement <sup>1</sup>		3-4
Upper division technical electives: minimum 12 units <sup>2,3</sup>		12
Select 6 units of upper division NUC ENG courses, in consultation with faculty adviser		
Select 6 units of upper division MEC ENG courses, in consultation with faculty adviser		

- <sup>1</sup> Students must take one course with ethics content. This may be fulfilled within the humanities/social sciences requirement by taking one of the following courses: ANTHRO 156B, BIO ENG 100, ENGIN 125, ENGIN 157AC, ESPM 161, ESPM 162, GEOG 31, IAS 157AC, ISF 100E, L & S 160B, MEC ENG 191AC, PHILOS 2, PHILOS 104, PHILOS 107, SOCIOL 116.

- <sup>2</sup> Students may receive up to three units of technical elective credit for graded research in MEC ENG H194, MEC ENG 196 or NUC ENG H194.

<sup>3</sup> Technical electives cannot include:

- Any course taken on a *Pass/No Pass* basis
- Any of the following courses: MEC ENG 191AC, MEC ENG 190K, and MEC ENG 191K.

## Students in the College of Engineering must complete no fewer than 120 semester units with the following provisions:

1. Completion of the requirements of one engineering major program (<http://engineering.berkeley.edu/academics/undergraduate-programs>) study.
2. A minimum overall grade point average of 2.00 (C average) and a minimum 2.00 grade point average in upper division technical coursework required of the major.
3. The final 30 units and two semesters must be completed in residence in the College of Engineering on the Berkeley campus.
4. All technical courses (math, science and engineering), required of the major or not, must be taken on a letter graded basis (unless they are only offered P/NP).
5. Entering freshmen are allowed a maximum of eight semesters to complete their degree requirements. Entering junior transfers are allowed a maximum of four semesters to complete their degree requirements. (Note: junior transfers admitted missing three or more courses from the lower division curriculum are allowed five semesters.) Summer terms are optional and do not count toward the maximum. Students are responsible for planning and satisfactorily completing all graduation requirements within the maximum allowable semesters.
6. Adhere to all college policies and procedures (<http://engineering.berkeley.edu/academics/undergraduate-guide>) as they complete degree requirements.
7. Complete the lower division program before enrolling in upper division engineering courses.

## Humanities and Social Science (H/SS) Requirement

To promote a rich and varied educational experience outside of the technical requirements for each major, the College of Engineering has a six-course Humanities and Social Sciences breadth requirement (<http://engineering.berkeley.edu/student-services/degree-requirements/humanities-and-social-sciences>), which must be completed to graduate. This requirement, built into all the engineering programs of study, includes two reading and composition courses (R&C), and four additional courses within which a number of specific conditions must be satisfied. Follow these guidelines to fulfill this requirement:

1. Complete a minimum of six courses from the approved Humanities/ Social Sciences (H/SS) lists (<http://coe.berkeley.edu/hssreq>).
2. Courses must be a minimum of 3 semester units (or 4 quarter units).
3. Two of the six courses must fulfill the college's Reading and Composition (R&C) requirement. These courses must be taken for a letter grade (C- or better required) and must be completed by no later than the end of the sophomore year (fourth semester of enrollment). The first half of R&C, the "A" course, must be completed by the end of the freshman year; the second half of R&C, the "B" course, must be completed by no later than the end of the sophomore year. View a detailed list of courses (<http://ls-advise.berkeley.edu/requirement/rccourses.html>) that fulfill Reading and Composition requirements, or use the College of Letters and Sciences search engine (<http://ls-breadth.berkeley.edu>) to view R&C courses offered in a given semester.

4. The four additional courses must be chosen within College of Engineering guidelines from the H/SS lists (see below). These courses may be taken on a Pass/Not Passed basis (P/NP).
5. Two of the six courses must be upper division (courses numbered 100-196).
6. One of the six courses must satisfy the campus American Cultures requirement. For detailed lists of courses that fulfill American Cultures requirements, visit the American Cultures (<http://guide.berkeley.edu/archive/2017-18/undergraduate/colleges-schools/engineering/american-cultures-requirement>) site.
7. A maximum of two exams (Advanced Placement, International Baccalaureate, or A-Level) may be used toward completion of the H/SS requirement. View the list of exams (<http://engineering.berkeley.edu/academics/undergraduate-guide/exams>) that can be applied toward H/SS requirements.
8. Courses may fulfill multiple categories. For example, if you complete CY PLAN 118AC (<http://guide.berkeley.edu/search/?P=CY%20PLAN%20118AC>) that would satisfy the American Cultures requirement and one upper division H/SS requirement.
9. No courses offered by any engineering department other than BIO ENG 100 (<http://guide.berkeley.edu/search/?P=BIO%20ENG%20100>), COMPSCI C79 (<http://guide.berkeley.edu/search/?P=COMPSCI%20C79>), ENGIN 125 (<http://guide.berkeley.edu/search/?P=ENGIN%20125>), ENGIN 157AC (<http://guide.berkeley.edu/search/?P=ENGIN%20157AC>), MEC ENG 191K (<http://guide.berkeley.edu/search/?P=MEC%20ENG%20191K>) and MEC ENG 191AC may be used to complete H/SS requirements.
10. Foreign language courses may be used to complete H/SS requirements. View the list of language options (<http://ls-advise.berkeley.edu/requirement/fl.html>).
11. Courses numbered 97, 98, 99, or above 196 may not be used to complete any H/SS requirement
12. The College of Engineering uses modified versions of five of the College of Letters and Science (L&S) breadth requirements lists to provide options to our students for completing the H/SS requirement. No courses on the L&S Biological Sciences or Physical Sciences breadth lists may be used to complete H/SS requirements. Within the guidelines above, choose courses from any of the lists below.

- Arts and Literature (<http://guide.berkeley.edu/archive/2017-18/undergraduate/colleges-schools/letters-science/breadth-requirement-arts-literature>)
- Foreign Language (<http://ls-advise.berkeley.edu/requirement/fl.html>)
- Historical Studies (<http://guide.berkeley.edu/archive/2017-18/undergraduate/colleges-schools/letters-science/breadth-requirement-historical-studies>)
- International Studies (<http://guide.berkeley.edu/archive/2017-18/undergraduate/colleges-schools/letters-science/breadth-requirement-international-studies>)
- Philosophy and Values (<http://guide.berkeley.edu/archive/2017-18/undergraduate/colleges-schools/letters-science/breadth-requirement-philosophy-values>)
- Social and Behavioral Studies (<http://guide.berkeley.edu/archive/2017-18/undergraduate/colleges-schools/letters-science/breadth-requirement-social-behavioral-sciences>)

## Class Schedule Requirements

- Minimum units per semester: 12.0.
- Maximum units per semester: 20.5.
- Minimum technical courses: College of Engineering undergraduates must enroll each semester in no fewer than two technical courses (of a minimum of 3 units each) required of the major program of study in which the student is officially declared. (Note: for most majors, normal progress will require enrolling in 3-4 technical courses each semester).
- All technical courses (math, science, engineering), required of the major or not, must be taken on a letter-graded basis (unless only offered as P/NP).
- A student's proposed schedule must be approved by a faculty adviser (or on approval from the dean or a designated staff adviser) each semester prior to enrolling in courses.

## Minimum Academic (Grade) Requirements

- A minimum overall and semester grade point average of 2.00 (C average) is required of engineering undergraduates. A student will be subject to dismissal from the University if during any fall or spring semester their overall UC GPA falls below a 2.00, or their semester GPA is less than 2.00.
- Students must achieve a minimum grade point average of 2.00 (C average) in upper division technical courses required for the major curriculum each semester. A student will be subject to dismissal from the University if their upper division technical grade point average falls below 2.00.
- A minimum overall grade point average of 2.00, and a minimum 2.00 grade point average in upper division technical course work required for the major is needed to earn a Bachelor of Science in Engineering.

## Unit Requirements

To earn a Bachelor of Science in Engineering, students must complete at least 120 semester units of courses subject to certain guidelines:

- Completion of the requirements of one engineering major program (<http://engineering.berkeley.edu/academics/undergraduate-programs>) of study.
- A maximum of 16 units of special studies coursework (courses numbered 97, 98, 99, 197, 198, or 199) is allowed towards the 120 units; a maximum of four is allowed in a given semester.
- A maximum of 4 units of physical education from any school attended will count towards the 120 units.
- Students may receive unit credit for courses graded P (including P/NP units taken through EAP) up to a limit of one-third of the total units taken and passed on the Berkeley campus at the time of graduation.

## Normal Progress

Students in the College of Engineering must enroll in a full-time program and make normal progress each semester toward the bachelor's degree. The continued enrollment of students who fail to achieve minimum academic progress shall be subject to the approval of the dean. (Note: students with official accommodations established by the Disabled Students' Program, with health or family issues, or with other reasons deemed appropriate by the dean may petition for an exception to normal progress rules.)

## University of California Requirements

Entry Level Writing (<http://guide.berkeley.edu/archive/2017-18/undergraduate/colleges-schools/natural-resources/entry-level-writing-requirement>)

All students who will enter the University of California as freshmen must demonstrate their command of the English language by fulfilling the Entry Level Writing Requirement. Fulfillment of this requirement is also a prerequisite to enrollment in all reading and composition courses at UC Berkeley.

American History and American Institutions (<http://guide.berkeley.edu/archive/2017-18/undergraduate/colleges-schools/natural-resources/american-history-institutions-requirement>)

The American History and Institutions requirements are based on the principle that a U.S. resident graduated from an American university should have an understanding of the history and governmental institutions of the United States.

## Campus Requirement

American Cultures (<http://guide.berkeley.edu/archive/2017-18/undergraduate/colleges-schools/natural-resources/american-cultures-requirement>)

American Cultures (AC) is the one requirement that all undergraduate students at UC Berkeley need to take and pass in order to graduate. The requirement offers an exciting intellectual environment centered on the study of race, ethnicity and culture in the United States. AC courses offer students opportunities to be part of research-led, highly accomplished teaching environments, grappling with the complexity of American Culture.

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

Freshman				
	Fall	Units	Spring	Units
CHEM 4A or 1A <b>and</b> 1AL <sup>1</sup>		4	MATH 1B	4
MATH 1A		4	PHYSICS 7A	4
ENGIN 25		2	ENGIN 7	4
Reading & Composition course from List A		4	Reading & Composition course from List B	4
Humanities/Social Sciences course		3-4		
		<b>17-18</b>		<b>16</b>
Sophomore				
	Fall	Units	Spring	Units
MATH 53		4	MATH 54	4
PHYSICS 7B		4	PHYSICS 7C	4
ENGIN 26		2	MEC ENG 40	3
ENGIN 27		2	MEC ENG C8	3
Humanities/Social Sciences course		3-4	NUC ENG 100	3
		<b>15-16</b>		<b>17</b>
Junior				
	Fall	Units	Spring	Units
MEC ENG 104		3	EL ENG 16A or 49	4
MEC ENG 108		4	MEC ENG 106	3
MEC ENG 109		3	MEC ENG 132	3
NUC ENG 101		4	NUC ENG 15C	4

		Humanities/ Social Sciences course with Ethics Content <sup>2</sup>	3-4	
	14		17-18	
			Senior	
	Fall	Units	Spring	
MEC ENG 102A		4	MEC ENG 102B	4
Technical Electives <sup>3,4</sup>		9	MEC ENG 107	3
Humanities/Social Sciences course		3-4	NUC ENG 104	4
			NUC ENG 17C	3
			Technical Elective <sup>3,4</sup>	3
		16-17		17
Total Units: 129-133				

<sup>1</sup> CHEM 4A is intended for students majoring in chemistry or a closely-related field.

<sup>2</sup> Students must take one course with ethics content. This may be fulfilled within the humanities/social sciences requirement by taking one of the following courses: ANTHRO 156B, BIO ENG 100, ENGIN 125, ENGIN 157AC, ESPM 161, ESPM 162, GEOG 31, IAS 157AC,

ISF 100E, L & S 160B, MEC ENG 191AC, PHILOS 2, PHILOS 104, PHILOS 197, SOCIOL 145.

<sup>3</sup> Technical elective units must include at least 6 units of upper division MEC ENG courses and 6 units of upper division NUC ENG courses. Students may receive up to 3 units of technical elective credit for graded research in MEC ENG H194, MEC ENG 196 or NUC ENG H194.

<sup>4</sup> Technical electives cannot include:

- Any course taken on a *Pass/No Pass* basis
- Any of the following courses: MEC ENG 191AC, MEC ENG 190K, and MEC ENG 191K.

## Courses

- Mechanical Engineering (p. )
- Nuclear Engineering (p. )

## Mechanical Engineering

### MEC ENG 24 Freshman Seminars 1 Unit

Terms offered: Fall 2018, Fall 2017, Spring 2017

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

Freshman Seminars: Read More [+]

#### Rules & Requirements

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

#### Hours & Format

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

#### Additional Details

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

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

Freshman Seminars: Read Less [-]

### MEC ENG 40 Thermodynamics 3 Units

Terms offered: Fall 2018, Summer 2018 10 Week Session, Spring 2018

This course introduces the fundamentals of energy storage, thermophysical properties of liquids and gases, and the basic principles of thermodynamics which are then applied to various areas of engineering related to energy conversion and air conditioning.

Thermodynamics: Read More [+]

#### Rules & Requirements

**Prerequisites:** Chemistry 1A, Engineering 7, Mathematics 1B, and Physics 7B

#### Hours & Format

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

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

#### Additional Details

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

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

Thermodynamics: Read Less [-]

## MEC ENG C85 Introduction to Solid Mechanics 3 Units

Terms offered: Fall 2018, Spring 2018, Fall 2017

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

Introduction to Solid Mechanics: Read More [+]

### Rules & Requirements

**Prerequisites:** Mathematics 53 and 54 (may be taken concurrently); Physics 7A

**Credit Restrictions:** Students will receive no credit for Mechanical Engineering C85/Civil and Environmental Engineering C30 after completing Mechanical Engineering W85. A deficient grade in Mechanical Engineering W85 may be removed by taking Mechanical Engineering C85/Civil and Environmental Engineering C30.

### Hours & Format

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

#### Summer:

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

### Additional Details

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

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

**Instructors:** Armero, Papadopoulos, Zohdi, Johnson

**Also listed as:** CIV ENG C30

Introduction to Solid Mechanics: Read Less [-]

## MEC ENG W85 Introduction to Solid Mechanics 3 Units

Terms offered: Summer 2018 8 Week Session, Summer 2016, Summer 2016 10 Week Session, Summer 2015 8 Week Session

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

Introduction to Solid Mechanics: Read More [+]

### Objectives Outcomes

**Course Objectives:** To learn statics and mechanics of materials

**Student Learning Outcomes:** - Correctly draw free-body

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

### Rules & Requirements

**Prerequisites:** Mathematics 53 and 54 (may be taken concurrently); Physics 7A

**Credit Restrictions:** Students will receive no credit for Mechanical Engineering W85/Civil and Environmental Engineering W30 after completing Mechanical Engineering C85/Civil and Environmental Engineering C30. A deficient grade in Mechanical Engineering C85/Civil and Environmental Engineering C30 may be removed by taking Mechanical Engineering W85/Civil and Environmental Engineering W30.

### Hours & Format

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

#### Summer:

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

**Online:** This is an online course.

### Additional Details

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

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

**Instructor:** Govindjee

**Also listed as:** CIV ENG W30

Introduction to Solid Mechanics: Read Less [-]



## MEC ENG 98 Supervised Independent Group Studies 1 - 4 Units

Terms offered: Fall 2016, Summer 2016 10 Week Session, Spring 2016

Organized group study on various topics under the sponsorship and direction of a member of the Mechanical Engineering faculty.

Supervised Independent Group Studies: Read More [+]

### Rules & Requirements

**Prerequisites:** Consent of instructor

**Repeat rules:** Course may be repeated for credit without restriction.

### Hours & Format

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

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

### Additional Details

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

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

Supervised Independent Group Studies: Read Less [-]

## MEC ENG 101 Introduction to Lean Manufacturing Systems 3 Units

Terms offered: Spring 2018, Spring 2017, Spring 2016

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.

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

### Hours & Format

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

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

### Additional Details

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

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

**Instructors:** Dornfeld, McMains

Introduction to Lean Manufacturing Systems: Read Less [-]

## MEC ENG 102A Introduction to Mechanical Systems for Mechatronics 4 Units

Terms offered: Fall 2017, Spring 2017, Fall 2016

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

Introduction to Mechanical Systems for Mechatronics: Read More [\[+\]](#)

### Objectives Outcomes

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

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

### Rules & Requirements

**Prerequisites:** Engineering 26 (waived for Junior Transfers), Mechanical Engineering C85, ME 104, ME 132 (can be taken as a co-requisite if the course schedule allows) Electrical Engineering 16A or 40. Reading and Composition courses completed

### Hours & Format

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

### Additional Details

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

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

Introduction to Mechanical Systems for Mechatronics: Read Less [\[-\]](#)

## MEC ENG 102B Mechatronics Design 4 Units

Terms offered: Fall 2018, Spring 2018, Fall 2017

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

Mechatronics Design: Read More [\[+\]](#)

### Objectives Outcomes

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

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

### Rules & Requirements

**Prerequisites:** E 25, E 26 (junior transfers students are exempt from this requirement), E 27, as well as EE 16A or EE 40

### Hours & Format

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

### Additional Details

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

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

Mechatronics Design: Read Less [\[-\]](#)

## MEC ENG 103 Experimentation and Measurements 4 Units

Terms offered: Fall 2018

This course introduces students to modern experimental techniques for mechanical engineering, and improves students' teamwork and communication skills. Students will work in a laboratory setting on systems ranging in complexity from desktop experiments with only a few instruments up to systems such as an internal combustion engine with a wide variety of sensors. State-of-the-art software for data acquisition and analysis will be introduced and used throughout the course. The role of error and uncertainty, and uncertainty propagation, in measurements and analysis will be examined. Design of experiments will be addressed through examples and homework. The role and limitations of spectral analysis of digital data will be discussed.

Experimentation and Measurements: Read More [+]

### Objectives Outcomes

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

**Student Learning Outcomes:** (a) an ability to apply knowledge of mathematics, science, and engineering  
(b) an ability to design and conduct experiments, as well as to analyze and interpret data  
(c) an ability to function on multi-disciplinary teams  
(d) an ability to identify, formulate, and solve engineering problems  
(e) an understanding of professional and ethical responsibility  
(f) an ability to communicate effectively  
(g) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context  
(h) a recognition of the need for, and an ability to engage in life-long learning  
(j) a knowledge of contemporary issues  
(i) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

### Rules & Requirements

**Prerequisites:** MEC85, ME40, EE 100/EE 49, and ME 109

**Credit Restrictions:** Students will not receive credit for this course if they have taken both ME 102A and ME 107.

### Hours & Format

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

### Additional Details

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

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

**Instructors:** Johnson, Makiharju, Chen

Experimentation and Measurements: Read Less [-]

## MEC ENG 104 Engineering Mechanics II 3 Units

Terms offered: Fall 2018, Summer 2018 10 Week Session, Spring 2018

This course is an introduction to the dynamics of particles and rigid bodies. The material, based on a Newtonian formulation of the governing equations, is illustrated with numerous examples ranging from one-dimensional motion of a single particle to planar motions of rigid bodies and systems of rigid bodies.

Engineering Mechanics II: Read More [+]

### Rules & Requirements

**Prerequisites:** C85 and Engineering 7

### Hours & Format

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

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

### Additional Details

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

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

Engineering Mechanics II: Read Less [-]

## MEC ENG 106 Fluid Mechanics 3 Units

Terms offered: Fall 2018, Summer 2018 10 Week Session, Spring 2018

This course introduces the fundamentals and techniques of fluid mechanics with the aim of describing and controlling engineering flows.

Fluid Mechanics: Read More [+]

### Rules & Requirements

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

### Hours & Format

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

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

### Additional Details

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

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

Fluid Mechanics: Read Less [-]



## MEC ENG 107 Mechanical Engineering Laboratory 3 Units

Terms offered: Spring 2018, Fall 2017, Spring 2017

Experimental investigation of engineering systems and of phenomena of interest to mechanical engineers. Design and planning of experiments.

Analysis of data and reporting of experimental results.

Mechanical Engineering Laboratory: Read More [+]

### Objectives Outcomes

**Course Objectives:** Through a series of three experiments from a number of experiments students design, perform, analyze, and report on complex prototypical engineering systems as a group.

**Student Learning Outcomes:** (a) an ability to apply knowledge of mathematics, science, and engineering  
(b) an ability to design and conduct experiments, as well as to analyze and interpret data  
(e) an ability to identify, formulate, and solve engineering problems  
(g) an ability to communicate effectively  
(i) a recognition of the need for, and ability to engage in life-long learning  
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

### Rules & Requirements

**Prerequisites:** 102A; senior standing

### Hours & Format

**Fall and/or spring:** 15 weeks - 2-2 hours of lecture, 0-1 hours of discussion, and 3-3 hours of laboratory per week

### Additional Details

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

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

Mechanical Engineering Laboratory: Read Less [-]

## MEC ENG 108 Mechanical Behavior of Engineering Materials 4 Units

Terms offered: Fall 2018, Spring 2018, Fall 2017

This course covers elastic and plastic deformation under static and dynamic loads. Failure by yielding, fracture, fatigue, wear, and environmental factors are also examined. Topics include engineering materials, heat treatment, structure-property relationships, elastic deformation and multiaxial loading, plastic deformation and yield criteria, dislocation plasticity and strengthening mechanisms, creep, stress concentration effects, fracture, fatigue, and contact deformation.

Mechanical Behavior of Engineering Materials: Read More [-]

### Objectives Outcomes

**Course Objectives:** The central theme of this course is the mechanical behavior of engineering materials, such as metals, ceramics, polymers, and composites, subjected to different types of loading. The main objectives are to provide students with basic understanding of phase transformation by heat treating and stress-induced hardening, linear and nonlinear elastic behavior, deformation under multiaxial loading, plastic deformation and yield criteria, dislocation plasticity and strengthening mechanisms, creep, stress concentration effects, brittle versus ductile fracture, fracture mechanisms at different scales, fatigue, contact deformation, and wear.

**Student Learning Outcomes:** (a) an ability to apply knowledge of mathematics, science, and engineering  
(b) an ability to design and conduct experiments, as well as to analyze and interpret data  
(c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability  
(e) an ability to identify, formulate, and solve engineering problems  
(i) a recognition of the need for, and an ability to engage in life-long learning  
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

### Rules & Requirements

**Prerequisites:** C85

### Hours & Format

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

**Summer:** 10 weeks - 4.5 hours of lecture, 1.5 hours of discussion, and 3 hours of laboratory per week

### Additional Details

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

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

Mechanical Behavior of Engineering Materials: Read Less [-]

## MEC ENG 109 Heat Transfer 3 Units

Terms offered: Fall 2018, Summer 2018 10 Week Session, Spring 2018  
This course covers transport processes of mass, momentum, and energy from a macroscopic view with emphasis both on understanding why matter behaves as it does and on developing practical problem solving skills. The course is divided into four parts: introduction, conduction, convection, and radiation.

Heat Transfer: Read More [a]

### Rules & Requirements

**Prerequisites:** 40 and 106

### Hours & Format

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

### Summer:

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

### Additional Details

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

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

Heat Transfer: Read Less [-]

## MEC ENG 110 Introduction to Product Development 3 Units

Terms offered: Summer 2018 10 Week Session, Summer 2017 10 Week Session, Spring 2017

The course provides project-based learning experience in innovative new product development, with a focus on mechanical engineering systems. Design concepts and techniques are introduced, and the student's design ability is developed in a design or feasibility study chosen to emphasize ingenuity and provide wide coverage of engineering topics. Relevant software will be integrated into studio sessions, including solid modeling and environmental life cycle analysis. Design optimization and social, economic, and political implications are included.

Introduction to Product Development: Read More [a]

### Rules & Requirements

**Prerequisites:** Junior or higher standing

### Hours & Format

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

**Summer:** 10 weeks - 4.5-4.5 hours of lecture and 0-1 hours of voluntary per week

### Additional Details

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

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

Introduction to Product Development: Read Less [-]

## MEC ENG C115 Molecular Biomechanics and Mechanobiology of the Cell 4 Units

Terms offered: Spring 2016, Spring 2015, Spring 2014

This course applies methods of statistical continuum mechanics to subcellular biomechanical phenomena ranging from nanoscale (molecular) to microscale (whole cell and cell population) biological processes at the interface of mechanics, biology, and chemistry.

Molecular Biomechanics and Mechanobiology of the Cell: Read More [a]

### Objectives Outcomes

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

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

### Rules & Requirements

**Prerequisites:** Math 54; Physics 7A; BioE102 or MEC85 or instructor's consent

### Hours & Format

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

### Additional Details

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

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

**Instructor:** Mofrad

**Also listed as:** BIO ENG C112

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

## MEC ENG C117 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. Natural and synthetic load-bearing biomaterials for clinical applications are reviewed. Biocompatibility of biomaterials and host response to structural implants are examined. Quantitative treatment of biomechanical issues and constitutive relationships of tissues are covered in order to design biomaterial replacements for structural function. Material selection for load bearing applications including reconstructive surgery, orthopedics, dentistry, and cardiology are addressed. Mechanical design for longevity including topics of fatigue, wear, and fracture are reviewed. Case studies that examine failures of devices are presented.

Structural Aspects of Biomaterials: Read More [+]

### Rules & Requirements

**Prerequisites:** Biology 1A, Engineering 45, Civil and Environmental Engineering 130 or 130N or Bioengineering 102, and Engineering 190

**Credit Restrictions:** Students will receive no credit for Mechanical Engineering C117 after completing Mechanical Engineering C215/ Bioengineering C222.

### Hours & Format

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

### Additional Details

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

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

**Instructor:** Pruitt

**Also listed as:** BIO ENG C117

Structural Aspects of Biomaterials: Read Less [-]

## MEC ENG 118 Introduction to Nanotechnology and Nanoscience 3 Units

Terms offered: Spring 2017, Spring 2015, Spring 2013

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

### Rules & Requirements

**Prerequisites:** Chemistry 1A and Physics 7B. Physics 7C and Engineering 45 (or the equivalent) recommended

### Hours & Format

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

### Additional Details

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

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

**Instructors:** Lin, Sohn

Introduction to Nanotechnology and Nanoscience: Read Less [-]

## MEC ENG 119 Introduction to MEMS (Microelectromechanical Systems) 3 Units

Terms offered: Fall 2017, Fall 2015, Fall 2013

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

Introduction to MEMS (Microelectromechanical Systems): Read More [+]

### Rules & Requirements

**Prerequisites:** EE 16A or EE 40, and Physics 7B

### Hours & Format

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

### Additional Details

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

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

Introduction to MEMS (Microelectromechanical Systems): Read Less [-]

## MEC ENG 120 Computational Biomechanics Across Multiple Scales 3 Units

Terms offered: Fall 2018, Fall 2016, Spring 2015

This course applies the methods of computational modeling and continuum mechanics to biomedical phenomena spanning various length scales ranging from molecular to cellular to tissue and organ levels. The course is intended for upper level undergraduate students who have been exposed to undergraduate continuum mechanics (statics and strength of materials.)

Computational Biomechanics Across Multiple Scales: Read More [+]

### Rules & Requirements

**Prerequisites:** Mechanical Engineering C85

### Hours & Format

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

### Additional Details

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

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

**Instructor:** Mofrad

Computational Biomechanics Across Multiple Scales: Read Less [-]

## MEC ENG 122 Processing of Materials in Manufacturing 3 Units

Terms offered: Spring 2018, Spring 2017, Spring 2016

Fundamentals of manufacturing processes (metal forming, forging, metal cutting, welding, joining, and casting); selection of metals, plastics, and other materials relative to the design and choice of manufacturing processes; geometric dimensioning and tolerancing of all processes.

Processing of Materials in Manufacturing: Read More [+]

### Rules & Requirements

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

### Hours & Format

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

### Additional Details

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

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

Processing of Materials in Manufacturing: Read Less [-]

## MEC ENG 125 Industry-Associated Capstones in Mechanical Engineering (iACME) 4 Units

Terms offered: Fall 2018, Spring 2018

iACME provide opportunities for Mechanical Engineering undergraduates to tackle real-world engineering problems. Student teams, consisting of no more than four students, will apply to work on specific industry-initiated projects. Teams will be selected based on prior experience in research/internships, scholastic achievements in ME courses, and most importantly, proposed initial approaches toward tackling the specific project. ME faculty, alumni of the Mechanical Engineering Department, and industry participants will mentor selected teams. Projects fall within a wide range of mechanical engineering disciplines, e.g. biomedical, automotive/transportation, energy, design, etc.

Industry-Associated Capstones in Mechanical Engineering (iACME): Read More [+]

### Objectives Outcomes

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

- learn the fundamental concepts of approaching practical engineering problems;
- enhance skills in communication with clients and other engineers;
- enhance skills in design, prototyping, testing, and analysis.

**Student Learning Outcomes:** (a) an ability to apply knowledge of mathematics, science, and engineering  
(b) an ability to design and conduct experiments, as well as to analyze and interpret data  
(c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability  
(d) an ability to function on multi-disciplinary teams  
(e) an ability to identify, formulate, and solve engineering problems  
(f) an understanding of professional and ethical responsibility  
(g) an ability to communicate effectively  
(h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context  
(i) a recognition of the need for, and an ability to engage in life-long learning  
(j) a knowledge of contemporary issues  
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

### Rules & Requirements

**Prerequisites:** Senior standing and a minimum GPA of 3.0

### Hours & Format

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

### Additional Details

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

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

**Instructors:** O'Connell , Sohn

Industry-Associated Capstones in Mechanical Engineering (iACME): Read Less [-]

## MEC ENG 130 Design of Planar Machinery 3 Units

Terms offered: Fall 2018, Fall 2017, Fall 2016

Synthesis, analysis, and design of planar machines. Kinematic structure, graphical, analytical, and numerical analysis and synthesis. Linkages, cams, reciprocating engines, gear trains, and flywheels.

Design of Planar Machinery: Read More [+]

### Rules & Requirements

**Prerequisites:** 104

### Hours & Format

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

### Additional Details

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

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

**Instructor:** Youssefi

Design of Planar Machinery: Read Less [-]

## MEC ENG 131 Vehicle Dynamics and Control 4 Units

Terms offered: Spring 2018, Spring 2016, Spring 2015

Physical understanding of automotive vehicle dynamics including simple lateral, longitudinal and ride quality models. An overview of active safety systems will be introduced including the basic concepts and terminology, the state-of-the-art development, and basic principles of systems such as ABS, traction control, dynamic stability control, and roll stability control. Passive, semi-active and active suspension systems will be analyzed. Concepts of autonomous vehicle technology including drive-by-wire and steer-by-wire systems, adaptive cruise control and lane keeping systems. Design of software control systems for an actual 1/10 scale race vehicle. Vehicle Dynamics and Control: Read More [+]

### Objectives Outcomes

**Course Objectives:** At the end of the course the students should be able to:

- Formulate simple but accurate dynamic models for automotive longitudinal, lateral and ride quality analysis.
- Assess the stability of dynamic systems using differential equation theory, apply frequency-response methods to assess system response to external disturbances, sensor noise and parameter variations.
- Have a basic understanding of modern automotive safety systems including ABS, traction control, dynamic stability control and roll control.
- Follow the literature on these subjects and perform independent design, research and development work in this field.
- Expected to design feedback control systems for an actual 1/10 scaled vehicle platform which will be distributed to every group of two students in the class

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

### Rules & Requirements

**Prerequisites:** Math 53, 54, Physics 7A-7B. Programming (E7) Ordinary differential equations (Math 1B, Math 54) Elementary linear algebra (M54), and ME 132

### Hours & Format

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

### Additional Details

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

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

**Instructor:** Borrelli

Vehicle Dynamics and Control: Read Less [-]



## MEC ENG 132 Dynamic Systems and Feedback 3 Units

Terms offered: Fall 2018, Summer 2018 10 Week Session, Spring 2018

Physical understanding of dynamics and feedback. Linear feedback control of dynamic systems. Mathematical tools for analysis and design. Stability. Modeling systems with differential equations. Linearization. Solution to linear, time-invariant differential equations.

Dynamic Systems and Feedback: Read More [a+]

### Rules & Requirements

**Prerequisites:** Math 53, 54, Physics 7A-7B

### Hours & Format

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

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

### Additional Details

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

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

Dynamic Systems and Feedback: Read Less [-]

## MEC ENG 133 Mechanical Vibrations 3 Units

Terms offered: Fall 2016, Spring 2014, Spring 2013

An introduction to the theory of mechanical vibrations including topics of harmonic motion, resonance, transient and random excitation, applications of Fourier analysis and convolution methods. Multidegree of freedom discrete systems including principal mode, principal coordinates and Rayleigh's principle.

Mechanical Vibrations: Read More [a+]

### Objectives Outcomes

**Course Objectives:** Introduce basic aspects of vibrational analysis, considering both single and multi-degree-of-freedom systems. Discuss the use of exact and approximate methods in the analysis of complex systems. Familiarize students with the use of MATLAB as directed toward vibration problems.

**Student Learning Outcomes:** (a) an ability to apply knowledge of mathematics, science, and engineering  
(b) an ability to design and conduct experiments, as well as to analyze and interpret data  
(c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability  
(e) an ability to identify, formulate, and solve engineering problems  
(f) an understanding of professional and ethical responsibility  
(g) an ability to communicate effectively  
(i) a recognition of the need for, and an ability to engage in life-long learning  
(j) a knowledge of contemporary issues  
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Upon completion of the course students shall be able to: Derive the equations of motion for vibratory systems. Linearize nonlinear systems so as to allow a linear vibrational analysis. Compute the natural frequency (or frequencies) of vibratory systems and determine the system's modal response. Determine the overall response based upon the initial conditions and/or steady forcing input. Design a passive vibration absorber to ameliorate vibrations in a forced system.

### Rules & Requirements

**Prerequisites:** 104

### Hours & Format

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

**Summer:** 10 weeks - 5 hours of lecture per week

### Additional Details

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

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

Mechanical Vibrations: Read Less [-]

## MEC ENG C134 Feedback Control Systems 4 Units

Terms offered: Fall 2018, Spring 2018, Fall 2017

Analysis and synthesis of linear feedback control systems in transform and time domains. Control system design by root locus, frequency response, and state space methods. Applications to electro-mechanical and mechatronics systems.

Feedback Control Systems: [Read More](#) [+]

### Rules & Requirements

**Prerequisites:** EE 16A and either ME 132 or EE 120

### Hours & Format

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

### Additional Details

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

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

**Also listed as:** EL ENG C128

Feedback Control Systems: [Read Less](#) [-]

## MEC ENG 135 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:** Engineering 7

### Hours & Format

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

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

### Additional Details

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

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

**Instructor:** Kazerooni

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

## MEC ENG 136 Introduction to Control of Unmanned Aerial Vehicles 3 Units

Terms offered: Fall 2018, Fall 2017, Fall 1998

This course introduces students to the control of unmanned aerial vehicles (UAVs). The course will cover modeling and dynamics of aerial vehicles, and common control strategies. Laboratory exercises allow students to apply knowledge on a real system, by programming a microcontroller to control a UAV.

Introduction to Control of Unmanned Aerial Vehicles: [Read More](#) [+]

### Objectives Outcomes

**Course Objectives:** Introduce the students to analysis, modeling, and control of unmanned aerial vehicles. Lectures will cover:

- Principle forces acting on a UAV, including aerodynamics of propellers
- The kinematics and dynamics of rotations, and 3D modeling of vehicle dynamics
- Typical sensors, and their modeling
- Typical control strategies, and their pitfalls
- Programming a microcontroller

During the laboratory sessions, students will apply these skills to create a model-based controller for a UAV.

**Student Learning Outcomes:** (a) an ability to apply knowledge of mathematics, science, and engineering  
(b) an ability to design and conduct experiments, as well as to analyze and interpret data  
(g) an ability to communicate effectively  
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

### Rules & Requirements

**Prerequisites:** Mechanical Engineering 132 (or equivalent), Mechanical Engineering 104 (or equivalent), recommended: Mechanical Engineering 106

### Hours & Format

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

### Additional Details

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

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

**Instructor:** Mueller

Introduction to Control of Unmanned Aerial Vehicles: [Read Less](#) [-]

## MEC ENG 138 Introduction to Micro/Nano Mechanical Systems Laboratory 3 Units

Terms offered: Spring 2018, Spring 2015, 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. Introduction to 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/Undergraduate

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

Introduction to Micro/Nano Mechanical Systems Laboratory: Read Less [\[-\]](#)

## MEC ENG 140 Combustion Processes 3 Units

Terms offered: Fall 2018, Fall 2016, Fall 2015

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.

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

### Rules & Requirements

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

### Hours & Format

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

### Additional Details

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

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

**Instructors:** Fernandez-Pello, Chen

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

## MEC ENG 146 Energy Conversion Principles 3 Units

Terms offered: Fall 2018, Spring 2018, Fall 2016

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

Energy Conversion Principles: Read More [\[+\]](#)

### Rules & Requirements

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

### 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/Undergraduate

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

**Instructor:** Carey

Energy Conversion Principles: Read Less [\[-\]](#)

## MEC ENG 150A Solar-Powered Vehicles: Analysis, Design and Fabrication 3 Units

Terms offered: Summer 2015 10 Week Session, Summer 2014 10 Week Session, Spring 2014

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

Solar-Powered Vehicles: Analysis, Design and Fabrication: Read More [\[+\]](#)

### Objectives Outcomes

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

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

### Rules & Requirements

**Prerequisites:** Math 54, Physics 7A; Upper division status in engineering

### Hours & Format

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

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

### Additional Details

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

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

Solar-Powered Vehicles: Analysis, Design and Fabrication: Read Less [\[-\]](#)

## MEC ENG 151 Advanced Heat Transfer 3 Units

Terms offered: Fall 2018, Spring 2017, Spring 2014

Basic principles of heat transfer and their application. Subject areas include steady-state and transient system analyses for conduction, free and forced convection, boiling, condensation and thermal radiation.

Advanced Heat Transfer: Read More [\[+\]](#)

### Rules & Requirements

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

### Hours & Format

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

### Additional Details

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

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

Advanced Heat Transfer: Read Less [\[-\]](#)

## MEC ENG 151A Conductive and Radiative Transport 3 Units

Terms offered: Not yet offered

Fundamentals of conductive heat transfer. Analytical and numerical methods for heat conduction in rigid media. Fundamentals of radiative transfer. Radiative properties of solids, liquids and gas media. Radiative transport modeling in enclosures and participating media.

Conductive and Radiative Transport: [Read More](#) [+]

### Objectives Outcomes

**Course Objectives:** The course will provide students with knowledge of the physics of conductive transport in solids, the analysis of steady and transient heat conduction by both analytical and numerical methods and the treatment of phase change problems. Furthermore, the course will provide students with knowledge of radiative properties, the mechanisms of radiative transfer and will present theory and methods of solution of radiative transfer problems in participating and nonparticipating media.

**Student Learning Outcomes:** Students will gain knowledge of the mechanisms of conductive transfer and will develop the ability to quantify steady and transient temperature in important engineering problems often encountered (e.g. manufacturing, materials processing, bio-thermal treatment and electronics cooling) by applying analytical methods and by constructing numerical algorithms. Students will also gain knowledge of the fundamental radiative properties and the mechanisms of radiative transport in enclosures, absorbing, emitting and scattering media as well as the interaction of thermal radiation with other modes of heat transfer.

### Rules & Requirements

**Prerequisites:** Undergraduate courses in engineering thermodynamics, fluid dynamics and heat transfer (Mechanical Engineering 40, Mechanical Engineering 106 and Mechanical Engineering 109 or equivalent). Each student must have access to a PC, Macintosh or workstation machine with scientific programming capabilities for use in homework and projects

**Credit Restrictions:** Students who have taken ME 151 or ME 250A will not receive credit.

### Hours & Format

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

### Additional Details

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

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

**Instructor:** Grigoropoulos

Conductive and Radiative Transport: [Read Less](#) [-]

## MEC ENG 151B Convective Transport and Computational Methods 3 Units

Terms offered: Not yet offered

The transport of heat and mass in fluids in motion; free and forced convection in laminar and turbulent flow over surfaces and within ducts. Fundamentals of computational methods used for solving the governing transport equations will also be covered.

Convective Transport and Computational Methods: [Read More](#) [+]

### Objectives Outcomes

**Course Objectives:** This course will provide students with knowledge of the physics of convective transport and an introduction to computational tools that can model convective processes in important applications such as electronics cooling, aerospace thermal management. The course also teaches students to construct computational models of natural and forced convection processes in boundary layers nears surfaces, in enclosures and in ducts or pipes that can be used to design heat exchangers and thermal management equipment for applications.

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

Students will gain a knowledge of the mechanisms of convective heat and mass transfer for flow over surfaces and within ducts, and will develop the ability to construct computer programs that implement computation methods that predict the flow and temperature fields and heat transfer performance for convective flows of interest in engineering applications.

### Rules & Requirements

**Prerequisites:** Undergraduate courses in engineering thermodynamics, fluid dynamics and heat transfer (Mechanical Engineering 40, Mechanical Engineering 106 and Mechanical Engineering 109 or equivalent). Each student must have access to a PC, Macintosh or workstation machine with scientific programming capabilities for use in homework and projects

**Credit Restrictions:** Students should not receive credit for this course if they have taken ME 252 or ME 250B.

### Hours & Format

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

### Additional Details

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

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

**Instructor:** Carey

Convective Transport and Computational Methods: [Read Less](#) [-]



## MEC ENG 160 Ocean Engineering Seminar 2 Units

Terms offered: Not yet offered

Lectures on new developments in ocean, offshore, and arctic engineering.

Ocean Engineering Seminar: Read More [+]

### Objectives Outcomes

**Course Objectives:** To provide exposure of the field of ocean engineering, arctic engineering and related subject areas to students with the intention to show the broad and interdisciplinary nature of this field, particularly recent or new developments.

**Student Learning Outcomes:** (f) an understanding of professional and ethical responsibility

(h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context

(i) a recognition of the need for, and an ability to engage in life-long learning

(j) a knowledge of contemporary issues

Students will learn of new developments in ocean, offshore, and arctic engineering, connecting much of what is learned in other courses to practical applications and active research topics.

### Rules & Requirements

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

### Hours & Format

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

### Additional Details

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

**Grading/Final exam status:** Offered for pass/not pass grade only. Alternative to final exam.

**Instructors:** Makiharju, Alam

Ocean Engineering Seminar: Read Less [-]

## MEC ENG 163 Engineering Aerodynamics 3 Units

Terms offered: Fall 2018, Fall 2016, Fall 2014

Introduction to the lift, drag, and moment of two-dimensional airfoils, three-dimensional wings, and the complete airplane. Calculations of the performance and stability of airplanes in subsonic flight.

Engineering Aerodynamics: Read More [+]

### Rules & Requirements

**Prerequisites:** 106

### Hours & Format

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

### Additional Details

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

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

**Instructor:** Savas

Engineering Aerodynamics: Read Less [-]

## MEC ENG 164 Marine Statics and Structures 3 Units

Terms offered: Fall 2012, Fall 2011, Fall 2009

Terminology and definition of hull forms, conditions of static equilibrium and stability of floating submerged bodies. Effects of damage on stability. Structural loads and response. Box girder theory. Isotropic and orthotropic plate bending and bucking.

Marine Statics and Structures: Read More [+]

### Rules & Requirements

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

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

### Hours & Format

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

### Additional Details

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

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

**Instructor:** Mansour

**Formerly known as:** C164

Marine Statics and Structures: Read Less [-]

## MEC ENG 165 Ocean-Environment Mechanics 3 Units

Terms offered: Spring 2018, Spring 2017, Fall 2015

Ocean environment. Physical properties and characteristics of the oceans. Global conservation laws. Surface-waves generation. Gravity-wave mechanics, kinematics, and dynamics. Design consideration of ocean vehicles and systems. Model-testing techniques. Prediction of resistance and response in waves--physical modeling and computer models.

Ocean-Environment Mechanics: Read More [+]

### Rules & Requirements

**Prerequisites:** 106 or Civil and Environmental Engineering 100

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

### Hours & Format

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

### Additional Details

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

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

**Instructor:** Yeung

**Formerly known as:** C165

Ocean-Environment Mechanics: Read Less [-]

## MEC ENG 167 Microscale Fluid Mechanics 3 Units

Terms offered: Spring 2018, Spring 2016, Spring 2015

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

Microscale Fluid Mechanics: Read More [+]

### Rules & Requirements

**Prerequisites:** 40, 106, 109, (106 and 109 may be taken concurrently) Physics 7B or equivalent

### Hours & Format

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

### Additional Details

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

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

**Instructors:** Morris, Szeri

Microscale Fluid Mechanics: Read Less [-]

## MEC ENG 168 Mechanics of Offshore Systems 3 Units

Terms offered: Fall 2018, Fall 2017, Fall 2015

This course covers major aspects of offshore engineering including ocean environment, loads on offshore structures, cables and mooring, underwater acoustics and arctic operations.

Mechanics of Offshore Systems: Read More [+]

### Objectives Outcomes

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

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

### Rules & Requirements

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

### Hours & Format

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

### Additional Details

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

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

**Instructor:** Alam

Mechanics of Offshore Systems: Read Less [-]

## MEC ENG 170 Engineering Mechanics III 3 Units

Terms offered: Spring 2018, Spring 2017, Spring 2016

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

Engineering Mechanics III: Read More [+]

### Rules & Requirements

**Prerequisites:** 104 or consent of instructor

### 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/Undergraduate

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

**Instructors:** O'Reilly, Casey

Engineering Mechanics III: Read Less [-]

## MEC ENG 173 Fundamentals of Acoustics 3 Units

Terms offered: Spring 2017, Spring 2013, Spring 2011

Plane and spherical sound waves. Sound intensity. Propagation in tubes and horns. Resonators. Standing waves. Radiation from oscillating surface. Reciprocity. Reverberation and diffusion. Electro-acoustic loud speaker and microphone problems. Environmental and architectural acoustics. Noise measurement and control. Effects on man.

Fundamentals of Acoustics: Read More [+]

### Rules & Requirements

**Prerequisites:** 104

### Hours & Format

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

### Additional Details

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

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

**Instructor:** Johnson

Fundamentals of Acoustics: Read Less [-]

## MEC ENG 175 Intermediate Dynamics 3 Units

Terms offered: Fall 2018, Fall 2017, Fall 2016

This course introduces and investigates Lagrange's equations of motion for particles and rigid bodies. The subject matter is particularly relevant to applications comprised of interconnected and constrained discrete mechanical components. The material is illustrated with numerous examples. These range from one-dimensional motion of a single particle to three-dimensional motions of rigid bodies and systems of rigid bodies. Intermediate Dynamics: Read More [+]

### Rules & Requirements

**Prerequisites:** 104 or equivalent

### Hours & Format

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

### Additional Details

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

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

Intermediate Dynamics: Read Less [-]

## MEC ENG C176 Orthopedic Biomechanics 4 Units

Terms offered: Fall 2017, Fall 2016, Fall 2015

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

### Rules & Requirements

**Prerequisites:** Mechanical Engineering C85, Civil Engineering C30, or Bioengineering 102, or equivalent; concurrent enrollment OK. Proficiency in MatLab or equivalent. Prior knowledge of biology or anatomy is not assumed

### Hours & Format

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

### Additional Details

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

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

**Instructor:** Keaveny

**Also listed as:** BIO ENG C119

Orthopedic Biomechanics: Read Less [-]

## MEC ENG C178 Designing for the Human Body 3 Units

Terms offered: Fall 2018, 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. 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 to 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".

### Student Learning Outcomes: RELATIONSHIP OF THE COURSE TO ABET PROGRAM OUTCOMES

- (a) an ability to apply knowledge of mathematics, science, and engineering
- (b) an ability to design and conduct experiments, as well as to analyze and interpret data
- (d) an ability to function on multi-disciplinary teams
- (e) an ability to identify, formulate, and solve engineering problems
- (f) an understanding of professional and ethical responsibility
- (g) an ability to communicate effectively
- (h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
- (i) a recognition of the need for, and an ability to engage in life-long learning
- (j) a knowledge of contemporary issues
- (k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

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. Physics 7A, Math 1A and 1B

**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 - 1-3 hours of lecture per week

### Additional Details

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

## MEC ENG C180 Engineering Analysis Using the Finite Element Method 3 Units

Terms offered: Spring 2018, Spring 2017, Spring 2016

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

Engineering Analysis Using the Finite Element Method: Read More [+]

### Rules & Requirements

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

### Hours & Format

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

### Additional Details

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

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

**Also listed as:** CIV ENG C133

Engineering Analysis Using the Finite Element Method: Read Less [-]

## MEC ENG 185 Introduction to Continuum Mechanics 3 Units

Terms offered: Fall 2018, Fall 2017, Fall 2016

This course is a general introduction to the fundamental concepts of the mechanics of continuous media. Topics covered include the kinematics of deformation, the concept of stress, and the conservation laws for mass, momentum and energy. This is followed by an introduction to constitutive theory with applications to well-established models for viscous fluids and elastic solids. The concepts are illustrated through the solution of tractable initial-boundary-value problems. This course presents foundation-level coverage of theory underlying a number of sub-fields, including Fluid Mechanics, Solid Mechanics and Heat Transfer. Introduction to Continuum Mechanics: Read More [+]

### Objectives Outcomes

**Course Objectives:** Students will gain a deep understanding of the concepts and methods underlying modern continuum mechanics. The course is designed to equip students with the background needed to pursue advanced work in allied fields.

**Student Learning Outcomes:** ABET Outcomes:

- (a) an ability to apply knowledge of mathematics, science, and engineering,
- (e) an ability to identify, formulate, and solve engineering problems,
- (g) an ability to communicate effectively,
- (h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context,
- (i) a recognition of the need for, and an ability to engage in life-long learning,
- (k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

### Rules & Requirements

**Prerequisites:** Physics 7A, Math 53 and Math 54, as well as some prior exposure to the elementary mechanics of solids and fluids

**Credit Restrictions:** Students will not receive credit if they have taken ME 287.

### Hours & Format

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

### Additional Details

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

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

**Instructors:** Casey, Johnson, Papadopoulos, Steigmann

Introduction to Continuum Mechanics: Read Less [-]



## MEC ENG 190L Practical Control System Design: A Systematic Loopshaping Approach 1 Unit

Terms offered: Spring 2018, Fall 2015, Spring 2014

After a review of basic loopshaping, we introduce the loopshaping design methodology of McFarlane and Glover, and learn how to use it effectively. The remainder of the course studies the mathematics underlying the new method (one of the most prevalent advanced techniques used in industry) justifying its validity.

Practical Control System Design: A Systematic Loopshaping Approach: Read More [\[+\]](#)

### Rules & Requirements

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

### Hours & Format

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

### Additional Details

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

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

**Instructor:** Packard

Practical Control System Design: A Systematic Loopshaping Approach: Read Less [\[-\]](#)

## MEC ENG 190M Model Predictive Control 1 Unit

Terms offered: Spring 2015, Fall 2009

Basics on optimization and polyhedra manipulation. Analysis and design of constrained predictive controllers for linear and nonlinear systems.

Model Predictive Control: Read More [\[+\]](#)

### Rules & Requirements

**Prerequisites:** 132

### Hours & Format

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

### Additional Details

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

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

**Instructor:** Borrelli

Model Predictive Control: Read Less [\[-\]](#)

## MEC ENG 190Y Practical Control System Design: A Systematic Optimization Approach 1 Unit

Terms offered: Spring 2013, Spring 2010, Spring 2009

The Youla-parametrization of all stabilizing controllers allows certain time-domain and frequency-domain closed-loop design objectives to be cast as convex optimizations, and solved reliably using off-the-shelf numerical optimization codes. This course covers the Youla parametrization, basic elements of convex optimization, and finally control design using these techniques.

Practical Control System Design: A Systematic Optimization Approach: Read More [\[+\]](#)

### Rules & Requirements

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

### Hours & Format

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

### Additional Details

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

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

**Instructor:** Packard

Practical Control System Design: A Systematic Optimization Approach: Read Less [\[-\]](#)

## MEC ENG 191K Professional Communication 3 Units

Terms offered: Fall 2018, Summer 2018 First 6 Week Session, Summer 2018 Second 6 Week Session

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

Professional Communication: Read More [\[+\]](#)

### Rules & Requirements

**Prerequisites:** English R1A-R1B or equivalent

### Hours & Format

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

### Summer:

6 weeks - 8 hours of lecture per week

8 weeks - 5.5 hours of lecture per week

### Additional Details

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

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

Professional Communication: Read Less [\[-\]](#)

## MEC ENG 193A Special Topics in Biomechanical Engineering 1 - 4 Units

Terms offered: Spring 2017

This 193 series covers current topics of research interest in biomechanical engineering. The course content may vary semester to semester. Check with the department for current term topics.

Special Topics in Biomechanical Engineering: Read More [+]

### Objectives Outcomes

**Course Objectives:** Course objectives will vary.

**Student Learning Outcomes:** Student outcomes will vary.

### Rules & Requirements

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

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

**Instructor:** Faculty

Special Topics in Biomechanical Engineering: Read Less [-]

## MEC ENG 193B Special Topics in Controls 1 - 4 Units

Terms offered: Fall 2018

This 193 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.

Special Topics in Controls: Read More [+]

### Objectives Outcomes

**Course Objectives:** Will vary with course.

**Student Learning Outcomes:** Will vary with course.

### Rules & Requirements

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

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

Special Topics in Controls: Read Less [-]

## MEC ENG 193C Special Topics in Design 1 - 4 Units

Terms offered: Fall 2018, Fall 2016

This 193 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.

Special Topics in Design: Read More [+]

### Objectives Outcomes

**Course Objectives:** Will vary with course.

**Student Learning Outcomes:** Will vary with course.

### Rules & Requirements

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

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

**Instructor:** Faculty

Special Topics in Design: Read Less [-]

## MEC ENG 193D Special Topics in Dynamics 1 - 4 Units

Terms offered: Prior to 2007

This 193 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.

Special Topics in Dynamics: Read More [+]

### Objectives Outcomes

**Course Objectives:** Will vary with course.

**Student Learning Outcomes:** Will vary with course.

### Rules & Requirements

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

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

**Instructor:** Faculty

Special Topics in Dynamics: Read Less [-]

## MEC ENG 193E Special Topics in Energy Science and Technology 1 - 4 Units

Terms offered: Spring 2018, Spring 2017

This 193 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.

Special Topics in Energy Science and Technology: [Read More](#) [+]

### Objectives Outcomes

**Course Objectives:** Will vary with course.

**Student Learning Outcomes:** Will vary with course.

### Rules & Requirements

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

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

**Instructor:** Faculty

Special Topics in Energy Science and Technology: [Read Less](#) [-]

## MEC ENG 193F Special Topics in Fluids 1 - 4 Units

Terms offered: Prior to 2007

This 193 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.

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

### Objectives Outcomes

**Course Objectives:** Will vary with course.

**Student Learning Outcomes:** Will vary with course.

### Rules & Requirements

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

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

**Instructor:** Faculty

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

## **MEC ENG 193G Special Topics in Manufacturing 1 - 4 Units**

Terms offered: Prior to 2007

This 193 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.

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

### **Objectives Outcomes**

**Course Objectives:** Will vary by course.

**Student Learning Outcomes:** Will vary by course.

### **Rules & Requirements**

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

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

**Instructor:** Faculty

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

## **MEC ENG 193H Special Topics in Materials 1 - 4 Units**

Terms offered: Prior to 2007

This 193 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.

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

### **Objectives Outcomes**

**Course Objectives:** Will vary with course.

**Student Learning Outcomes:** Will vary with course.

### **Rules & Requirements**

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

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

**Instructor:** Faculty

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



## MEC ENG 193I Special Topics in Mechanics 1 - 4 Units

Terms offered: Prior to 2007

This 193 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.

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

### Objectives Outcomes

**Course Objectives:** Will vary with course.

**Student Learning Outcomes:** Will vary with course.

### Rules & Requirements

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

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

**Instructor:** Faculty

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

## MEC ENG 193J Special Topics in MEMS/Nano 1 - 4 Units

Terms offered: Prior to 2007

This 193 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.

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

### Objectives Outcomes

**Course Objectives:** Will vary with course.

**Student Learning Outcomes:** Will vary with course.

### Rules & Requirements

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

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

**Instructor:** Faculty

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

## MEC ENG 193K Special Topics in Ocean Engineering 1 - 4 Units

Terms offered: Prior to 2007

This 193 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.

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

### Objectives Outcomes

**Course Objectives:** Will vary by course.

**Student Learning Outcomes:** Will vary by course.

### Rules & Requirements

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

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

**Instructor:** Faculty

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

## MEC ENG H194 Honors Undergraduate Research 2 - 4 Units

Terms offered: Spring 2016, Spring 2015, Spring 2014

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

Honors Undergraduate Research: [Read More](#) [+]

### Rules & Requirements

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

**Repeat rules:** Course may be repeated for credit without restriction.

### Hours & Format

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

#### Summer:

6 weeks - 1-5 hours of independent study per week

8 weeks - 4-8 hours of independent study per week

### Additional Details

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

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

Honors Undergraduate Research: [Read Less](#) [-]

## MEC ENG 196 Undergraduate Research 2 - 4 Units

Terms offered: Spring 2016, Fall 2015, Spring 2015

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

Undergraduate Research: Read More [\[+\]](#)

### Rules & Requirements

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

**Repeat rules:** Course may be repeated for credit without restriction.

### Hours & Format

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

#### Summer:

6 weeks - 5-10 hours of independent study per week

8 weeks - 4-8 hours of independent study per week

### Additional Details

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

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

Undergraduate Research: Read Less [\[-\]](#)

## MEC ENG 197 Undergraduate Engineering Field Studies 1 - 4 Units

Terms offered: Fall 2015, Summer 2015 10 Week Session

Supervised experience relative to specific aspects of practice in engineering. Under guidance of a faculty member, the student will work in industry, primarily in an internship setting or another type of short-time status. Emphasis is to attain practical experience in the field.

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

### Objectives Outcomes

**Student Learning Outcomes:** (h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context

(j) a knowledge of contemporary issues

(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

### Rules & Requirements

**Repeat rules:** Course may be repeated for credit without restriction.

### Hours & Format

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

#### Summer:

6 weeks - 8-30 hours of internship per week

10 weeks - 5-18 hours of internship per week

### Additional Details

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

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

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

## MEC ENG 198 Directed Group Studies for Advanced Undergraduates 1 - 4 Units

Terms offered: Fall 2018, Spring 2018, Fall 2017

Group study of a selected topic or topics in Mechanical Engineering. Credit for 198 or 199 courses combined may not exceed 4 units in any single term. See College for other restrictions.

Directed Group Studies for Advanced Undergraduates: [Read More](#) [+]

### Rules & Requirements

**Prerequisites:** Upper division standing and good academic standing

**Repeat rules:** Course may be repeated for credit without restriction.

### Hours & Format

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

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

### Additional Details

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

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

Directed Group Studies for Advanced Undergraduates: [Read Less](#) [-]

## MEC ENG 199 Supervised Independent Study 1 - 4 Units

Terms offered: Spring 2018, Spring 2017, Summer 2016 8 Week Session  
Supervised independent study. Enrollment restrictions apply; see the introduction to Courses and Curricula section of this catalog.

Supervised Independent Study: [Read More](#) [+]

### Rules & Requirements

**Prerequisites:** Consent of instructor and major adviser

**Repeat rules:** Course may be repeated for credit without restriction.

### Hours & Format

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

### Summer:

6 weeks - 1-5 hours of independent study per week

8 weeks - 1-4 hours of independent study per week

### Additional Details

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

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

Supervised Independent Study: [Read Less](#) [-]

## Nuclear Engineering

### NUC ENG 24 Freshman Seminars 1 Unit

Terms offered: Fall 2018, Spring 2018, Fall 2017

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

Freshman Seminars: [Read More](#) [+]

### Rules & Requirements

**Repeat rules:** Course may be repeated for credit when topic changes. 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:** Nuclear Engineering/Undergraduate

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

Freshman Seminars: [Read Less](#) [-]

## NUC ENG 100 Introduction to Nuclear Engineering 3 Units

Terms offered: Spring 2018, Spring 2017, Spring 2016

The class provides students with an overview of the contemporary nuclear energy technology with emphasis on nuclear fission as an energy source. Starting with the basic physics of the nuclear fission process, the class includes discussions on reactor control, thermal hydraulics, fuel production, and spent fuel management for various types of reactors in use around the world as well as analysis of safety and other nuclear-related issues. This class is intended for sophomore NE students, but is also open to transfer students and students from other majors.

Introduction to Nuclear Engineering: [Read More](#) [+]

### Rules & Requirements

**Prerequisites:** Physics 7A and 7B, Physics 7C may be taken concurrently. Mathematics 53 and 54 may be taken concurrently

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Nuclear Engineering/Undergraduate

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

Introduction to Nuclear Engineering: [Read Less](#) [-]

## NUC ENG 101 Nuclear Reactions and Radiation 4 Units

Terms offered: Fall 2018, Fall 2017, Fall 2016

Energetics and kinetics of nuclear reactions and radioactive decay, fission, fusion, and reactions of low-energy neutrons; properties of the fission products and the actinides; nuclear models and transition probabilities; interaction of radiation with matter.

Nuclear Reactions and Radiation: [Read More](#) [+]

### Rules & Requirements

**Prerequisites:** Physics 7C

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Nuclear Engineering/Undergraduate

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

**Instructors:** Bernstein, L.

Nuclear Reactions and Radiation: [Read Less](#) [-]

## NUC ENG 102 Nuclear Reactions and Radiation Laboratory 3 Units

Terms offered: Spring 2016, Spring 2015, Spring 2013

Laboratory course in nuclear physics. Experiments will allow students to directly observe phenomena discussed in Nuclear Engineering 101. These experiments will give students exposure to (1) electronics, (2) alpha, beta, gamma radiation detectors, (3) radioactive sources, and (4) experimental methods relevant for all aspects of nuclear science. Experiments include: Rutherford scattering, x-ray fluorescence, muon lifetime, gamma-gamma angular correlations, Mossbauer effect, and radon measurements.

Nuclear Reactions and Radiation Laboratory: [Read More](#) [+]

### Rules & Requirements

**Prerequisites:** 101

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Nuclear Engineering/Undergraduate

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

**Instructor:** Norman

Nuclear Reactions and Radiation Laboratory: [Read Less](#) [-]

## NUC ENG 104 Radiation Detection and Nuclear Instrumentation Laboratory 4 Units

Terms offered: Spring 2018, Spring 2017, Spring 2016

Basic science of radiation measurement, nuclear instrumentation, neutronics, radiation dosimetry. The lectures emphasize the principles of radiation detection. The weekly laboratory applies a variety of radiation detection systems to the practical measurements of interest for nuclear power, nuclear and non-nuclear science, and environmental applications. Students present goals and approaches of the experiments being performed.

Radiation Detection and Nuclear Instrumentation Laboratory: [Read More](#) [+]

### Rules & Requirements

**Prerequisites:** 101 or equivalent or consent of instructor; 150 or equivalent recommended

### Hours & Format

**Fall and/or spring:** 15 weeks - 2 hours of lecture and 4 hours of laboratory per week

### Additional Details

**Subject/Course Level:** Nuclear Engineering/Undergraduate

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

**Instructor:** Vetter

**Formerly known as:** 104A

Radiation Detection and Nuclear Instrumentation Laboratory: [Read Less](#) [-]

## NUC ENG 107 Introduction to Imaging 3 Units

Terms offered: Fall 2018, Fall 2016, Fall 2014

Introduction to medical imaging physics and systems, including x-ray computed tomography (CT), nuclear magnetic resonance (NMR), positron emission tomography (PET), and SPECT; basic principles of tomography and an introduction to unfolding methods; resolution effects of counting statistics, inherent system resolution and human factors.

Introduction to Imaging: [Read More](#) [+]

### Rules & Requirements

**Prerequisites:** 101 and 104A or consent of instructor

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Nuclear Engineering/Undergraduate

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

**Instructor:** Vetter

Introduction to Imaging: [Read Less](#) [-]

**NUC ENG 120 Nuclear Materials 4 Units**

Terms offered: Fall 2018, Fall 2017, Fall 2016

Effects of irradiation on the atomic and mechanical properties of materials in nuclear reactors. Fission product swelling and release; neutron damage to structural alloys; fabrication and properties of uranium dioxide fuel.

Nuclear Materials: Read More [+]

**Rules & Requirements**

**Prerequisites:** Engineering 45 and an upper division course in thermodynamics

**Hours & Format**

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

**Additional Details**

**Subject/Course Level:** Nuclear Engineering/Undergraduate

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

**Instructor:** Wirth

Nuclear Materials: Read Less [-]

**NUC ENG 124 Radioactive Waste Management 3 Units**

Terms offered: Spring 2017, Spring 2016, Spring 2015

Components and material flowsheets for nuclear fuel cycle, waste characteristics, sources of radioactive wastes, compositions, radioactivity and heat generation; waste treatment technologies; waste disposal technologies; safety assessment of waste disposal.

Radioactive Waste Management: Read More [+]

**Rules & Requirements**

**Prerequisites:** Engineering 117 or equivalent course

**Hours & Format**

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

**Additional Details**

**Subject/Course Level:** Nuclear Engineering/Undergraduate

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

**Instructor:** Ahn

Radioactive Waste Management: Read Less [-]

**NUC ENG 130 Analytical Methods for Non-proliferation 3 Units**

Terms offered: Spring 2018, Spring 2017, Spring 2016

Use of nuclear measurement techniques to detect clandestine movement and/or possession of nuclear materials by third parties. Nuclear detection, forensics, signatures, and active and passive interrogation methodologies will be explored. Techniques currently deployed for arms control and treaty verification will be discussed. Emphasis will be placed on common elements of detection technology from the viewpoint of resolution of threat signatures from false positives due to naturally occurring radioactive material. Topics include passive and active neutron signals, gamma ray detection, fission neutron multiplicity, and U and Pu isotopic identification and age determination.

Analytical Methods for Non-proliferation: Read More [+]

**Rules & Requirements**

**Prerequisites:** 101 or equivalent course in nuclear physics, or consent of instructor

**Hours & Format**

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

**Additional Details**

**Subject/Course Level:** Nuclear Engineering/Undergraduate

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

**Instructor:** Morse

Analytical Methods for Non-proliferation: Read Less [-]

**NUC ENG 150 Introduction to Nuclear Reactor Theory 4 Units**

Terms offered: Spring 2018, Spring 2017, Spring 2016

Neutron interactions, nuclear fission, and chain reacting systematics in thermal and fast nuclear reactors. Diffusion and slowing down of neutrons. Criticality calculations. Nuclear reactor dynamics and reactivity feedback. Production of radionuclides in nuclear reactors.

Introduction to Nuclear Reactor Theory: Read More [+]

**Rules & Requirements**

**Prerequisites:** 101; Mathematics 53 and 54

**Hours & Format**

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

**Additional Details**

**Subject/Course Level:** Nuclear Engineering/Undergraduate

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

**Instructors:** Greenspan, Vujic

Introduction to Nuclear Reactor Theory: Read Less [-]



## NUC ENG 155 Introduction to Numerical Simulations in Radiation Transport 3 Units

Terms offered: Spring 2018, Spring 2017, Spring 2016

Computational methods used to analyze radiation transport described by various differential, integral, and integro-differential equations. Numerical methods include finite difference, finite elements, discrete ordinates, and Monte Carlo. Examples from neutron and photon transport; numerical solutions of neutron/photon diffusion and transport equations. Monte Carlo simulations of photon and neutron transport. An overview of optimization techniques for solving the resulting discrete equations on vector and parallel computer systems.

Introduction to Numerical Simulations in Radiation Transport: Read More [\[+\]](#)

### 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:** Nuclear Engineering/Undergraduate

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

**Instructors:** Vujic, Wirth

Introduction to Numerical Simulations in Radiation Transport: Read Less [\[-\]](#)

## NUC ENG 156 Nuclear Criticality Safety 3 Units

Terms offered: Not yet offered

This course provides an introduction to the field of nuclear criticality safety. Topics include: a review of basic concepts related to criticality (fission, cross sections, multiplication factor, etc.); criticality safety accidents; standards applicable to criticality safety; hand calculations and Monte Carlo methods used in criticality safety analysis; criticality safety evaluation documents.

Nuclear Criticality Safety: Read More [\[+\]](#)

### Objectives Outcomes

**Course Objectives:** The objective of this course is to acquaint Nuclear Engineering students with the concepts and practice of nuclear criticality safety, and to help prepare them for a future career in this field.

**Student Learning Outcomes:** At the end of this course, students should be able to:

Explain and define criticality safety factors for operations.

Discuss previous criticality accidents and their causal factors, including parameters involved in solution and metal critical accidents.

Identify and discuss the application of several common hand calculation methods.

Describe the importance of validation of computer codes and how it is accomplished.

Discuss ANSI/ANS criticality safety regulations.

Describe DOE regulations and practices in the nuclear criticality safety field.

Complete a Criticality Safety Evaluation.

### Rules & Requirements

**Prerequisites:** Nuc Eng 150, or consent of instructor

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Nuclear Engineering/Undergraduate

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

**Instructor:** Fratoni

Nuclear Criticality Safety: Read Less [\[-\]](#)

## NUC ENG 161 Nuclear Power Engineering 4 Units

Terms offered: Fall 2018, Fall 2017, Fall 2016

Energy conversion in nuclear power systems; design of fission reactors; thermal and structural analysis of reactor core and plant components; thermal-hydraulic analysis of accidents in nuclear power plants; safety evaluation and engineered safety systems.

Nuclear Power Engineering: Read More [ + ]

### Rules & Requirements

**Prerequisites:** Course(s) in fluid mechanics and heat transfer; junior-level course in thermodynamics

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Nuclear Engineering/Undergraduate

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

**Instructor:** Peterson

Nuclear Power Engineering: Read Less [ - ]

## NUC ENG 162 Radiation Biophysics and Dosimetry 3 Units

Terms offered: Spring 2018, Spring 2017, Spring 2016

Interaction of radiation with matter; physical, chemical, and biological effects of radiation on human tissues; dosimetry units and measurements; internal and external radiation fields and dosimetry; radiation exposure regulations; sources of radiation and radioactivity; basic shielding concepts; elements of radiation protection and control; theories and models for cell survival, radiation sensitivity, carcinogenesis, and dose calculation.

Radiation Biophysics and Dosimetry: Read More [ + ]

### Rules & Requirements

**Prerequisites:** Upper division standing or consent of instructor

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Nuclear Engineering/Undergraduate

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

**Instructor:** Vujic

Radiation Biophysics and Dosimetry: Read Less [ - ]

## NUC ENG 167 Risk-Informed Design for Advanced Nuclear Systems 3 Units

Terms offered: Fall 2017, Fall 2015, Fall 2014

Project-based class for design and licensing of nuclear facilities, including advanced reactors. Elements of a project proposal. Regulatory framework and use of deterministic and probabilistic licensing criteria. Siting criteria. External and internal events. Identification and analysis of design basis and beyond design basis events. Communication with regulators and stakeholders. Ability to work in and contribute to a design team.

Risk-Informed Design for Advanced Nuclear Systems: Read More [ + ]

### Objectives Outcomes

**Course Objectives:** \* Introduce students to the methods and models for event identification, accident analysis, and risk assessment and management for internally and externally initiated events.

\* Introduce students to the regulatory requirements for design, construction and operation of nuclear facilities licensed by the U.S. Nuclear Regulatory Commission.

\* Introduce students to the safety principles and methods used to design, construct and operate a safe nuclear facility, for a specific site and application.

\* Provide a basic understanding of similarities and differences in regulation of nuclear facilities versus other technologies (biotech, commercial aviation, commercial space launch, civil infrastructure).

\* Provide a basic understanding the risk-informed design process and an opportunity to experience contributing in a focused area to a design project.

\* Provide students with experiential knowledge in developing schedules, allocating work responsibilities, and working in teams.

\* Provide students with experiential knowledge in the preparation and evaluation a Safety Analysis Report for meeting USNRC regulatory requirements, including response to Requests for Additional Information (RAIs).

**Student Learning Outcomes:** \* Develop a broad understanding of safety principles and methods used in design, construction and licensing of nuclear facilities.

\* Develop a broad understanding of the U.S. Nuclear Regulatory Commission's regulatory requirements for nuclear facilities.

\* Have awareness of key similarities and differences in regulation of nuclear facilities versus other technologies (biotech, commercial aviation, commercial space launch, civil infrastructure).

\* Have awareness of the major topics covered in a Safety Analysis Report (SAR) and experience in developing and writing at least one element of a SAR.

\* Have developed experience and skills in communication with the business community, the public, and regulators.

\* Have developed experience and skills in establishing a project schedule, allocating work responsibilities, and working in teams.

\* Have understanding of application of event identification, event frequency and consequence analysis, risk assessment and management for internally and externally initiated events in the design process.

### Rules & Requirements

**Prerequisites:** Completion of at least two upper-division engineering courses providing relevant skills: ChemE 150A, ChemE 180, CE 111, CE 120, CE152, CE 166, CE 175, E 120, IEOR 166, IEOR 172, ME 106, ME 109, ME 128, ME 146, NE 120, NE 124, NE 150, NE 161

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Nuclear Engineering/Undergraduate

## NUC ENG 170A Nuclear Design: Design in Nuclear Power Technology and Instrumentation 3 Units

Terms offered: Spring 2018, Spring 2017, Spring 2016

Design of various fission and fusion power systems and other physically based applications. Each semester a topic will be chosen by the class as a whole. In addition to technology, the design should address issues relating to economics, the environment, and risk assessment.

Nuclear Design: Design in Nuclear Power Technology and Instrumentation: Read More [\[+\]](#)

### Rules & Requirements

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

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Nuclear Engineering/Undergraduate

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

**Formerly known as:** 170

Nuclear Design: Design in Nuclear Power Technology and Instrumentation: Read Less [\[-\]](#)

## NUC ENG 170B Nuclear Design: Design in Bionuclear, Nuclear Medicine, and Radiation Therapy 3 Units

Terms offered: Spring 2010, Spring 2009, Spring 2008

A systems approach to the development of procedures for nuclear medicine and radiation therapy. Each semester a specific procedure will be studied and will entail the development of the biological and physiological basis for a procedure, the chemical and biochemical characteristics of appropriate drugs, dosimetric requirements and limitations, the production and distribution of radionuclides and/or radiation fields to be applied, and the characteristics of the instrumentation to be used.

Nuclear Design: Design in Bionuclear, Nuclear Medicine, and Radiation Therapy: Read More [\[+\]](#)

### Rules & Requirements

**Prerequisites:** 107, 161, or consent of instructor

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Nuclear Engineering/Undergraduate

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

**Formerly known as:** 167

Nuclear Design: Design in Bionuclear, Nuclear Medicine, and Radiation Therapy: Read Less [\[-\]](#)

## NUC ENG 175 Methods of Risk Analysis 3 Units

Terms offered: Fall 2018, Fall 2013, Fall 2011

Methodological approaches for the quantification of technological risk and risk based decision making. Probabilistic safety assessment, human health risks, environmental and ecological risk analysis.

Methods of Risk Analysis: Read More [\[+\]](#)

### Rules & Requirements

**Prerequisites:** Upper division standing

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Nuclear Engineering/Undergraduate

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

**Instructor:** Kastenbergh

Methods of Risk Analysis: Read Less [\[-\]](#)

## NUC ENG 180 Introduction to Controlled Fusion 3 Units

Terms offered: Fall 2018, Fall 2017, Fall 2016

Introduction to energy production by controlled thermonuclear reactions. Nuclear fusion reactions, energy balances for fusion systems, survey of plasma physics; neutral beam injection; RF heating methods; vacuum systems; tritium handling.

Introduction to Controlled Fusion: Read More [\[+\]](#)

### Rules & Requirements

**Prerequisites:** Physics 7C

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Nuclear Engineering/Undergraduate

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

**Instructor:** Morse

Introduction to Controlled Fusion: Read Less [\[-\]](#)

## NUC ENG H194 Honors Undergraduate Research 1 - 4 Units

Terms offered: Fall 2018, Summer 2018, Spring 2018

Supervised research. Students who have completed three or more upper division courses may pursue original research under the direction of one of the members of the staff. A final report or presentation is required. A maximum of three units of H194 may be used to fulfill a technical elective requirement in the Nuclear Engineering general program or joint major programs.

Honors Undergraduate Research: Read More [+]

### Rules & Requirements

**Prerequisites:** Upper division technical GPA of 3.3, consent of instructor and faculty advisor

**Repeat rules:** Course may be repeated for credit up to a total of 8 units. Course may be repeated for a maximum of 8 units.

### Hours & Format

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

**Summer:** 10 weeks - 1.5-6 hours of independent study per week

### Additional Details

**Subject/Course Level:** Nuclear Engineering/Undergraduate

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

Honors Undergraduate Research: Read Less [-]

## NUC ENG 198 Group Study for Advanced Undergraduates 1 - 4 Units

Terms offered: Fall 2018, Spring 2018, Fall 2017

Group studies of selected topics.

Group Study for Advanced Undergraduates: Read More [+]

### Rules & Requirements

**Prerequisites:** Upper division standing

**Repeat rules:** Course may be repeated for credit without restriction.

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Nuclear Engineering/Undergraduate

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

Group Study for Advanced Undergraduates: Read Less [-]

## NUC ENG 199 Supervised Independent Study 1 - 4 Units

Terms offered: Fall 2018, Spring 2018, Fall 2017

Supervised independent study. Enrollment restrictions apply; see the Introduction to Courses and Curricula section of this catalog.

Supervised Independent Study: Read More [+]

### Rules & Requirements

**Prerequisites:** Consent of instructor and major adviser

**Credit Restrictions:** Course may be repeated for credit for a maximum of 4 units per semester.

**Repeat rules:** Course may be repeated for credit without restriction.

### Hours & Format

**Fall and/or spring:** 15 weeks - 0 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:** Nuclear Engineering/Undergraduate

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

Supervised Independent Study: Read Less [-]

## NUC ENG S199 Supervised Independent Study 1 - 4 Units

Terms offered: Prior to 2007

Supervised independent study. Please see section of the for description and prerequisites.

Supervised Independent Study: Read More [+]

### Rules & Requirements

**Prerequisites:** Consent of instructor and major adviser

**Credit Restrictions:** Course may be repeated for credit for a maximum of 4 units per semester.

**Repeat rules:** Course may be repeated for credit without restriction.

### Hours & Format

**Summer:** 8 weeks - 0 hours of independent study per week

### Additional Details

**Subject/Course Level:** Nuclear Engineering/Undergraduate

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

Supervised Independent Study: Read Less [-]