

# Mechanical Engineering

## Bachelor of Science (BS)

Mechanical engineers serve society by solving problems in transportation, energy, the environment, and human health. The activity of mechanical engineers extends from investigation of physical phenomena governing the behavior of our surroundings to the manufacture and evaluation of products. The technical domain of the mechanical engineering profession encompasses topic areas, including acoustics, automatic control, bioengineering, combustion, cryogenics, design, dynamics, energy conversion, engines, environment, heat transfer, lubrication, mass transfer, manufacturing and sustainability, materials processing, mechanics of solids and fluids, mechanisms, petroleum, plasma dynamics, propulsion, thermodynamics, vibration, and wave propagation.

The undergraduate program in mechanical engineering seeks to provide students with a broad education emphasizing an excellent foundation in scientific and engineering fundamentals. The objectives of the undergraduate program are to prepare undergraduate students for employment or advanced studies with four primary constituencies: industry, the national laboratories, state and federal agencies, and academia (graduate research programs).

## Accreditation

Our programs are accredited by ABET (<http://www.abet.org/accreditation>), a non-profit and non-governmental accrediting agency for academic programs in the disciplines of applied science, computing, engineering, and engineering technology. ABET is a recognized accreditor in the United States (U.S.) by the Council for Higher Education Accreditation (<http://www.chea.org>). For information about how the program achieves ABET course outcomes, please see the Department's website (<http://www.me.berkeley.edu/undergraduate/degree-program/program-objectives-and-outcomes-abet>).

## Admission to the Major

Prospective undergraduates to the College of Engineering will apply for admission to a specific program in the college. For further information, please see the College of Engineering's website (<http://coe.berkeley.edu/students/prospective-students/admissions.html>).

Admission to Engineering via a Change of College application for current UC Berkeley students is highly unlikely and very competitive as there few, if any, spaces that open in the college each year to students admitted to other colleges at UC Berkeley. For further information regarding a Change of College to Engineering, please see the College's website (<http://coe.berkeley.edu/students/current-undergraduates/change-of-college>).

## Five-Year BS/MS Program

This program is for Berkeley ME undergraduates who wish to broaden their education experiences at Berkeley. In contrast to the existing Berkeley Mechanical Engineering MS program, it is completely course-based. Students in the five-year BS/MS program are also able to take some courses in professional disciplines such as business or public policy. This two semester program is not intended for students with the desire to continue to the PhD. For further information regarding this option, please see the department's website (<http://www.me.berkeley.edu/graduate/degree-programs/five-year-bsms-program>).

[www.me.berkeley.edu/graduate/degree-programs/five-year-bsms-program](http://www.me.berkeley.edu/graduate/degree-programs/five-year-bsms-program)).

## Minor Program

The department offers a minor program in Mechanical Engineering. For admission to the minor, students must have a minimum overall grade point average (GPA) of 3.00 as well as a minimum 3.00 GPA in the prerequisite courses. For information regarding the prerequisites, please see the Minor Requirements tab on this page.

After completion of the prerequisite courses, students will need to complete and submit to the Mechanical Engineering Student Services Office (Room 6189/6193 Etcheverry) a Petition for Admission form which can be found here (<http://www.me.berkeley.edu/undergraduate/degree-program-requirements/me-minor-program>). The department will verify the completion of the minor and send the paperwork to the appropriate parties after final grades are available.

## Joint Majors

The Department of Mechanical Engineering also offers two joint majors, with other departments in the College of Engineering. For further information on these programs, please click the links below: Materials Science and Engineering/Mechanical Engineering (<http://guide.berkeley.edu/archive/2016-17/undergraduate/degree-programs/materials-science-engineering-mechanical-joint-major>) (Department of Materials Science and Engineering) Mechanical Engineering/Nuclear Engineering (<http://guide.berkeley.edu/archive/2016-17/undergraduate/degree-programs/mechanical-engineering-nuclear>) (Department of Nuclear Engineering)

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

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

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

## Lower Division Requirements

|                  |  |   |
|------------------|--|---|
| MATH 1A          | Calculus   | 4 |
| MATH 1B          | Calculus   | 4 |
| MATH 53          | Multivariable Calculus   | 4 |
| MATH 54          | Linear Algebra and Differential Equations                          | 4 |
| CHEM 1A<br>& 1AL | General Chemistry<br>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 |
| ENGIN 7     | Introduction to Computer Programming for Scientists and Engineers | 4 |
| ENGIN 25    | Visualization for Design <sup>2</sup>                             | 2 |
| ENGIN 26    | Three-Dimensional Modeling for Design <sup>2</sup>                | 2 |
| ENGIN 27    | Introduction to Manufacturing and Tolerancing <sup>2</sup>        | 2 |
| MEC ENG 40  | Thermodynamics  | 3 |
| MEC ENG C85 | Introduction to Solid Mechanics                                   | 3 |
| EL ENG 16A  | Designing Information Devices and Systems I                       | 4 |

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

<sup>2</sup> All junior transfer admits are exempt from completing ENGIN 26. Junior transfer admits who have completed the equivalent of Engin 28 are exempt from completing the series (ENGIN 25, ENGIN 26 and ENGIN 27), unless their transfer institution has articulated equivalents for the series.

## 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  |
| Technical electives, minimum 18 units <sup>1,2,3</sup>              |   | 18 |
| Select at least one course from the design elective list:           |   |    |
| ENGIN 128   | Advanced Engineering Design Graphics <sup>1</sup>   |    |
| MEC ENG 101 Introduction to Lean Manufacturing Systems              |   |    |
| MEC ENG 110 Introduction to Product Development                     |   |    |
| MEC ENG C11 Structural Aspects of Biomaterials                      |   |    |
| MEC ENG 119 Introduction to MEMS (Microelectromechanical Systems)   |   |    |
| MEC ENG 130 Design of Planar Machinery                              |   |    |
| MEC ENG 135 Design of Microprocessor-Based Mechanical Systems       |   |    |
| MEC ENG 146 Energy Conversion Principles                            |   |    |
| MEC ENG 165 Ocean-Environment Mechanics                             |   |    |
| MEC ENG C17 Orthopedic Biomechanics                                 |   |    |
| Select at least one course from quantitative science elective list: |   |    |
| ENGIN 117   | Methods of Engineering Analysis <sup>1</sup>        |    |
| ENGIN 177   | Advanced Programming with MATLAB <sup>1</sup>       |    |
| MATH 128A   | Numerical Analysis <sup>1</sup>                     |    |
| MEC ENG 120 Computational Biomechanics Across Multiple Scales       |   |    |
| MEC ENG C18 Engineering Analysis Using the Finite Element Method    |   |    |

<sup>1</sup> Technical electives: 18 units of technical electives are required, of which at least 12 units must be upper division mechanical engineering courses. Any upper division course taught by mechanical engineering faculty may be used as part of the 12 units of upper division mechanical engineering courses. In addition, ENGIN 117, ENGIN 128, ENGIN 177 and MATH 128A can count toward the 12 unit upper division ME course requirement. Students may receive up to three units of technical elective credit for work on a research project in either MEC ENG 196 or MEC ENG H194.

<sup>2</sup> Only one lower division course can be used toward the technical elective requirement. Approved lower division courses include: ASTRON 7A, ASTRON 7B, BIO ENG 10, BIOLOGY 1A, BIOLOGY 1B, CHEM 1B, CHEM 3A, CHEM 3B, CHEM 4B, CIV ENG 11, CIV ENG 60, CIV ENG 70, CIV ENG 93, COMPSCI C8, COMPSCI 61A, COMPSCI 61B, COMPSCI 61C, COMPSCI 70, DES INV 15, DES INV 22, DES INV 90E, EPS 50, EL ENG 16B, ENGIN 15, ENGIN 45, INTEGRI 32, MATH 55, MCELLBI 32, PHYSICS 7C, STAT 20, STAT 21.

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

- Any course taken on a *Pass/No Pass* basis
- Courses numbered 24, 39, 84, or 88
- Any of the following courses: BIO ENG 100, CHM ENG 185, COMPSCI C79, COMPSCI 195, COMPSCI H195, DES INV courses (except DES INV 15, DES INV 22, DES INV 90E, DES INV 190E), ENGIN 125, ENGIN 157AC, IND ENG 95, IND ENG 171, IND ENG 185, IND ENG 186, IND ENG 190 series, IND ENG 191, IND ENG 192, IND ENG 195, MEC ENG 191AC, MEC ENG 190K, and MEC ENG 191K

Minor programs are areas of concentration requiring fewer courses than an undergraduate major. These programs are optional but can provide depth and breadth to a UC Berkeley education. The College of Engineering does not offer additional time to complete a minor, but it is usually possible to finish within the allotted time with careful course planning. Students are encouraged to meet with their ESS adviser to discuss the feasibility of completing a minor program.

All the engineering departments offer minors. Students may also consider pursuing a minor in another school or college.

## General Guidelines

- All courses taken to fulfill the minor requirements must be taken for graded credit.
- A minimum overall grade point average (GPA) of 3.0 and a minimum GPA of 3.0 in the prerequisite courses is required for acceptance into the minor program.
- A minimum grade point average (GPA) of 2.0 is required for courses used to fulfill the minor requirements.
- No more than one upper division course may be used to simultaneously fulfill requirements for a student's major and minor programs.
- Completion of the minor program cannot delay a student's graduation.

## Requirements

### Prerequisites

|             |                                      |   |
|-------------|--------------------------------------|---|
| PHYSICS 7A  | Physics for Scientists and Engineers | 4 |
| MEC ENG 40  | Thermodynamics                       | 3 |
| MEC ENG 104 | Engineering Mechanics II             | 3 |
| MEC ENG C85 | Introduction to Solid Mechanics      | 3 |

### Upper Division Requirements

Select three additional upper division technical courses in mechanical engineering

## 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://coe.berkeley.edu/students/guide/departments>) of 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 lists 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/2016-17/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-ap-ib-level-and-transfer-credit-information>) 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>), COMPSI C79 (<http://guide.berkeley.edu/search/?P=COMPSI%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 (<http://guide.berkeley.edu/search/?P=MEC%20ENG%20191AC>) 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/2016-17/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/2016-17/undergraduate/colleges-schools/letters-science/breadth-requirement-historical-studies>)

- International Studies (<http://guide.berkeley.edu/archive/2016-17/undergraduate/colleges-schools/letters-science/breadth-requirement-international-studies>)
- Philosophy and Values (<http://guide.berkeley.edu/archive/2016-17/undergraduate/colleges-schools/letters-science/breadth-requirement-philosophy-values>)
- Social and Behavioral Studies (<http://guide.berkeley.edu/archive/2016-17/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 of 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 of 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://coe.berkeley.edu/students/guide/departments>) 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.)

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

|   |      |       |  | Freshman |
|---|------|-------|--|----------|
|   | Fall | Units | Spring                                   | Units    |
| CHEM 4A or 1A <i>and</i> 1AL <sup>1</sup> |      | 4     | MATH 1B                                  | 4        |
| MATH 1A                                   |      | 4     | PHYSICS 7A                               | 4        |
| ENGIN 25 <sup>2</sup>                     |      | 2     | ENGIN 7                                  | 4        |
| Reading & Composition course from List A  |      | 4     | Reading & Composition course from List B | 4        |
| Optional Freshman Seminar or ENGIN 92     |      | 0-1   | Optional Freshman Seminar                | 0-1      |
|   |      | 14-15 | 16-17                                    |          |
| Sophomore                                 |      |       |  |          |
|   | Fall | Units | Spring                                   | Units    |
| MATH 53                                   |      | 4     | MATH 54                                  | 4        |
| PHYSICS 7B                                |      | 4     | MEC ENG 40                               | 3        |
| ENGIN 26 <sup>2</sup>                     |      | 2     | MEC ENG C85                              | 3        |
| ENGIN 27 <sup>2</sup>                     |      | 2     | Humanities/ Social Sciences course       | 3-4      |
| Humanities/Social Sciences course         |      | 3-4   | Free Elective                            | 1        |
|   |      | 15-16 | 14-15                                    |          |
| Junior                                    |      |       |  |          |
|   | Fall | Units | Spring                                   | Units    |
| MEC ENG 104                               |      | 3     | EL ENG 16A                               | 4        |
| MEC ENG 106                               |      | 3     | MEC ENG 105                              | 3        |
| MEC ENG 108                               |      | 4     | MEC ENG 132                              | 3        |
| Technical Elective <sup>3,4,5</sup>       |      | 3     | Technical Elective <sup>3,4,5</sup>      | 3        |
| Humanities/Social Sciences course         |      | 3-4   | Humanities/ Social Sciences course       | 3-4      |
|   |      | 16-17 | 16-17                                    |          |
| Senior                                    |      |       |  |          |
|   | Fall | Units | Spring                                   | Units    |
| MEC ENG 102A                              |      | 4     | MEC ENG 102B                             | 4        |
| Technical Electives <sup>3,4,5</sup>      |      | 6     | MEC ENG 107                              | 3        |
| Free Elective                             |      | 3-4   | Technical Electives <sup>3,4,5</sup>     | 6        |
|   |      |       | Free Elective                            | 3        |
|   |      | 13-14 | 16                                       |          |
| Total Units: 120-127                      |      |       |  |          |

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

<sup>2</sup> All junior transfer admits are exempt from completing ENGIN 26. Junior transfer admits who have completed the equivalent of Engin 28 are exempt from completing the series (ENGIN 25, ENGIN 26 and ENGIN 27), unless their transfer institution has articulated equivalents for the series.



3. Technical electives: 18 units of technical electives are required, of which at least 12 units must be upper division mechanical engineering courses.
- Of these 12 units, 3 units must be a design course selected from the following: ENGIN 128, MEC ENG 101, MEC ENG 110, MEC ENG C117, MEC ENG 119, MEC ENG 130, MEC ENG 135, MEC ENG 146, MEC ENG 165, MEC ENG 177, MATH 128A, MEC ENG 120, MEC ENG C180. Also, one of the technical elective courses must be selected from the quantitative science list:
- ENGIN 117, ENGIN 177, MATH 128A, MEC ENG 120, MEC ENG C180.
- Any upper division course taught by mechanical engineering faculty may be used as part of the 12 units of upper division mechanical engineering courses. In addition, ENGIN 117, ENGIN 128, ENGIN 177 and MATH 128A can count toward the 15 unit upper division ME course requirement.
- Students may receive up to three units of technical elective credit for work on a research project in either MEC ENG 196 or MEC ENG H194.
4. Only one lower division course can be used toward the technical elective requirement. Approved lower division courses include: ASTRON 7A, ASTRON 7B, BIO ENG 10, BIOLOGY 1A plus BIOLOGY 1AL, BIOLOGY 1B, CHEM 1B, CHEM 3A plus CHEM 3AL, CHEM 3B plus CHEM 3BL.
5. Technical electives cannot include:
- Any course taken on a *Pass/No Pass* basis
  - Courses numbered 24, 39, 84, or 88
  - Any of the following courses: BIO ENG 100, CHM ENG 185, COMPSCI C79, COMPSCI 195, COMPSCI H195, DES INV courses (except DES INV 15, DES INV 22, DES INV 90E, DES INV 190E), ENGIN 125, ENGIN 157AC, IND ENG 95, IND ENG 171, IND ENG 185, IND ENG 186, IND ENG 190 series, IND ENG 191, IND ENG 192, IND ENG 195, MEC ENG 191AC, MEC ENG 190K, and MEC ENG 191K
- social, political, ethical, health and safety, manufacturability, and sustainability.
4. An ability to function on multi-disciplinary teams.
  5. An ability to identify, formulate, and solve engineering problems.
  6. An understanding of professional and ethical responsibility.
  7. An ability to communicate effectively.
  8. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.
  9. A recognition of the need for and an ability to engage in life-long learning.
  10. A knowledge of contemporary issues.
  11. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
- Students in Mechanical Engineering have a number of advising options, listed in sequential order:
- ## College of Engineering (COE)
- All undergraduates have an adviser at the College referred to as the Engineering Student Services (ESS) Adviser. ESS advisers assist students in a variety of ways including course selection (primarily for freshmen, sophomores and transfer students), explaining graduation requirements and college policies, monitoring progress toward the degree, suggesting enrichment opportunities, and providing support (or referrals to campus resources) to help students reach their academic goals. They are also the first stop for students who wish to file a petition

## Learning Goals for the Major

The objectives of the Mechanical Engineering undergraduate program are to produce graduates who do the following:

1. Vigorously engage in post-baccalaureate endeavors, whether in engineering graduate study, in engineering practice, or in the pursuit of other fields such as science, law, medicine, business or public policy.
2. Apply their mechanical engineering education to address the full range of technical and societal problems with creativity, imagination, confidence and responsibility.
3. Actively seek out positions of leadership within their profession and their community.
4. Serve as ambassadors for engineering by exhibiting the highest ethical and professional standards, and by communicating the importance and excitement of this dynamic field.
5. Retain the intellectual curiosity that motivates lifelong learning and allows for a flexible response to the rapidly evolving challenges of the 21st century.

## Skills

The Department of Mechanical Engineering has adopted the ABET Outcomes as its Program Outcomes. Mechanical Engineering graduates have the following:

1. An ability to apply knowledge of mathematics, science, and engineering.
2. An ability to design and conduct experiments as well as to analyze and interpret data.
3. 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.

4. An ability to function on multi-disciplinary teams.
5. An ability to identify, formulate, and solve engineering problems.
6. An understanding of professional and ethical responsibility.
7. An ability to communicate effectively.
8. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.
9. A recognition of the need for and an ability to engage in life-long learning.
10. A knowledge of contemporary issues.
11. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Students in Mechanical Engineering have a number of advising options, listed in sequential order:

**College of Engineering (COE)**

All undergraduates have an adviser at the College referred to as the Engineering Student Services (ESS) Adviser. ESS advisers assist students in a variety of ways including course selection (primarily for freshmen, sophomores and transfer students), explaining graduation requirements and college policies, monitoring progress toward the degree, suggesting enrichment opportunities, and providing support (or referrals to campus resources) to help students reach their academic goals. They are also the first stop for students who wish to file a petition. Advising assignments are made alphabetically. Students who are unsure of who their adviser is should refer to the COE's undergraduate advising information page (<http://coe.berkeley.edu/students/current-undergraduates/advising/student-affairs-advising.html>).

## ME Student Services Office

This office is students' primary source of department-specific administrative information.

### ME Faculty Adviser

Faculty advisers for new students will be assigned by the beginning of October and a listing will be available online. Faculty are great sources for information regarding classes, research opportunities, and career planning. Furthermore, all ME students are required to see their faculty advisers (or go to drop-in advising) to get their advising codes before signing up for the next semester's courses.

## Vice Chair for Undergraduate Matters

The vice chair handles all undergraduate student petitions and can serve as a liaison between students and their respective advisers as well as students and the ME chair. He is also responsible for the ME undergraduate curriculum and heads the Committee on Undergraduate Study.

## Department Chair

In rare instances when issues cannot be resolved by the vice chair, the ME chair may become involved.

## Advising Staff and Hours

Undergraduate Student Services Adviser  
Shareena Samson

shareena@me.berkeley.edu

6193 Etcheverry Hall

510-642-4094

Monday, Tuesday, Wednesday, and Friday: 9 to noon and 1 to 4 p.m.

Thursday: 1 to 4 p.m.

## Student Groups and Organizations

Aero-design Society of Automotive Engineers ([https://](https://callink.berkeley.edu/organization/asae)

[callink.berkeley.edu/organization/asae](https://callink.berkeley.edu/organization/asae)) (ASAE)

American Institute of Aeronautics and Astronautics at Cal ([http://](http://aiaa.berkeley.edu)

[aiaa.berkeley.edu](http://aiaa.berkeley.edu)) (AIAA-Cal)

American Society of Mechanical Engineers Student Chapter ([http://](http://asme.berkeley.edu)

[asme.berkeley.edu](http://asme.berkeley.edu)) (ASME)

Berkeley Energy and Resources Collaborative (<http://berc.berkeley.edu>)

(BERC)

The Black Engineering and Science Students Association ([http://](http://ucbessa.berkeley.edu)

[ucbessa.berkeley.edu](http://ucbessa.berkeley.edu)) (BESSA)

Black Graduate Engineering and Science Students Association (BGESS)

Cal Human Powered Vehicle (<http://calhvp.berkeley.edu>) (CalHPV)

Design + Engineering Collaborative (<http://dec.berkeley.edu>) (DEC)

Formula SAE at Berkeley (<http://fsae.berkeley.edu>)

Graduate Women of Engineering (<http://www.me.berkeley.edu/gwe>)

(GWE)

Hispanic Engineers and Scientists (<http://hes.berkeley.edu>) (HES)

Korean Graduate Student Association (<http://www.kgsa.net/web>) (KGSA)

Latino Association of Graduate Students in Engineering and Science

(<http://lagses.berkeley.edu>) (LAGSES)

Mechanical Engineering Graduate Student Council ([http://](http://best.berkeley.edu/%7Emfuge/megsco/wiki/index.php/Main_Page)

[best.berkeley.edu/%7Emfuge/megsco/wiki/index.php/Main\\_Page](http://best.berkeley.edu/%7Emfuge/megsco/wiki/index.php/Main_Page))

(MEGSCO)

Out in Science, Technology, Engineering, and Mathematics ([http://](http://berkeley.ostem.org)

[berkeley.ostem.org](http://berkeley.ostem.org)) (oSTEM)

Pi Tau Sigma (<http://pts.berkeley.edu>) --The Mechanical Engineering

Honor Society

Pioneers in Engineering (<https://pioneers.berkeley.edu>)

Society of Asian Scientists and Engineers (<http://www.saseconnect.org>)

(SASE)

Society of Naval Architects and Marine Engineers ([http://www.sname.org/](http://www.sname.org/ucb/home)

[ucb/home](http://www.sname.org/ucb/home)) (Cal\_SNAME)

Society of Women Engineers (<http://swe.berkeley.edu>) (SWE)

Super Mileage Vehicle Team (<http://smv.berkeley.edu>) (SMV)

Tau Beta Pi (<https://tbp.berkeley.edu>)

UC Berkeley Solar Vehicle Team (<http://calsol.berkeley.edu>) (CalSol)

## Mechanical Engineering

### MEC ENG 24 Freshman Seminars 1 Unit

Terms offered: Fall 2017, Spring 2017, Fall 2016

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

#### Hours & Format

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

#### Additional Details

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

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

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

### MEC ENG 40 Thermodynamics 3 Units

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

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: Spring 2018, Fall 2017, Summer 2017 10 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 [+]

### 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

**Also listed as:** CIV ENG C30

Introduction to Solid Mechanics: Read Less [-]

## MEC ENG W85 Introduction to Solid Mechanics 3 Units

Terms offered: Summer 2016, Summer 2016 10 Week Session, Summer 2015 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.

### 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: Spring 2018, Fall 2017, Spring 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: Not yet offered

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

**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: Spring 2018, Fall 2017, Spring 2017

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: Spring 2018, Fall 2017, Summer 2017 10 Week Session

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: Spring 2018, Fall 2017, Spring 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: Spring 2018, Fall 2017, Summer 2017 10 Week Session  
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](#) [+]

### 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 2017 10 Week Session, Spring 2017, Summer 2016 10 Week Session

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](#) [+]

### 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](#) [+]

### 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 2016, Spring 2015, Spring 2014

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 130 Design of Planar Machinery 3 Units

Terms offered: Fall 2017, Fall 2016, Fall 2015

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 3 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. Upon completion of this course, students should be able to follow the literature on these subjects and perform independent design, research, and development work in this field.

Vehicle Dynamics and Control: Read More [\[+\]](#)

### Rules & Requirements

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

### Hours & Format

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

### Additional Details

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

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

**Instructor:** Hedrick

Vehicle Dynamics and Control: Read Less [\[-\]](#)

## MEC ENG 132 Dynamic Systems and Feedback 3 Units

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

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 [+]

### 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 [+]

### 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: Spring 2018, Fall 2017, Spring 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 2017, Fall 1998, Fall 1996

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 2016, Fall 2015, Fall 2014

Fundamentals of combustion, flame structure, flame speed, flammability, ignition, stirred reaction, kinetics and nonequilibrium processes, pollutant formation. Application to engines, energy production and fire safety. 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: Spring 2018, Fall 2016, Spring 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: Spring 2017, Spring 2014, Spring 2008

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 163 Engineering Aerodynamics 3 Units

Terms offered: Fall 2016, Fall 2014, Fall 2013

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 buckling.

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 2017, Fall 2015, Fall 2014

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, Tongue

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.

Fundamentals of Acoustics: Read Less [-]

## MEC ENG 175 Intermediate Dynamics 3 Units

Terms offered: Fall 2017, Fall 2016, Fall 2015

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 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 and 1-2 hours of laboratory 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 2017, Fall 2016, Fall 2015

Kinematics of deformation, the concept of stress, conservation of mass and balance of linear momentum, angular momentum and energy. Mechanical constitutive equations for ideal fluid, linear elastic solid. Introduction to Continuum Mechanics: Read More [\[+\]](#)

### Rules & Requirements

**Prerequisites:** Physics 7A; Mathematics 53, 54

### Hours & Format

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

### Additional Details

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

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

Introduction to Continuum Mechanics: Read Less [\[-\]](#)

## MEC ENG 190K Professional Communication for Mechanical Engineers 1 Unit

Terms offered: Prior to 2007

The course emphasizes understanding of and performance in professional speaking situations, including presentations, meetings, interviews, and informal business conversations. It emphasizes collaborative projects with distance partners. It combines theory and practice, integrating extensive speaking practice and individual critiques from instructor and students. The purpose is to advance students' ability to collaborate and communicate effectively in a variety of professional environments.

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

### 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.

Professional Communication for Mechanical Engineers: 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 191AC Cases and Conflicts in Engineering Ethics 3 Units

Terms offered: Summer 2011 10 Week Session, Summer 2011 8 Week Session

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

Cases and Conflicts in Engineering Ethics: Read More [+]

### Hours & Format

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

### Additional Details

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

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

Cases and Conflicts in Engineering Ethics: Read Less [-]

## MEC ENG 191K Professional Communication 3 Units

Terms offered: Spring 2018, Fall 2017, Summer 2017 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.

### **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: Prior to 2007

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.

### **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: Spring 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.

### 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.

### 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.

### 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.

### 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.

### 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.

### 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.

### **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.

### **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.

### 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.

### 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.

### 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.

### 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 2017, Spring 2017, Fall 2016

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.

### 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 2017, Summer 2016 8 Week Session, Spring 2016  
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.

#### **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 [\[-\]](#)