Engineering Mathematics and Statistics

Bachelor of Science (BS)
The Engineering Mathematics and Statistics major offered through the Engineering Science Program offers students an opportunity to study pure and applied mathematics as essential components of modern engineering. By combining courses in pure mathematics, applied mathematics, statistics, the physical sciences, and engineering, a student may individualize a program of study, of theory, or of applications of both. It provides a broad foundation for graduate studies in theoretical branches of engineering, as well as in mathematics, and can prepare students for a career in specific sectors of industry or business.

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 Science degree programs via a Change of College application for current UC Berkeley students is competitive as there are few — if any — spaces available in this major for students admitted to other colleges at UC Berkeley. For further information regarding a Change to College of Engineering, please see the College’s website (http://coe.berkeley.edu/students/current-undergraduates/change-of-college/).

Minor Program
There is no minor program in Engineering Mathematics and Statistics.

Other Majors offered by the Engineering Science Program
Energy Engineering (http://guide.berkeley.edu/undergraduate/degree-programs/energy-engineering/) (Major and Minor)
Engineering Physics (http://guide.berkeley.edu/undergraduate/degree-programs/engineering-physics/) (Major)
Environmental Engineering Science (http://guide.berkeley.edu/undergraduate/degree-programs/environmental-engineering-science/) (Major)

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

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

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

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

Lower Division Major Requirements

<table>
<thead>
<tr>
<th>Course</th>
<th>Description</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 1A</td>
<td>Calculus</td>
<td>4</td>
</tr>
<tr>
<td>MATH 1B</td>
<td>Calculus</td>
<td>4</td>
</tr>
<tr>
<td>MATH 53</td>
<td>Multivariable Calculus</td>
<td>4</td>
</tr>
<tr>
<td>MATH 54</td>
<td>Linear Algebra and Differential Equations</td>
<td>4</td>
</tr>
<tr>
<td>CHEM 4A</td>
<td>General Chemistry and Quantitative Analysis</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>or CHEM 1A General Chemistry</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&amp; 1AL and General Chemistry Laboratory</td>
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</tr>
<tr>
<td>PHYSICS 7A</td>
<td>Physics for Scientists and Engineers</td>
<td>4</td>
</tr>
<tr>
<td>PHYSICS 7B</td>
<td>Physics for Scientists and Engineers</td>
<td>4</td>
</tr>
<tr>
<td>PHYSICS 7C</td>
<td>Physics for Scientists and Engineers</td>
<td>4</td>
</tr>
<tr>
<td>ENGIN 7</td>
<td>Introduction to Computer Programming for Scientists and Engineers</td>
<td>4</td>
</tr>
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</table>

or COMPSCI 6 The Structure and Interpretation of Computer Programs

<table>
<thead>
<tr>
<th>Course</th>
<th>Description</th>
<th>Units</th>
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</thead>
<tbody>
<tr>
<td>ENGIN 177</td>
<td>Advanced Programming with MATLAB</td>
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<tr>
<td>or COMPSCI 6 Data Structures</td>
<td></td>
<td></td>
</tr>
<tr>
<td>or COMPSCI 6 Data Structures and Programming Methodology</td>
<td></td>
<td></td>
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</tbody>
</table>

Lower division technical electives
Select two from the following:

COMPSCI C8 Foundations of Data Science [4]
COMPSCI 61A The Structure and Interpretation of Computer Programs [4]
COMPSCI 61A The Structure and Interpretation of Computer Programs [4]
COMPSCI 61B Data Structures [4]
COMPSCI Machine Structures (Lab-Centric) [4]
EECS 16A Designing Information Devices and Systems I [4]
EECS 16B Designing Information Devices and Systems II [4]
ENGIN 7 Introduction to Computer Programming for Scientists and Engineers [4]
ENGIN 29 Manufacturing and Design Communication [4]
MAT SCI 45 Properties of Materials & 45L and Properties of Materials Laboratory
MATH 55 Discrete Mathematics
MEC ENGI C85/ CIV ENG C30 Introduction to Solid Mechanics [3]

1 CHEM 4A is intended for students majoring in chemistry or a closely-related field.
2 Other courses may be used if approved by a faculty adviser.
3 This course may only be used as a lower division technical elective if not being used to satisfy other requirements above.
Upper Division Requirements

Due to the interdisciplinary nature of this major, electives must be selected and approved in consultation with a faculty adviser.

**Upper Division Requirements**

Due to the interdisciplinary nature of this major, electives must be selected and approved in consultation with a faculty adviser.

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
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</thead>
<tbody>
<tr>
<td>MATH 110</td>
<td>Linear Algebra</td>
<td>4</td>
</tr>
<tr>
<td>MATH 104</td>
<td>Introduction to Analysis</td>
<td>4</td>
</tr>
<tr>
<td>MATH 105</td>
<td>Second Course in Analysis</td>
<td>4</td>
</tr>
<tr>
<td>or MATH 185</td>
<td>Introduction to Complex Analysis</td>
<td>4</td>
</tr>
<tr>
<td>MATH 128A</td>
<td>Numerical Analysis</td>
<td>4</td>
</tr>
<tr>
<td>STAT 134</td>
<td>Concepts of Probability</td>
<td>4</td>
</tr>
<tr>
<td>or EECS 126</td>
<td>Probability and Random Processes</td>
<td></td>
</tr>
<tr>
<td>or STAT 140</td>
<td>Probability for Data Science</td>
<td></td>
</tr>
<tr>
<td>or IND ENG 172</td>
<td>Probability and Risk Analysis for Engineers</td>
<td></td>
</tr>
</tbody>
</table>

Select three math/statistics technical electives: 10-12

Select one course in mathematics, one course in statistics, and one course from either, from the following:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
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</thead>
<tbody>
<tr>
<td>MATH H104</td>
<td>Honors Introduction to Analysis</td>
<td>4</td>
</tr>
<tr>
<td>MATH 105</td>
<td>Second Course in Analysis</td>
<td>4</td>
</tr>
<tr>
<td>MATH H113</td>
<td>Honors Introduction to Abstract Algebra</td>
<td>4</td>
</tr>
<tr>
<td>MATH 113</td>
<td>Introduction to Abstract Algebra</td>
<td>4</td>
</tr>
<tr>
<td>MATH 114</td>
<td>Second Course in Abstract Algebra</td>
<td>4</td>
</tr>
<tr>
<td>MATH 115</td>
<td>Introduction to Number Theory</td>
<td>4</td>
</tr>
<tr>
<td>MATH 116</td>
<td>Cryptography</td>
<td>4</td>
</tr>
<tr>
<td>MATH 118</td>
<td>Fourier Analysis, Wavelets, and Signal Processing</td>
<td>4</td>
</tr>
<tr>
<td>MATH 121A</td>
<td>Mathematical Tools for the Physical Sciences</td>
<td>4</td>
</tr>
<tr>
<td>MATH 121B</td>
<td>Mathematical Tools for the Physical Sciences</td>
<td>4</td>
</tr>
<tr>
<td>MATH 123</td>
<td>Ordinary Differential Equations</td>
<td>4</td>
</tr>
<tr>
<td>MATH 124</td>
<td>Programming for Mathematical Applications</td>
<td>4</td>
</tr>
<tr>
<td>MATH 126</td>
<td>Introduction to Partial Differential Equations</td>
<td>4</td>
</tr>
<tr>
<td>MATH 127</td>
<td>Mathematical and Computational Methods in Molecular Biology</td>
<td>4</td>
</tr>
<tr>
<td>MATH 128B</td>
<td>Numerical Analysis</td>
<td>4</td>
</tr>
<tr>
<td>MATH 130</td>
<td>Groups and Geometries</td>
<td>4</td>
</tr>
<tr>
<td>MATH 136</td>
<td>Incompleteness and Undecidability</td>
<td>4</td>
</tr>
<tr>
<td>MATH 140</td>
<td>Metric Differential Geometry</td>
<td>4</td>
</tr>
<tr>
<td>MATH 141</td>
<td>Elementary Differential Topology</td>
<td>4</td>
</tr>
<tr>
<td>MATH 142</td>
<td>Elementary Algebraic Topology</td>
<td>4</td>
</tr>
<tr>
<td>MATH 143</td>
<td>Elementary Algebraic Geometry</td>
<td>4</td>
</tr>
<tr>
<td>MATH 151</td>
<td>Mathematics of the Secondary School Curriculum I</td>
<td>4</td>
</tr>
<tr>
<td>MATH 152</td>
<td>Mathematics of the Secondary School Curriculum II</td>
<td>4</td>
</tr>
<tr>
<td>MATH 170</td>
<td>Mathematical Methods for Optimization</td>
<td>4</td>
</tr>
<tr>
<td>MATH 172</td>
<td>Combinatorics</td>
<td>4</td>
</tr>
<tr>
<td>MATH H185</td>
<td>Honors Introduction to Complex Analysis</td>
<td>4</td>
</tr>
<tr>
<td>MATH 185</td>
<td>Introduction to Complex Analysis</td>
<td>4</td>
</tr>
<tr>
<td>MATH 189</td>
<td>Mathematical Methods in Classical and Quantum Mechanics</td>
<td>4</td>
</tr>
<tr>
<td>ENGIN 117</td>
<td>Methods of Engineering Analysis</td>
<td>3</td>
</tr>
<tr>
<td>STAT 135</td>
<td>Concepts of Statistics</td>
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</tr>
<tr>
<td>STAT 150</td>
<td>Stochastic Processes</td>
<td>3</td>
</tr>
<tr>
<td>STAT 151A</td>
<td>Linear Modelling: Theory and Applications</td>
<td>4</td>
</tr>
<tr>
<td>STAT 152</td>
<td>Sampling Surveys</td>
<td>4</td>
</tr>
<tr>
<td>STAT 153</td>
<td>Introduction to Time Series</td>
<td>4</td>
</tr>
<tr>
<td>STAT 154</td>
<td>Modern Statistical Prediction and Machine Learning</td>
<td>4</td>
</tr>
<tr>
<td>STAT 157</td>
<td>Seminar on Topics in Probability and Statistics</td>
<td>3</td>
</tr>
<tr>
<td>STAT 158</td>
<td>The Design and Analysis of Experiments</td>
<td>4</td>
</tr>
</tbody>
</table>

Additional upper division technical electives: select 16 units of upper division engineering courses, in consultation with faculty adviser.

1. Technical electives must include 16 units of upper division engineering courses, selected in consultation with the student's faculty adviser, in order to provide depth in an area of engineering with high mathematical content—typically, most of these courses will come from a single engineering department, but courses that complement each other from different departments are also permissible. Engineering courses cannot include: any course taken on a P/NP basis; BIO ENG 100, DES INV courses (except DES INV 190E), ENGIN 125, ENGIN 157AC, ENGIN 180, ENGIN 185, ENGIN 187, IND ENG 172, IND ENG 185, IND ENG 186, IND ENG 190 series, IND ENG 191, IND ENG 192, IND ENG 195, MEC ENG 190K, 191AC, 191K. Graded research units (such as H194 or 196) are reviewed on a case by case basis and may be petitioned.

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 ([https://engineering.berkeley.edu/students/undergraduate-guide/degree-requirements/major-programs/](https://engineering.berkeley.edu/students/undergraduate-guide/degree-requirements/major-programs/)) 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) that can fulfill requirements for the student's major 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 five semesters to complete their degree requirements. Summer terms are optional and do not count toward the maximum. Students are responsible for planning and satisfactorily completing all graduation requirements within the maximum allowable semesters.
6. Adhere to all college policies and procedures ([http://engineering.berkeley.edu/academics/undergraduate-guide/](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 Sciences (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/](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://engineering.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). The first half (R&C Part A) must be completed by the end of the freshman year; the second half (R&C Part B) must be completed by no later than the end of the sophomore year. Please see the Reading and Composition Requirement (http://guide.berkeley.edu/undergraduate/colleges-schools/engineering/reading-composition-requirement/) page for a complete list of R&C courses available and a list of exams that can be applied toward the R&C Part A requirement. Students can also use the Class Schedule (https://classes.berkeley.edu/) to view R&C courses offered in a given semester. Note: Only R&C Part A can be fulfilled with an AP, IB, or A-Level exam score. Test scores do not fulfill R&C Part B for College of Engineering students.
4. The four additional courses must be chosen from the five areas listed in #13 below. These four courses may be taken on a pass/no pass basis.
5. Special topics courses of 3 semester units or more will be reviewed on a case-by-case basis.
6. Two of the six courses must be upper division (courses numbered 100-196).
7. One of the six courses must satisfy the campus American Cultures (http://guide.berkeley.edu/undergraduate/colleges-schools/engineering/american-cultures-requirement/) (AC) requirement. Note that any American Cultures course of 3 units or more may be used to meet H/SS.
8. A maximum of two exams (Advanced Placement, International Baccalaureate, or A-Level) may be used toward completion of the H/SS requirement. View the list of exams (http://engineering.berkeley.edu/academics/undergraduate-guide/exams/) that can be applied toward H/SS requirements.
9. No courses offered by any engineering department other than BIO ENG 100, COMPSCI C79, ENGIN 125, ENGIN 157AC, ENGIN 185, and MEC ENG 191K may be used to complete H/SS requirements.
10. Language courses may be used to complete H/SS requirements. View the list of language options (http://guide.berkeley.edu/undergraduate/colleges-schools/engineering/approved-foreign-language-courses/).
11. Courses may fulfill multiple categories. For example, CY PLAN 118AC satisfies both the American Cultures requirement and one upper division H/SS requirement.
12. Courses numbered 97, 98, 99, or above 196 may not be used to complete any H/SS requirement.
13. 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. The five areas are:
   - Arts and Literature
   - Historical Studies
   - International Studies

Within the guidelines above, choose courses from any of the Breadth areas listed above. (Please note that you cannot use courses on the Biological Science or Physical Science Breadth list to complete the H/SS requirement.) To find course options, go to the Class Schedule (http://engineering.berkeley.edu/), (http://classes.berkeley.edu/search/class) select the term of interest, and use the Breadth Requirements filter.

Class Schedule Requirements

- Minimum units per semester: 12.0
- Maximum units per semester: 20.5
- Minimum technical courses: College of Engineering undergraduates must include at least two letter graded technical courses (of at least 3 units each) in their semester program. Every semester students are expected to make satisfactory progress in their declared major. Satisfactory progress is determined by the student’s Engineering Student Services Advisor. (Note: For most majors, normal progress (https://engineering.berkeley.edu/academics/undergraduate-guide/policies-procedures/scholarship-progress/#ac12282) will require enrolling in 3-4 technical courses each semester). Students who are not in compliance with this policy by the end of the fifth week of the semester are subject to a registration block that will delay enrollment for the following semester.
- All technical courses (math, science, engineering) that satisfy requirements for the major must be taken on a letter-graded basis (unless only offered as P/NP).

Minimum Academic (Grade) Requirements

- Minimum overall and semester grade point averages of 2.00 (C average) are required of engineering undergraduates. Students will be subject to dismissal from the University if during any fall or spring semester their overall UC GPA falls below a 2.00, or their semester GPA is less than 2.00.
- Students must achieve a minimum grade point average of 2.00 (C average) in upper division technical courses required for the major curriculum each semester.
- A minimum overall grade point average of 2.00 and a minimum 2.00 grade point average in upper division technical course work required for the major are required to earn a Bachelor of Science in the College of 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 (https://engineering.berkeley.edu/academics/undergraduate-guide/degree-requirements/major-programs/) of study.
- A maximum of 16 units of special studies coursework (courses numbered 97, 98, 99, 197, 198, or 199) is allowed to count towards the B.S. degree, and no more than 4 units in any single term can be counted.
- A maximum of 4 units of physical education from any school attended will count towards the 120 units.
- Passed (P) grades may account for no more than one third of the total units completed at UC Berkeley, Fall Program for Freshmen (FPF), UC Education Abroad Program (UCEAP), or UC Berkeley...
Washington Program (UCDC) toward the 120 overall minimum unit requirement. Transfer credit is not factored into the limit. This includes transfer units from outside of the UC system, other UC campuses, credit-bearing exams, as well as UC Berkeley Extension XB units.

**Normal Progress**

Students in the College of Engineering must enroll in a full-time program and make normal progress (https://engineering.berkeley.edu/students/undergraduate-guide/policies-procedures/scholarship-progress/#ac12282) each semester toward the bachelor's degree. The continued enrollment of students who fail to achieve minimum academic progress shall be subject to the approval of the dean. (Note: Students with official accommodations established by the Disabled Students' Program, with health or family issues, or with other reasons deemed appropriate by the dean may petition for an exception to normal progress rules.)

**University of California Requirements**

Entry Level Writing (https://www.ucop.edu/elwr/)

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

American History and American Institutions (http://guide.berkeley.edu/undergraduate/education/#universityrequirementstext)

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

**Campus Requirement**

American Cultures (http://guide.berkeley.edu/undergraduate/education/#campusrequirementstext)

The American Cultures requirement is a Berkeley campus requirement, one that all undergraduate students at Berkeley need to pass in order to graduate. You satisfy the requirement by passing, with a grade not lower than C- or P, an American Cultures course. You may take an American Cultures course anytime during your undergraduate career at Berkeley. The requirement was instituted in 1991 to introduce students to the diverse cultures of the United States through a comparative framework. Courses are offered in more than fifty departments in many different disciplines at both the lower and upper division level.

The American Cultures requirement and courses constitute an approach that responds directly to the problem encountered in numerous disciplines of how better to present the diversity of American experience to the diversity of American students whom we now educate.

Faculty members from many departments teach American Cultures courses, but all courses have a common framework. The courses focus on themes or issues in United States history, society, or culture; address theoretical or analytical issues relevant to understanding race, culture, and ethnicity in American society; take substantial account of groups drawn from at least three of the following: African Americans, indigenous peoples of the United States, Asian Americans, Chicano/ Latino Americans, and European Americans; and are integrative and comparative in that students study each group in the larger context of American society, history, or culture.

This is not an ethnic studies requirement, nor a Third World cultures requirement, nor an adjusted Western civilization requirement. These courses focus upon how the diversity of America's constituent cultural traditions have shaped and continue to shape American identity and experience.

Visit the Class Schedule (http://classes.berkeley.edu/) or the American Cultures website (http://americancultures.berkeley.edu/) for the specific American Cultures courses offered each semester. For a complete list of approved American Cultures courses at UC Berkeley and California Community Colleges, please see the American Cultures Subcommittee's website (https://academic-senate.berkeley.edu/committees/amcult/). See your academic advisor if you have questions about your responsibility to satisfy the American Cultures breadth requirement.

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.

**Entry Level Writing**

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<thead>
<tr>
<th>Course</th>
<th>Fall Units</th>
<th>Spring Units</th>
</tr>
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<tbody>
<tr>
<td>CHEM 4A or 1A and 1AL</td>
<td>5 MATH 1B</td>
<td>4</td>
</tr>
<tr>
<td>MATH 1A</td>
<td>4 PHYSICS 7A</td>
<td>4</td>
</tr>
<tr>
<td>Reading &amp; Composition Part A Course</td>
<td>4 ENGIN 7 or COMPSCI 61A</td>
<td></td>
</tr>
<tr>
<td>Humanities/Social Sciences Course</td>
<td>3-4 First Lower Division Technical Elective</td>
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<table>
<thead>
<tr>
<th>Freshman</th>
<th>16-17</th>
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<tbody>
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<td>15-16</td>
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**First Lower Division Technical Elective**

<table>
<thead>
<tr>
<th>Course</th>
<th>Fall Units</th>
<th>Spring Units</th>
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<tr>
<td>MATH 53</td>
<td>4 MATH 54</td>
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<tr>
<td>PHYSICS 7B</td>
<td>4 PHYSICS 7C</td>
<td>4</td>
</tr>
<tr>
<td>Second Lower Division Technical Elective</td>
<td>3-4 ENGIN 177, COMPSCI 61B, or COMPSCI 61BL</td>
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</tr>
<tr>
<td>Reading &amp; Composition Part B Course</td>
<td>4 Humanities/ Social Sciences Course</td>
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<table>
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<tr>
<th>Sophomore</th>
<th>15-16</th>
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<td>14-16</td>
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**Second Lower Division Technical Elective**

<table>
<thead>
<tr>
<th>Course</th>
<th>Fall Units</th>
<th>Spring Units</th>
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<tbody>
<tr>
<td>MATH 104</td>
<td>4 MATH 105 or 185</td>
<td>4</td>
</tr>
<tr>
<td>MATH 110</td>
<td>4 MATH 128A</td>
<td>4</td>
</tr>
<tr>
<td>STAT 134, EECS 126, IND ENG 172, or STAT 140</td>
<td>4 Upper Division Technical Elective</td>
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</tr>
<tr>
<td>Humanities/Social Science Course</td>
<td>3-4 Humanities/ Social Science Course</td>
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<table>
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<tr>
<th>Junior</th>
<th>15-16</th>
</tr>
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<tbody>
<tr>
<td>15-16</td>
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**Third Lower Division Technical Elective**

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<thead>
<tr>
<th>Course</th>
<th>Fall Units</th>
<th>Spring Units</th>
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</thead>
<tbody>
<tr>
<td>MATH 105</td>
<td>4 MATH 105 or 185</td>
<td>4</td>
</tr>
<tr>
<td>MATH 110</td>
<td>4 MATH 128A</td>
<td>4</td>
</tr>
<tr>
<td>STAT 134, EECS 126, IND ENG 172, or STAT 140</td>
<td>4 Upper Division Technical Elective</td>
<td></td>
</tr>
<tr>
<td>Humanities/Social Science Course</td>
<td>3-4 Humanities/ Social Science Course</td>
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<th>Senior</th>
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ENGIN 1 Engineering Your Life: Skills for Leadership, Discovery and Service 1 Unit

Terms offered: Spring 2020

This course provides the framework for engineering an empowered life through leadership, discovery and service. The class focuses on development of self, emotional intelligence, strategic thinking, problem solving, teamwork, diversity, and service learning. Skills include developing self-awareness; understanding our unique strengths; debunking the imposter syndrome; creating plans of action and setting goals; giving and receiving assessments; interpreting body language; managing time and life-balance; and creating mission statements.

Teamwork skills include methods for inspiring others; variations in leadership styles and team dynamics; rhythm of action for projects and teams; difficult conversations and conflict resolution; mechanisms. Engineering Your Life: Skills for Leadership, Discovery and Service: Read More [+]

Objectives & Outcomes

Course Objectives: This course offers the requisite framework for engineering an empowered life. The course provides students with requisite skills for authentic leadership, self-discovery and societal service. These attributes are in alignment with the mission of the College of Engineering and the Berkeley campus.

Student Learning Outcomes: Students will learn how to assess personal strengths, implement plans of action and develop mission statements. Students will learn how to optimize their knowledge with assessment of learning styles along with key communication tools necessary for conflict resolution and inspiration of others (teamwork). Through a series of active exercises and self-reflection activities the students will learn requisite skills for self-discovery and the creation of a personal leadership plan.

Rules & Requirements

Prerequisites: Designed for engineering freshmen, the class is open to all students in the College of Engineering or by permission of instructor.

Hours & Format

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

Additional Details

Subject/Course Level: Engineering/Undergraduate

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

Instructor: Pruitt

Engineering Your Life: Skills for Leadership, Discovery and Service: Read Less [-]
ENGIN 7 Introduction to Computer Programming for Scientists and Engineers 4 Units
Terms offered: Fall 2020, Summer 2020 10 Week Session, Spring 2020
Elements of procedural and object-oriented programming. Induction, iteration, and recursion. Real functions and floating-point computations for engineering analysis. Introduction to data structures. Representative examples are drawn from mathematics, science, and engineering. The course uses the MATLAB programming language. Sponsoring departments: Civil and Environmental Engineering and Mechanical Engineering.
Introduction to Computer Programming for Scientists and Engineers:
Read More [+]

Rules & Requirements

Prerequisites: MATH 1B (may be taken concurrently)

Credit Restrictions: Students will receive no credit for Engineering 7 after completing Engineering W7. A deficient grade in Engineering W7 may be repeated by taking Engineering 7.

Hours & Format

Fall and/or spring: 15 weeks - 2 hours of lecture, 1 hour of discussion, and 4 hours of laboratory per week

Summer: 10 weeks - 3 hours of lecture, 1.5 hours of discussion, and 6 hours of laboratory per week

Additional Details

Subject/Course Level: Engineering/Undergraduate

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

Formerly known as: 77

Introduction to Computer Programming for Scientists and Engineers:
Read Less [-]

ENGIN W7 Introduction to Computer Programming for Scientists and Engineers 4 Units
Terms offered: Summer 2016 10 Week Session, Summer 2015 10 Week Session, Summer 2014 10 Week Session
Elements of procedural and object-oriented programming. Induction, iteration, and recursion. Real functions and floating-point computations for engineering analysis. Introduction to data structures. Representative examples are drawn from mathematics, science, and engineering. The course uses the MATLAB programming language.
Introduction to Computer Programming for Scientists and Engineers:
Read More [+]

Rules & Requirements

Prerequisites: MATH 1B (may be taken concurrently)

Credit Restrictions: Students will receive no credit for Engineering W7 after completing Engineering 7 or 77. A deficient grade in Engineering 7 or 77 may be removed by taking Engineering W7.

Hours & Format

Fall and/or spring: 15 weeks - 2 hours of web-based lecture, 4 hours of laboratory, and 1 hour of web-based discussion per week

Summer: 10 weeks - 6 hours of web-based lecture, 0 hours of laboratory, and 7.5 hours of web-based discussion per week

Online: This is an online course.

Additional Details

Subject/Course Level: Engineering/Undergraduate

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

Instructor: Papadopoulos

Introduction to Computer Programming for Scientists and Engineers:
Read Less [-]
ENGIN 11 A Hands-on Introduction to Radiation Detection: Getting to know our Radioactive World 3 Units
Terms offered: Fall 2020, Fall 2019, Spring 2007
Introduction to basic concepts in radiation detection and radioactivity, electrical circuits, and data analytics. Lectures provide the theoretical foundation of the work being performed in the accompanying laboratory. The course will contain three sections: introduction to how radiation interacts with matter and radiation detection technologies; development of the tools (mathematical and computational) needed for analyzing various types of radiation and environmental data; and building of a basic radiation sensor system.

A Hands-on Introduction to Radiation Detection: Getting to know our Radioactive World: Read More [+]

Objectives & Outcomes

Course Objectives: The course is suitable for Nuclear Engineering students, other Engineering majors, and any students interested in gaining a general understanding of radiation detection.

The focus of this course will be on the application of the nuclear science, radiation detection, and data analysis concepts covered to the building of a multi-sensor radiation detection system, following a template for the required data acquisition software and circuit integration.

Fieldwork related to a chosen research topic will be carried out in small groups, with group oral presentations and final reports. Students will be introduced to research opportunities on campus and at nearby lab facilities through tours of lab spaces throughout the department and field trips to LBNL and LLNL.

Students will be introduced to core concepts in nuclear science, statistical analysis, and computation, while being given practical experience applying those concepts to radiation detection and data analysis. The objective of this course is to provide Freshman and Sophomore students with an introduction to the fundamentals of nuclear radiation and radiation detection through a hands-on approach.

Student Learning Outcomes: Be able to outline and carry out a research project, prepare written and oral presentations of that work, and demonstrate how the sensors they built work.

By the end of this course, students should be able to:

- Identify types of radioactivity, radiation detection methods and sources of environmental radiation,
- Create simple circuit designs making use of standard circuit components, demonstrate basic soldering skills, and demonstrate a familiarity with printed circuit board design tools,
- Make use of software tools including the Python programming language, version control with git, and shell environments,
- Perform statistical analysis of large data sets and quantify statistical and systematic uncertainties in experimental data.

Rules & Requirements

Credit Restrictions: Students will receive no credit for ENGIN 11 after completing ENGIN 11. A deficient grade in ENGIN 11 may be removed by taking ENGIN 11.

Hours & Format

Fall and/or spring: 15 weeks - 1.5 hours of lecture and 2 hours of laboratory per week

Additional Details

Subject/Course Level: Engineering/Undergraduate

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

ENGIN 24 Freshman Seminar 1 Unit
Terms offered: Spring 2012, Fall 2011, Fall 2008
The Berkeley Seminar Program is designed to provide students with the opportunity to explore an intellectual topic with a faculty member in a small seminar setting. Berkeley Seminars are offered in all college departments, and topics vary from department to department and semester to semester.

Freshman Seminar: Read More [+]

Rules & Requirements

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

Hours & Format

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

Additional Details

Subject/Course Level: Engineering/Undergraduate

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

Freshman Seminar: Read Less [-]
**ENGIN 25 Visualization for Design 2 Units**

Terms offered: Fall 2020, Spring 2020, Fall 2019

Development of 3-dimensional visualization skills for engineering design. Sketching as a tool for design communication. Presentation of 3-dimensional geometry with 2-dimensional engineering drawings. This course will introduce the use of 2-dimensional CAD on computer workstations as a major graphical analysis and design tool. A group design project is required. Teamwork and effective communication are emphasized.

**Objectives & Outcomes**

**Course Objectives:**
- Improve 3-dimensional visualization skills; enable a student to create and understand engineering drawings; introduce 2-dimensional computer-aided geometry modeling as a visualization, design, and analysis tool; enhance critical thinking and design skills; emphasize communication skills, both written and oral; develop teamwork skills; offer experience in hands-on engineering projects; develop early abilities in identifying, formulating, and solving engineering problems; introduce students to the societal context of engineering practice.

**Student Learning Outcomes:**
- Upon completion of the course, students shall be able to communicate 3-dimensional geometry effectively using sketches; operate 2-dimensional CAD software with a high degree of skill and confidence; understand and create engineering drawings; visualize 3-dimensional geometry from a series of 2-dimensional drawings.

**Hours & Format**
- Fall and/or spring: 15 weeks - 1 hour of lecture and 2 hours of laboratory per week

**Additional Details**
- Subject/Course Level: Engineering/Undergraduate
- Grading/Final exam status: Letter grade. Final exam required.
- Instructors: Lieu, McMains

**ENGIN 26 Three-Dimensional Modeling for Design 2 Units**

Terms offered: Fall 2020, Spring 2020, Fall 2019

Three-dimensional modeling for engineering design. This course will emphasize the use of CAD on computer workstations as a major graphical analysis and design tool. Students develop design skills, and practice applying these skills. A group design project is required. Hands-on creativity, teamwork, and effective communication are emphasized.

**Objectives & Outcomes**

**Course Objectives:**
- Introduce computer-based solid, parametric, and assembly modeling as a tool for engineering design; enhance critical thinking and design skills; emphasize communication skills, both written and oral; develop teamwork skills; offer experience in hands-on, creative engineering projects; reinforce the societal context of engineering practice; develop early abilities in identifying, formulating, and solving engineering problems.

**Student Learning Outcomes:**
- Upon completion of the course, students shall be able to operate 3-dimensional solid modeling software tools with a high degree of skill and confidence; specify dimensions for parts and assemblies such that they can be fabricated, and fit such that they function with the desired result; produce rapid-prototype models of parts and assemblies to demonstrate their desired functionality; understand the design of systems, components, and processes to meet desired needs within realistic constraints.

**Hours & Format**
- Fall and/or spring: 15 weeks - 1 hour of lecture and 2 hours of laboratory per week

**Additional Details**
- Subject/Course Level: Engineering/Undergraduate
- Grading/Final exam status: Letter grade. Final exam required.
- Instructors: Lieu, McMains, Youssefi
ENGIN 27 Introduction to Manufacturing and Tolerancing 2 Units
Terms offered: Fall 2020, Summer 2020 10 Week Session, Spring 2020
Geometric dimensioning and tolerancing (GD&T), tolerance analysis for fabrication, fundamentals of manufacturing processes (metal cutting, welding, joining, casting, molding, and layered manufacturing).
Introduction to Manufacturing and Tolerancing: Read More [+]

Objectives & Outcomes

Course Objectives: Enable a student to create and understand tolerances in engineering drawings; enhance critical thinking and design skills; emphasize communication skills, both written and oral; offer hands-on experience in manufacturing; develop abilities in identifying, formulating, and solving engineering problems; introduce students to the context of engineering practice.

Student Learning Outcomes: Upon completion of the course, students shall be able to fabricate basic parts in the machine shop; understand and communicate tolerance requirements in engineering drawings using industry standard GD&T; use metrology tools to evaluate if physical parts are within specified tolerances; demonstrate familiarity with manufacturing processes; and design parts that can be fabricated realistically and economically using these processes.

Rules & Requirements

Prerequisites: ENGIN 25 (may be taken concurrently)

Hours & Format

Fall and/or spring: 15 weeks - 1 hour of lecture and 2 hours of laboratory per week
Summer: 10 weeks - 1.5 hours of lecture and 3 hours of laboratory per week

Additional Details

Subject/Course Level: Engineering/Undergraduate

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

Instructors: McMains, Lieu, Taylor

Introduction to Manufacturing and Tolerancing: Read Less [-]

ENGIN 29 Manufacturing and Design Communication 4 Units
Terms offered: Not yet offered
An introduction to manufacturing process technologies and the ways in which dimensional requirements for manufactured objects are precisely communicated, especially through graphical means. Fundamentals of cutting, casting, molding, additive manufacturing, and joining processes are introduced. Geometric dimensioning and tolerancing (GD&T), tolerance analysis for fabrication, concepts of process variability, and metrology techniques are introduced and practiced. 3-D visualization skills for engineering design are developed via sketching and presentation of 3-D geometries with 2-D engineering drawings. Computer-aided design software is used. Teamwork and effective communication are emphasized through lab activities and a design project.
Manufacturing and Design Communication: Read More [+]

Objectives & Outcomes

Course Objectives: Develop early abilities in identifying, formulating, and solving engineering problems. Emphasize communication skills, both written and oral; develop teamwork skills. Enable a student to create and understand tolerances in engineering drawings. Enhance critical thinking and design skills. Improve 3-dimensional visualization skills; enable a student to create and understand engineering drawings. Introduce 2-dimensional computer-aided geometry modeling as a visualization, design, and analysis tool. Introduce students to the societal context of engineering practice. Offer an experience in hands-on engineering projects.

Student Learning Outcomes: A knowledge of contemporary issues. A recognition of the need for, and an ability to engage in life-long learning. An ability to apply knowledge of mathematics, science, and engineering. An ability to communicate effectively. 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. An ability to design and conduct experiments, as well as to analyze and interpret data. An ability to identify, formulate, and solve engineering problems. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice. An understanding of professional and ethical responsibility.

Rules & Requirements

Prerequisites: ENGIN 26 or equivalent experience in three-dimensional solid modeling (e.g. Solidworks, Fusion 360) is recommended

Hours & Format

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

Additional Details

Subject/Course Level: Engineering/Undergraduate

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

Instructors: Taylor, Hayden, McMains, Sarah, Stuart, Hannah

Manufacturing and Design Communication: Read Less [-]
ENGIN 39B Freshman/Sophomore Seminar
1.5 - 4 Units
Terms offered: Spring 2010, Spring 2009, Spring 2008
Freshman and sophomore seminars offer lower division students the opportunity to explore an intellectual topic with a faculty member and a group of peers in a small-seminar setting. These seminars are offered in all campus departments; topics vary from department to department and from semester to semester. Enrollment limits are set by the faculty, but the suggested limit is 25.
Freshman/Sophomore Seminar: Read More [+]
Rules & Requirements
Repeat rules: Course may be repeated for credit without restriction.
Hours & Format
Fall and/or spring: 15 weeks - 1.5-4 hours of seminar per week
Additional Details
Subject/Course Level: Engineering/Undergraduate
Grading/Final exam status: The grading option will be decided by the instructor when the class is offered. Final exam required.
Freshman/Sophomore Seminar: Read Less [-]

ENGIN 39E Freshman/Sophomore Seminar
1.5 - 4 Units
Terms offered: Spring 2010, Spring 2009, Spring 2008
Freshman and sophomore seminars offer lower division students the opportunity to explore an intellectual topic with a faculty member and a group of peers in a small-seminar setting. These seminars are offered in all campus departments; topics vary from department to department and from semester to semester. Enrollment limits are set by the faculty, but the suggested limit is 25.
Freshman/Sophomore Seminar: Read More [+]
Rules & Requirements
Repeat rules: Course may be repeated for credit without restriction.
Hours & Format
Fall and/or spring: 15 weeks - 1.5-4 hours of seminar per week
Additional Details
Subject/Course Level: Engineering/Undergraduate
Grading/Final exam status: The grading option will be decided by the instructor when the class is offered. Final exam required.
Freshman/Sophomore Seminar: Read Less [-]

ENGIN 39F Freshman/Sophomore Seminar
1.5 - 4 Units
Terms offered: Fall 2010
Freshman and sophomore seminars offer lower division students the opportunity to explore an intellectual topic with a faculty member and a group of peers in a small-seminar setting. These seminars are offered in all campus departments; topics vary from department to department and from semester to semester. Enrollment limits are set by the faculty, but the suggested limit is 25.
Freshman/Sophomore Seminar: Read More [+]
Rules & Requirements
Repeat rules: Course may be repeated for credit without restriction.
Hours & Format
Fall and/or spring: 15 weeks - 1.5-4 hours of seminar per week
Additional Details
Subject/Course Level: Engineering/Undergraduate
Grading/Final exam status: The grading option will be decided by the instructor when the class is offered. Final exam required.
Freshman/Sophomore Seminar: Read Less [-]

ENGIN 40 Engineering Thermodynamics 4 Units
Terms offered: Fall 2020, Fall 2019, Fall 2018
Fundamental laws of thermodynamics for simple substances; application to flow processes and to nonreacting mixtures; statistical thermodynamics of ideal gases and crystalline solids; chemical and materials thermodynamics; multiphase and multicomponent equilibria in reacting systems; electrochemistry. Sponsoring Departments: Materials Science and Engineering and Nuclear Engineering.
Engineering Thermodynamics: Read More [+]
Rules & Requirements
Prerequisites: PHYSICS 7B and MATH 54. CHEM 1B recommended
Credit Restrictions: Students will receive no credit for Engineering 40 after taking Engineering 115, Chemical Engineering 141 or Mechanical Engineering 40.
Hours & Format
Fall and/or spring: 15 weeks - 3 hours of lecture and 1 hour of discussion per week
Additional Details
Subject/Course Level: Engineering/Undergraduate
Grading/Final exam status: Letter grade. Final exam required.
Instructors: Bolind, Persson
Engineering Thermodynamics: Read Less [-]
ENGIN 47 Supplementary Work in Lower Division Engineering 1 - 3 Units
Terms offered: Fall 2016, Fall 2012, Spring 2012
May be taken only with permission of the Dean of the College of Engineering. Students with partial credit in a lower division engineering course may complete the work under this heading.

Rules & Requirements
Prerequisites: Limited to students who must make up a fraction of a required lower division course
Repeat rules: Course may be repeated for credit without restriction.

Hours & Format
Fall and/or spring: 15 weeks - 0 hours of independent study per week
Summer: 8 weeks - 1.5-5.5 hours of independent study per week

Additional Details
Subject/Course Level: Engineering/Undergraduate
Grading/Final exam status: Letter grade. Final exam required.

ENGIN 78 Statistics and Data Science for Engineers 4 Units
Terms offered: Fall 2020
This course introduces engineering students to elements of statistics and probability, followed by a module-based introduction to select computational techniques from data science and stochastic optimization. Each module is based on a contemporary engineering problem of broad interest. The computational techniques presented in the course are drawn from Bayesian optimization, supervised learning, neural networks, classification, and Kalman filtering.

Objectives & Outcomes
Course Objectives: Enhance the students’ computational skills in tackling engineering problems whose complexity may necessitate data-driven solutions. Familiarize students with practical concepts of quantitative statistics and probability. Introduce students to select state-of-the-art algorithms from data science and stochastic optimization in the context of engineering problems.
Student Learning Outcomes: A knowledge of contemporary issues. An ability to apply knowledge of mathematics, science, and engineering. 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. An ability to design and conduct experiments, as well as to analyze and interpret data. An ability to identify, formulate, and solve engineering problems. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.

Rules & Requirements
Prerequisites: ENGIN 7, MATH 1A, MATH 1B, and MATH 53; and MATH 54 (may be taken concurrently)

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

Additional Details
Subject/Course Level: Engineering/Undergraduate
Grading/Final exam status: Letter grade. Final exam required.
Instructor: Papadopoulos

Statistics and Data Science for Engineers: Read More [+]
Statistics and Data Science for Engineers: Read More [-]
ENGIN 92 Perspectives in Engineering 1 Unit
Terms offered: Fall 2020, Fall 2019, Fall 2018
This series of lectures provides students, especially undeclared Engineering students, with information on the various engineering disciplines to guide them toward choice of major. Lecturers describe research activities, how they made their own career choices, and indicate future opportunities. Recommended for all Engineering Science students and required for Engineering undeclared students.
Perspectives in Engineering: Read More [+]

Rules & Requirements
Repeat rules: Course may be repeated for credit without restriction.

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

Additional Details
Subject/Course Level: Engineering/Undergraduate
Grading/Final exam status: Offered for pass/not pass grade only. Final exam not required.
Perspectives in Engineering: Read Less [-]

ENGIN 93 Energy Engineering Seminar 1 Unit
Terms offered: Fall 2020, Fall 2019, Fall 2018
Weekly seminar with different speakers on energy-related topics. The goal is to expose students to a broad range of energy issues.
Energy Engineering Seminar: Read More [+]

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

Additional Details
Subject/Course Level: Engineering/Undergraduate
Grading/Final exam status: Offered for pass/not pass grade only. Final exam not required.
Instructor: Zohdi
Energy Engineering Seminar: Read Less [-]

ENGIN 98 Directed Group Studies for Lower Division Undergraduates 1 - 4 Units
Terms offered: Fall 2020, Spring 2020, Fall 2019
Seminars for group study of selected topics, which will vary from year to year. Intended for students in the lower division.
Directed Group Studies for Lower Division Undergraduates: Read More [+]

Rules & Requirements
Prerequisites: Consent of instructor
Repeat rules: Course may be repeated for credit without restriction.

Hours & Format
Fall and/or spring: 15 weeks - 1-4 hours of directed group study per week
Summer:
6 weeks - 2.5-10 hours of directed group study per week
8 weeks - 1.5-7.5 hours of directed group study per week
10 weeks - 1.5-6 hours of directed group study per week

Additional Details
Subject/Course Level: Engineering/Undergraduate
Grading/Final exam status: Offered for pass/not pass grade only. Final exam not required.
Directed Group Studies for Lower Division Undergraduates: Read Less [-]

ENGIN 117 Methods of Engineering Analysis 3 Units
Terms offered: Fall 2019, Fall 2017, Fall 2015
Methods of theoretical engineering analysis; techniques for analyzing partial differential equations and the use of special functions related to engineering systems. Sponsoring Department: Mechanical Engineering.
Methods of Engineering Analysis: Read More [+]

Rules & Requirements
Prerequisites: MATH 53 and MATH 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: Engineering/Undergraduate
Grading/Final exam status: Letter grade. Final exam required.
Methods of Engineering Analysis: Read Less [-]
ENGIN 120 Principles of Engineering Economics 3 Units
Terms offered: Fall 2020, Spring 2020, Fall 2019
Rules & Requirements
Prerequisites: Completion of 60 units of an approved engineering curriculum
Credit Restrictions: Students will receive no credit for Engineering 120 after taking Industrial Engineering 120.
Hours & Format
Fall and/or spring: 15 weeks - 2 hours of lecture and 1 hour of discussion per week
Summer: 8 weeks - 4 hours of lecture and 2 hours of discussion per week
Additional Details
Subject/Course Level: Engineering/Undergraduate
Grading/Final exam status: Letter grade. Final exam required.
Instructor: Adler

ENGIN 125 Ethics, Engineering, and Society 3 Units
Terms offered: Spring 2020, Spring 2014, Fall 2013
How should engineers analyze and resolve the ethical issues inherent in engineering? This seminar-style course provides an introduction to how theories, concepts, and methods from the humanities and social science can be applied to ethical problems in engineering. Assignments incorporate group and independent research designed to provide students an opportunity to contribute novel findings to the emerging field of engineering ethics while building their analytical and communication skills. This course cannot be used to fulfill any engineering technical requirements (units or courses).
Ethics, Engineering, and Society: Read More [+]
Hours & Format
Fall and/or spring: 15 weeks - 2 hours of lecture and 1 hour of discussion per week
Summer: 6 weeks - 5 hours of lecture and 3 hours of discussion per week
8 weeks - 4 hours of lecture and 2 hours of discussion per week
Additional Details
Subject/Course Level: Engineering/Undergraduate
Grading/Final exam status: Letter grade. Final exam not required.
Instructor: Lieu

ENGIN 128 Advanced Engineering Design Graphics 3 Units
Terms offered: Fall 2020, Fall 2019, Fall 2018
Advanced Engineering Design Graphics: Read More [+]
Rules & Requirements
Prerequisites: ENGIN 26
Hours & Format
Fall and/or spring: 15 weeks - 2 hours of lecture and 3 hours of laboratory per week
Additional Details
Subject/Course Level: Engineering/Undergraduate
Grading/Final exam status: Letter grade. Final exam not required.
Instructor: Lieu

ENGIN 147 Supplementary Work in Upper Division Engineering 1 - 3 Units
Terms offered: Fall 2016, Fall 2015, Spring 2015
May be taken only with permission of the Dean of the College of Engineering. Students with partial credit in an upper division engineering course may complete the work under this heading.
Supplementary Work in Upper Division Engineering: Read More [+]
Rules & Requirements
Prerequisites: Limited to students who must make up a fraction of a required upper division course
Repeat rules: Course may be repeated for credit without restriction.
Hours & Format
Fall and/or spring: 15 weeks - 0 hours of independent study per week
Additional Details
Subject/Course Level: Engineering/Undergraduate
Grading/Final exam status: Letter grade. Final exam required.
Supplementary Work in Upper Division Engineering: Read Less [-]
ENGIN 150 Basic Modeling and Simulation Tools for Industrial Research Applications 3 Units
Terms offered: Fall 2019, Fall 1997, Fall 1996
The course emphasizes elementary modeling, numerical methods and their implementation on physical problems motivated by phenomena that students are likely to encounter in their careers, involving biomechanics, heat-transfer, structural analysis, control theory, fluid-flow, electrical conduction, diffusion, etc. This will help students develop intuition about the strengths and weaknesses of a variety of modeling & numerical methods, as well as develop intuition about modeling physical systems & strengths and weaknesses of a variety of numerical methods, including: Discretization of differential equations, Methods for solving nonlinear systems, Gradient-based methods and machine learning algorithms for optimization, stats & quantification

Rules & Requirements
Prerequisites: ENGIN 7 or COMPSCI 61A, PHYSICS 7A, MATH 53, and MATH 54

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

Additional Details
Subject/Course Level: Engineering/Undergraduate
Grading/Final exam status: Letter grade. Final exam required.

Basic Modeling and Simulation Tools for Industrial Research Applications: Read More [+]

ENGIN 151 Modeling and Simulation of Infectious Diseases 3 Units
Terms offered: Not yet offered
The course emphasizes elementary modeling, numerical methods and their implementation on physical problems motivated by real-world phenomena involving various aspects of infection diseases. This course is broken into five parts: part 1-modeling and simulation of the infection zone from respiratory emission, part 2-rapid simulation of viral decontamination efficacy with uv irradiation, part 3-an agent-based computational framework for simulation of global pandemic and social response, part 4-machine learning and parameter identification, part 5-deep dive into advanced models: continuum mechanics, solid-fluid interaction and electromagnetism.

Objectives & Outcomes
Course Objectives: Comprised of an introduction to essential mathematical modeling and simulation tools needed for various aspects of the modeling and simulation of infectious diseases. Six capstone projects, drawn from Parts 1-5 are assigned, applying the modeling and simulation tools.

Rules & Requirements
Prerequisites: ENGIN 7, COMPSCI 61A, or DATA C8 + COMPSCI 88; and PHYSICS 7A; and MATH 53 AND MATH 54

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

Additional Details
Subject/Course Level: Engineering/Undergraduate
Grading/Final exam status: Letter grade. Final exam required.
Instructor: Tarek Zohdi
**ENGIN 157AC Engineering, The Environment, and Society 4 Units**

Terms offered: Spring 2020, Spring 2019, Spring 2018

This course engages students at the intersection of environmental justice, social justice, and engineering to explore how problems that are commonly defined in technical terms are at their roots deeply socially embedded. Through partnerships with community-based organizations, students are trained to recognize the socio-political nature of technical problems so that they may approach solutions in ways that prioritize social justice. Topics covered include environmental engineering as it relates to air, water, and soil contamination; race, class, and privilege; expertise; ethics; and engaged citizenship. This course cannot be used to complete any engineering technical unit requirements.

*Engineering, The Environment, and Society: Read More [+]*

**Hours & Format**

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

**Additional Details**

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

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

**Also listed as:** IAS 157AC

*Engineering, The Environment, and Society: Read Less [-]*

**ENGIN 177 Advanced Programming with MATLAB 3 Units**

Terms offered: Spring 2017, Spring 2015, Spring 2014

The course builds an understanding, demonstrates engineering uses, and provides hand-on experience for object-oriented programming as well as exposes a practical knowledge of advanced features available in MATLAB. The course will begin with a brief review of basic MATLAB features and quickly move to class organization and functionality. The introduced concepts are reinforced by examining the advanced graphical features of MATLAB. The material will also include the effective use of programs written in C and FORTRAN, and will cover SIMULINK, a MATLAB toolbox providing for an effective ways of model simulations. Throughout the course, the emphasis will be placed on examples and homework assignments from engineering disciplines.

*Advanced Programming with MATLAB: Read More [+]*

**Rules & Requirements**

**Prerequisites:** ENGIN 7, MATH 53 and MATH 54 (one of these math courses may be taken concurrently)

*Advanced Programming with MATLAB: Read Less [-]*

**ENGIN 180 Preparing for the Fields and Jobs of the Future 3 Units**

Terms offered: Spring 2018

The course is concerned with giving students the tools to prepare for the fields and jobs of the future. Across all university departments and majors, the numbers of students who do not work in the fields in which they've received their degrees is not only significant, but growing. For example, anywhere from 20-40% of STEM graduates do not work in the fields in which they received their degrees. This does not mean that students shouldn't major in STEM, but that one of the primary purposes of higher education is learning how to learn. Accordingly, this course presents a number of frameworks that are critical for thinking about that which has not yet been invented.

*Preparing for the Fields and Jobs of the Future: Read More [+]*

**Hours & Format**

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

**Additional Details**

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

**Grading/Final exam status:** Letter grade. Alternate method of final assessment during regularly scheduled final exam group (e.g., presentation, final project, etc.).

*Instructor:* Ian I. Mitroff

*Preparing for the Fields and Jobs of the Future: Read Less [-]*

**ENGIN 185 The Art of STEM Communication 3 Units**

Terms offered: Spring 2020, Fall 2019, Spring 2019

This course provides engineering majors with the fundamental skills for effective technical communication. During the course of the semester, students will develop communications for public dissemination, covering a project or initiative within UC Berkeley’s College of Engineering. This work will call on students to: (a) cultivate interest in a broad range of topics related to Engineering; (b) become an engaged and critical reader of academic and general-interest science publications; (c) learn how to assess, plan for, and respond to a variety of communicative situations; (d) produce focused, and at the same time, narratively-rich, accounts of Engineering research.

*The Art of STEM Communication: Read More [+]*

**Hours & Format**

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

**Additional Details**

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

**Grading/Final exam status:** Letter grade. Alternate method of final assessment during regularly scheduled final exam group (e.g., presentation, final project, etc.).

*Instructors:* Frenklach, Packard

*The Art of STEM Communication: Read Less [-]*
ENGIN 187 Global Engineering: The Challenges of Globalization and Disruptive Innovation 1 or 2 Units
Terms offered: Fall 2019
The course examines the challenges of innovation beyond new technology development: from the challenges of global expansion, to the issues of unintended consequences of technology and the ability of technology to support or hinder social justice. The course will provide examples in a variety of global locations (e.g., Latin America, Southeast Asia, Africa, China, and India), utilizing case examples (written and presented by speakers) that illustrate the challenges faced in a range of fields of engineering and technology, from water and transportation to information and communications technology, and from start-ups to major corporations, government entities, and policy makers.
Global Engineering: The Challenges of Globalization and Disruptive Innovation: Read More [+]

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

Hours & Format
Fall and/or spring: 8 weeks - 2-4 hours of lecture per week

Additional Details
Subject/Course Level: Engineering/Undergraduate
Grading/Final exam status: Letter grade. Alternative to final exam.

Global Engineering: The Challenges of Globalization and Disruptive Innovation: Read Less [-]

ENGIN 194 Undergraduate Research 3 Units
Terms offered: Spring 2020, Spring 2019, Spring 2018
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. Final report and presentation required.
Undergraduate Research: Read More [+]

Rules & Requirements
Prerequisites: Consent of instructor and adviser, junior or senior standing
Repeat rules: Course may be repeated for credit without restriction.

Hours & Format
Fall and/or spring: 15 weeks - 0 hours of independent study per week

Additional Details
Subject/Course Level: Engineering/Undergraduate
Grading/Final exam status: Letter grade. Final exam required.
Undergraduate Research: Read Less [-]

ENGIN 198 Directed Group Studies for Advanced Undergraduates 1 - 4 Units
Terms offered: Spring 2020, Spring 2019, Fall 2018
Group study of selected topics.
Directed Group Studies for Advanced Undergraduates: Read More [+]

Rules & Requirements
Prerequisites: Upper division standing, plus particular courses to be specified by instructor
Repeat rules: Course may be repeated for credit without restriction.

Hours & Format
Fall and/or spring: 15 weeks - 1-4 hours of directed group study per week
Summer: 8 weeks - 1.5-7.5 hours of directed group study per week

Additional Details
Subject/Course Level: 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 [-]