# Engineering Physics

## Bachelor of Science (BS)

The engineering physics major offered through the Engineering Science Program interweaves classical and modern physics, chemistry, and mathematics with their engineering applications. Chief among the attractions of the major is its flexibility in that students have the ability to take diverse engineering, math, and science classes based on individual research goals. The solid base in physics and mathematics is augmented with a selection of engineering course options that prepare students to tackle complex problems faced by society.

## Admission to the Major

Prospective undergraduates in the College of Engineering must apply to one specific major/degree program. 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 very competitive as there are few open spaces. 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/).

## Minor Program

There is no minor program in engineering physics.

## Other Majors offered by the Engineering Science Program

- Energy Engineering (http://guide.berkeley.edu/undergraduate/degree-programs/energy-engineering/) (Major and Minor)
- Engineering Mathematics and Statistics (http://guide.berkeley.edu/undergraduate/degree-programs/engineering-math-statistics/) (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 requirements listed below 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.

## Lower Division Requirements

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</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>or PHYSICS 81</td>
<td>Introduction to Mathematical Physics</td>
<td></td>
</tr>
<tr>
<td>CHEM 1A</td>
<td>General Chemistry</td>
<td>5</td>
</tr>
<tr>
<td>&amp; 1AL</td>
<td>and General Chemistry Laboratory</td>
<td></td>
</tr>
<tr>
<td>or CHEM 4A</td>
<td>General Chemistry and Quantitative Analysis</td>
<td></td>
</tr>
<tr>
<td>ENGIN 7</td>
<td>Introduction to Computer Programming for Scientists and Engineers</td>
<td>3-4</td>
</tr>
<tr>
<td>or COMPSCI 6</td>
<td>The Structure and Interpretation of Computer Programs</td>
<td></td>
</tr>
<tr>
<td>or COMPSCI 6</td>
<td>Data Structures</td>
<td></td>
</tr>
<tr>
<td>or PHYSICS 71</td>
<td>Introduction to Computational Techniques in Physics</td>
<td></td>
</tr>
<tr>
<td>PHYSICS 5A</td>
<td>Introductory Mechanics and Relativity</td>
<td>3-4</td>
</tr>
<tr>
<td>or PHYSICS 7A</td>
<td>Physics for Scientists and Engineers</td>
<td></td>
</tr>
<tr>
<td>PHYSICS 5B</td>
<td>Introductory Electromagnetism, Waves, and Optics</td>
<td>5</td>
</tr>
<tr>
<td>&amp; 5BL</td>
<td>and Introduction to Experimental Physics I</td>
<td></td>
</tr>
<tr>
<td>or PHYSICS 7E</td>
<td>Physics for Scientists and Engineers</td>
<td></td>
</tr>
<tr>
<td>PHYSICS 5C</td>
<td>Introductory Thermodynamics and Quantum Mechanics</td>
<td>5</td>
</tr>
<tr>
<td>&amp; 5CL</td>
<td>and Introduction to Experimental Physics II</td>
<td></td>
</tr>
<tr>
<td>or PHYSICS 7E</td>
<td>Physics for Scientists and Engineers</td>
<td></td>
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</tbody>
</table>

Lower division technical electives, select three from the following: 11-14

- ASTRON 7A  Introduction to Astrophysics [4]
- ASTRON 7B  Introduction to Astrophysics [4]
- BIOLOGY 1A General Biology Lecture & 1AL and General Biology Laboratory
- BIOLOGY 1B General Biology Lecture and Laboratory [4]
- CHEM 1B  General Chemistry [4]
- CHEM 3A  Chemical Structure and Reactivity & 3AL and Organic Chemistry Laboratory
- CHEM 4B  General Chemistry and Quantitative Analysis [5]
- EECS 16A Designing Information Devices and Systems I [4]
- EECS 16B Designing Information Devices and Systems II [4]
- MAT SCI 45 Properties of Materials [3] (MAT SCI 45L recommended)
- MEC ENG C85/ CIV ENG C30 Introduction to Solid Mechanics [3]
- ENGIN 92 Perspectives in Engineering (Optional) [1]

## Upper Division Requirements

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

- MEC ENG 104  Engineering Mechanics II [3-4]
- or PHYSICS 10 Analytic Mechanics
- MEC ENG 185  Introduction to Continuum Mechanics [3]
- or MEC ENG 1 Fluid Mechanics
At least 40 units of approved upper division technical subjects

Students planning to pursue graduate school in physics are

The 15 units of upper division engineering and 14 units of upper
division physics units completed. If in selecting options to meet
upper division requirements the totals do not come to 15 units
of engineering and 14 units of physics, additional units (chosen
in consultation with a faculty adviser) must be added.

• A minimum of 14 units of upper division physics.

• The 15 units of upper division engineering and 14 units of upper
division physics DO include all required upper division engineering
and physics units completed. If in selecting options to meet upper
division requirements the totals do not come to 15 units of
engineering and 14 units of physics, additional units (chosen in
consultation with a faculty adviser) must be added.

• At least 40 units of approved upper division technical subjects
(mathematics, statistics, science, and engineering). These 40 units
DO include all required upper division technical course work taken
for the major.

3 CHEM 4A is intended for students majoring in chemistry or a closely
related field.
• 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 Requirements
• Students must have a minimum overall and semester grade point average of 2.00 (C average). 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.
• Students must make normal degree progress toward the Bachelor of Science degree and their officially declared major.

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/students/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 their declared major. Students who fail to achieve normal academic progress shall be subject to dismissal. (Note: Students with official accommodations established by the Disabled Students' Program, with health or family issues, or with other reasons deemed appropriate by the dean may petition for an exception to normal progress rules.)

University of California Requirements
Entry Level Writing (http://guide.berkeley.edu/undergraduate/education/#earningyourdegreetext)
All students who will enter the University of California as freshmen must demonstrate their command of the English language by satisfying the Entry Level Writing Requirement (ELWR). The UC Entry Level Writing Requirement website (https://admission.universityofcalifornia.edu/elwr/) provides information on how to satisfy the requirement.

American History and American Institutions (http://guide.berkeley.edu/undergraduate/education/#earningyourdegreetext)
The American History and Institutions (AH&I) requirements are based on the principle that a US 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/#earningyourdegreetext)
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 any time 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.

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.
Chemistry and Physics Foundations

Math Series Courses 1

<table>
<thead>
<tr>
<th>Course</th>
<th>Units</th>
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<tbody>
<tr>
<td>CHEM 4A</td>
<td>4</td>
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Humanities/Social Sciences Courses 2

<table>
<thead>
<tr>
<th>Course</th>
<th>Units</th>
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</thead>
<tbody>
<tr>
<td>EL ENG 131 or PHYSICS 141A</td>
<td>3-4</td>
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</table>

Electromagnetic & Optics Series Courses 1

<table>
<thead>
<tr>
<th>Course</th>
<th>Units</th>
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<tbody>
<tr>
<td>MAT SCI 45L</td>
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Electrical Engineering Courses

<table>
<thead>
<tr>
<th>Course</th>
<th>Units</th>
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</thead>
<tbody>
<tr>
<td>EL ENG 143, NUC ENG 104, or PHYSICS 111A</td>
<td>3</td>
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</table>

Mathematical Series Courses 2

<table>
<thead>
<tr>
<th>Course</th>
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</tr>
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<tbody>
<tr>
<td>MEC ENG 185</td>
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Technical Electives 3

<table>
<thead>
<tr>
<th>Course</th>
<th>Units</th>
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</thead>
<tbody>
<tr>
<td>MAT SCI 111 or PHYSICS 110A</td>
<td>3-4</td>
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Physics Courses

<table>
<thead>
<tr>
<th>Course</th>
<th>Units</th>
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<tbody>
<tr>
<td>PHYSICS 111A</td>
<td>3-4</td>
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Free Electives

<table>
<thead>
<tr>
<th>Course</th>
<th>Units</th>
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<tbody>
<tr>
<td>Free Elective</td>
<td>3</td>
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</tbody>
</table>

Total Units: 123-141

1. CHEM 4A is intended for students majoring in Chemistry or a closely-related field.
2. The Humanities/Social Sciences (H/SS) requirement includes two approved Reading & Composition (R&C) courses and four additional approved courses, with which a number of specific conditions must be satisfied. R&C 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. The remaining courses may be taken at any time during the program. See Humanities and Social Science Requirements for complete details and a list of approved courses.

3. Technical electives must include:
   - Three courses from the following lower division technical electives: ASTRON 7A, ASTRON 7B, BIOLOGY 1A plus BIOLOGY 1AL, BIOLOGY 1B, CHEM 1B, CHEM 3A plus CHEM 3AL, CHEM 4B, COMPSCI 70, EECS 16A, EECS 16B, MAT SCI 45 (MAT SCI 45L recommended), MEC ENG C85/CIV ENG C30.
   - 15 units of upper division courses in engineering. Upper division engineering units cannot include: any course taken on a Pass/No Pass basis; any course that counts as H/SS; BIO ENG 100, DES INV courses (except DES INV 190E), ENGIN 125, ENGIN 157AC, ENGIN 180, ENGIN 183 series, ENGIN 185, ENGIN 187, ENGIN 195 series, IND ENG 172, IND ENG 185, IND ENG 186, the IND ENG 190 series, IND ENG 191, IND ENG 192, IND ENG 195, MEC ENG 191AC, MEC ENG 190K, and MEC ENG 191K.
   - A minimum of 14 units of upper division physics.
   - The 15 units of upper division engineering and 14 units of upper division physics DO include all required upper division engineering and physics units completed. If in selecting options to meet upper division requirements the totals do not come to 15 units of engineering and 14 units of physics, additional units (chosen in consultation with a faculty adviser) must be added.
   - At least 40 units of approved upper division technical subjects (mathematics, statistics, science, and engineering). These 40 units DO include all required upper division technical course work taken for the major.

4. Math Series: Select one sequence from the following: MATH 104 and MATH 185; or MATH 121A and MATH 121B.
5. Students planning to pursue graduate school in physics are advised to complete PHYSICS 111B (for 3 units) to satisfy the laboratory requirement. Note: Students will need to obtain consent of the PHYSICS 111B instructor if they have not completed the prerequisites of PHYSICS 111A and PHYSICS 137A.
6. Electromagnetic & Optics Series: Select one sequence from the following: PHYSICS 110A and PHYSICS 110B; or EL ENG 117 and EL ENG 118.

Major Maps help undergraduate students discover academic, co-curricular, and discovery opportunities at UC Berkeley based on intended major or field of interest. Developed by the Division of Undergraduate Education in collaboration with academic departments, these experience maps will help you:

- **Explore** your major and gain a better understanding of your field of study
- **Connect** with people and programs that inspire and sustain your creativity, drive, curiosity and success
- **Discover** opportunities for independent inquiry, enterprise, and creative expression
- **Engage** locally and globally to broaden your perspectives and change the world
- **Reflect** on your academic career and prepare for life after Berkeley

Use the major map below as a guide to planning your undergraduate journey and designing your own unique Berkeley experience.

View the Engineering Physics Major Map PDF. (https://ue.berkeley.edu/sites/default/files/engineering_science.pdf)