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 few open spaces in engineering for 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) .

Minor Program

There is no minor program in engineering physics

Other Majors offered by the Engineering Science Program

Energy Engineering (http://guide.berkeley.edu/archive/2015-16/undergraduate/degree-programs/energy-engineering) (Major and Minor)
Engineering Mathematics and Statistics (http://guide.berkeley.edu/archive/2015-16/undergraduate/degree-programs/engineering-math-statistics) (Major)
Environmental Engineering Science (http://guide.berkeley.edu/archive/2015-16/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 (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 & 1AL	General Chemistry and General Chemistry Laboratory [1]	4
or CHEM 4A	General Chemistry and Quantitative Analysis	
CHEM 1B	General Chemistry [1]	4
or CHEM 4B	General Chemistry and Quantitative Analysis	
PHYSICS 7A	Physics for Scientists and Engineers	4
PHYSICS 7B	Physics for Scientists and Engineers	4
PHYSICS 7C	Physics for Scientists and Engineers	4
ENGIN 7	Introduction to Computer Programming for Scientists and Engineers	4
or COMPSCI 61A	The Structure and Interpretation of Computer Programs	
Lower division technical electives, select two from the following:		6-10
ASTRON 7A	Introduction to Astrophysics	
ASTRON 7B	Introduction to Astrophysics	
BIOLOGY 1A & 1AL	General Biology Lecture and General Biology Laboratory	
BIOLOGY 1B	General Biology Lecture and Laboratory	
CHEM 3A & 3AL	Chemical Structure and Reactivity and Organic Chemistry Laboratory	
CIV ENG C30/ MEC ENG C85	Introduction to Solid Mechanics	
EL ENG 16A	Designing Information Devices and Systems I	
ENGIN 45	Properties of Materials	

[1] CHEM 4A and CHEM 4B are intended for students majoring in chemistry or a closely-related field.

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 105	Analytic Mechanics	
PHYSICS 137A	Quantum Mechanics	4
PHYSICS 137B	Quantum Mechanics	4
PHYSICS 112	Introduction to Statistical and Thermal Physics	4
or ENGIN 115	Engineering Thermodynamics	
MAT SCI 111	Properties of Electronic Materials	4
or PHYSICS 141A	Solid State Physics	
MEC ENG 185	Introduction to Continuum Mechanics	3
or MEC ENG 106	Fluid Mechanics	
NUC ENG 104	Radiation Detection and Nuclear Instrumentation Laboratory [1]	3-4

or EL ENG 143	Microfabrication Technology	
or PHYSICS 111A	Instrumentation Laboratory	
Math series, select one sequence from the following:		8
MATH 104 & MATH 185	Introduction to Analysis and Introduction to Complex Analysis	
MATH 121A & MATH 121B	Mathematical Tools for the Physical Sciences and Mathematical Tools for the Physical Sciences	
Electromagnetic & optics series, select one sequence from the following:		7-8
PHYSICS 110A & PHYSICS 1	Electromagnetism and Optics and Electromagnetism and Optics	
EL ENG 117 & EL ENG 118	Electromagnetic Fields and Waves and Introduction to Optical Engineering	
EL ENG 117 & BIO ENG 1(	Electromagnetic Fields and Waves and Optics and Microscopy	
Upper division technical subjects [2]		

1 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.

2 At least 40 units of approved upper division technical subjects (mathematics, statistics, science, and engineering) must be completed. Of these 40 units, at least 15 units must be upper division engineering and at least 14 units must be upper division physics. These 40 units *do* include all required upper division technical course work taken for the major. Upper division engineering technical elective units cannot include any course taken on a *Pass/No Pass* basis and any of the following courses: BIO ENG 100, CHM ENG 185, COMPSCI 195, COMPSCI H195, DES INV 190 ENGIN 125, ENGIN 157AC, 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.

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/2015-16/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), COMPSCI C79 (http://guide.berkeley.edu/search/?P=COMPSCI%20C79), ENGIN 125 (http://

guide.berkeley.edu/search/?P=ENGIN%20125), ENGIN 157AC (http://guide.berkeley.edu/search/?P=ENGIN%20157AC), MEC ENG 191K (http://guide.berkeley.edu/search/?P=MEC%20ENG%20191K) and MEC ENG 191AC (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://engineering.berkeley.edu/student-services/degree-requirements/foreign-language-courses) .
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/2015-16/undergraduate/colleges-schools/letters-science/breadth-requirement-arts-literature)
- Foreign Language (http://engineering.berkeley.edu/student-services/degree-requirements/foreign-language-courses)
- Historical Studies (http://guide.berkeley.edu/archive/2015-16/undergraduate/colleges-schools/letters-science/breadth-requirement-historical-studies)
- International Studies (http://guide.berkeley.edu/archive/2015-16/undergraduate/colleges-schools/letters-science/breadth-requirement-international-studies)
- Philosophy and Values (http://guide.berkeley.edu/archive/2015-16/undergraduate/colleges-schools/letters-science/breadth-requirement-philosophy-values)
- Social and Behavioral Studies (http://guide.berkeley.edu/archive/2015-16/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 ***and*** 1AL[1]	4	CHEM 1B or 4B[1]		4
MATH 1A	4	MATH 1B		4
Reading & Composition Course from List A	4	PHYSICS 7A		4
Humanities/Social Sciences Course	3-4	ENGIN 7 or COMPSCI 61A		4
Freshman Seminar or ENGIN 92 (optional)	0-1			
	15-17			**16**
				Sophomore
Fall	**Units**	**Spring**		**Units**
MATH 53	4	MATH 54		4
PHYSICS 7B	4	PHYSICS 7C		4
Technical Elective[2]	3-5	Technical Elective[2]		3-5
Reading & Composition Course from List B	4	Humanities/Social Sciences Course		3-4
	15-17			**14-17**

				Junior
Fall	**Units**	**Spring**		**Units**
MEC ENG 104 or PHYSICS 105	3-4	ENGIN 115 or PHYSICS 112		4
PHYSICS 137A	4	PHYSICS 137		4
Math Series Course 1[3]	4	Math Series Course 2[3]		4
Humanities/Social Sciences Course	3-4	Technical Elective[2]		3-4
Free Elective	2			
	16-18			**15-16**
				Senior
Fall	**Units**	**Spring**		**Units**
EL ENG 143, NUC ENG 104, or PHYSICS 111A[4]	3-4	MEC ENG 185 or 106		3
MAT SCI 111 or PHYSICS 141A	4	Electromagnet & Optics Series course 2[5]		3-4
Electromagnetics & Optics Series Course 1[5]	4	Technical Elective[2]		3-4
Technical Elective[2]	3-4	Humanities/ Social Sciences Course		3-4
Free Elective	1	Free Elective		2
	15-17			**14-17**

Total Units: 120-135

1 CHEM 4A and CHEM 4B are intended for students majoring in Chemistry or a closely-related field.

2 Technical electives must include:

- Two courses from the following lower-division technical electives: ASTRON 7A, ASTRON 7B, BIOLOGY 1A plus BIOLOGY 1AL, BIOLOGY 1B, CHEM 3A plus CHEM 3AL, CIV ENG C30/MEC ENG C85, EL ENG 16A, or ENGIN 45.
- 15 units of upper-division courses in engineering. Upper-division engineering units cannot include: any course taken on a *Pass/No Pass* basis and any of the following courses: BIO ENG 100, CHM ENG 185, COMPSCI 195, COMPSCI H195, DES INV 190 ENGIN 125, ENGIN 157AC, 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 ENGIN 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 Math Series: Select one sequence from the following: MATH 104 and MATH 185; or MATH 121A and MATH 121B.

4 NUC ENG 104 offered in spring only, prerequisite is NUC ENG 101. 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.

5 Electromagnetic & Optics Series: Select one sequence from the following: PHYSICS 110A and PHYSICS 110B; EL ENG 117 and EL ENG 118; or EL ENG 117 and BIO ENG 164.