Aerospace Engineering

Leonardo da Vinci wrote, “Once you have tasted flight, you will forever walk the earth with your eyes turned skyward. For there you have been, and there you will always long to return.” Perhaps, like da Vinci, you’ve always been obsessed with airborne machines: Gliders and lighter-than-air craft. Fixed-wing airplanes and jets. Autogyros and helicopters. Or even rockets, satellites, and spacecraft. Aeronautical engineers generally design aircraft to fly within the Earth’s atmosphere, while astronautical engineers design the technology for spacecraft to fly beyond the atmosphere. Either way, the sky’s the limit.

Major Program

At Berkeley Engineering, we offer a modern aerospace engineering major that combines comprehensive topical coverage, technical rigor and practical relevance. This major has been designed from the ground up for students who aspire to become leaders in an emerging era of aerospace technologies, including sustainable aviation, autonomous flight and space exploration. With a UC Berkeley aerospace engineering degree, you can find employment in industry — such as multinational corporations that design and manufacture aerospace systems at scale, or mid-size and small private companies that develop targeted technologies — or in federal government agencies such as NASA, the FAA or federal defense organizations.

The aerospace engineering degree program will begin instruction with an inaugural freshman class in Fall 2022.

Minor Program

To declare your intention to pursue the Aerospace Minor, please use your Berkeley email address/calnet ID and fill out the following application to declare (https://docs.google.com/forms/d/e/1FAIpQLSc5GQhRPAoxKuc0rm2_Dylp1hlPl3P84Pt78lYL6NL_2SdWoQ/viewform/?usp=sf_link) form.

Non-Mechanical Engineering major students can declare their intention to complete the minor after completing prerequisite courses MEC ENG C85 Introduction to Solid Mechanics, MEC ENG 106 Fluid Mechanics, and MEC ENG 132 Dynamic Systems and Feedback. Mechanical Engineering majors are allowed to overlap prerequisite courses. Students must have a minimum overall grade-point average of 3.0, as well as a minimum grade-point average of 3.0 in the prerequisite courses, in order to be admitted to the minor program.

The Aerospace Engineering Major will be offered beginning Fall 2022.

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.

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 upper division 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

AERO ENG 1	Aerospace Engineering 1 Seminar	1
AERO ENG 2	Aerospace Engineering 2 Seminar	1
AERO ENG 10	Course Not Available	
CIV ENG C30	Introduction to Solid Mechanics	3
or MEC ENG C	Introduction to Solid Mechanics	
COMPSCI 61A	The Structure and Interpretation of Computer Programs	4
ENGIN 7	Introduction to Computer Programming for Scientists and Engineers	4
ENGIN 40	Engineering Thermodynamics	3-4
or MEC ENG 40	Thermodynamics	
ENGIN 178	Statistics and Data Science for Engineers	4
MAT SCI 45	Properties of Materials	3
MATH 1A	Calculus	4
MATH 1B	Calculus	4
MATH 53	Multivariable Calculus	4
MATH 54	Linear Algebra and Differential Equations	4
or PHYSICS 89	Introduction to Mathematical Physics	
or AERO ENG 11	Course Not Available	
PHYSICS 7A	Physics for Scientists and Engineers	4
PHYSICS 7B	Physics for Scientists and Engineers	4
Science Course		

Upper Division Requirements

Students must complete the Upper Division Core Requirements and four Technical Electives. Two additional Free Electives are also required.

Upper Division Core Requirements

CIV ENG 126	Engineering Dynamics and Vibrations	3
or MEC ENG 104	Engineering Mechanics II	
MEC ENG 100	Electronics for the Internet of Things	4
or EL ENG 120	Signals and Systems	
or EECS 149	Introduction to Embedded and Cyber Physical Systems	
MEC ENG 106	Fluid Mechanics	3
MEC ENG 132	Dynamic Systems and Feedback	3
or EL ENG C128	Feedback Control Systems	
or MEC ENG C	Feedback Control Systems	
MEC ENG 163	Engineering Aerodynamics	3

Technical Electives

For the technical electives, students are required to take four courses in two of the tracks listed below (exceptions due to impacted courses or courses not offered can be resolved through petition to the exec committee):

Communications Systems		
EL ENG 121	Introduction to Digital Communication Systems	4
EL ENG 122	Introduction to Communication Networks	4
EL ENG 117	Electromagnetic Fields and Waves	4
EL ENG 142	Integrated Circuits for Communications	4
COMPSCI 168	Introduction to the Internet: Architecture and Protocols	4
Computational Tools		
CIV ENG C133	Engineering Analysis Using the Finite Element Method	3
or MEC ENG C	Engineering Analysis Using the Finite Element Method	
ENGIN 150	Basic Modeling and Simulation Tools for Industrial Research Applications	4
IND ENG 174	Simulation for Enterprise-Scale Systems	3
NUC ENG 155	Introduction to Numerical Simulations in Radiation Transport	3
Control, Autonomy, & AI		
MEC ENG 136	Introduction to Control of Unmanned Aerial Vehicles	3
EL ENG C106A	Introduction to Robotics	4
EL ENG C106B	Robotic Manipulation and Interaction	4
COMPSCI 188	Introduction to Artificial Intelligence	4
COMPSCI 189	Introduction to Machine Learning	4
IND ENG 142	Introduction to Machine Learning and Data Analytics	3
Design		
MEC ENG 132	Dynamic Systems and Feedback	3
EL ENG 192	Mechatronic Design Laboratory	4
Dynamical Systems		
MEC ENG 170	Engineering Mechanics III	3
MEC ENG 175	Intermediate Dynamics	3
Humans & Automation		
CIV ENG 190	Special Topics in Civil and Environmental Engineering	1-4
COMPSCI 160	User Interface Design and Development	4
COG SCI 131	Computational Models of Cognition	4
IND ENG 170	Industrial Design and Human Factors	3
Manufacturing		
IND ENG 130	Methods of Manufacturing Improvement	3
MAT SCI 121	Metals Processing	3
MEC ENG 122	Processing of Materials in Manufacturing	3
MEC ENG 127	Introduction to Composite Materials	3
Materials		
MAT SCI 113	Mechanical Behavior of Engineering Materials	3
MAT SCI 136	Materials in Energy Technologies	4
MAT SCI 102	Bonding, Crystallography, and Crystal Defects	3
MAT SCI 104L	Materials Characterization Laboratory	1
MAT SCI 112	Corrosion (Chemical Properties)	3
MEC ENG 127	Introduction to Composite Materials	3
NUC ENG 120	Nuclear Materials	4
MEC ENG 108	Mechanical Behavior of Engineering Materials	4
Mechanics		
MEC ENG 185	Introduction to Continuum Mechanics	3
CIV ENG 132	Applied Structural Mechanics	3
Operations & Project Management		
CIV ENG 167	Engineering Project Management	3
ENGIN 120	Principles of Engineering Economics	3
IND ENG 130	Methods of Manufacturing Improvement	3
IND ENG 150	Production Systems Analysis	3
IND ENG 153	Logistics Network Design and Supply Chain Management	3
Optimization		
EECS 127	Optimization Models in Engineering	4
IND ENG 160	Nonlinear and Discrete Optimization	3
IND ENG 162	Linear Programming and Network Flows	3
IND ENG 164	Introduction to Optimization Modeling	3
Power		
CIV ENG 190	Special Topics in Civil and Environmental Engineering	1-4
MEC ENG 140	Combustion Processes	3
MEC ENG 146	Energy Conversion Principles	3
MEC ENG 154	Thermophysics for Applications	3
NUC ENG 150	Introduction to Nuclear Reactor Theory	4
NUC ENG 161	Nuclear Power Engineering	4
Propulsion		
AEROSPC 143	Course Not Available	
MEC ENG 109	Heat Transfer	3
MEC ENG 140	Combustion Processes	3
MEC ENG 151A	Conductive and Radiative Transport	3
MEC ENG 151B	Convective Transport and Computational Methods	3
MEC ENG 154	Thermophysics for Applications	3
Risk Management		
CIV ENG 193	Engineering Risk Analysis	3
IND ENG 165	Engineering Statistics, Quality Control, and Forecasting	4
IND ENG 166	Decision Analytics	3
IND ENG 172	Probability and Risk Analysis for Engineers	4
NUC ENG 167	Risk-Informed Design for Advanced Nuclear Systems	3
NUC ENG 175	Methods of Risk Analysis	3
Space Technologies		
NUC ENG 140	Course Not Available	
NUC ENG 162	Radiation Biophysics and Dosimetry	3

Students can receive an aerospace minor by successfully completing the following courses:

MEC ENG 127	Introduction to Composite Materials	3
MEC ENG 136	Introduction to Control of Unmanned Aerial Vehicles	3
MEC ENG 163	Engineering Aerodynamics	3
Prequisite Courses		

MEC ENG C85	Introduction to Solid Mechanics	3
MEC ENG 106	Fluid Mechanics	3
MEC ENG 132	Dynamic Systems and Feedback	3

Non-Mechanical Engineering majors can declare their intention to complete the minor after completing prerequisite courses MEC ENG C85, MEC ENG 106, and MEC ENG 132. Mechanical Engineering majors are allowed to overlap prerequisite courses.

Students must have a minimum overall grade-point average of 3.0, as well as a minimum grade-point average of 3.0 in the prerequisite courses, in order to be admitted to the minor program. Students outside of the Mechanical Engineering major must take all 6 courses (the pre-requisite courses and the minor courses) to complete the minor. Students must have a minimum of 2.00 grade-point average in the minor courses at graduation. Completion of the minor cannot delay graduation.

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/) 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/) 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/), 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. See the humanities and social sciences (https://engineering.berkeley.edu/students/undergraduate-guide/degree-requirements/humanities-and-social-sciences/) section of our website for details.

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/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 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/archive/2021-22/undergraduate/education/#universityrequirementstext)

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

Campus Requirement

American Cultures (http://guide.berkeley.edu/archive/2021-22/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 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.

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 adviser 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.

	Freshman
Fall Units	
MATH 1A	4
Science Course 1	4
MAT SCI 45 or COMPSCI 61A	3-4
AERO ENG 1	1
Reading & Composition Part A Course 2	4
	16-17

Total Units: 16-17

	Freshman
Spring Units	
MATH 1B	4
PHYSICS 7A	4
ENGIN 7 or MAT SCI 45	4
AEROSPC 2	
Reading & Composition Part B Course 2	4
	16

Total Units: 16

	Sophomore
Fall Units	
MATH 53	4
PHYSICS 7B	4
Humanities/Social Sciences Course 2	3-4
AEROSPC 10	
	11-12

Total Units: 11-12

	Sophomore
Spring Units	
MATH 54, PHYSICS 89, or 11	4
CIV ENG C30 or MEC ENG C85	3
ENGIN 40 or MEC ENG 40	4
Humanities/Social Sciences Course 2	3-4
	14-15

Total Units: 14-15

	Junior
Fall Units	
MEC ENG 106	3
CIV ENG 126 or MEC ENG 104	3
ENGIN 78, CIV ENG 93, or DATA C100	3-4
Humanities/Social Sciences Course 2	4
	13-14

Total Units: 13-14

	Junior
Spring Units	
MEC ENG 163	3
MEC ENG 100, EL ENG 120, or EECS 149	4
MEC ENG 132, EL ENG C128, or MEC ENG C134	3
Humanities/Social Sciences Course 2	4
	14

Total Units: 14

	Senior
Fall Units	
Technical Elective 3	4
Technical Elective 3	4
Free Elective 4	3-4
MEC ENG 103	4
	15-16

Total Units: 15-16

	Senior
Spring Units	
Technical Elective 3	4
Technical Elective 3	4
Free Elective 4	3-4
AEROSPC 100	0.0
	11-12

Total Units: 11-12

Total Units: 120 (minimum)

1 For the required science courses, in addition to PHYSICS 7A and PHYSICS 7B, students will take one of ASTRON 7A (http://guide.berkeley.edu/archive/2021-22/search/?P=ASTRON+7A), ASTRON 10 (http://guide.berkeley.edu/archive/2021-22/search/?P=ASTRON+10), BIOLOGY 1A/1AL (http://guide.berkeley.edu/archive/2021-22/search/?P=BIOLOGY+1AL), BIOLOGY 1B (http://guide.berkeley.edu/archive/2021-22/search/?P=BIOLOGY+1B), CHEM 1A/1AL (http://guide.berkeley.edu/archive/2021-22/search/?P=CHEM+1A), CHEM 1B (http://guide.berkeley.edu/archive/2021-22/search/?P=CHEM+1B), CHEM 3A/3AL (http://guide.berkeley.edu/archive/2021-22/search/?P=CHEM+3A), CHEM 3B/3BL (http://guide.berkeley.edu/archive/2021-22/search/?P=CHEM+3B), CHEM 4A (http://guide.berkeley.edu/archive/2021-22/search/?P=CHEM+4A), CHEM 4B (http://guide.berkeley.edu/archive/2021-22/search/?P=CHEM+4B), MCELLBI 32 (http://guide.berkeley.edu/archive/2021-22/search/?P=MCELLBI+32), or PHYSICS 7C (http://guide.berkeley.edu/archive/2021-22/search/?P=PHYSICS+7C).

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 engineering.berkeley.edu/hss (https://engineering.berkeley.edu/academics/undergraduate-guide/degree-requirements/humanities-and-social-sciences/) for complete details and a list of approved courses.