Aerospace Engineering (AERO ENG)

Courses

AERO ENG 1 Aerospace Engineering 1 Seminar 1 Unit

Terms offered: Fall 2025, Fall 2024, Fall 2023
This is a freshman-level seminar course offered every Fall semester consisting of general-audience lectures by leading practitioners of aerospace engineering from the Bay Area and beyond. This seminar will be coordinated by a faculty member in charge of identifying and scheduling the speakers.

Objectives & Outcomes

Course Objectives: This seminar series is intended to provide a cutting-edge professional perspective to the students, to reinforce their appreciation for the technological and societal relevance of the discipline, and to stimulate their interest in the technical component of the aerospace engineering curriculum.

Student Learning Outcomes: An appreciation of the technological challenges and professional opportunities within the discipline of aerospace engineering

Hours & Format

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

Additional Details

Subject/Course Level: Aerospace Engineering/Undergraduate

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

Instructors: Papadopoulos, Tomlin, Fratoni, Leachman, Minor

AERO ENG 2 Aerospace Engineering 2 Seminar 1 Unit

Terms offered: Spring 2025, Spring 2024, Spring 2023
This is a freshman-level seminar course offered every Spring semester that showcases aerospace-related research by the UC Berkeley campus engineering and scientific community (including Lawrence Berkeley National Laboratory and the Space Sciences Laboratory). This seminar will be coordinated by one of the faculty who will be in charge of scheduling the speakers.

Objectives & Outcomes

Course Objectives: This seminar series is intended to introduce first-year engineering majors to the wide array of aerospace-related research conducted on campus and to serve as an intellectual inspiration to those who contemplate pursuing the aerospace engineering major.

Student Learning Outcomes: An appreciation of the breadth of aerospace engineering and the opportunities of undergraduate student engagement in aerospace-related research on campus.

Hours & Format

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

Additional Details

Subject/Course Level: Aerospace Engineering/Undergraduate

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

Instructors: Papadopoulos, Tomlin, Fratoni, Leachman, Minor

AERO ENG 10 Introduction to Aerospace Engineering Design 4 Units

Terms offered: Fall 2025, Fall 2024, Fall 2023
This course introduces mathematical engineering concepts and a wide range of analysis and design techniques of relevance to aerospace engineering via approximately 3-week modules covering the following topics: dynamics and control of a small quad-rotor aircraft; dynamics of elliptic, hyperbolic, and parabolic orbits, including rendezvous of objects in the same circular orbit; control volume analysis of a rocket engine; sling-shot effect to drive space probes into space; thermal control in outer space; optimization of airfoils using morphing techniques; rapid prototyping-assisted design of lightweight materials.

Rules & Requirements

Prerequisites: Prerequisite: MATH 51, MATH 52, MATH 53 (may be taken concurrently), PHYSICS 7A; and programming (COMPSCI 61A or ENGIN 7)

Hours & Format

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

Additional Details

Subject/Course Level: Aerospace Engineering/Undergraduate

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

Instructors: Papadopoulos, Marcus, Tomlin, Savas, Beyen, Minor

AERO ENG 24 Freshman Seminars 1 Unit

Terms offered: Spring 2023
The Berkeley Seminar Program has been designed to provide new students with the opportunity to explore an intellectual topic with a faculty member in a small-seminar setting. Berkeley Seminars are offered in all campus departments, and topics vary from department to department and semester to semester.
Objectives & Outcomes

Course Objectives: To introduce interested students to a particular component of aerospace engineering and to demonstrate the technological challenges, as well as the broader societal impact of the discipline.

Student Learning Outcomes: Upon completion of this seminar, the student will have attained a critical understanding of the intersection of science, technology, and society in the context of an aerospace-related topic.

Rules & Requirements

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

Hours & Format

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

Additional Details

Subject/Course Level: Aerospace Engineering/Undergraduate

Grading/Final exam status: Offered for pass/not pass grade only. Final Exam To be decided by the instructor when the class is offered.

AERO ENG 98 Supervised Group Study and Research 1 - 4 Units

Terms offered: Spring 2025
Organized group study on various topics selected by lower division students under the sponsorship and direction of a member of the Aerospace Engineering faculty.
Rules & Requirements

Prerequisites: Consent of instructor. Lower division standing

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: 10 weeks - 1.5-6 hours of directed group study per week

Additional Details

Subject/Course Level: Aerospace Engineering/Undergraduate

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

AERO ENG 100 Aerospace Capstone 4 Units

Terms offered: Fall 2025
This capstone course challenges students to integrate their aerospace knowledge to design, analyze and build a system for an aerospace mission. Students can choose to focus on astronautical satellite systems or aeronautical drone systems. The course covers topics including structures, materials and environments, orbital and flight mechanics, attitude determination, stability and control, aeronautical and astronautical propulsion, aerodynamics, communications, and systems engineering.
Objectives & Outcomes

Course Objectives: This course is the capstone design experience for the Aerospace Engineering Program challenging undergraduate majors to apply their learning to practically design, analyze and build a system addressing a mission need. The course guides students through full-system design lifecycle processes, which include identifying system requirements, developing a preliminary design, analyzing and prototyping the design, identifying critical subsystem designs, and finally assessing the test and/or flight readiness. The course integrates theoretical knowledge in lectures, hands-on work in the lab and machine shop, with practical insights through guest lectures by industry experts. This capstone bridges theory and practice in a fast-paced, future-focused course.

Rules & Requirements

Prerequisites: MEC ENG 100 (Instrumentation or equivalent), MEC ENG 104 (Dynamics or equivalent), MEC ENG 132 (Controls or equivalent), MEC ENG 106 Fluid Mechanics

Hours & Format

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

Additional Details

Subject/Course Level: Aerospace 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.).

AERO ENG C162 Introduction to Flight Mechanics 3 Units

Terms offered: Fall 2025, Fall 2024, Fall 2023

This course introduces flight mechanics and a wide range of analysis and design techniques of relevance to the flight and performance characteristics of aerospace vehicles. The course consists of 6 major modules with the following topics: introduction, flow types, lift and drag, aircraft performance, stability and control, and, prominently, space flight. The entire course is enriched with numerous practical examples from real life that help to understand the practical use of the subject matter.

Objectives & Outcomes

Course Objectives: This course intends to introduce undergraduate engineering majors with an interest in aerospace engineering to analysis and design techniques of relevance to the flight and performance characteristics of aerospace vehicles in a self-contained manner and in anticipation of the engineering science coursework in the upper division. Simultaneously, the course intends to make tangible connections between the theory and relevant practical examples in aerospace engineering by means of the discussion of research facilities at NASA Ames (wind-tunnels and simulators), X-planes, relevant airliner accidents, launch and re-entry telemetry data, etc.

Student Learning Outcomes: Upon completion of this course, students should be able to:

- Calculate lift and drag of a 2D airfoil and a 3D wing in subsonic and supersonic speed regimes
- Calculate thrust and power required for level flight
- Compute the range and endurance of propeller-driven as well as jet-powered aircraft
- Compute the necessary runway length for takeoff and landing
- Analyze aircraft trim conditions
- Assess longitudinal balance and static stability of an aircraft
- Find orbit parameters from the orbital geometry
- Design a Hohmann orbit transfer and compute the total DV
- Calculate peak deceleration and speed at touchdown in a re-entry path for ballistic as well as gliding flight.
- Describe and discuss various design methodologies and their trade-offs.

Rules & Requirements

Prerequisites: MATH 52; PHYSICS 7A; and MEC ENG 106 (may be taken concurrently)

Hours & Format

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

Additional Details

Subject/Course Level: Aerospace Engineering/Undergraduate

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

Instructors: Lombaerts, Papadopoulos

Also listed as: MEC ENG C162

AERO ENG C166 Introduction to Compressible Flow 3 Units

Terms offered: Fall 2024

This course introduces the theory of compressible flows (gases) and the mathematics representation of different flow regimes. Students will learn about the governing equations of general compressible flows and special cases such as inviscid and irrotational flows. The course will cover the following topics: 1D-flow, converging-diverging nozzle, normal and oblique shock definitions and practical examples for aerospace applications, Mach waves, wave equation, shock tube, transonic flow, supersonic flow, method of characteristics, and an introduction to hypersonic flows. Practical examples of aerospace applications such as turbomachinery flows, flow past an airfoil and a 3D wing will be included.

Objectives & Outcomes

Course Objectives: This course intends to introduce undergraduate engineering majors with an interest in aerospace engineering to the theory and concepts of compressible flow regimes, their definitions, governing equations, and techniques to evaluate flow characteristics using a variety of real-world aerospace use cases including both internal and external flows.

Student Learning Outcomes: • Be able to explain various terms in the governing equations of compressible flows and describe assumptions and derive equations for special flow types such as inviscid flows, quasi 1D flows, and irrotational flows.
• Define compressible flow and be able to provide a quantitative estimation of a flow to be compressible.
• Explain the flow behavior and characteristics in subsonic, transonic, supersonic and hypersonic flow regimes.

Rules & Requirements

Prerequisites: MEC ENG 104, MEC ENG 163

Credit Restrictions: Students will receive no credit for AERO ENG C166 after completing MEC ENG 166. A deficient grade in AERO ENG C166 may be removed by taking MEC ENG 166, or MEC ENG 166.

Hours & Format

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

Additional Details

Subject/Course Level: Aerospace Engineering/Undergraduate

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

Instructors: Papadopoulos, Gollner, Marcus, Savas

Also listed as: MEC ENG C166

AERO ENG C184 Flight Vehicle Structures and Aeroelasticity 3 Units

Terms offered: Spring 2025
This course introduces engineering students to the analysis and design of load-bearing components of flight structures, ranging from subsonic aircraft to rockets. Emphasis is placed on the quasi-static and dynamic analysis of structural components which are prevalent in aerospace engineering. Attention is also devoted to a comprehensive design roadmap of flight vehicle structures from the full system- to the individual component-level

Objectives & Outcomes

Course Objectives: 1. Familiarize students with the different load-bearing components and loads encountered in flight vehicles.

2. Sharpen the students' skills in the statics and dynamics of thin-walled structures.

3. Enhance the students' aerospace engineering design skills by leveraging the use of the finite element method as a tool for both global and local analysis.

Student Learning Outcomes: 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.

(g) A knowledge of contemporary issues.

Ability to apply knowledge of mathematics, science, and engineering.

Ability to design and conduct experiments, as well as to analyze and interpret data
Ability to identify, formulate, and solve engineering problems.

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.

Understanding of professional and ethical responsibility.

Rules & Requirements

Prerequisites: CIV ENG C30 / MEC ENG C85, and MEC ENG 104 or CIV ENG 126

Hours & Format

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

Additional Details

Subject/Course Level: Aerospace Engineering/Undergraduate

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

Instructor: Papadopoulos

Formerly known as: Mechanical Engineering 184

AERO ENG 193 Special Topics in Aerospace Engineering 1 - 4 Units

Terms offered: Spring 2025
This course covers current topics of interest in Aerospace Engineering. Topics and content may vary semester to semester.

Objectives & Outcomes

Course Objectives: Varies with Course. To introduce aerospace-focused students in a cogent and comprehensive manner to select topics related to the engineering systems, processes, and practices encountered in atmospheric and/or space flight.

Rules & Requirements

Prerequisites: Upper-division standing is required. Course prerequisites vary and depend on the specific topic of the course, per the discretion of the instructor

Repeat rules: Course may be repeated for credit when topic changes. Students may enroll in multiple sections of this course within the same semester.

Hours & Format

Fall and/or spring: 15 weeks - 1-4 hours of lecture per week

Summer:
6 weeks - 2.5-10 hours of lecture per week
8 weeks - 1-4 hours of lecture per week
10 weeks - 2-4 hours of lecture per week

Additional Details

Subject/Course Level: Aerospace Engineering/Undergraduate

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

Instructor: Faculty

AERO ENG C193P The Final Frontier? Space Technology and National Security Policy 4 Units

Terms offered: Fall 2025

This course explores the intersection of space and national security policy, focusing on the impacts of the evolving strategic environment in space. Students examine the key actors, technologies, and policy frameworks that shape the role of space in the global economy and in modern defense. Topics include: satellite technologies, the militarization of space, the role of private industry in the domain, and governance challenges posed by emerging technologies. The course engages with case studies on U.S., Russian, and Chinese space policies, and international efforts to govern space. By the end of the course, students will understand how space capabilities influence international security and are prepared to take part in policy debates.

Hours & Format

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

Additional Details

Subject/Course Level: Aerospace 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: Reddie

Also listed as: PUB POL C151

AERO ENG H194 Honors Undergraduate Research 2 - 4 Units

Terms offered: Prior to 2007

Undergraduate students in good academic standing who have completed a satisfactory number of science and engineering courses may pursue original honors research under the supervision of a faculty member. A minimum of 3 units of AERO ENG H194 may be considered as equivalent to one technical elective course in the Aerospace Engineering major subject to the approval of the Director of Aerospace Engineering programs in the College of Engineering.

Rules & Requirements

Prerequisites: A minimum cumulative GPA of 3.3. Consent of instructor, junior or senior standing

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

Hours & Format

Fall and/or spring: 15 weeks - 2-4 hours of independent study per week

Summer:
6 weeks - 1-5 hours of independent study per week
8 weeks - 4-8 hours of independent study per week

Additional Details

Subject/Course Level: Aerospace 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.).

AERO ENG 196 Undergraduate Research 2 - 4 Units

Terms offered: Prior to 2007

Undergraduate students in good standing who have completed a satisfactory number of science and engineering courses may pursue original research under the supervision of a faculty member. A minimum of 3 units of AERO ENG 196 may be considered as equivalent to one technical elective course in the Aerospace Engineering major subject to the approval of the Director of Aerospace Engineering programs in the College of Engineering.

Rules & Requirements

Prerequisites: Consent of instructor, junior or senior standing

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

Hours & Format

Fall and/or spring: 15 weeks - 2-4 hours of independent study per week

Summer:
6 weeks - 5-10 hours of independent study per week
8 weeks - 4-8 hours of independent study per week

Additional Details

Subject/Course Level: Aerospace 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.).

AERO ENG 197 Undergraduate Aerospace Engineering Field Studies 0.5 - 4 Units

Terms offered: Prior to 2007

Supervised field experience relative to specific aspects of practice in aerospace engineering. Under guidance of a faculty member, the student will work in government or industry, primarily in an internship setting or related type of short-time project. Emphasis is placed on attaining practical experience in the aerospace engineering field.

Objectives & Outcomes

Course Objectives: To allow students to undertake an internship or related field study as part of their regular studies.

Rules & Requirements

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

Hours & Format

Fall and/or spring: 15 weeks - 1.5-12 hours of internship per week

Summer:
6 weeks - 4-30 hours of internship per week
10 weeks - 2.5-18 hours of internship per week

Additional Details

Subject/Course Level: Aerospace Engineering/Undergraduate

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

AERO ENG 198 Directed Group Study for Advanced Undergraduates 1 - 4 Units

Terms offered: Spring 2025, Fall 2024, Spring 2024
Group study of a selected topic or topics in Aerospace Engineering. Credit for 198 or 199 courses combined may not exceed 4 units in any single term. See College for other restrictions.

Rules & Requirements

Prerequisites: Upper division standing and good academic standing

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: 10 weeks - 1.5-6 hours of directed group study per week

Additional Details

Subject/Course Level: Aerospace Engineering/Undergraduate

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

AERO ENG 199 Supervised Independent Study 1 - 4 Units

Terms offered: Prior to 2007
Undergraduate students in good standing who have completed a satisfactory number of science and engineering courses may pursue supervised independent study under the supervision of a faculty member.

Rules & Requirements

Prerequisites: Consent of instructor, junior and senior standing

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

Hours & Format

Fall and/or spring: 15 weeks - 1-4 hours of independent study per week

Summer:
6 weeks - 1-5 hours of independent study per week
8 weeks - 1-4 hours of independent study per week

Additional Details

Subject/Course Level: Aerospace Engineering/Undergraduate

Grading/Final exam status: Offered for pass/not pass grade only. Alternate method of final assessment during regularly scheduled final exam group (e.g., presentation, final project, etc.).