Bachelor of Science in Aerospace Engineering

The field of aerospace engineering developed because of humanity's desire for aircraft systems for military, commercial, and civilian purposes; it was first called aeronautical engineering or aeronautics. When the space age began, it was natural for aeronautical engineers to participate in the development of spacecraft systems for space exploration. This branch of engineering became known as astronautical engineering or astronautics, and the combined field is called aerospace engineering or aeronautics and astronautics. Because of the diverse nature of the work, the aerospace engineer must have a basic knowledge of physics, mathematics, digital computation, and the various disciplines of aerospace engineering: aerodynamics and propulsion, structural mechanics, flight mechanics and orbital mechanics, and control. Because of their extensive education in fundamental disciplines, aerospace engineers can work in areas other than aerospace engineering and are employed in a wide range of careers.

The objectives of the aerospace engineering degree program are to prepare students for professional practice in aerospace engineering and related engineering and scientific fields; to prepare students for such postbaccalaureate study as their aptitudes and professional goals may dictate; to instill in students a commitment to lifelong education and to ethical behavior throughout their professional careers; and to make students aware of the global and societal effects of technology. To meet these objectives, the faculty has designed a rigorous curriculum that emphasizes fundamentals in the basic sciences, mathematics, and the humanities, and integrates classroom and laboratory experiences in the engineering disciplines of aerodynamics and propulsion, structural mechanics, mechanics of materials, flight and orbital mechanics, controls, computation, electromechanical systems, design, and technical communication. The curriculum requires students to use modern engineering tools, to work individually, and to practice teamwork.

The first two years of the aerospace engineering curriculum emphasize fundamental material along with engineering sciences, while the third year introduces concepts in the areas of aerodynamics and propulsion, structural mechanics, flight mechanics and orbital mechanics, and flight control. The fourth year provides further depth in aerospace engineering, with emphasis on design and laboratory courses. During the junior year, the student elects to pursue one of two design tracks, atmospheric flight or space flight. Both tracks are complemented by general education courses and courses offered in other engineering disciplines. In addition, the student may choose electives that increase the breadth of the program or that provide additional depth within one or more subdisciplines within the department. All of the following subdisciplines are also represented in the elective options.

Aerodynamics and Propulsion

This subdiscipline involves fluid motion, propulsion, lift and drag on wings and other bodies, high-speed heating effects, and wind tunnel investigation of these problems. Topics of study include fluid mechanics, gas dynamics, heat transfer, aerodynamics, propulsion, computational fluid dynamics, and experimental fluid mechanics.

Structural Mechanics

This subdiscipline includes the study of airplane, spacecraft, and missile structures, the materials that make them efficient, and methods for testing, analysis, and design of new structural systems. Course topics include structural analysis, structural dynamics, materials (including advanced composites), aeroelasticity, experimental structural mechanics, and computer-aided design of structures.

Flight Mechanics and Orbital Mechanics

Flight mechanics involves the analysis of the motion of aircraft, missiles, rockets, reentry vehicles, and spacecraft that are subjected to gravitational, propulsive, and aerodynamic forces; the study of uncontrolled motion of satellites and coasting spacecraft is usually referred to as orbital mechanics. Subject matter in these areas includes trajectory analysis and optimization; attitude dynamics, stability, and control; flight test; orbit determination; orbital operations; systems engineering; sensors; satellite hardware applications; and simulation.

Flight Control

Control theory is applied in aerospace engineering to the development of automatic flight control systems for aircraft (autopilots and stability augmentation systems), attitude control systems for satellites, and guidance and control systems for missiles, rockets, reentry vehicles, and spacecraft. Course topics include linear system theory, classical control theory, digital control, and probability theory.

Student Outcomes

Attainment of these outcomes prepares graduates to enter the professional practice of engineering. Aerospace engineering graduates should demonstrate:

- An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
- An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
- An ability to communicate effectively with a range of audiences
- An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
- An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
- An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
- An ability to acquire and apply new knowledge as needed, using appropriate learning strategies

Portable Computing Devices

Students entering aerospace engineering are required to have access to a portable computing device capable of running the software tools required for undergraduate engineering analyses (MATLAB, SOLIDWORKS, Word, Excel, etc.) and accessing the remote server for the department. This device does not need to be brought to campus on a daily basis, but individual courses may require that the device be brought to certain lectures, labs, and/or exams. Minimum and recommended specifications may be found on the department website.

Curriculum †

Courses used to fulfill technical elective requirements must be approved by the aerospace engineering faculty before the student enrolls in them.

The student must take all courses required for the degree on the letter-grade basis and must earn a grade of at least *C-* in each course, except for those listed as Remaining Core Curriculum courses. He or she must also maintain grade point averages of at least 2.00 in the major area of study and in required technical courses as described in Academic Standards, and a cumulative University grade point average of at least 2.00 as described in the General Information Catalog.

Requirements		Hours
Aerospace Engineering Courses		
ASE 120K	Low-Speed Aerodynamics Laboratory	1
ASE 320	Low-Speed Aerodynamics	3
ASE 324L	Aerospace Materials Laboratory	3
ASE 330M	Linear System Analysis	3
ASE 362K	Compressible Flow	3
ASE 366K	Spacecraft Dynamics	3
ASE 367K	Flight Dynamics	3
ASE 370C	Feedback Control Systems	3
ASE 375	Electromechanical Systems	3
ASE 376K	Propulsion	3
Chemistry		
CH 301	Principles of Chemistry I [093]	3
Computational Engineering		
COE 301	Introduction to Computer Programming	3
COE 311K	Engineering Computation	3
Engineering Mechanics		
E M 306	Statics	3
E M 311M	Dynamics	3
E M 319	Mechanics of Solids	3
Mathematics		
M 408C	Differential and Integral Calculus [020]	4
M 408D	Sequences, Series, and Multivariable Calculus	4
M 427J	Differential Equations with Linear Algebra	4
M 427L	Advanced Calculus for Applications II	4
Physics		
PHY 105M	Laboratory For Physics 302K, 303K, and 317K	1
PHY 105N	Laboratory For Physics 302L, 303L, and 317L	1
PHY 303K	Engineering Physics I [030]	3
PHY 303L	Engineering Physics II [030]	3
Rhetoric and Writing		
RHE 306	Rhetoric and Writing [010]	3
Other required courses		
Design track courses		7
Approved aerospace electives		9
Approved technical elective		3
Structures elective		3
M E 210	Engineering Design Graphics	2
M E 310T	Applied Thermodynamics	3
E S 333T	Engineering Communication [010]	3
Remaining Core Curriculum Courses		
E 316L	British Literature [040]	3
or E 316M	American Literature	
or E 316N	World Literature	
or E 316P	Masterworks of Literature	
American and Texas government [070]		6
American history [060]		6
Social and behavioral sciences [080]		3
Visual and performing arts [050]		3
UGS 302	First-Year Signature Course [090]	3
or UGS 303	First-Year Signature Course	
Total Hours		**127**

Design Track Options

The design track option allows the student to choose seven semester hours of courses in either atmospheric flight or space flight. Each student should choose a design track by the end of the first semester of the junior year and plan an academic program to meet the track requirements in the next three semesters. Many students choose electives that will strengthen their backgrounds in one specialty area, but this is not required. It should be noted that a student may choose the design courses in the other track as electives.

Design Track 1, Atmospheric Flight

Also called aeronautics, this track provides the student with a well-rounded program of study emphasizing the major disciplines of aerodynamics, propulsion, structures, design, performance, flight mechanics, and control of aircraft. These subjects are treated at a fundamental level that lays a foundation for work in a broad variety of specialties in the aircraft industry. This option is intended for the undergraduate student whose primary interest is aircraft.

Aerospace Engineering 361K, *Aircraft Design I*
Aerospace Engineering 361L, *Aircraft Design II*
Aerospace Engineering 162M, *High-Speed Aerodynamics Laboratory*

Design Track 2, Space Flight

Also called astronautics, this track offers a well-rounded program of study that provides a background in the traditional areas of materials, structures, propulsion, and controls, while also giving the student a chance to learn about the space environment, attitude determination and control, orbital mechanics, mission design, and spacecraft systems engineering. These subjects are treated at a fundamental level that lays a foundation for work in a broad variety of specialties in space-related industries. This option is intended for the undergraduate student whose primary interest is space and spacecraft.

Aerospace Engineering 166M, *Spacecraft Systems Laboratory*
Aerospace Engineering 374K, *Space Systems Engineering Design*
Aerospace Engineering 374L, *Spacecraft/Mission Design*

Structures Elective

The degree requires all students to take three semester hours of an approved structures elective.
Students pursuing the Design Track 1, Atmospheric Flight, must take Aerospace Engineering 365, *Structural Dynamics*, to fulfill this requirement.
Students pursuing Design Track 2, Space Flight, will choose one of four options to fulfill this requirement:
Aerospace Engineering 339/Engineering Mechanics 339, *Advanced Strength of Materials*
Aerospace Engineering 357, *Mechanics of Composite Materials*
Aerospace Engineering 365, *Structural Dynamics*

Computational Engineering 321K, *Computational Methods for Structural Analysis*.

Aerospace Electives

The degree requires all students to take nine semester hours of approved aerospace electives. The list of approved electives may be found on the department website. For students pursuing Design Track 1, Atmospheric Flight, six of the nine hours must include Aerospace Engineering 364, *Applied Aerodynamics*, and either Computational Engineering 321K, *Computational Methods for Structural Analysis* or Computational Engineering 347, *Introduction to Computational Fluid Dynamics*.

Special Projects Laboratories

The department offers students the opportunity to participate in special projects such as student-built radio-controlled aircraft competitions and student satellite-building projects. These time-intensive projects are open to all aerospace engineering students with at least 15 semester hours of University credit toward the degree and a grade point average of at least 2.50. Academic credit for participation in departmentally approved student projects is available on the pass/fail basis through the course Aerospace Engineering 128. Three such laboratory courses can be combined to count as one three-hour technical elective; one such laboratory course can be combined with a two-hour cooperative program to count as one three-hour technical elective.

Core Component Areas: [010] Communication; [020] Mathematics; [030] Natural Science and Technology, Part I; [040] Humanities; [050] Visual and Performing Arts; [060] U.S. History; [070] American and Texas Government; [080] Social and Behavioral Sciences; [090] First-Year Signature Course; [093] Natural Science and Technology, Part II

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† Effective April 2025, UT Austin no longer requires Skills and Experience flags.