

AEROSPACE ENGINEERING SCIENCES - BACHELOR OF SCIENCE (BSAE)

The undergraduate curriculum in aerospace engineering sciences is designed to prepare students to advance to a distinguished professional career in the aerospace industry or for graduate school, consistent with our stated program educational objectives. In particular, this involves providing students with an interdisciplinary systems perspective of aerospace engineering. The curriculum accomplishes these goals by:

- providing a strong basis in mathematics, science, and engineering fundamentals;
- extending these fundamentals to advanced topics in aerospace engineering;
- complementing the engineering education with sufficient exposure to the humanities and social sciences; and
- beginning and ending in major design experiences that stress an interdisciplinary systems perspective.

AES students are also encouraged to consider a technical minor or double major in electrical engineering, computer science, applied math, engineering physics, astrophysical and planetary sciences, or atmospheric and oceanic sciences. In most cases, the junior- and senior-level courses required for the above-mentioned minors can be applied to the technical elective requirements.

For students having sufficient ability and interest, planning for graduate study should begin by the start of the junior year. Such a plan should consider the foreign language requirements of appropriate graduate schools and an advanced mathematics program. Students who wish to combine the business and aerospace engineering sciences curricula are advised to consider obtaining the BS degree in aerospace and a master's degree in business rather than a combined BS degree.

For more information, visit the department's Prospective Students (<https://www.colorado.edu/aerospace/prospective-students/undergraduates/>) webpage.

Requirements

The Bachelor of Science curriculum in Aerospace Engineering Sciences is revised annually to keep up with advances in technology, to make use of new educational methodologies, and to satisfy current program accreditation criteria. A minimum of 128 credit hours is required. For up-to-date program requirements, visit the Bachelor of Science in Aerospace Engineering Sciences web page (<https://www.colorado.edu/aerospace/current-students/undergraduates/curriculum/>).

In addition, students must meet the general undergraduate degree requirements of the College of Engineering and Applied Science. (<https://www.colorado.edu/engineering-advising/get-your-degree/graduation-requirements/>)

Required Courses and Credits

Code	Title	Credit Hours
Required Courses		
ASEN 1022	Materials Science for Aerospace Engineers	3
ASEN 1320	Aerospace Computing and Engineering Applications	4
or CSCI 1300	Computer Science 1: Starting Computing	
or CHEN 1310	Introduction to Engineering Computing	
or ECEN 1310	C Programming for ECE	
ASEN 1400/ ASTR 2500	Gateway to Space	3
or ASEN 1403	Introduction to Rocket Engineering	
or GEEN 1400	Engineering Projects	
or ECEN 1400	Introduction to Digital and Analog Electronics	
ASEN 2012	Experimental and Computational Methods in Aerospace Engineering Sciences	2
ASEN 2701	Introduction to Statics, Structures, and Materials	3
ASEN 2702	Introduction to Thermodynamics and Aerodynamics	3
ASEN 2703	Introduction to Dynamics and Systems	3
ASEN 2704	Introduction to Aerospace Vehicle Design and Performance	3
ASEN 2802	Aerospace Sciences Lab I	1
ASEN 2803	Dynamics and Controls Lab	1
ASEN 2804	Aerospace Vehicle Design Lab	2
ASEN 3700	Orbital Mechanics/Attitude Dynamics and Control	3
ASEN 3711	Aerodynamics	3
ASEN 3712	Structures	3
ASEN 3713	Thermodynamics and Heat Transfer	3
ASEN 3728	Aircraft Dynamics	3
ASEN 3801	Aerospace Vehicles Dynamics and Controls Lab	1
ASEN 3802	Aerospace Sciences Lab II	1
ASEN 4013	Foundations of Propulsion	3
ASEN 3300	Aerospace Electronics and Communications	4
ASEN 4018	Senior Projects 1: Design Synthesis	4
ASEN 4028	Senior Projects 2: Design Practicum	4
Basic Engineering Electives		
<i>Required Math</i>		
APPM 1350	Calculus 1 for Engineers	4
or MATH 1300	Calculus 1	
or APPM 1345	Calculus 1 with Algebra, Part B	
APPM 1360	Calculus 2 for Engineers	4
or MATH 2300	Calculus 2	
APPM 2350	Calculus 3 for Engineers	4
or MATH 2400	Calculus 3	
APPM 2360	Introduction to Differential Equations with Linear Algebra	4

or MATH 2130 & MATH 3430	Introduction to Linear Algebra for Non-Mathematics Majors and Ordinary Differential Equations	
or MATH 2135 & MATH 3430	Introduction to Linear Algebra for Mathematics Majors and Ordinary Differential Equations	
Required Science		
PHYS 1110	General Physics 1	4
or PHYS 1115	General Physics 1 for Majors	
PHYS 1120	General Physics 2	4
or PHYS 1125	General Physics 2 for Majors	
Required Humanities, Social Sciences and Writing		
College-approved humanities & social sciences courses. At least 6 credits must be upper-division (3000 level or higher). ¹		15
College-approved writing course. ¹		3
Electives		
Technical Electives ²		15
Free Electives		11
Total Credit Hours		128

¹ Courses from approved Humanities, Social Sciences and Writing Requirements (<https://www.colorado.edu/engineering-advising/get-your-degree/degree-requirements/humanities-social-sciences-and-writing-requirements/>).

² A technical elective is generally a course in math, engineering, or science at the 3000 level or above. Any ASEN course at the 4000 level or above that is not a required course can be used as a technical elective. Upper-division independent study courses from technical areas (math, science and engineering) are acceptable for up to 6 credit hours of technical elective credit. A full listing of approved technical elective courses can be found in the degree audit.

Prerequisites and Passing Grades

The minimum passing grade for a course that is a prerequisite for another required course is C-. If a grade of D+ or lower is earned in a course which is a prerequisite to another, the student may not register for the subsequent course until the first grade has been raised to a C- or higher.

The minimum passing grade for a course that is not specifically a prerequisite for another required course is D-.

The Ann and HJ Smead Department of Aerospace Engineering Sciences (AES) reserves the right to drop students enrolled in ASEN courses who have not met the minimum prerequisite grade requirements. It is the student's responsibility to communicate with the department if summer coursework and/or transfer credit will be used to meet the prerequisite requirement.

Recommended Four-Year Plan of Study

Year One

Fall Semester		Credit Hours
APPM 1350 or MATH 1300	Calculus 1 for Engineers or Calculus 1	4
GEEN 1400 or ASEN 1403	Engineering Projects or Introduction to Rocket Engineering	3

ASEN 1320 or CSCI 1300	Aerospace Computing and Engineering Applications or Computer Science 1: Starting Computing	4
ASEN 1009	Undergraduate Aerospace Seminar	1
Humanities/Social Science Elective ¹		3
Credit Hours		15

Spring Semester

APPM 1360 or MATH 2300	Calculus 2 for Engineers or Calculus 2	4
PHYS 1110	General Physics 1	4
ASEN 1022	Materials Science for Aerospace Engineers	3
Humanities/Social Science Elective ¹		6
Credit Hours		17

Year Two

Fall Semester

APPM 2360 or MATH 2130 and MATH 3430	Introduction to Differential Equations with Linear Algebra or Introduction to Linear Algebra for Non-Mathematics Majors and Ordinary Differential Equations	4
ASEN 2012	Experimental and Computational Methods in Aerospace Engineering Sciences	2
ASEN 2701	Introduction to Statics, Structures, and Materials	3
ASEN 2702	Introduction to Thermodynamics and Aerodynamics	3
ASEN 2802	Aerospace Sciences Lab I	1
Free Elective		3
Credit Hours		16

Spring Semester

APPM 2350 or MATH 2400	Calculus 3 for Engineers or Calculus 3	4
ASEN 2703	Introduction to Dynamics and Systems	3
ASEN 2803	Dynamics and Controls Lab	1
ASEN 2704	Introduction to Aerospace Vehicle Design and Performance	3
ASEN 2804	Aerospace Vehicle Design Lab	2
PHYS 1120	General Physics 2	4
Credit Hours		17

Year Three

Fall Semester

Block A ²		
ASEN 3711	Aerodynamics	3
ASEN 3712	Structures	3
ASEN 3713	Thermodynamics and Heat Transfer	3
ASEN 3802	Aerospace Sciences Lab II	1
Humanities/Social Science Elective ¹		3
Free Elective		3
Credit Hours		16

Spring Semester

Block B ²		
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ASEN 3300	Aerospace Electronics and Communications	4
ASEN 3700	Orbital Mechanics/Attitude Dynamics and Control	3
ASEN 3728	Aircraft Dynamics	3
ASEN 3801	Aerospace Vehicles Dynamics and Controls Lab	1
Technical Elective ³		3
Free Elective		1
Credit Hours		15
Year Four		
Fall Semester		
ASEN 4013	Foundations of Propulsion	3
ASEN 4018	Senior Projects 1: Design Synthesis	4
Technical Elective ³		6
College-approved writing course ⁴		3
Credit Hours		16
Spring Semester		
ASEN 4028	Senior Projects 2: Design Practicum	4
Technical Elective ³		6
Humanities/Social Science Elective ¹		3
Free Elective		3
Credit Hours		16
Total Credit Hours		128

¹ Students may choose courses from the list of college-approved humanities and social sciences (HSS) electives (<https://www.colorado.edu/engineering-advising/get-your-degree/degree-requirements/humanities-social-sciences-and-writing-requirements/>).

² The order in which course blocks are taken can be reversed. Block A and Block B are both offered in the fall and spring semesters.

³ A technical elective is generally a course in math, engineering, or science at the 3000 level or above. Any ASEN course at the 4000 level or above that is not a required course can be used as a technical elective. Upper-division independent study courses from technical areas (math, science and engineering) are acceptable for up to 6 credit hours of technical elective credit. A full listing of approved technical elective courses can be found in the degree audit.

⁴ Students may choose a course from the list of college-approved writing courses (<https://www.colorado.edu/engineering-advising/get-your-degree/degree-requirements/humanities-social-sciences-and-writing-requirements/>).

Learning Outcomes

Upon completing the program, students are expected to be able to:

- Establish themselves in professional careers or receive a graduate degree.
- Demonstrate ethical leadership, project management and/or innovation.
- Play significant roles in the research and development of engineering systems and products.
- Identify, formulate and solve complex engineering problems by applying principles of engineering, science and mathematics.
- Apply engineering design principles 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.

- Communicate effectively with a range of audiences.
- 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.
- Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks and meet objectives.
- Develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
- Acquire and apply new knowledge as needed, using appropriate learning strategies.
- Knowledgeable in the professional context of the practice of aerospace engineering and the expectations of new graduates in aerospace engineering organizations, including an awareness of ethics issues, economics and the business environment.
- Knowledgeable in the history of aerospace engineering, providing a perspective on current events.
- Knowledgeable in aerospace engineering as a highly multidisciplinary endeavor, requiring a systems perspective to integrate technologies and manage complexity.
- Knowledgeable in major principles and scientific methods underlying the technologies comprising aerospace vehicles and systems.

Bachelor's–Accelerated Master's Degree Program(s)

The bachelor's–accelerated master's (BAM) degree program options offer currently enrolled CU Boulder undergraduate students the opportunity to receive a bachelor's and master's degree in a shorter period of time. Students receive the bachelor's degree first, but begin taking graduate coursework as undergraduates (typically in their senior year).

Because some courses are allowed to double count for both the bachelor's and the master's degrees, students receive a master's degree in less time and at a lower cost than if they were to enroll in a stand-alone master's degree program after completion of their baccalaureate degree. In addition, staying at CU Boulder to pursue a bachelor's–accelerated master's program enables students to continue working with their established faculty mentors.

Admission Requirements

BS and MS in Aerospace Engineering Sciences

In order to gain admission to the BAM program named above, a student must meet the following criteria:

- Have a CU cumulative GPA of 3.50 or higher.
- Have a minimum Major GPA (in sophomore level/2000+ coursework and above) of 3.50.
- Have at least junior class standing; enrolled in ASEN 3000-level courses.
- Completion of all MAPS requirements and no deficiencies remaining (students admitted to CU Boulder prior to Fall 2023 only).
- Transfer students must have completed a minimum of 24 credit hours at CU Boulder.

BS in Aerospace Engineering Sciences, Professional ME in Engineering Management

In order to gain admission to the BAM program named above, a student must meet the following criteria:

- Have a CU cumulative GPA of 3.0 or higher.
- Have at least junior class standing.
- Completion of all MAPS requirements and no deficiencies remaining (students admitted to CU Boulder prior to Fall 2023 only).

Program Requirements

For both programs named above, students may take up to and including 12 hours while in the undergraduate program which can later be used toward the master's degree. However, only 6 credits may be double counted toward the bachelor's degree and the master's degree. Students must apply to graduate with the bachelor's degree, and apply to continue with the master's degree, early in the semester in which the undergraduate requirements will be completed.

Please see the Aerospace Engineering Sciences BAM degree program (<https://www.colorado.edu/aerospace/current-students/undergraduates/bsms-degree/>) webpage for more information.