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 professional area 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 webpage.

Requirements

The Bachelor of Science curriculum in Aerospace Engineering Sciences is revised annually to keep up with new advances in technology, to make use of new educational methodologies, and to satisfy updated 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

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credit Hours</th>
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</thead>
<tbody>
<tr>
<td>ASEN 1022</td>
<td>Materials Science for Aerospace Engineers</td>
<td>3</td>
</tr>
<tr>
<td>ASEN 2001</td>
<td>Aerospace 1: Introduction to Statics, Structures, and Materials</td>
<td>4</td>
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<tr>
<td>ASEN 2002</td>
<td>Aerospace 2: Introduction to Thermodynamics and Aerodynamics</td>
<td>4</td>
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<tr>
<td>ASEN 2003</td>
<td>Aerospace 3: Introduction to Dynamics and Systems</td>
<td>5</td>
</tr>
<tr>
<td>ASEN 2004</td>
<td>Aerospace 4: Aerospace Vehicle Design and Performance</td>
<td>5</td>
</tr>
<tr>
<td>ASEN 2012</td>
<td>Experimental and Computational Methods in Aerospace Engineering Sciences</td>
<td>2</td>
</tr>
<tr>
<td>ASEN 3111</td>
<td>Aerodynamics</td>
<td>4</td>
</tr>
<tr>
<td>ASEN 3112</td>
<td>Structures</td>
<td>4</td>
</tr>
<tr>
<td>ASEN 3113</td>
<td>Thermodynamics and Heat Transfer</td>
<td>4</td>
</tr>
<tr>
<td>ASEN 3128</td>
<td>Aircraft Dynamics</td>
<td>4</td>
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<tr>
<td>ASEN 3200</td>
<td>Orbital Mechanics/Attitude Dynamics and Control</td>
<td>4</td>
</tr>
<tr>
<td>ASEN 3300</td>
<td>Aerospace Electronics and Communications</td>
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<tr>
<td>ASEN 4013</td>
<td>Foundations of Propulsion</td>
<td>3</td>
</tr>
<tr>
<td>ASEN 4018</td>
<td>Senior Projects 1: Design Synthesis</td>
<td>4</td>
</tr>
<tr>
<td>ASEN 4028</td>
<td>Senior Projects 2: Design Practicum</td>
<td>4</td>
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</table>

Basic Engineering Electives

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASEN 1320</td>
<td>Aerospace Computing and Engineering Applications</td>
<td>4</td>
</tr>
<tr>
<td>or CSCI 1300</td>
<td>Computer Science 1: Starting Computing</td>
<td>4</td>
</tr>
<tr>
<td>or CHEN 1310</td>
<td>Introduction to Engineering Computing</td>
<td>4</td>
</tr>
<tr>
<td>or ECEN 1310</td>
<td>C Programming for ECE</td>
<td>4</td>
</tr>
<tr>
<td>ASEN 1400</td>
<td>Gateway to Space</td>
<td>3</td>
</tr>
<tr>
<td>or ASEN 1403</td>
<td>Introduction to Rocket Engineering</td>
<td>3</td>
</tr>
<tr>
<td>or GEEN 1400</td>
<td>Engineering Projects</td>
<td>3</td>
</tr>
<tr>
<td>or ECEN 1400</td>
<td>Introduction to Digital and Analog Electronics</td>
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</tbody>
</table>

Required Math and Science

Math

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credit Hours</th>
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<tbody>
<tr>
<td>APPM 1350</td>
<td>Calculus 1 for Engineers</td>
<td>4</td>
</tr>
<tr>
<td>or MATH 1300</td>
<td>Calculus 1</td>
<td>4</td>
</tr>
<tr>
<td>or APPM 1345</td>
<td>Calculus 1 with Algebra, Part B</td>
<td>4</td>
</tr>
<tr>
<td>APPM 1360</td>
<td>Calculus 2 for Engineers</td>
<td>4</td>
</tr>
<tr>
<td>or MATH 2300</td>
<td>Calculus 2</td>
<td>4</td>
</tr>
<tr>
<td>APPM 2350</td>
<td>Calculus 3 for Engineers</td>
<td>4</td>
</tr>
<tr>
<td>or MATH 2400</td>
<td>Calculus 3</td>
<td>4</td>
</tr>
<tr>
<td>APPM 2360</td>
<td>Introduction to Differential Equations with Linear Algebra</td>
<td>4</td>
</tr>
<tr>
<td>or MATH 2130 &amp; MATH 3430</td>
<td>Introduction to Linear Algebra for Non-Mathematics Majors and Ordinary Differential Equations</td>
<td>4</td>
</tr>
</tbody>
</table>
Aerospace Engineering Sciences - Bachelor of Science (BSAE)

or MATH 2135 & MATH 3430  Introduction to Linear Algebra for Mathematics Majors and Ordinary Differential Equations

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
College-approved writing course. 1

Electives

Professional Area Electives 2  15
Free Electives 6

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 professional area elective (PAE) 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 professional area elective. Upper-division independent study courses from technical areas (math, science and engineering) are acceptable for up to 6 credit hours of professional area elective credit. A full listing of approved PAE 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 C- 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

Course | Title | Credit Hours
--- | --- | ---
**Freshman**
**Fall Semester**
APPM 1350 | Calculus 1 for Engineers | 4
First-Year Projects course | | 3
ASEN 1320 | Aerospace Computing and Engineering Applications | 4
Humanities or social science elective 1 | | 3

**Spring Semester**
APPM 1360 | Calculus 2 for Engineers | 4
ASEN 1022 | Materials Science for Aerospace Engineers | 3
PHYS 1110 | General Physics 1 | 4
Humanities or social science elective 1 | | 6

**Sophomore**
**Fall Semester**
APPM 2350 | Calculus 3 for Engineers | 4
ASEN 2001 | Aerospace 1: Introduction to Statics, Structures, and Materials | 4
ASEN 2002 | Aerospace 2: Introduction to Thermodynamics and Aerodynamics | 4
ASEN 2012 | Experimental and Computational Methods in Aerospace Engineering Sciences | 2

Free electives | | 2

**Spring Semester**
APPM 2360 | Introduction to Differential Equations with Linear Algebra | 4
ASEN 2003 | Aerospace 3: Introduction to Dynamics and Systems | 5
ASEN 2004 | Aerospace 4: Aerospace Vehicle Design and Performance | 5
PHYS 1120 | General Physics 2 | 4

**Senior**
**Fall Semester**
ASEN 3112 | Structures | 4
ASEN 3113 | Thermodynamics and Heat Transfer | 4
ASEN 3200 | Orbital Mechanics/Attitude Dynamics and Control | 4
Humanities or social science elective 1 | | 3

**Spring Semester**
ASEN 3111 | Aerodynamics | 4
ASEN 3128 | Aircraft Dynamics | 4
ASEN 3300 | Aerospace Electronics and Communications | 4
Professional area elective 3 | | 3

College-approved writing course 2 | | 3
Upon graduation, students are expected to be able to:

**Student Outcomes**

**Department will have:**
- During their first few years after the completion of their degrees,
- **Program Educational Objectives**

<table>
<thead>
<tr>
<th>Professional area electives</th>
<th>6</th>
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</thead>
<tbody>
<tr>
<td><strong>Spring Semester</strong></td>
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<tr>
<td>ASEN 4028</td>
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<tr>
<td>Senior Projects 2: Design Practicum</td>
<td></td>
</tr>
<tr>
<td>Professional area electives</td>
<td>6</td>
</tr>
<tr>
<td>Humanities or social science elective</td>
<td>3</td>
</tr>
<tr>
<td>Free elective</td>
<td>3</td>
</tr>
<tr>
<td><strong>Credit Hours</strong></td>
<td>16</td>
</tr>
<tr>
<td><strong>Total Credit Hours</strong></td>
<td>128</td>
</tr>
</tbody>
</table>

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 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/).
3 A professional area elective (PAE) 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 professional area elective. Upper-division independent study courses from technical areas (math, science, and engineering) are acceptable for up to 6 credit hours of professional area elective credit. A full listing of approved PAE courses can be found in the degree audit.

**Program Educational Objectives**

During their first few years after the completion of their degrees, graduates of the Ann and H.J. Smead Aerospace Engineering Sciences Department will have:
- established themselves in professional careers or received a graduate degree,
- demonstrated ethical leadership, project management and/or innovation, and
- played significant roles in the research and development of engineering systems and products.

**Student Outcomes**

Upon graduation, students are expected to be able to:
- Identify, formulate and solve complex engineering problems by applying principles of engineering, science and mathematics.
- 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.
- 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.

Students completing the undergraduate degree in aerospace engineering sciences will be knowledgeable in the following areas:
- the professional context of the practice of aerospace engineering and expectations of new graduates in aerospace engineering organizations, including an awareness of ethics issues, economics, and the business environment,
- the history of aerospace engineering, providing a perspective on current events,
- aerospace engineering as a highly multidisciplinary endeavor, requiring a systems perspective to integrate technologies and manage complexity, and
- 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.

**BS and MS in Aerospace Engineering Sciences Admission Requirements**

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
- Transfer students must have completed a minimum of 24 credit hours at CU Boulder.

**Program Requirements**

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/) web page for more information.