AEROSPACE SCIENCE & ENGINEERING, BACHELOR OF SCIENCE

College of Engineering
Barbara S. Linke, Dr. –Ing. Habil, Vice Chairperson for Undergraduate Studies

Mechanical & Aerospace Engineering Undergraduate Programs
The Department of Mechanical & Aerospace Engineering administers two undergraduate programs in the College of Engineering (1) Mechanical Engineering, (2) Aerospace Science & Engineering

For more information about our programs, please see Undergraduate Majors (http://mae.ucdavis.edu/undergraduate/undergraduate-majors/).

Mission
The Department of Mechanical & Aerospace Engineering is committed to educating future engineers so that they may contribute to the economic growth and well-being of the state, the nation, and the world, and to the advancement of knowledge in the mechanical and aerospace sciences.

Objectives
The objectives of the Mechanical Engineering and Aerospace Science & Engineering programs are to produce graduates who do one or more of the following: a. Practice mechanical engineering and/or aerospace engineering in a broad range of agencies, industries, and institutes; b. Pursue graduate education; c. Participate in research and development, and other creative and innovative efforts in science, engineering, and technology; d. Pursue entrepreneurial endeavors.

Division of Aerospace Science & Engineering
The Division of Aerospace Science & Engineering administers the Aerospace Science & Engineering Program within the Department of Mechanical & Aerospace Engineering.

Aerospace Science & Engineering Undergraduate Program
The Aerospace Science & Engineering program is accredited by the Engineering Accreditation Commission of ABET (http://www.abet.org).

Aerospace Science & Engineering majors learn to apply the principles of the physical sciences and engineering to the design of aerospace vehicles. Specific objectives include the design, development and manufacture of aerospace vehicles and other transportation systems through the integration of disciplines associated with aerodynamics, propulsion, structures and guidance/control.

Our Bachelor of Science degree in Aerospace Science & Engineering provides a broad background and fundamental education in mathematics, the physical sciences, and the engineering sciences. These fundamentals, when complemented by the required technical courses, prepare students for employment in government or industry, while simultaneously establishing an excellent foundation for graduate studies.

Aerodynamics & Fluid Mechanics
This field of study is based on the fundamentals of fluid mechanics and applied aircraft aerodynamics. Areas of current research include computational fluid dynamics, turbulent boundary layer flows, aeroacoustics, rotorcraft aerodynamics, wind turbine aerodynamics, active flow control, subsonic wind tunnel measurement, vortex generators, fixed-wing tip vortices, parachute drag prediction and aircraft design and optimization. Many of these projects are sponsored by government agencies and leading industrial companies, such as NASA, the U.S. Army, Sandia National Laboratory, the National Science Foundation and Boeing. Computational research is conducted using UC Davis High Performance Computing (HPC), NASA HPC, DoD HPC and DoE HPC. Experimental studies are conducted in the UC Davis Wind Tunnel Facility.

Relevant courses: EAE 126 & EAE 127.

Suggested Advisors
J. P. Delplanque, C. P. van Dam, M. Hafez, S. Lee, N. Sarigul-Klijn, S. K. Robinson

Aerospace Control
This field of study includes control theory and its application to aerospace systems. Areas of current research include adaptive control, networked system control, hybrid system control, and controller design for unmanned aerial systems, spacecraft, and other machines. Many of these projects are sponsored by government agencies and leading industrial companies, such as NASA Ames Research Center, NASA Jet Propulsion Laboratory, the National Science Foundation and Boeing.

Relevant course: EAE 129.

Suggested Advisors
S. Joshi, Z. Kong, N. Sarigul-Klijn

Aerospace Propulsion
This field of study involves air-breathing jet engines and rocket propulsion. Areas of current research include turbomachinery, computational fluid dynamics, open rotor, jet noise, turbine cooling, innovative gas-turbine cycles, rocket engine feed systems and cooling tubes, propeller design and centrifugal compressors. Many of these projects are sponsored by government agencies and leading industrial companies, such as The Wright-Patterson Air Force Research Laboratory (AFRL), Lawrence Livermore National Laboratory, Los Alamos National Laboratory, Aerojet Rocketdyne and the University of California. Computational research is conducted using UC Davis High Performance Computing (HPC), NASA HPC, DoD HPC and DoE HPC.

Relevant courses: EAE 138 & EAE 140.

Suggested Advisors
J. P. Delplanque, S. Lee, N. Sarigul-Klijn

Structures & Materials
This field of study analyzes the structures and materials used in aerospace engineering, expanding from traditional mechanics of materials in order to correctly understand the behavior of thin-walled structures under bending, torsion and axial loads. Composite materials are being used extensively in new airplanes and helicopters, space structures, as well as in wind energy, ships, transportation, infrastructure and biomedical joints. Current research in composite structures encompasses several areas of engineering, includes durability of
composites due to in service load (for example, thermo-hygro-mechanical fatigue, impact, etc.) and structural health monitoring methods.

**Relevant courses:** EAE 133, EAE 135 & MAE 237 (graduate level/technical elective).

**Suggested Advisors**
V. La Saponara

**Spacecraft Engineering**
This field of study includes rocket propulsion, orbital mechanics, spacecraft design, human life-support in space, space environments, mission design and systems engineering. Current research in the MAE department includes spacecraft and habitat design, CubeSat design, human life-support systems and safety, space robotics, autonomous systems supported by machine learning, radiation protection, atmospheric entry and metallic additive manufacturing. A variety of federally-funded national laboratories fund this research, and research projects often result in internship and employment opportunities for students in organizations like NASA, Lawrence Livermore Lab, SpaceX, Blue Origin, Sierra Nevada, Lockheed Martin, Northrup Grumman, Aerospace Corp, Space Systems Loral and Boeing.

**Relevant courses:** EAE 140, EAE 142, EAE 143A, EAE 143B.

**Suggested Advisors**
S. Joshi, N. Sarigul-Klijn, S. K. Robinson

**Aeroelasticity & Vibrations**
This field of study looks at aircraft structural dynamics and aeroelasticity. Areas of current research include aerospace structures, aeroelasticity, biomechanics, flow-induced vibrations, vibroacoustics and minimum weight design with aeroelastic and acoustic constraints. Research is also done on landing recovery systems, including winged, rotor, or parachute recovery system trades and scaled flight testing and the long-duration effects of space flight on the human spine. Aerospace engineers in this research area also work to develop advanced finite element methods to solve steep gradient problems of high temperature due to aerodynamic heating or shock loading, innovative power generation systems and environmental noise control methods. Many of these projects are sponsored by government agencies and leading industrial companies.

**Relevant course:** EAE 133, EAE 135.

**Suggested Advisors**
V. La Saponara, N. Sarigul-Klijn

Students are encouraged to adhere carefully to all prerequisite requirements. The instructor is authorized to drop students from a course for which stated prerequisites have not been completed.

Exclusive of General Education units, the minimum number of units required for the Aerospace Science & Engineering major is 160.
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tbody>
<tr>
<td>ENG 103</td>
<td>Fluid Mechanics</td>
</tr>
<tr>
<td>ENG 104</td>
<td>Mechanics of Materials</td>
</tr>
<tr>
<td>ENG 105</td>
<td>Thermodynamics</td>
</tr>
<tr>
<td>ENG 190</td>
<td>Professional Responsibilities of Engineers</td>
</tr>
</tbody>
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**Mechanical Engineering**

- EME 106     Thermo-Fluid Dynamics
- EME 108     Measurement Systems
- EME 109     Experimental Methods for Thermal Fluids
- EME 165     Heat Transfer
- EME 172     Automatic Control of Engineering Systems

**Applied Mathematics Elective**

4 units from:
- ENG 180     Engineering Analysis
- or EME 115  Introduction to Numerical Analysis & Methods
- or MAT 128A Numerical Analysis
- or MAT 128C Numerical Analysis in Differential Equations
- or ECS 130  Scientific Computation

**Technical Electives**

12 units from:
- EAE 140     Rocket Propulsion
- EAE 142     Orbital Mechanics
- EAE 143A    Space Vehicle Design
- EAE 143B    (Pending Approval)

Astronautics Elective; choose one:
- EAE 126     Theoretical & Computational Aerodynamics
- EME 139     Stability of Flexible Dynamic Systems

Aeronautics Elective; choose one:
- From the above Astronautics Elective list if not used in satisfaction of other degree requirements.

Technical Elective; choose one:
- From the above Aeronautics Elective list if not used in satisfaction of other degree requirements.

Up to 4 units may be selected from any upper division engineering course including any engineering 192 or 199 not used in satisfaction of other degree requirements.

- **Upper Division Composition Requirement** 0-4

Choose one; grade of C- or better is required:
- UWP 101     Advanced Composition
- UWP 102E    Writing in the Disciplines: Engineering
- UWP 104A    Writing in the Professions: Business Writing
- UWP 104E    Writing in the Professions: Science
- UWP 104T    Writing in the Professions: Technical Writing

or
- Passing the Upper Division Composition Exam

**Upper Division Required Courses Subtotal** 86-90

**Total Units** 160-164

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1 Courses that cannot be used are BIM 110L, ENG 160, ECS 188 or any 197T course.