AEROSPACE SCIENCE & ENGINEERING, BACHELOR OF SCIENCE

College of Engineering

Valeria La Saponara, Ph.D., 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 (BS) program is accredited by the Engineering Accreditation Commission of ABET (http://www.abet.org/) under the commission's General Criteria and Program Criteria for Aerospace and Similarly Named Engineering Programs.

Aerospace Science & Engineering majors learn to apply the principles of 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

Relevant courses: EAE 126 & EAE 127.

Suggested Advisors

C. Badrya, J. P. Delplanque, C. Harvey, S. Lee, S. K. Robinson, N. Sarigul-Klijn

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.

Aerospace Control

Relevant course: EAE 129.

Suggested Advisors

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

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.

Aerospace Propulsion

Relevant courses: EAE 138 & EAE 140.

Suggested Advisors

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

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.

Structures & Materials

Relevant courses: EAE 133, EAE 135, EME 139, MAE 237 (graduate level/technical elective).

Suggested Advisors

V. La Saponara, N. Sarigul-Klijn

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. Numerical methods (particularly, Finite Elements) are needed for the modeling of complex multi-material and multi-loading structures.

Spacecraft Engineering

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

Suggested Advisors

S. Joshi, S. K. Robinson, N. Sarigul-Klijn, R. Whittle

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.

Aeroelasticity & Vibrations

Relevant course: EME 139

Suggested Advisors

N. Sarigul-Klijn

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.

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.

The major requirements below are in addition to meeting University Degree Requirements (https://catalog.ucdavis.edu/undergraduate-education/university-degree-requirements/) & College Degree Requirements (https://catalog.ucdavis.edu/undergraduate-education/college-degree-requirements/); unless otherwise noted. The minimum number of units required for the Aerospace Science & Engineering Bachelor of Science is 160.

Code	Title	Units
Lower Division Required Courses		
Mathematics		
MAT 021A	Calculus	4
MAT 021B	Calculus	4
MAT 021C	Calculus	4
MAT 021D	Vector Analysis	4
MAT 022A	Linear Algebra	3
MAT 022B	Differential Equations	3
Physics		
PHY 009A	Classical Physics	5
PHY 009B	Classical Physics	5
PHY 009C	Classical Physics	5
Chemistry		
CHE 002A	General Chemistry	5
or CHE 002AH	Honors General Chemistry	
CHE 002B	General Chemistry	5
or CHE 002BH	Honors General Chemistry	
Engineering		
ENG 004	Engineering Graphics in Design	3
ENG 017	Circuits I	4
or ENG 017V	Circuits I	
ENG 035	Statics	4
ENG 045	Properties of Materials	4
or ENG 045Y	Properties of Materials	
ENG 006	Engineering Problem Solving	4
Lower Division Composition/Writing		*4*
Choose one; a grade of C- or better is required:		
COM 001	Major Works of the Ancient World	
COM 002	Major Works of the Medieval & Early Modern World	
COM 003	Major Works of the Modern World	
COM 004	Major Works of the Contemporary World	
ENL 003	Introduction to Literature	
or ENL 003V	Introduction to Literature	
NAS 005	Introduction to Native American Literature	
UWP 001	Introduction to Academic Literacies (Recommended)	
UWP 001V	Introduction to Academic Literacies: Online (Recommended)	
UWP 001Y	Introduction to Academic Literacies (Recommended)	
Communication		*4*
Choose one:		
CMN 001	Introduction to Public Speaking	
or CMN 001V	Introduction to Public Speaking	
ENG 003	Introduction to Engineering Design	
or ENG 003Y	Introduction to Engineering Design	
Lower Division Required Courses Subtotal		74
Upper Division Required Courses		
Aerospace Science & Engineering		*28*
Required Aerospace Courses		
EAE 127	Applied Aircraft Aerodynamics [2]	
EAE 129	Stability & Control of Aerospace Vehicles [3]	
EAE 133	Finite Element Methods in Structures [2]	
EAE 135	Aerospace Structures [3]	

EAE 138	Aircraft Propulsion [3]	
Senior Design Capstone, choose one series (Winter & Spring Quarter Only): [4]		
EAE 130A & EAE 130B	Aircraft Performance & Design and Aircraft Performance & Design (taken in consecutive quarters)	
EAE 143A & EAE 143B	Space Vehicle Design and Space Mission Design (taken in consecutive quarters)	
Engineering		*22*
ENG 100	Electronic Circuits & Systems	
ENG 102	Dynamics	
ENG 103	Fluid Mechanics	
ENG 104	Mechanics of Materials	
or ENG 104V	Mechanics of Materials	
ENG 105	Thermodynamics	
ENG 190	Professional Responsibilities of Engineers	
Mechanical Engineering		*20*
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*
Choose one:		
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*
Astronautics Elective; choose one:		
EAE 140	Rocket Propulsion [2]	
EAE 142	Orbital Mechanics [3]	
EAE 143A	Space Vehicle Design [4]	
EAE 143B	Space Mission Design [4]	
Aeronautics Elective; choose one:		
EAE 126	Theoretical & Computational Aerodynamics	
EME 139	Stability of Flexible Dynamic Systems	
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. [1]		
Upper Division Composition Requirement		*0-4*
Choose one; grade of C- or better is required:		
UWP 101	Advanced Composition	
or UWP 101V	Advanced Composition	
or UWP 101Y	Advanced Composition	
UWP 102E	Writing in the Disciplines: Engineering	
UWP 104A	Writing in the Professions: Business Writing	
or UWP 104AV	Writing in the Professions: Business Writing	
or UWP 104AY	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**

1

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

2

The following courses are historically **ONLY** offered in Fall quarter: EAE 127, EAE 133, EAE 140

3

The following courses are historically **ONLY** offered in Winter quarter: EAE 129, EAE 135, EAE 138, EAE 142

4

These courses are part of the Senior Design Capstone Project and are completed in the Winter and Spring quarter of the final year of study.