AEROSPACE ENGINEERING

Undergraduate Study

For undergraduate curriculum in aerospace engineering leading to the degree Bachelor of Science. The Aerospace Engineering Program is accredited by the Engineering Accreditation Commission of ABET, https://www.abet.org (https://www.abet.org/), under the commission's General Criteria and Program Criteria for Aerospace and Similarly Named Engineering Programs.

The aerospace engineer is primarily concerned with the design, analysis, testing, and overall operation of vehicles which operate in air and space. The curriculum is designed to provide the student with an education in the fundamental principles of aerodynamics, flight dynamics, propulsion, structural mechanics, flight controls, design, testing, and space technologies. A wide variety of opportunities awaits the aerospace engineering graduate in research, development, design, production, sales, and management in the aerospace industry, and in many related industries in which fluid flow, control, structural, and transportation challenges play major roles.

Make To Innovate (M:2:I) is an exciting new program in the Aerospace Engineering Department that engages students in hands-on projects to augment their understanding of engineering fundamentals.

A cooperative education program in aerospace engineering is available in cooperation with government agencies and industry. The usual four-year curriculum is extended for students who participate in alternating industrial experience periods and academic periods. This arrangement offers valuable practical experience and financial assistance during the college years.

Undergraduate Mission and Educational Objectives

The Department of Aerospace Engineering maintains an internationally recognized academic program in aerospace engineering via ongoing consultation with students, faculty, industry, and aerospace professionals. Results of these consultations are used in a process of continuous academic improvement to provide the best possible education for our students.

Mission statement:

The mission of the aerospace engineering program is to prepare the aerospace engineering student for a career with wide-ranging opportunities in research, development, design, production, sales, and management in the aerospace industry and in the many related industries which are involved with the solution of multi-disciplinary, advanced technology problems.

Program Educational Objectives:

The objectives of the Aerospace Engineering program at ISU are to produce graduates:

- Who actively contribute to the field of aerospace, related fields or other disciplines;
- Are critical thinkers and lifelong learners; and
- Are aware of the societal, economic and environmental impact of their work.

Student Learning Outcomes

Upon graduation, students should have:

- 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.

CURRICULUM IN AEROSPACE ENGINEERING

Leading to the degree Bachelor of Science.

TOTAL CREDITS REQUIRED: 129.0.

Any transfer credit courses applied to the degree program require a grade of C or better (but will not be calculated into the ISU cumulative GPA, Basic Program GPA or Core GPA). See also Basic Program and Special Programs. Note: Department does not allow Pass/Not Pass credits to be used to meet graduation requirements for either required or elective courses.

INTERNATIONAL PERSPECTIVES [1]: 3 CR.
U.S. DIVERSITY [1]: 3 CR.
COMMUNICATION PROFICIENCY/LIBRARY REQUIREMENT:

ENGL 1500	Critical Thinking and Communication (Must have a C or better in this course)	3
ENGL 2500	Written, Oral, Visual, and Electronic Composition (Must have a C or better in this course)	3
LIB 1600	Introduction to College Level Research	1
One of the following:		3
ENGL 3140	Technical Communication (C or better in this course)	3
ENGL 3090	Proposal and Report Writing (C or better in this course)	3

GENERAL EDUCATION ELECTIVES: 12.0 CR. [2]

Complete 12 cr. General Education Electives are requirements for graduation so may not be taken on a P-NP basis.

BASIC PROGRAM: 24 CR.

A minimum GPA of 2.00 required for this set of courses (please note that transfer course grades will not be calculated into the Basic Program GPA). See Requirement for Entry into Professional Program in College of Engineering Overview section.

CHEM 1670	General Chemistry for Engineering Students	4
or CHEM 1770	General Chemistry I	
ENGL 1500	Critical Thinking and Communication (Must have a C or better in this course)	3
ENGR 1010	Engineering Orientation	
AERE 1600	Aerospace Engineering Problems With Computer Applications Laboratory [3]	3
LIB 1600	Introduction to College Level Research	1
MATH 1650	Calculus I	4
MATH 1660	Calculus II	4
PHYS 2310	Introduction to Classical Physics I	4
PHYS 2310L	Introduction to Classical Physics I Laboratory	1
Total Credits		**24**

MATH AND PHYSICAL SCIENCE: 12 CR.

MATH 2650	Calculus III	4
MATH 2670	Elementary Differential Equations and Laplace Transforms	4
PHYS 2320	Introduction to Classical Physics II	4
Total Credits		**12**

AEROSPACE ENGINEERING CORE: 47 CR.

A minimum GPA of 2.00 required for this set of courses, including any transfer courses (please note that transfer course grades will not be calculated into the Core GPA):

AERE 2610	Introduction to Performance and Design	3
AERE 3100	Aerodynamics I: Incompressible Flow	3
AERE 3110	Aerodynamics II: Compressible Flow	3
AERE 3210	Flight Structures Analysis	3
AERE 3310	Flight Control Systems I	3
AERE 3220	Aerospace Structures Laboratory	2
AERE 3440	Aerodynamics and Propulsion Laboratory	3
AERE 3510	Astrodynamics I	3
AERE 3550	Aircraft Flight Dynamics and Control	3
AERE 4110	Aerospace Vehicle Propulsion	3
AERE 4150	Rocket Propulsion	3
or AERE 4330	Spacecraft Dynamics and Control	
AERE 4210	Advanced Flight Structures	3
AERE 4610	Modern Design Methodology with Aerospace Applications	3
AERE 4620	Design of Aerospace Systems	3
EM 3240	Mechanics of Materials	3
ME 2310	Engineering Thermodynamics I	3
Total Credits		**47**

OTHER REMAINING COURSES: 34 CR.

ENGL 2500	Written, Oral, Visual, and Electronic Composition (Must have a C or better in this course)	3
CE 2740	Engineering Statics	3
ME 3450	Engineering Dynamics	3
MATE 2730	Principles of Materials Science and Engineering	3
AERE 1610	Numerical, Graphical and Laboratory Techniques for Aerospace Engineering	4
AERE 3610	Computational Techniques for Aerospace Design	3
AERE 3620	Aerospace Systems Integration	3
3 credits from the following		3
any AERE or EM graduate level (5000+ level) course		
AERE 4070	Applied Formal Methods	
AERE 4120	Spacecraft Electric Propulsion	
AERE 4150	Rocket Propulsion	
AERE 4170	Experimental Mechanics	
AERE 4220	Vibrations and Aeroelasticity	
AERE 4230	Composite Flight Structures	
AERE 4260	Design of Aerospace Structures	
AERE 4320	Flight Control Systems II	

AERE 4330	Spacecraft Dynamics and Control	
AERE 4420	V/STOL Aerodynamics and Performance	
AERE 4450	Experimental Flow Mechanics and Heat Transfer	
AERE 4460	Computational Fluid Dynamics	
AERE 4480	Fluid Dynamics of Turbomachinery	
AERE 4510	Astrodynamics II	
AERE 4520	Introduction To Systems Engineering And Analysis	
AERE 4630	Introduction to Multidisciplinary Design Optimization (MDO)	
AERE 4640	Spacecraft Systems	
AERE 4680	Large-Scale Complex Engineered Systems (LSCES)	
AERE 4800	Ultrasonic Nondestructive Evaluation	
AERE 4830	Aeroacoustics	
One of the following:		3
ENGL 3140	Technical Communication (Must have a C or better in this course)	3
ENGL 3090	Proposal and Report Writing (Must have a C or better in this course)	3
Technical Electives (see below) [2]		3
Career Electives (see below) [2]		3
Total Credits		**40**

Technical Electives, 3 cr. and Career Electives, 3 cr. selected from preceding AERE list or departmental-approved 3000-level or above courses relevant to technical and career areas.

Seminar/Co-op/Internships/Flight Experience:

AERE 1920	Aerospace Seminar
AERE 3010	Flight Experience

Co-op and internships are optional

1. These university requirements will add to the minimum credits of the program unless the university-approved courses are also allowed by the department to meet other course requirements within the degree program. U.S. diversity and international perspectives courses may not be taken Pass/Not Pass.
2. Choose from department approved list. (http://www.aere.iastate.edu/students/undergraduate_program/)
3. See Basic Program for Professional Engineering Curricula for accepted substitutions for curriculum designated courses in the Basic Program.

See also: A 4-year plan of study grid showing course template by semester.

Aerospace Engineering, B.S.

Freshman

Fall	Credits	Spring	Credits
MATH 1650	4	MATH 1660	4
CHEM 1670	4	PHYS 2310	4
AERE 1600	3	PHYS 2310L	1
LIB 1600	1	AERE 1610	4
ENGL 1500	3	General Education Elective	3
ENGR 1010	R	AERE 1920	R
	15		**16**

Sophomore

Fall	Credits	Spring	Credits
MATH 2650	4	MATH 2670	4
PHYS 2320	4	ME 3450	3
MATE 2730	3	EM 3240	3
CE 2740	3	AERE 2610	3
ENGL 2500	3	ENGL 3140 or 3090	3
	17		**16**

Junior

Fall	Credits	Spring	Credits
AERE 3210	3	AERE 4210	3
AERE 3220	2	AERE 3610	3
ME 2310	3	AERE 3620	3
AERE 3100	3	AERE 3440	3
AERE 3510	3	AERE 3110	3
AERE 3550	3	AERE 3310	3
AERE 3010	R		
	17		**18**

Senior

Fall	Credits	Spring	Credits
Technical Elective	3	Technical Elective	3
AERE 4610	3	Technical Elective	3
AERE 4110	3	AERE 4620	3
AERE 4150 or 4330	3	General Education Elective	3
General Education Elective	3	General Education Elective	3
	15		**15**

Nondestructive Evaluation (NDE)

The NDE Minor (http://catalog.iastate.edu/collegeofengineering/non_destructiveevaluationengineering/) is multidisciplinary and open to undergraduates in the College of Engineering.

BS/MS & BS/ME Degree Programs

The concurrent BS/MS & BS/ME (https://www.aere.iastate.edu/graduate-students/concurrent-degrees/) classification offers an opportunity for well-qualified Iowa State juniors and seniors to begin working on a master's degree before completing a bachelor's degree.

Graduate Study

The department offers graduate programs that lead to the degrees Master of Engineering, Master of Science, and Doctor of Philosophy with major in aerospace engineering and minor work to students taking major work in other departments. For all graduate degrees, it is possible to establish a co-major program with another graduate degree-granting department. Within the aerospace program, students can specialize in one or more of the following areas: aerospace systems design, atmospheric and space flight dynamics, computational fluid dynamics, control systems, wind engineering, fluid mechanics, optimization, structural analysis, and non-destructive evaluation.

Master of Science and Master of Engineering

The Master of Science degree requires a thesis and has strong research emphasis. The Master of Science degree is recommended for students who anticipate entering a doctoral program later. The Master of Engineering degree does not require either research credits or a thesis and is intended for students who do not anticipate pursuing a doctoral degree. The Master of Engineering degree can be completed with coursework only or with a combination of coursework and creative component. Credits for creative component will be obtained by registering for **AERE 5990 Creative Component.** A written report and an oral presentation will be given to the student's graduate committee.

At least 30 credits of acceptable graduate work are required for both the Master of Science and the Master of Engineering degrees. For specific course, research, and creative component requirements, see the departmental Graduate Student Handbook (http://www.aere.iastate.edu/files/2015/04/AerE-Graduate-Handbook-Revised-S15.pdf).

Bachelor of Science/Master of Science Concurrent Degree Program

The department offers concurrent BS/MS and BS/ME degree programs (http://www.aere.iastate.edu/students/concurrent-degrees/) and a concurrent B.S./MBA degree program which offer an opportunity for well-qualified Iowa State juniors and seniors to begin working on a master's degree before completing a bachelor's degree. The concurrent degree programs reduce by one year the normal time period for completing both degrees separately.

Preparation for Graduate Work

The normal prerequisite for major graduate work in aerospace engineering is the completion of an undergraduate curriculum substantially equivalent to that required of aerospace engineering students at this university. Due to the diversity of interests of aerospace faculty, students whose prior undergraduate or graduate education has been in allied engineering and/or scientific fields may also qualify. In such cases, it may be necessary for the student to take additional work to provide the requisite aerospace background. A prospective graduate student is urged to specify the degree program and the specific field(s) of interest on the application for admission.

Courses are offered at the times stated in the course description. Where no specific time of offering is stated, the course may be offered during any semester provided there is sufficient demand.

Graduate Minor Work

Minor work for aerospace engineering majors is usually selected from mathematics, physics, electrical engineering, engineering mechanics, mechanical engineering, materials science, meteorology, computer science, and computer engineering.