

AEROSPACE ENGINEERING, BS

for the degree of Bachelor of Science in Aerospace Engineering

department website: <https://www.ae.illinois.edu/>
department faculty: Aerospace Engineering Faculty (<https://ae.illinois.edu/directory/faculty>)
overview of college admissions & requirements: The Grainger College of Engineering (<https://grainger.illinois.edu/admissions>)
college website: <https://grainger.illinois.edu/>
email: aerospace@illinois.edu

The Aerospace Engineering curriculum provides a strong fundamental background in engineering, mathematics, and science, along with the ability to apply this fundamental knowledge to the analysis and design of future aircraft and spacecraft. It also prepares students for lifelong learning and the attainment of their career goals in the field of aerospace engineering and in a wide range of other areas. The concepts of system design are introduced early in the curriculum and culminate in the yearlong senior capstone design experience (AE 442, AE 443), in which students work in teams to respond to a design challenge from industry, government, or a professional engineering society. A total of 18 hours of technical and free electives allows the student to pursue an individualized program of study.

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Overview of Curricular Requirements

The curriculum requires 128 hours for graduation and is organized as follows.

Orientation and Professional Development

These courses introduce the opportunities and resources your college, department, and curriculum can offer you as you work to achieve your career goals. They also provide the skills to work effectively and successfully in the engineering profession.

Code	Title	Hours
AE 100	Intro to Aerospace Engineering ¹	2
ENG 100	Engineering Orientation ²	0
Total Hours		0

¹ This optional course may be used to help meet free elective requirements.

² External transfer students take ENG 300 instead.

Foundational Mathematics and Science

These courses stress the basic mathematical and scientific principles upon which the engineering discipline is based.

Code	Title	Hours
CHEM 102	General Chemistry I	3
CHEM 103	General Chemistry Lab I	1
MATH 221	Calculus I ¹	4
MATH 225	Introductory Matrix Theory	2

MATH 231	Calculus II	3
MATH 241	Calculus III	4
MATH 285	Intro Differential Equations	3
PHYS 211	University Physics: Mechanics	4
PHYS 212	University Physics: Elec & Mag	4
PHYS 213	Univ Physics: Thermal Physics	2
Total Hours		30

¹ MATH 220 may be substituted, with four of the five credit hours applying toward the degree. MATH 220 is appropriate for students with no background in calculus.

Aerospace Engineering Technical Core

These courses stress fundamental concepts and basic laboratory techniques that comprise the common intellectual understanding of aerospace engineering.

Code	Title	Hours
AE 202	Aerospace Flight Mechanics	3
AE 311	Incompressible Flow	3
AE 312	Compressible Flow	3
AE 321	Mechs of Aerospace Structures	3
AE 323	Applied Aerospace Structures	3
AE 352	Aerospace Dynamical Systems	3
AE 353	Aerospace Control Systems	3
AE 370	Aerospace Numerical Methods	3
AE 433	Aerospace Propulsion	3
AE 442	Aerospace Systems Design I	3
AE 443	Aerospace Systems Design II	3
AE 460	Aerodynamics & Propulsion Lab	2
AE 461	Structures & Control Lab	2
AE 483	Unmanned Aerial Vehicle (UAV) Navigation and Control	3
ECE 205	Electrical and Electronic Circuits	3
ECE 206	Electrical and Electronic Circuits Lab	1
IE 300	Analysis of Data ¹	3
ME 200	Thermodynamics	3
MSE 280	Engineering Materials	3
TAM 210	Introduction to Statics	2
TAM 212	Introductory Dynamics	3
Total Hours		58

¹ STAT 400 may be substituted.

Technical Electives

These courses stress the rigorous analysis and design principles practiced in the major subdisciplines of aerospace engineering.

Code	Title	Hours
Selected from the departmentally approved list of Technical Electives, satisfying these distribution requirements:		
Chosen from AE Technical Electives listed below		6
AE 199	Undergraduate Open Seminar	0 to 5
AE 402	Orbital Mechanics	3 or 4
AE 403	Spacecraft Attitude Control	3 or 4

AE 410	Computational Aerodynamics	3 or 4	ECE 310	Digital Signal Processing	3
AE 412	Viscous Flow & Heat Transfer	4	ECE 311	Digital Signal Processing Lab	1
AE 416	Applied Aerodynamics	3 or 4	ECE 329	Fields and Waves I	3
AE 419	Aircraft Flight Mechanics	3 or 4	ECE 330	Power Ckts & Electromechanics	3
AE 420	Finite Element Analysis	3 or 4	ECE 342	Electronic Circuits	3
AE 427	Mechanics of Polymers	3	ECE 343	Electronic Circuits Laboratory	1
AE 428	Mechanics of Composites	3	ECE 385	Digital Systems Laboratory	3
AE 434	Rocket Propulsion	3 or 4	ECE 473	Fund of Engrg Acoustics	3 or 4
AE 435	Electric Propulsion	3 or 4	ECE 486	Control Systems	4
AE 451	Aeroelasticity	3 or 4	ENG 491	Interdisciplinary Design Proj (Sections SAE and HYP)	1 to 4
AE 454	Systems Dynamics & Control	3 or 4	MSE 401	Thermodynamics of Materials	3
AE 456	Global Nav Satellite Systems	4	MSE 440	Mechanical Behavior of Metals	3
AE 468	Optical Remote Sensing	3	MSE 443	Design of Engineering Alloys	3
AE 482	Introduction to Robotics	4	MSE 498	Special Topics (Section CM3)	1 to 4
AE 497	Independent Study	1 to 4	SE 310	Design of Structures and Mechanisms	3
AE 498	Special Topics	1 to 4	SE 420	Digital Control Systems	4
ENG 491	Interdisciplinary Design Proj (CU1 & CU2)	1 to 4	SE 423	Mechatronics	3
Chosen from AE Technical Electives or Non-AE Technical Electives		6	IE 310	Deterministic Models in Optimization	3
ASTR 404	Stellar Astrophysics	3	MATH 347	Fundamental Mathematics	3
ASTR 405	Planetary Systems	3	MATH 402	Non Euclidean Geometry	3 or 4
ASTR 406	Galaxies and the Universe	3	MATH 413	Intro to Combinatorics	3 or 4
ASTR 414	Astronomical Techniques	4	MATH 416	Abstract Linear Algebra	3 or 4
ATMS 301	Atmospheric Thermodynamics	3	MATH 442	Intro Partial Diff Equations	3 or 4
ATMS 302	Atmospheric Dynamics I	3	MATH 446	Applied Complex Variables	3 or 4
ATMS 303	Synoptic-Dynamic Wea Analysis	4	MATH 461	Probability Theory	3 or 4
ATMS 304	Radiative Transfer-Remote Sens	3	MATH 482	Linear Programming	3 or 4
ATMS 305	Computing and Data Analysis	3	MATH 484	Nonlinear Programming	3 or 4
ATMS 306	Cloud Physics	3	MATH 489	Dynamics & Differential Eqns	3 or 4
ATMS 313	Synoptic Weather Forecasting	4	ME 320	Heat Transfer	4
ATMS 406	Tropical Meteorology	4	ME 360	Signal Processing	3.5
ATMS 410	Radar Remote Sensing	4	ME 370	Mechanical Design I	3
CEE 310	Transportation Engineering	3	ME 400	Energy Conversion Systems	3 or 4
CEE 330	Environmental Engineering	3	ME 401	Refrigeration and Cryogenics	3 or 4
CEE 360	Structural Engineering	3	ME 498	Special Topics	0 to 4
CEE 380	Geotechnical Engineering	3	MSE 450	Polymer Science & Engineering	3 or 4
CEE 407	Airport Design	3 or 4	MSE 453	Plastics Engineering	3
CEE 412	High-Speed Rail Engineering	3 or 4	MSE 457	Polymer Chemistry	3 or 4
CEE 451	Environmental Fluid Mechanics	3	NPRE 201	Energy Systems	2 or 3
CEE 471	Structural Mechanics	3 or 4	NPRE 402	Nuclear Power Engineering	3 or 4
CHEM 232	Elementary Organic Chemistry I	3 or 4	NPRE 470	Fuel Cells & Hydrogen Sources	3
CHEM 233	Elementary Organic Chem Lab I	2	NPRE 475	Wind Power Systems	3 or 4
CHEM 236	Fundamental Organic Chem I	4	NPRE 498	Special Topics (Energy Storage and Conveyance)	1 to 4
CS 101	Intro Computing: Engrg & Sci	3	PHYS 325	Classical Mechanics I	3
CS 125	Intro to Computer Science	4	PHYS 326	Classical Mechanics II	3
CS 225	Data Structures	4	PHYS 435	Electromagnetic Fields I	3
CS 420	Parallel Progrmg: Sci & Engrg	3 or 4	PHYS 485	Atomic Phys & Quantum Theory	3
CS 461	Computer Security I	4	PHYS 486	Quantum Physics I	4
CS 465	User Interface Design	3 or 4	STAT 428	Statistical Computing	3 or 4
CSE 412	Numerical Thermo-Fluid Mechs	2 to 4	STAT 448	Advanced Data Analysis	4
ECE 210	Analog Signal Processing	4	TAM 324	Behavior of Materials	4
ECE 220	Computer Systems & Programming	4			

TAM 451	Intermediate Solid Mechanics	4
TAM 456	Experimental Stress Analysis	3
TAM 470	Computational Mechanics	3 or 4
TE 401	Developing Breakthrough Projects	1 to 4
TMGT 461	Tech, Eng, & Mgt Final Project	2

Liberal Education

The liberal education courses (<https://wiki.illinois.edu/wiki/display/ugadvise/Degree+Requirements/#DegreeRequirements-LiberalEducationElectives>) develop students' understanding of human culture and society, build skills of inquiry and critical thinking, and lay a foundation for civic engagement and lifelong learning.

Code	Title	Hours
	Electives from the campus General Education Social and Behavioral Sciences list.	6
	Electives from the campus General Education Humanities and the Arts list.	6
	Electives either from a list approved by the college, or from the campus General Education lists for Social and Behavioral Sciences or Humanities and the Arts.	6
Total Hours		18

Students must also complete the campus cultural studies requirement by completing (i) one western/comparative culture(s) course, (ii) one non-western culture(s) course, and (iii) one U.S. Minority Culture(s) course from the General Education cultural studies lists. Most students select liberal education courses that simultaneously satisfy these cultural studies requirements. Courses from the western, non-western, and U.S. Minority lists that fall into free electives or other categories may also be used satisfy the cultural studies requirements.

Composition

These courses teach fundamentals of expository writing.

Code	Title	Hours
RHET 105	Writing and Research	4
	Advanced Composition (satisfied by completing the sequence AE 442 + AE 443 in the Aerospace Engineering Technical Core)	
Total Hours		4

Free Electives

These unrestricted electives, subject to certain exceptions as noted at the College of Engineering Advising Website (<https://wiki.illinois.edu/wiki/display/ugadvise/Degree+Requirements/#DegreeRequirements-FreeElectives>), give the student the opportunity to explore any intellectual area of unique interest. This freedom plays a critical role in helping students to define research specialties or to complete minors.

Code	Title	Hours
	Free electives. Additional unrestricted course work, subject to certain exceptions as noted at the College of Engineering advising Web site, so that there are at least 128 credit hours earned toward the degree.	6

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Suggested Sequence

The schedule that follows is illustrative, showing the typical sequence in which courses would be taken by a student with no college course credit already earned and who intends to graduate in four years. Each individual's case may vary, but the position of required named courses is generally indicative of the order in which they should be taken.

First Year

First Semester	Hours	
AE 100 ¹ Intro to Aerospace Engineering	2	
CHEM 102 General Chemistry I	3	
CHEM 103 General Chemistry Lab I	1	
ENG 100 Engineering Orientation	0	
MATH 221 ² Calculus I	4	
RHET 105 Writing and Research	4	
or		
Liberal education elective ^{3,4}		
Liberal education elective ³	3	
Semester Hours		17

Second Semester

MATH 231 Calculus II	3	
PHYS 211 University Physics: Mechanics	4	
RHET 105 Writing and Research	4	
or		
Liberal education elective ^{3,4}		
Liberal education elective ³	3	
MATH 225 Introductory Matrix Theory	2	
Semester Hours		16

Second Year

First Semester

MATH 241 Calculus III	4	
PHYS 212 University Physics: Elec Mag	4	
TAM 210 Introduction to Statics	2	
MSE 280 Engineering Materials	3	
Liberal education elective ³	3	
Semester Hours		16

Second Semester

MATH 285 Intro Differential Equations	3	
ME 200 Thermodynamics	3	
PHYS 213 Univ Physics: Thermal Physics	2	
TAM 212 Introductory Dynamics	3	
AE 202 Aerospace Flight Mechanics	3	
Liberal education elective ³	3	
Semester Hours		17

Third Year

First Semester

AE 311 Incompressible Flow	3	
AE 321 Mechs of Aerospace Structures	3	
AE 352 Aerospace Dynamical Systems	3	
ECE 205 Electrical and Electronic Circuits	3	
IE 300 ⁵ Analysis of Data	3	
Semester Hours		15

Second Semester

AE 312	Compressible Flow	3
AE 323	Applied Aerospace Structures	3
AE 353	Aerospace Control Systems	3
AE 370	Aerospace Numerical Methods	3
ECE 206	Electrical and Electronic Circuits Lab	1
Liberal education elective ³		3
Semester Hours		16
Fourth Year		
First Semester		
AE 442 ⁶	Aerospace Systems Design I	3
AE 460	Aerodynamics Propulsion Lab	2
AE 483	Unmanned Aerial Vehicle (UAV) Navigation and Control	3
AE 433	Aerospace Propulsion	3
Free Elective		3
Technical Elective ⁷		3
Semester Hours		17
Second Semester		
AE 443 ⁶	Aerospace Systems Design II	3
AE 461	Structures Control Lab	2
Technical Electives ⁷		9
Semester Hours		14
Total Hours:		128

⁷ Technical elective credits totaling twelve hours, selected from a departmentally approved list of Technical Electives (<https://aerospace.illinois.edu/academics/undergraduate/undergraduate-tech-electives>), satisfying these distribution requirements: (i) six hours of AE Technical Electives; (ii) six hours of AE Technical Electives or Non-AE Technical Electives.

¹ Entering freshmen are expected to enroll in AE 100 (<http://catalog.illinois.edu/search/?P=AE%20100>) in the fall of the first year. This optional course may be used to help meet free elective requirements.

² MATH 220 (<http://catalog.illinois.edu/search/?P=MATH%20220>) may be substituted with four of the five credit hours applying toward the degree. MATH 220 (<http://catalog.illinois.edu/search/?P=MATH%20220>) is appropriate for students with no background in calculus.

³ Liberal education electives (<https://wiki.illinois.edu/wiki/display/ugadvise/Degree+Requirements/#DegreeRequirements-LiberalEducationElectives>) must include 6 hours of social & behavioral sciences and 6 hours of humanities & the arts course work from the campus General Education lists. The remaining 6 hours may be selected from a list maintained by the college, or additional course work from the campus General Education lists for social & behavioral sciences or humanities & the arts. Students must also complete the campus cultural studies requirement by completing (i) one western/comparative culture(s), (ii) one non-western, and (iii) one U.S. minority culture(s) course from the General Education cultural studies lists. Most students select liberal education courses that simultaneously satisfy the Humanities and the Arts and cultural studies course requirements. Courses from the western, non-western, and U.S. minority lists that fall into free electives or other categories may also be used satisfy the Humanities and the Arts or cultural studies requirements.

⁴ RHET 105 (<http://catalog.illinois.edu/search/?P=RHET%20105>) may be taken in the first or second semester of the first year as authorized. The alternative is a liberal education elective.

⁵ STAT 400 (<http://catalog.illinois.edu/search/?P=STAT%20400>) may be substituted.

⁶ Sequence satisfies the General Education Advanced Composition requirement.