Aerospace Engineering (BS)

The Aerospace Engineering degree program prepares its graduates for careers in aircraft and space systems design, analysis and manufacturing.

Aerospace engineering is the application of science and engineering principles to the design, development, and implementation of systems or vehicles that travel above the surface of the earth. These vehicles may include low-speed propeller-powered aircraft, high-speed jet-powered aircraft, remotely piloted vehicles, micro air vehicles, hovercraft, and helicopters, as well as rockets, spacecraft, space stations, planetary rovers, and such specialty equipment as heat shields and other protective and deployment devices. The design of these vehicles and systems is both difficult and challenging because they must operate reliably and efficiently in harsh environments. Aerospace engineering is intimately involved in the design, manufacture, control, and operation of these systems coupled with a consideration of environmental, economical, ethical, and social issues.

Plan Requirements

First Year		
Fall Semester		**Hours**
CH 101	Chemistry - A Molecular Science [1]	3
CH 102	General Chemistry Laboratory [1]	1
E 101	Introduction to Engineering & Problem Solving [2]	1
E 115	Introduction to Computing Environments	1
MA 141	Calculus I [1]	4
ENG 101	Academic Writing and Research [2]	4
Select one of the following Economics Courses:		3
ARE 201	Introduction to Agricultural & Resource Economics	
ARE 201A	Introduction to Agricultural & Resource Economics	
EC 201	Principles of Microeconomics	
EC 205	Fundamentals of Economics	
	Hours	**17**
Spring Semester		
CSC 113	Introduction to Computing - MATLAB	3
GC 120	Foundations of Graphics	3
MA 241	Calculus II [1]	4
PY 205 & PY 206	Physics for Engineers and Scientists I and Physics for Engineers and Scientists I Laboratory [1]	4
E 102	Engineering in the 21st Century	2
	Hours	**16**
Second Year		
Fall Semester		
MA 242	Calculus III	4
MAE 206	Engineering Statics [2]	3
MAE 250	Introduction to Aerospace Engineering	1
MAE 251	Aerospace Vehicle Performance [2]	3
PY 208 & PY 209	Physics for Engineers and Scientists II and Physics for Engineers and Scientists II Laboratory	4
	Hours	**15**
Spring Semester		
MA 341	Applied Differential Equations I	3
MAE 208	Engineering Dynamics [2]	3
MAE 214	Solid Mechanics [2]	3
MAE 252	Aerodynamics I	3
MAE 253	Experimental Aerodynamics I	1
	Hours	**13**
Third Year		
Fall Semester		
MAE 201	Thermal-Fluid Sciences [2]	3
MAE 315 or MAE 361	Fundamentals of Vibrations or Dynamics & Controls	3
MAE 371	Aerospace Structures I	3
MAE 372	Aerospace Vehicle Structures Lab	1
ENG 331	Communication for Engineering and Technology	3
	Hours	**13**
Spring Semester		
MAE 351	Aerodynamics II	3
MAE 352	Experimental Aerodynamics II	1
Both MAE 457 and MAE 467 are required. One can be taken in the third year and the other in the fourth year.		3
MAE 457 or MAE 467	Flight Vehicle Stability and Control or Introduction to Space Flight	
Structures Elective (p. 2)		3
Math Elective (p. 2)		3
	Hours	**13**
Fourth Year		
Fall Semester		
MAE 405	Controls Lab	1
MAE 435	Principles of Automatic Control	3
MAE 451	Experimental Aerodynamics III	1
MAE 480	Aerospace Vehicle Design I	3
Propulsion Elective (p. 2)		3
Technical Elective (p. 2)		3
	Hours	**14**
Spring Semester		
MAE 481	Aerospace Vehicle Design II	3
Both MAE 457 and MAE 467 are required. One can be taken in the third year and the other in the fourth year.		3
MAE 467 or MAE 457	Introduction to Space Flight or Flight Vehicle Stability and Control	
Technical Elective (p. 2)		3
Ethics Elective (verify requirement) (p. 3)		
	Hours	**9**
	Total Hours	**110**

[1] A grade of C or higher is required.

[2] A grade of C- or higher is required.

Code	Title	Hours
GEP Courses		
GEP Humanities (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-humanities/)		6
GEP Social Sciences (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-social-sciences/)		3
GEP Health and Exercise Studies (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-health-exercise-studies/)		2
GEP US Diversity, Equity, and Inclusion (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-usdei/)		3
GEP Interdisciplinary Perspectives (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-interdisciplinary-perspectives/)		3
GEP Global Knowledge (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-global-knowledge/) (verify requirement)		
World Language Proficiency (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/world-language-proficiency/) (verify requirement)		
Total Hours		**17**

Structures Elective

Code	Title	Hours
MAE 430	Applied Finite Element Analysis	3
MAE 472	Aerospace Structures II	3

Math Elective

Code	Title	Hours
MA 305	Introductory Linear Algebra and Matrices	3
MA 405	Introduction to Linear Algebra	3
ST 312	Introduction to Statistics II	3
ST 370	Probability and Statistics for Engineers	3
ST 371	Introduction to Probability and Distribution Theory	3
ST 372	Introduction to Statistical Inference and Regression	3

Propulsion Elective

Code	Title	Hours
MAE 458	Propulsion	3
MAE 459	Rocket Propulsion	3

Technical Electives

Code	Title	Hours
Aerodynamics & Propulsion		
MAE 452	Aerodynamics of V/STOL Vehicles	3
MAE 455	Boundary Layer Theory	3
MAE 456	Computational Methods in Aerodynamics	3
MAE 458	Propulsion	3
MAE 459	Rocket Propulsion	3
Structures & Manufacturing		
MAE 430	Applied Finite Element Analysis	3
MAE 472	Aerospace Structures II	3
Non-MAE Technical Electives		
ECE 331	Principles of Electrical Engineering	3
MSE 201	Structure and Properties of Engineering Materials	3
Additional Technical Electives		
MAE 398	Relativistic Dynamics: An Evolution in Space, Time, and Matter	3
MAE 402	Aerosol Science and Technology	3
MAE 403	Air Conditioning	3
MAE 406	Energy Conservation in Industry	3
MAE 407	Steam and Gas Turbines	3
MAE 408	Internal Combustion Engine Fundamentals	3
MAE 410	Modern Manufacturing Processes	3
MAE 412	Design of Thermal System	3
MAE 413	Design of Mechanical Systems	3
MAE 420	Dynamic Analysis of Human Movement	3
MAE 421	Design of Solar Energy Systems	3
MAE 426	Fundamentals of Product Design	3
MAE 430	Applied Finite Element Analysis	3
MAE 440	Non-Destructive Testing and Evaluation	3
MAE 470	Space Exploration Systems	3
MAE 448	Computational Methods in Engineering	3
MAE 482	Engineering Entrepreneurship Senior Design I	3
MAE 483	Engineering Entrepreneurship Senior Design II	3
MAE 495	Special Topics in Mechanical and Aerospace Engineering	3
MAE 496	Undergraduate Project Work in Mechanical and Aerospace Engineering	3
MAE 500 Level Courses (with departmental approval)		
Available to students who are admitted to an engineering ABM program OR have a minimum 3.5 overall GPA and completed all required 3rd year MAE lecture courses		
MAE 501	Advanced Engineering Thermodynamics	3
MAE 502	Aerosol Science and Technology	3
MAE 504	Fluid Dynamics Of Combustion I	3
MAE 505	Heat Transfer Theory and Applications	3
MAE 508	Automotive Power Systems	3
MAE 511	Advanced Dynamics I	3
MAE 513	Principles of Structural Vibration	3
MAE 515	Advanced Automotive Vehicle Dynamics	3
MAE 517	Advanced Precision Manufacturing for Products, Systems and Processes	3
MAE 518	Acoustic Radiation I	3
MAE 520	Dynamic Analysis of Human Movement	3
MAE 521	Linear Control and Design For Mimo Systems	3
MAE 522	Non Linear System Analysis and Control	3
MAE 525	Advanced Flight Vehicle Stability and Control	3
MAE 526	Fundamentals of Product Design	3
MAE 528	Experimental Flight Testing	3
MAE 531	Engineering Design Optimization	3
MAE 532	Smart Structures and Micro-Transducers	3
MAE 533	Finite Element Analysis I	3
MAE 534	Mechatronics Design	3
MAE 535	Design of Electromechanical Systems	3

MAE 536	Micro/Nano Electromechanical Systems	3
MAE 537	Mechanics Of Composite Structures	3
MAE 538	Smart Structures and Materials	3
MAE 539	Advanced Materials	3
MAE 540	Advanced Air Conditioning Design	3
MAE 541	Advanced Solid Mechanics I	3
MAE 543	Fracture Mechanics	3
MAE 544	Robot Mechanics and Control	3
MAE 545	Metrology For Precision Manufacturing	3
MAE 546	Photonic Sensor Applications in Structure	3
MAE 548	Computational Methods in Engineering	3
MAE 550	Foundations Of Fluid Dynamics	3
MAE 551	Airfoil Theory	3
MAE 552	Introduction to Experimental Fluid Dynamics and Measurement Systems	3
MAE 553	Compressible Fluid Flow	3
MAE 554	Hypersonic Aerodynamics	3
MAE 555	Applications of Acoustic and Elastic Wave Propagation	3
MAE 558	Microfluidics and Nanofluidics	3
MAE 560	Computational Fluid Mechanics and Heat Transfer	3
MAE 561	Wing Theory	3
MAE 562	Physical Gas Dynamics	3
MAE 570	Space Exploration Systems	3
MAE 573	Hydrodynamic Stability and Transition	3
MAE 575	Advanced Propulsion Systems	3
MAE 577	Multiscale Two-phase Flow Simulations	3
MAE 589	Special Topics In Mechanical and Aerospace Engineering	1-6

Ethics Electives

Code	Title	Hours
EED 414/514	Ethics for Engineering Education	3
IDS 201	Environmental Ethics	3
MS 402	Advanced Military Science - Military Justice, Ethics and Professionalism	3
NS 420	Naval Leadership and Ethics	3
PHI 214	Issues in Business Ethics	3
PHI 227	Data Ethics	3
PHI/STS 325	Bio-Medical Ethics	3
PHI 375	Ethics	3
STS 302	Contemporary Science, Technology and Human Values	3
STS 304	Ethical Dimensions of Progress	3

Semester Sequence

This is a sample.

First Year		
Fall Semester		**Hours**
CH 101	Chemistry - A Molecular Science [1]	3
CH 102	General Chemistry Laboratory [1]	1
E 101	Introduction to Engineering & Problem Solving [1,2]	1
E 115	Introduction to Computing Environments [1,2]	1
ENG 101	Academic Writing and Research [1,2]	4
MA 141	Calculus I [1]	4
Select one of the following:		3
EC 205	Fundamentals of Economics	
EC 201	Principles of Microeconomics	
ARE 201	Introduction to Agricultural & Resource Economics	
GEP Health and Exercise Studies (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-health-exercise-studies/)		1
	Hours	**18**
Spring Semester		
CSC 113	Introduction to Computing - MATLAB	3
GC 120	Foundations of Graphics	3
MA 241	Calculus II [1]	4
PY 205 & PY 206	Physics for Engineers and Scientists I and Physics for Engineers and Scientists I Laboratory [1]	4
GEP Health and Exercise Studies (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-health-exercise-studies/)		1
E 102	Engineering in the 21st Century	2
	Hours	**17**
Second Year		
Fall Semester		
MA 242	Calculus III	4
MAE 206	Engineering Statics [2]	3
MAE 250	Introduction to Aerospace Engineering	1
MAE 251	Aerospace Vehicle Performance [2]	3
PY 208 & PY 209	Physics for Engineers and Scientists II and Physics for Engineers and Scientists II Laboratory	4
	Hours	**15**
Spring Semester		
MA 341	Applied Differential Equations I	3
MAE 208	Engineering Dynamics [2]	3
MAE 214	Solid Mechanics [2]	3
MAE 252	Aerodynamics I [2]	3
MAE 253	Experimental Aerodynamics I	1
GEP Requirement (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/)		3
	Hours	**16**
Third Year		
Fall Semester		
MAE 201	Thermal-Fluid Sciences [2]	3
MAE 315	Fundamentals of Vibrations	3
MAE 371	Aerospace Structures I	3
MAE 372	Aerospace Vehicle Structures Lab	1
ENG 331	Communication for Engineering and Technology	3

Ethics ((p. 3)GEP Requirement (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/))		3
	Hours	**16**
Spring Semester		
MAE 351	Aerodynamics II	3
MAE 352	Experimental Aerodynamics II	1
Both MAE 457 and MAE 467 are required. One can be taken in the third year and the other in the fourth year.		3
MAE 457 or MAE 467	Flight Vehicle Stability and Control or Introduction to Space Flight	
Structures Elective (p.)		3
Math Elective (p.)		3
GEP Requirement (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/)		3
	Hours	**16**
Fourth Year		
Fall Semester		
MAE 405	Controls Lab	1
MAE 435	Principles of Automatic Control	3
MAE 451	Experimental Aerodynamics III	1
MAE 480	Aerospace Vehicle Design I	3
Propulsion Elective (p.)		3
Technical Elective (p. 2)		3
	Hours	**14**
Spring Semester		
MAE 481	Aerospace Vehicle Design II	3
Both MAE 457 and MAE 467 are required. One can be taken in the third year and the other in the fourth year.		3
MAE 467 or MAE 457	Introduction to Space Flight or Flight Vehicle Stability and Control	
Technical Elective (p. 2)		3
GEP Requirement (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/)		3
GEP Requirement (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/)		3
	Hours	**15**
	Total Hours	**127**

[1] A grade of C or higher is required.
[2] A grade of C- or higher is required.

Career Opportunities

Career Titles

- Aeronautical & Aerospace Engineer
- Aerospace Engineering Technician
- Airline Flight Control Administrator
- Airport Engineer
- Architect
- Aviation Inspector
- Electrical Engineer
- Engineering Professor
- Industrial Engineer
- Materials Engineer
- Mechanical Engineer
- Nuclear Engineer
- Pilot
- Product Safety Engineer
- Ship Pilot
- Structural Engineer

Learn More About Careers

NCcareers.org (https://nccareers.org/)
Explore North Carolina's central online resource for students, parents, educators, job seekers and career counselors looking for high quality job and career information.

Occupational Outlook Handbook (https://www.bls.gov/ooh/)
Browse the Occupational Outlook Handbook published by the Bureau of Labor Statistics to view state and area employment and wage statistics. You can also identify and compare similar occupations based on your interests.

Career One Stop Videos (https://www.careeronestop.org/)
View videos that provide career details and information on wages, employment trends, skills needed, and more for any occupation. Sponsored by the U.S. Department of Labor.

Focus 2 Career Assessment (https://careers.dasa.ncsu.edu/explore-careers/career-assessments/) (NC State student email address required)
This career, major and education planning system is available to current NC State students to learn about how your values, interests, competencies, and personality fit into the NC State majors and your future career. An NC State email address is required to create an account. Make an appointment with your career counselor (https://careers.dasa.ncsu.edu/about/hours-appointments/) to discuss the results.

Focus 2 Apply Assessment (https://www.focus2career.com/Portal/Register.cfm?SID=1929) (Available to prospective students)
A career assessment tool designed to support prospective students in exploring and choosing the right major and career path based on your unique personality, interests, skills and values. Get started with Focus 2 Apply and see how it can guide your journey at NC State.

American Institute of Aeronautics & Astronautics (https://www.aiaa.org/)
National Society of Professional Engineers (https://www.nspe.org/)