

### *Aerospace Engineering*

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#### Bachelor of Science

The Aerospace Engineering program exists in partial fulfillment of the University's purpose "to provide a comprehensive education to prepare graduates for productive careers and responsible citizenship with special emphasis on the needs of aviation, aerospace engineering, and related fields." The program's focus is primarily on the engineering of mission-oriented vehicles for atmospheric and space flight. The goal of the Aerospace Engineering program is to produce graduates who are ready for constructive roles in society, who qualify for entry-level engineering jobs in the aerospace industry or aviation-related fields, who qualify for admission to graduate programs in Aerospace Engineering (or related engineering fields), and who are prepared to continue learning throughout their lives.

In order to achieve these objectives, the following are the expected outcomes:

1. ***Engineering responsibilities and methodology.*** From their first semester onward, students will be made aware of what engineering is and what will be expected of them as engineers, including a commitment to continuing education and to engineering ethics. This will be accomplished through interdisciplinary team activities and design projects, workshops, and seminars, and the consistent assignment of open-ended problems throughout the curriculum.
2. ***Professional activity and development.*** Students will be encouraged throughout their Embry-Riddle careers to actively participate in professional organizations, to stay abreast of industry and government aeronautical/aerospace related activities and programs, and to continue their professional development.
3. ***Technical communication.*** Throughout the curriculum, wherever appropriate, student teams will make professional-quality verbal and written presentations.
4. ***General education.*** Students will satisfy the University's general education requirements to broaden the student's education, develop effective communication skills, and obtain awareness of social and ethical issues.
5. ***Basic science and mathematics.*** Students will demonstrate a knowledge of chemistry fundamentals (including oxidation/reduction, the essentials of physical chemistry, and the basics of organic compounds as related to composite materials), basic physics (mechanics, heat, sound, electricity, and optics), and mathematics (differential and integral calculus, differential equations, matrix algebra, and vector calculus) to use as tools in support of their studies of engineering topics and beyond.
6. ***Engineering mechanics.*** Students will demonstrate a knowledge of the fundamentals of classical engineering mechanics (as applied to rigid, elastic, and fluid media) to provide a foundation for the professional component of the curriculum as well as to become familiar with basic engineering problem-solving techniques, including team approaches.

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7. ***Aerodynamics and aeronautics.*** Students will demonstrate a knowledge of topics in aerodynamics, to include a majority of the following: the aerospace environment; applications of mass, momentum, energy, and entropy principles to one- and two-dimensional flows; potential flow; viscous flow and boundary layers; aerodynamics of airfoils in incompressible and compressible flows; steady-state aircraft performance; static stability; propeller and rotary wing fundamentals; applications of the concept of panel methods; supersonic flow; and aerodynamic heating.
  8. ***Thermal sciences.*** Students will demonstrate knowledge of a sequence of topics in thermodynamics, heat transfer, and propulsion so as to be able to assess the operational capabilities and analyze the performance of air-breathing and rocket engines.
  9. ***Structures.*** Students will demonstrate a knowledge of topics in aerospace structures and materials, to include as a minimum the equilibrium of forces and moments in three dimensions; shear and bending moment diagrams; stresses and deflections due to elastic tension, compression, shear, and torsion on stable cross sections; compression and shear buckling; composite materials; basics of the finite element method; and vibration, fatigue, and fracture mechanics concepts.
  10. ***Electronics.*** Students will demonstrate a knowledge of topics in electric circuits, analog and digital electronic fundamentals, electromechanical devices, and instrumentation fundamentals.
  11. ***Astronautics.*** Students will demonstrate a knowledge of topics in orbital mechanics, gyroscopic motion, and control systems with aerospace applications.
  12. ***Laboratories and data interpretation.*** Students will demonstrate an ability to perform laboratory work, including setting up and running an experiment, data collection, statistical processing of data and error analysis, in materials, structures, aerodynamics, power and energy systems, electronics, and instrumentation.
  13. ***Design.*** Students will carry out and defend the conceptual design of an aircraft or a spacecraft in an industry-like environment, in teams, using realistic constraints and considerations of cost, safety, manufacturability and maintainability, mission success, and the needs of the public. Students will likewise also carry out the detail design of an aircraft or a spacecraft system.
  14. ***Support hardware and software.*** The program will be supported throughout by the use of modern equipment and the most relevant modern tools and techniques of engineering analysis, design, and production, including student experience with industry-level solid modeling (CAD/CAM), finite element, and computational fluid mechanics software.
- To enter this program, students should have demonstrated competence in mathematics, physics, and chemistry in high school.
- The Aerospace Engineering program is accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology (111 Market Place, Suite 1050, Baltimore, MD 21202-4012; Telephone: (410) 347-7700; <http://www.abet.org>).

# Academic Programs at the Daytona Beach Campus

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## Degree Requirements

The Bachelor of Science in Aerospace Engineering program requires successful completion of a minimum of 129 credit hours. The program may be completed in eight semesters assuming appropriate background and full-time enrollment.

## First-Year Requirement

A student must attain a minimum cumulative grade point average of 2.25 in those courses prescribed by the College of Engineering Freshman Program (see page 158) before continuing the pursuit of an Aerospace Engineering degree.

## Remaining on Track for AE

Aerospace Engineering students must complete MA 241, MA 242, PS 150, PS 160, and EGR 115 with a C or better within three attempts (including audits and withdrawals) before attending any ES courses. Students should be aware that many courses have prerequisites and/or corequisites. Check the course descriptions at the back of this catalog before registering for classes to ensure required sequencing.

### FRESHMAN YEAR

See the common Freshman Year outline on page 160.

**Total Credits** 32

### SOPHOMORE YEAR

Course	Title	Credits
COM221	Technical Report Writing	3
COM219	Speech -OR-	
EGR 120	Graphical Communications	3
ES 201	Statics	3
ES 202	Solid Mechanics	3
ES 204	Dynamics	3
ES 206	Fluid Mechanics	3
MA 243	Calculus and Analytic Geometry III	4
MA 345	Differential Equations and Matrix Methods	4

PS 105	General Chemistry I	4
PS 250	Physics III for Engineers	3
PS 253	Physics Laboratory for Engineers	1

**Total Credits** 34

### JUNIOR YEAR (AERONAUTICS OPTION)

Course	Title	Credits
AE 301	Aerodynamics I	3
AE 302	Aerodynamics II	3
AE 313	Space Mechanics	3
AE 314	Experimental Aerodynamics I	1
AE 315	Experimental Aerodynamics Laboratory	1
AE 316	Aerospace Engineering Materials	3
AE 318	Aerospace Structures I	3
AE 413	Airplane Stability and Control	3
AE 418	Aerospace Structures II	3
ES 305	Thermodynamics	3
EE 335	Electrical Engineering	2
EE 336	Electrical Engineering Laboratory	1
MA 441	Mathematical Methods for Engineering & Physics I	3

**Total Credits** 32

### JUNIOR YEAR (ASTRONAUTICS OPTION)

Course	Title	Credits
AE 301	Aerodynamics I	3
AE 302	Aerodynamics II	3
AE 313	Space Mechanics	3
AE 314	Experimental Aerodynamics I	1
AE 315	Experimental Aerodynamics Laboratory	1
AE 316	Aerospace Engineering Materials	3
AE 318	Aerospace Structures I	3
AE 418	Aerospace Structures II	3
ES 305	Thermodynamics	3
EE 335	Electrical Engineering I	2
EE 336	Electrical Engineering Laboratory	1
MA 441	Mathematical Methods for Engineering & Physics I	3
	Technical Elective	3

**Total Credits** 32

### JUNIOR YEAR (AEROSPACE PROPULSION OPTION)

Course	Title	Credits
AE 301	Aerodynamics I	3
AE 302	Aerodynamics II	3
AE 313	Space Mechanics	3
AE 314	Experimental Aerodynamics I	1
AE 315	Experimental Aerodynamics Laboratory	1
AE 316	Aerospace Engineering Materials	3
AE 318	Aerospace Structures I	3

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AE	413	Airplane Stability and Control	3
AE	418	Aerospace Structures II	3
ES	305	Thermodynamics	3
EE	335	Electrical Engineering I	2
EE	336	Electrical Engineering Laboratory	1
MA	441	Mathematical Methods for Engineering & Physics I	3

**Total Credits** **32**

### SENIOR YEAR (AERONAUTICS OPTION)

Course	Title	Credits
AE	408 Turbine and Rocket Engines	3
AE	416 Aerospace Structures and Instrumentation	1
AE	417 Aerospace Structures and Instrumentation Laboratory	1
AE	420 Aircraft Preliminary Design	4
AE	421 Aircraft Detail Design	4
AE	432 Flight Dynamics and Control	3
ES	405 Electrical Engineering II	3
HU/SS	Lower-Level Elective	3
HU/SS	Upper-Level Elective	3
	Technical Electives	6

**Total Credits** **31**

### SENIOR YEAR (ASTRONAUTICS OPTION)

Course	Title	Credits
AE	408 Turbine and Rocket Engines	3
AE	416 Aerospace Structures and Instrumentation	1
AE	417 Aerospace Structures and Instrumentation Laboratory	1
AE	426 Spacecraft Attitude Dynamics and Control	4
AE	427 Spacecraft Preliminary Design	4
AE	434 Spacecraft Control	3
AE	445 Spacecraft Detail Design	4
ES	405 Electrical Engineering II	3
HU/SS	Lower-Level Elective	3
HU/SS	Upper-Level Elective	3
	Technical Elective	3

**Total Credits** **31**

### SENIOR YEAR (AEROSPACE PROPULSION OPTION)

Course	Title	Credits
AE	408 Turbine and Rocket Engines	3
AE	416 Aerospace Structures and Instrumentation	1
AE	417 Aerospace Structures and Instrumentation Laboratory	1
AE	432 Flight Dynamics and Control	3
AE	435 Air-Breathing Propulsion Preliminary Design	4
AE	440 Air-Breathing Propulsion Component Design	4
ES	405 Electrical Engineering	3
HU/SS	Lower-Level Elective	3
HU/SS	Upper-Level Elective	3
	Technical Elective	6

**Total Credits** **31**

### TOTAL DEGREE CREDITS

**129**

### Technical Electives:

AE: 350, 395\*, 399\*, 401, 409, 411, 415, 425, 433, 495\*, 499\*, 5XXU  
 CEAE: With prior approval of the Aerospace Engineering Department  
 CEC: 300, 315, 330, 340, 460  
 CIV: 447  
 CS: 303, 344, 350  
 EGR: 305  
 EP: 320, 391, 394 (Astronautics option only)  
 ES: 315 (Astronautics option only), 395\*, 399\*, 403, 412, 495\*, 499\*  
 MA: 412, 432, 438, 442, 443, 5XXU  
 ME: 304/305\*\* (was 300/L), 302, 303, 425  
 PS: 303, 320, 401 (Astronautics option only)  
 SE: 300  
 SYS: 301

Students may substitute upper-level AF, NSC, and MY courses or aeronautical certificates for the 6 credits of technical electives.

Students may take courses that are not listed above with prior approval of the Aerospace Engineering Department.

\* Need approval of Aerospace Engineering Department Chair before enrolling.

\*\* Lecture/Lab courses must be taken at the same time.