B.S. in Systems Engineering

The Bachelor of Science degree in Systems Engineering is designed to graduate engineers who can address system level analysis, integration, and risk issues throughout the system lifecycle, starting from the early conceptual design, to development, testing, operating, and decommissioning of systems. Graduates will naturally learn how to use systems thinking and analysis techniques to improve system performance over the entire life cycle.

In a few years of completing their undergraduate degree, graduates of the Bachelor of Science in Systems Engineering:

- Have established themselves in successful engineering careers in aviation, aerospace, and related fields and/or are pursuing advanced degrees.
- Are serving society and their professions as involved and responsible citizens, leaders, and role models.
- Are problem solvers, systems thinkers, and innovators.

The curriculum is designed to facilitate accomplishment of these objectives by program graduates. It provides a broad education, including fundamental knowledge about engineering systems and their hardware and software components. It also allows graduates to work in a team environment and to recognize the value of collaborative effort. The program lays a foundation for lifelong learning, professional growth, and ethical and responsible behavior in society.

There are two Areas of Concentration (AOC) to choose from: Aerospace Systems Engineering and Enterprise Systems Engineering. The courses in the AOCs allow students to broaden their general education or pursue specific interests. Upper-level courses involve students in team projects that emphasize industrial processes and practices.

Aerospace Systems Engineering Area of Concentration

The Systems Engineering degree with an Area of Concentration in Aerospace Systems Engineering produces graduates who have a solid knowledge of systems engineering and significant exposure to aerospace systems domain. The curriculum emphasizes fundamental concepts of aerospace engineering and system level design and analysis methodologies for aerospace systems.

Enterprise Systems Engineering Area of Concentration

The Systems Engineering degree with an Area of Concentration in Enterprise Systems Engineering emphasizes the generic systems engineering education, applicable to all large-scale engineering systems. The graduates will be able to succeed in a wide range of engineering domains.

Degree Requirements

The Bachelor of Science degree can be earned in eight semesters assuming appropriate background and full-time enrollment. Successful completion of a minimum of 125 credit hours is required. A minimum cumulative grade point average of 2.0 is needed for all required AE, CEC, CS, EE, ES, EGR, HF, and SYS courses that fulfill any degree requirement.

Students entering this program should have demonstrated a competence in mathematics and science (preferably physics). They should be prepared to enter Calculus I, having demonstrated proficiency in algebra and trigonometry. Students can prepare for the program by taking MA 143 before taking MA 241. For those students who have not taken physics in high school, it is recommended that PS 103 be taken prior to PS 150.

The Systems Engineering program is designed to prepare students to work as part of a team on the design and analysis of large-scale engineering systems. Systems engineering concepts, methods, and techniques are integrated through the curriculum. The curriculum includes courses in general education, math and science, and engineering. The latter is divided into engineering fundamentals, modeling and analysis, and systems engineering. In addition, a student can acquire a minor or a concentration in a domain area of interest. Students should be aware that several courses in each academic year may have prerequisites and/or corequisites. Check the course descriptions at the back of this catalog before registering for classes to ensure requisite sequencing.

Students will:

- Have an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
- Have 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.
- Have an ability to communicate effectively with a range of audiences.
- Have 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.
- Have 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.
- Have an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
- Have an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

General Education Requirements

For a full description of Embry-Riddle General Education guidelines, please see the General Education section of this catalog. These minimum requirements are applicable to all degree programs.

Communication Theory & Skills (COM 122, COM 219, COM 221)	9
Lower-Level Humanities	3
Lower-Level Social Sciences (PSY 101)	3
Lower or Upper-Level Humanities or Social Sciences	3
Upper-Level Humanities or Social Sciences	3
Computer Science *	3
Mathematics (MA 241 & MA 242)	8
Physical and Life Sciences (PS 150, PS 160, PS 226L)	7
Total Credits	**39**

* Computer Science required course: Aerospace Systems Engineering AOC must take EGR 115; Enterprise Systems Engineering AOC must take CS 223.

Systems Engineering Core Requirements

UNIV 101	College Success	1
MA 243	Calculus and Analytical Geometry III	4
MA 345	Differential Equations and Matrix Methods	4
MA 412	Probability and Statistics	3
EGR 101	Introduction to Engineering [3]	2
ES 201	Statics	3
ES 204	Dynamics	3

HF 300	Human Factors I: Principles and Fundamentals	3
HF 312	Ergonomics and Bioengineering	3
Technical Elective (Science + Lab) [1]		4
Technical Elective [2]		3
Systems Engineering Courses		
SYS 301	Introduction to Systems Engineering	3
SYS 302	System Engineering Design Considerations	3
SYS 303	Optimization in Systems Engineering	3
SYS 304	Trade Studies, Risk and Decision Analysis	3
SYS 401	Systems Modeling and Simulation	3
SYS 402	Optimization in Systems Engineering II	3
SYS 403	Systems Engineering Life Cycle Costing	3
SYS 415	Systems Engineering Practices: Specialty Engineering	3
SYS 417	Systems Engineering Capstone Project I	3
SYS 418	Systems Engineering Capstone Project II	3
Total Credits		**63**

Aerospace Systems Engineering Area of Concentration

AE 201	Aerospace Flight Vehicles	3
AE Courses (Pick one of the following)		3
AE 313	Space Mechanics	
AE 319	Aerodynamics	
AE 323	Spacecraft Systems	
EGR 120	Graphical Communications	3
EE 311	Robotics Technologies for Unmanned Systems	3
EE 327	Electrical Engineering Fundamentals	3
EE 328	Electrical Engineering Fundamentals Laboratory	1
EE 401	Control Systems Analysis and Design	3
EE 402	Control Systems Laboratory	1
ES 305	Thermodynamics	3
Total Credits		**23**

Enterprise Systems Engineering Area of Concentration

CEC 220	Digital Circuit Design	3
CEC 222	Digital Circuit Design Laboratory	1
CEC 320	Microprocessor Systems	3
CEC 322	Microprocessor Systems Laboratory	1
Systems Engineering Technical Electives (Pick four of the following)		12
SYS 310	Systems Architecture, Modeling and Simulation	
SYS 320	Systems Engineering Practices	
SYS 405	Aerospace Systems Guidance and Control	
SYS 410	Space Systems and Mission Analysis	
SYS 425	System Quality Engineering	
SYS 460	Systems Engineering Management	
Technical Elective [2]		3
Total Credits		**23**
Total Degree Credits		**125**

[1] Technical Elective (Science): Science course with a lab (4 credits). Examples: BIO 120 and BIO 120L / CHM 110 and CHM 110L / PS 228 and PS 228L / PS 250 and PS 253

[2] Technical Elective: CEC/CS/EE/SE/SYS/ME/AE/CE Upper-Level Elective (3 credits)

[3] Aerospace Systems Engineering AOC students are required to enroll in the Aerospace Engineering Topic of EGR 101; Enterprise Systems Engineering AOC students are required to enroll in the EECS Engineering Topic of EGR 101.

Aerospace Systems Engineering AOC - Plan of Study

Year One		
Term 1		**Credits**
COM 122	English Composition	3
EGR 101	Introduction to Engineering	2
EGR 120	Graphical Communications	3
	Lower-level Humanities or Social Sciences Elective	3
MA 241	Calculus and Analytical Geometry I	4
UNIV 101	College Success	1
	Credits Subtotal	**16.0**
Term 2		
EGR 115	Introduction to Computing for Engineers	3
	HU 14X Humanities Elective	3
MA 242	Calculus and Analytical Geometry II	4
PS 150	Physics for Engineers I	3
PSY 101	Introduction to Psychology	3
	Credits Subtotal	**16.0**
Year Two		
Term 1		
COM 221	Technical Report Writing	3
ES 201	Statics	3
ES 305	Thermodynamics	3
MA 243	Calculus and Analytical Geometry III	4
PS 160	Physics for Engineers II	3
	Credits Subtotal	**16.0**
Term 2		
AE 201	Aerospace Flight Vehicles	3
ES 204	Dynamics	3
HF 300	Human Factors I: Principles and Fundamentals	3
MA 345	Differential Equations and Matrix Methods	4
PS 226L	Physics I Laboratory	1
	Credits Subtotal	**14.0**
Year Three		
Term 1		
HF 312	Ergonomics and Bioengineering	3
MA 412	Probability and Statistics	3
SYS 301	Introduction to Systems Engineering	3
SYS 302	System Engineering Design Considerations	3
	Technical Elective (Science + Lab) [1]	4
	Credits Subtotal	**16.0**
Term 2		
AE 313	Space Mechanics	3
or AE 319	Aerodynamics	
or AE 323	Spacecraft Systems	
EE 311	Robotics Technologies for Uncrewed Systems	3
EE 327	Electrical Engineering Fundamentals	3
EE 328	Electrical Engineering Fundamentals Laboratory	1
SYS 303	Optimization in Systems Engineering	3
SYS 304	Trade Studies, Risk and Decision Analysis	3
	Credits Subtotal	**16.0**

Year Four		
Term 1		
COM 219	Speech	3
EE 401	Control Systems Analysis and Design	3
EE 402	Control Systems Laboratory	1
SYS 403	Systems Engineering Life Cycle Costing	3
SYS 417	Systems Engineering Capstone Project I	3
SYS 401	Systems Modeling and Simulation	3
	Credits Subtotal	**16.0**
Term 2		
SYS 402	Optimization in Systems Engineering II	3
SYS 415	Systems Engineering Practices: Specialty Engineering	3
SYS 418	Systems Engineering Capstone Project II	3
	Technical Elective [2]	3
	Upper-Level Humanities or Social Sciences	3
	Credits Subtotal	**15.0**
	Credits Total:	**125.0**

[1] Technical Elective (Science): Science course with a lab (4 credits). BIO 120 and BIO 120L / CHM 110 and CHM 110L / PS 228 and PS 228L / PS 250 and PS 253

[2] Technical Elective: CEC/CS/EE/SE/SYS/ME/AE/CE Upper-Level Elective (3 credits)

Enterprise Systems Engineering AOC - Plan of Study

Year One		
Term 1		**Credits**
COM 122	English Composition	3
CS 223	Scientific Programming in C	3
EGR 101	Introduction to Engineering	2
	Lower-level Humanities or Social Sciences Elective	3
MA 241	Calculus and Analytical Geometry I	4
UNIV 101	College Success	1
	Credits Subtotal	**16.0**
Term 2		
COM 219	Speech	3
	HU 14X Humanities Elective	3
MA 242	Calculus and Analytical Geometry II	4
PS 150	Physics for Engineers I	3
PSY 101	Introduction to Psychology	3
	Credits Subtotal	**16.0**
Year Two		
Term 1		
CEC 220	Digital Circuit Design	3
CEC 222	Digital Circuit Design Laboratory	1
COM 221	Technical Report Writing	3
ES 201	Statics	3
MA 412	Probability and Statistics	3
PS 160	Physics for Engineers II	3
	Credits Subtotal	**16.0**
Term 2		
CEC 320	Microprocessor Systems	3
CEC 322	Microprocessor Systems Laboratory	1
ES 204	Dynamics	3
MA 345	Differential Equations and Matrix Methods	4
PS 226L	Physics I Laboratory	1
	Technical Elective (Science + Lab) [1]	4
	Credits Subtotal	**16.0**
Year Three		
Term 1		
HF 300	Human Factors I: Principles and Fundamentals	3
MA 345	Differential Equations and Matrix Methods	4
SYS 301	Introduction to Systems Engineering	3
SYS 302	System Engineering Design Considerations	3
	Technical Elective [2]	3
	Credits Subtotal	**16.0**
Term 2		
HF 312	Ergonomics and Bioengineering	3
SYS 303	Optimization in Systems Engineering	3
SYS 304	Trade Studies, Risk and Decision Analysis	3
	SYS Technical Elective 300-level	3
	SYS Technical Elective 300-level	3
	Credits Subtotal	**15.0**
Year Four		
Term 1		
SYS 401	Systems Modeling and Simulation	3
SYS 402	Optimization in Systems Engineering II	3
SYS 403	Systems Engineering Life Cycle Costing	3
SYS 417	Systems Engineering Capstone Project I	3
	SYS Technical Elective 400-level	3
	Credits Subtotal	**15.0**
Term 2		
SYS 415	Systems Engineering Practices: Specialty Engineering	3
SYS 418	Systems Engineering Capstone Project II	3
	SYS Technical Elective 400-level	3
	Technical Elective [2]	3
	Upper-level Humanities or Social Sciences	3
	Credits Subtotal	**15.0**
	Credits Total:	**125.0**

[1] Technical Elective (Science): Science course with a lab (4 credits). BIO 120 and BIO 120L / CHM 110 and CHM 110L / PS 228 and PS 228L / PS 250 and PS 253

[2] Technical Elective: CEC/CS/EE/SE/SYS/ME/AE/CE Upper-Level Elective (3 credits)