

B.S. in Mechanical Engineering

Mechanical Engineering became a degree offering in Fall 2007. When designing this degree program our faculty wanted to ensure that we created a Mechanical Engineering degree that embraced Embry-Riddle's mission and recognized expertise in aerospace. Aerospace platforms, whether atmosphere or space-based, require skills from a team of engineers that include Aerospace, Electrical, Computer, and, of course, Mechanical Engineering. Given this, our ME degree stays within that focus of the aerospace platform with the three primary options of robotics, propulsion, and energy.

With minor exceptions, the freshman year in Mechanical Engineering is common to the Aerospace Engineering degree program. The second year in Mechanical Engineering builds fundamental skills in math and physics while introducing students to Engineering Mechanics and the Thermal Sciences. During the second semester of their sophomore year, Mechanical Engineering students in Embry-Riddle's program in Prescott will start taking courses aligned within the focus areas of robotics, propulsion, or energy. The robotics option emphasizes the design and analysis of autonomous vehicles that include uninhabited aerial vehicles (UAVs), autonomous space vehicles, and planetary rovers, as well as a variety of terrestrial robotic systems. The propulsion option emphasizes the thermal sciences and design and analysis of turbomachinery. Jet aircraft engines are the primary area of depth but piston and rocket propulsion are also studied. The energy option emphasizes the design of renewable energy systems. During the senior year, students will gain additional depth in their options and take capstone courses in designing a mechanical system aligned with their selected track.

Aerospace platforms are designed in teams and with that, we provide interdisciplinary opportunities centered around our ME students. Senior ME students have the opportunity to choose between five capstone sequences as a culminating event focused on teams, integration, and synthesis of four years of education. Mechanical engineers can choose capstone sequences that include:

- Propulsion sequence centered on jet aircraft and rocket engines.
- Robotics sequence centered on robotic arms and autonomous vehicles
- Energy sequence centered on alternative energy systems
- Astronautics sequence centered on spacecraft
- Aeronautics sequence centered on aircraft

The overall objective of the Mechanical Engineering program at Prescott is to produce graduates who will be successful practitioners of mechanical engineering. The program objectives to measure our accomplishment of this goal are engineers who:

- Demonstrate achievements in their chosen profession
- Contribute to the profession and the university
- Demonstrate professional preparation
- Exhibit professional ethics and integrity

The Mechanical Engineering program is accredited by the Engineering Accreditation Commission of ABET, <https://www.abet.org>.

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.

Degree Requirements

The Bachelor of Science in Mechanical Engineering program requires successful completion of a minimum of 128 credit hours. The program may be completed in eight semesters assuming appropriate background and full-time enrollment. A minimum cumulative grade point average of 2.00 is needed for all required AE, EGR, ES, and ME courses, excluding technical electives. The courses necessary to earn this degree are listed below.

Students should be aware that many courses have prerequisites and/or co-requisites. **Students must have a C or better in all pre-requisites for all required AE, COM 221, EGR, EP, ES, ME, and SYS courses.**

Program Requirements

General Education

Embry-Riddle degree programs require students to complete a minimum of 36 hours of General Education coursework. For a full description of Embry-Riddle General Education guidelines, please see the General Education section of this catalog.

Students may choose other classes outside of their requirements, but doing so can result in the student having to complete more than the degree's 128 credit hours. This will result in additional **time and cost** to the student.

Communication Theory and Skills	9
Computer Science/Information Technology	3
Mathematics	6
Physical and Life Sciences (Natural Sciences)	6
Humanities and Social Sciences	12
3 hours of lower-level Humanities	
3 hours of lower-level Social Science	
3 hours of lower-level or upper-level Humanities or Social Science	
3 hours of upper-level Humanities or Social Science	
Total Credits	36

Mechanical Engineering Core (94 Credits)

The following course of study outlines the quickest and most cost-efficient route for students to earn their B.S. in Mechanical Engineering. Students are encouraged to follow the course of study to ensure they complete all program required courses and their prerequisites within four years.

Courses in the core with a # will satisfy general education requirements.

AE 430	Control System Analysis and Design	3
CHM 113	General Chemistry for Engineering #	3
COM 122	English Composition #	3
COM 221	Technical Report Writing (Must Earn a C or better to pass COM 221) #	3
COM 420	Advanced Technical Communication I #	1
COM 430	Advanced Technical Communication II #	2

2 B.S. in Mechanical Engineering

EC 225	Engineering Economics #	3
EE 335	Electrical Engineering I	2
EE 336	Electrical Engineering I Laboratory	1
EGR 101	Introduction to Engineering	2
EGR 115	Introduction to Computing for Engineers #	3
EGR 201	Computer Aided Design of Mechanical Systems	3
ES 201	Statics	3
ES 202	Solid Mechanics	3
ES 204	Dynamics	3
ES 206	Fluid Mechanics	3
ES 208	Thermodynamics	3
ES 320	Engineering Materials Science	2
ES 321	Engineering Materials Science Laboratory	1
ES 403	Heat Transfer	3
General Education - lower-level or upper-level Humanities or Social Science #		3
General Education - lower-level Humanities #		3
HU 330	Values and Ethics (OR Study Abroad in HU/SS Upper-Level) #	3
or HU 335	Technology and Modern Civilization	
MA 241	Calculus and Analytical Geometry I #	4
MA 242	Calculus and Analytical Geometry II #	4
MA 243	Calculus and Analytical Geometry III	4
MA 335	Introduction to Linear and Abstract Algebra (For Robotics Option) ** Other Options can take: Math or Natural Science Upper-Level Elective)	3
MA 345	Differential Equations and Matrix Methods	4
PS 161	Physics I & II for Engineers	4
PS 250	Physics for Engineers III #	3
PS 253	Physics Laboratory for Engineers #	1
ME 200	Machine Shop Laboratory	1
ME 304	Introduction to Machine Design *	3
ME 305	Machine Design Laboratory	1
ME 400	Mechanical Vibrations **	3

Options

Energy Option (20 Credits)

EE 334	Electrical Engineering for Mechanical Engineers	3
Energy Electives		6
ES 324	Measurements and Instrumentation	2
ES 325	Measurements and Instrumentation Lab	1
ME 312	Alternative Energy I **	3
ME 403	Thermal Power Systems	3
ME 446	Thermal-Fluid Science and Energy Measurement **	1
ME 446L	Thermal-Fluid Science and Energy Measurement Laboratory **	1
Total Credits		20

Propulsion Option (20 Credits)

EE 334	Electrical Engineering for Mechanical Engineers	3
ES 324	Measurements and Instrumentation	2
ES 325	Measurements and Instrumentation Lab	1
ME 309	Airbreathing and Rocket Propulsion	3
ME 403	Thermal Power Systems	3
ME 446	Thermal-Fluid Science and Energy Measurement **	1

ME 446L	Thermal-Fluid Science and Energy Measurement Laboratory **	1
Propulsion Electives		6
Total Credits		20

Robotics Option (20 Credits)

CEC 220	Digital Circuit Design	3
CEC 222	Digital Circuit Design Laboratory	1
CS 125	Computer Science I	4
ME 302	Introduction to Robotics I *	3
ME 302L	Introduction to Robotics I Laboratory *	1
ME 404	Mechatronics	3
ME 404L	Mechatronics Laboratory	1
ME 406	Robotics II **	3
ME 406L	Robotics II Laboratory **	1

Capstone Design Sequence, Preliminary and Detail Design

ME students have five possible sequences for their capstone sequence:

Aeronautics (8 Credits)

AE 420	Aircraft Preliminary Design	4
AE 421	Aircraft Detail Design	4

Astronautics (8 Credits)

AE 427	Spacecraft Preliminary Design	4
AE 445	Spacecraft Detail Design	4

Energy (8 Credits)

ME 435	Energy Engineering Preliminary Design *	4
ME 440	Energy Engineering Detail Design **	4

Propulsion (8 Credits)

ME 429	Propulsion System Preliminary Design *	4
ME 431	Propulsion System Detail Design **	4

Robotics (8 Credits)

ME 407	Preliminary Design for Robotic Systems with Laboratory	4
ME 420	Detail Design of Robotic Systems with Laboratory	4

Technical Electives (6 Credits)

Technical Electives		6
Total Credits		128

Three credit hours of technical elective credit must be taken from available upper-level College of Engineering courses not specifically listed in the student's degree requirements.

AE

Upper-level, except Directed Studies

Cooperative Education courses

With prior approval of the Aerospace Engineering department. See Career Advisor for more information.

CEC

Upper-Level, except Directed Studies. (Must be approved by the Aerospace Engineering department before taking this course.)

CS	
CS 325	Programming in ADA
CS 420	Operating Systems *
EE	
Upper-Level, except Directed Studies	
EGR	
Upper-Level	
EP	
Upper-Level, except Directed Studies	
ES	
Upper-Level, except Directed Studies	
MA	
MA 348	Numerical Analysis I
MA 432	Linear Algebra
MA 441	Mathematical Methods for Engineering and Physics I
MA 442	Mathematical Methods for Engineering and Physics II
MA 443	Complex Variables
ME	
Upper-Level, except Directed Studies	
PS	
PS 303	Modern Physics **
PS 321	Classical Mechanics I *
PS 322	Classical Mechanics II **
PS 350	Quantum Mechanics I **
PS 375	Planetary Science
PS 420	Remote Sensing
SE	
SE 300	Software Engineering Practices **
SYS	
SYS 301	Introduction to Systems Engineering
SYS 304	Trade Studies, Risk and Decision Analysis
SYS 415	Systems Engineering Practices: Specialty Engineering

* Offered in Fall Only

** Offered in Spring Only

^ This course could be filled by any 300/400 level MA/PS/CHM/BIO/WX course (or approved by the department chair).

General Education Courses

UNIV 101 is taken in excess of degree requirements or meets open elective credit.

All Army ROTC students are required to complete SS 321 - U.S. Military History 1900-Present (3 credits) in order to commission.

Energy Option

Freshman Year

Fall		Credits
CHM 113	General Chemistry for Engineering	3
COM 122	English Composition	3
EGR 101	Introduction to Engineering	2
EGR 201	Computer Aided Design of Mechanical Systems	3
MA 241	Calculus and Analytical Geometry I	4
ME 200	Machine Shop Laboratory	1
UNIV 101	College Success	(1)
Credits Subtotal		16.0
Spring		
EC 225	Engineering Economics	3

	Humanities or Social Science Lower-Level or Upper-Level Elective	3
EGR 115	Introduction to Computing for Engineers	3
MA 242	Calculus and Analytical Geometry II	4
PS 161	Physics I & II for Engineers	4
Credits Subtotal		17.0

Sophomore Year

Fall		
COM 221	Technical Report Writing (Must Earn a C or better to pass COM 221)	3
ES 201	Statics	3
ES 208	Thermodynamics	3
MA 243	Calculus and Analytical Geometry III	4
PS 250	Physics for Engineers III	3
PS 253	Physics Laboratory for Engineers	1
Credits Subtotal		17.0

Spring

EE 335	Electrical Engineering I	2
EE 336	Electrical Engineering I Laboratory	1
ES 202	Solid Mechanics	3
ES 206	Fluid Mechanics	3
	Humanities Lower- Level Elective	3
MA 345	Differential Equations and Matrix Methods	4
Credits Subtotal		16.0

Junior Year

Fall		
EE 334	Electrical Engineering for Mechanical Engineers	3
ES 204	Dynamics	3
ES 324	Measurements and Instrumentation	2
ES 325	Measurements and Instrumentation Lab	1
ES 403	Heat Transfer	3
ME 403	Thermal Power Systems	3
Credits Subtotal		15.0

Spring

AE 430	Control System Analysis and Design	3
	Energy Elective	3
ME 312	Alternative Energy I	3
ME 446	Thermal-Fluid Science and Energy Measurement	1
ME 446L	Thermal-Fluid Science and Energy Measurement Laboratory	1
ES 320	Engineering Materials Science	2
ES 321	Engineering Materials Science Laboratory	1
	Math or Natural Science Upper-Level Elective	3
Credits Subtotal		17.0

Senior Year

Fall		
COM 420	Advanced Technical Communication I	1
	Energy Elective	3
ME 304	Introduction to Machine Design	3
ME 305	Machine Design Laboratory	1
	Preliminary Design	4
	Technical Electives	3
Credits Subtotal		15.0
Spring		
COM 430	Advanced Technical Communication II	2
	Detail Design	4

4 B.S. in Mechanical Engineering

HU 330	Values and Ethics (or HU/SS Upper-Level Study Abroad)	3
or HU 335	Technology and Modern Civilization	
ME 400	Mechanical Vibrations	3
	Technical Electives	3
Credits Subtotal		15.0
Credits Total:		128.0

Propulsion Option

Freshman Year

		Credits
Fall		
COM 122	English Composition	3
CHM 113	General Chemistry for Engineering	3
EGR 101	Introduction to Engineering	2
EGR 201	Computer Aided Design of Mechanical Systems	3
MA 241	Calculus and Analytical Geometry I	4
ME 200	Machine Shop Laboratory	1
UNIV 101	College Success	(1)
Credits Subtotal		16.0

Spring

EC 225	Engineering Economics	3
EGR 115	Introduction to Computing for Engineers	3
	Humanities or Social Science Lower-Level or Upper-Level Elective	3
MA 242	Calculus and Analytical Geometry II	4
PS 161	Physics I & II for Engineers	4
Credits Subtotal		17.0

Sophomore Year

		Credits
Fall		
COM 221	Technical Report Writing (Must earn a C or better to pass COM 221)	3
ES 201	Statics	3
ES 208	Thermodynamics	3
MA 243	Calculus and Analytical Geometry III	4
PS 250	Physics for Engineers III	3
PS 253	Physics Laboratory for Engineers	1
Credits Subtotal		17.0

Spring

EE 335	Electrical Engineering I	2
EE 336	Electrical Engineering I Laboratory	1
ES 202	Solid Mechanics	3
ES 206	Fluid Mechanics	3
	Humanities Lower-Level Elective	3
MA 345	Differential Equations and Matrix Methods	4
Credits Subtotal		16.0

Junior Year

		Credits
Fall		
EE 334	Electrical Engineering for Mechanical Engineers	3
ES 204	Dynamics	3
ES 324	Measurements and Instrumentation	2
ES 325	Measurements and Instrumentation Lab	1
ES 403	Heat Transfer	3
ME 309	Airbreathing and Rocket Propulsion	3
Credits Subtotal		15.0

Spring

AE 430	Control System Analysis and Design	3
ES 320	Engineering Materials Science	2
ES 321	Engineering Materials Science Laboratory	1

	Math or Natural Science Upper-Level Elective	3
ME 403	Thermal Power Systems	3
ME 446	Thermal-Fluid Science and Energy Measurement	1
ME 446L	Thermal-Fluid Science and Energy Measurement Laboratory	1
	Propulsion Elective	3
Credits Subtotal		17.0

Senior Year

Fall

COM 420	Advanced Technical Communication I	1
ME 304	Introduction to Machine Design	3
ME 305	Machine Design Laboratory	1
	Preliminary Design	4
	Propulsion Elective	3
	Technical Elective	3
Credits Subtotal		15.0

Spring

COM 430	Advanced Technical Communication II	2
	Detail Design	4
HU 330	Values and Ethics (or HU/SS Upper-Level Study Abroad)	3
or HU 335	Technology and Modern Civilization	
ME 400	Mechanical Vibrations	3
	Technical Elective	3
Credits Subtotal		15.0
Credits Total:		128.0

Robotics Option

Freshman Year

		Credits
Fall		
CHM 113	General Chemistry for Engineering	3
COM 122	English Composition	3
	Humanities or Social Science Lower-Level or Upper-Level Elective	3
EGR 101	Introduction to Engineering	2
MA 241	Calculus and Analytical Geometry I	4
UNIV 101	College Success	(1)
Credits Subtotal		15.0

Spring

CEC 220	Digital Circuit Design	3
CEC 222	Digital Circuit Design Laboratory	1
EGR 201	Computer Aided Design of Mechanical Systems	3
MA 242	Calculus and Analytical Geometry II	4
ME 200	Machine Shop Laboratory	1
PS 161	Physics I & II for Engineers	4
Credits Subtotal		16.0

Sophomore Year

Fall

COM 221	Technical Report Writing (Must Earn a C or better to pass COM 221)	3
EGR 115	Introduction to Computing for Engineers	3
ES 201	Statics	3
MA 243	Calculus and Analytical Geometry III	4
PS 250	Physics for Engineers III	3
PS 253	Physics Laboratory for Engineers	1
Credits Subtotal		17.0

Spring

CS 125	Computer Science I	4
--------	--------------------	---

EE 335	Electrical Engineering I	2
EE 336	Electrical Engineering I Laboratory	1
ES 204	Dynamics	3
MA 335	Introduction to Linear and Abstract Algebra	3
MA 345	Differential Equations and Matrix Methods	4

Credits Subtotal **17.0**

Junior Year

Fall

ES 202	Solid Mechanics	3
ES 208	Thermodynamics	3
	Humanities Lower-Level Elective	3
ME 302	Introduction to Robotics I	3
ME 302L	Introduction to Robotics I Laboratory	1
ME 404	Mechatronics	3
ME 404L	Mechatronics Laboratory	1

Credits Subtotal **17.0**

Spring

AE 430	Control System Analysis and Design	3
EC 225	Engineering Economics	3
ES 206	Fluid Mechanics	3
ES 320	Engineering Materials Science	2
ES 321	Engineering Materials Science Laboratory	1
ME 406	Robotics II	3
ME 406L	Robotics II Laboratory	1

Credits Subtotal **16.0**

Senior Year

Fall

COM 420	Advanced Technical Communication I	1
ES 403	Heat Transfer	3
ME 304	Introduction to Machine Design	3
ME 305	Machine Design Laboratory	1
ME 407	Preliminary Design for Robotic Systems with Laboratory	4
	Technical Elective	3

Credits Subtotal **15.0**

Spring

COM 430	Advanced Technical Communication II	2
HU 330	Values and Ethics (or HU/SS Upper-Level Study Abroad)	3
or HU 335	Technology and Modern Civilization	
ME 400	Mechanical Vibrations	3
ME 420	Detail Design of Robotic Systems with Laboratory	4
	Technical Elective	3

Credits Subtotal **15.0**

Credits Total: **128.0**