

# Robotics Engineering, B.S.

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## Degree Offered

- Bachelor of Science in Robotics Engineering (B.S.)

## Nature of the Program

Robotics engineering ranks amongst the fastest-growing profession globally according to a recent World Economic Forum Future of Jobs Report. This four-year degree program explores mechanical systems, computer science and engineering systems to provide students with a strong interdisciplinary foundation. Through the fundamentals of robotics systems, mobile robotics, robotic manipulators and autonomy students gain the knowledge and skills to develop their own robotics solutions. The culmination of this program is through the development of a yearlong capstone project giving students the experience to be prepared for a career in robotics engineering within the growing industry, government position or academia.

The robotics engineering program is designed to equip students with the knowledge and skills to excel in the engineering design and production of robotics and autonomous systems solutions. The program will prepare next-generation robotics engineers who are:

- Effective in the engineering design and production of robotics and autonomous systems solutions to alleviate the burden of human workload or create safer work environments.
- Versed to apply a theoretical foundation of mechanical, electrical and computer engineering systems to integrate and devise robotics solutions.
- Educated and trained to apply robotics solutions in collaboration with specialists in the field, ensuring a comprehensive and interdisciplinary approach to addressing challenges in robotic systems.

## General Education Foundations

Please use this link to view a list of courses that meet each GEF requirement. (<http://registrar.wvu.edu/gef/>)

NOTE: Some major requirements will fulfill specific GEF requirements. Please see the curriculum requirements listed below for details on which GEFs you will need to select.

Code	Title	Hours
<b>General Education Foundations</b>		
F1 - Composition & Rhetoric		3-6
ENGL 101 & ENGL 102 or ENGL 103	Introduction to Composition and Rhetoric and Composition, Rhetoric, and Research Accelerated Academic Writing	
F2A/F2B - Science & Technology		4-6
F3 - Math & Quantitative Reasoning		3-4
F4 - Society & Connections		3
F5 - Human Inquiry & the Past		3
F6 - The Arts & Creativity		3
F7 - Global Studies & Diversity		3
F8 - Focus (may be satisfied by completion of a minor, double major, or dual degree)		9
Total Hours		31-37

Please note that not all of the GEF courses are offered at all campuses. Students should consult with their advisor or academic department regarding the GEF course offerings available at their campus.

## Degree Requirements

Students must meet the following criteria to qualify for a Bachelor of Science in Robotics Engineering degree:

- Complete a minimum of 124 credit hours
- Satisfy WVU's undergraduate degree requirements
- Satisfy Statler College's undergraduate degree requirements (<http://catalog.wvu.edu/undergraduate/collegeofengineeringandmineralresources/#policiestext>)
- Complete all courses listed in the curriculum requirements with the required minimum grades
- Attain an overall grade point average of 2.00 or better
- Attain a WVU grade point average of 2.00 or better

- Attain a Statler grade point average of 2.00 or better
- A maximum of one math or science course with a grade of D+, D, or D- may be applied toward degree completion
- Complete a survey regarding their academic and professional experiences at WVU, as well as post-graduation job placement or continuing education plans.

The Statler GPA is computed based on all work taken at WVU with a subject code within Statler College (BIOM, BMEG, CE, CHE, CPE, CS, CSEE, CYBE, EE, ENGR, ENVE, ETEC, IENG, IH&S, MAE, MINE, PDA, PNGE, ROBE, SAFM, SENG) excluding ENGR 140, ENGR 150, and CS 101. The WVU GPA is computed based on all work taken at WVU. The Overall GPA is computed based on all work taken at WVU and transfer work.

## Curriculum Requirements

Code	Title	Hours
	University Requirements	16
	Fundamentals of Engineering Requirements	2
	Math and Science Requirements	28
	Robotics Engineering Program Requirements	78
	Total Hours	124

## University Requirements

Code	Title	Hours
	General Education Foundations (GEF) 1, 2, 3, 4, 5, 6, 7, and 8 (31-37 Credits)	
	Outstanding GEF Requirements 1, 5, 6, 7	15
ENGR 191	First-Year Seminar	1
	Total Hours	16

## Fundamentals of Engineering Requirements

Code	Title	Hours
	A minimum grade of C- is required in all Fundamentals of Engineering courses.	
ENGR 101	Engineering Problem Solving 1	2
	Total Hours	2

## Math and Science Requirements

Code	Title	Hours
	A minimum grade of C- is required in all Math and Science courses.	
	Lab Science (select one of the following):	4
CHEM 115 & 115L	Fundamentals of Chemistry 1 and Fundamentals of Chemistry 1 Laboratory	
BIOL 115 & 115L	Principles of Biology and Principles of Biology Laboratory	
GEOL 101 & 101L	Planet Earth and Planet Earth Laboratory	
	Calculus I (GEF 3):	4
MATH 155	Calculus 1	
MATH 153 & MATH 154	Calculus 1a with Precalculus and Calculus 1b with Precalculus	
MATH 156	Calculus 2	4
MATH 251	Multivariable Calculus	4
MATH 261	Elementary Differential Equations	4
PHYS 111 & 111L	General Physics 1 and General Physics 1 Laboratory	4
PHYS 112 & 112L	General Physics 2 and General Physics 2 Laboratory	4
	Total Hours	28

## Robotics Engineering Program Requirements

Code	Title	Hours
ECON 201	Principles of Microeconomics	3
EE 221 & 221L	Introduction to Electrical Engineering and Introduction to Electrical Engineering Laboratory	4
EE 251 & 251L	Digital Electronics and Digital Electronics Laboratory	4
CS 110 & 110L	Introduction to Computer Science and Introduction to Computer Science Laboratory	4
CS 111 & 111L	Introduction to Data Structures and Introduction to Data Structures Laboratory	4
CPE 271 & 271L	Introduction to Digital Logic Design and Digital Logic Laboratory	4
MAE 202	Sophomore Seminar	1
MAE 211 & 211L	Mechatronics and Mechatronics Laboratory	3
MAE 212L	Introduction to Computer Aided Design	1
MAE 241	Statics	3
MAE 242	Dynamics	3
MAE 243	Mechanics of Materials	3
MAE 244L	Dynamics and Strength Laboratory	1
CS 350	Computer System Concepts	3
CPE 310 & 310L	Microprocessor Systems and Microprocessor Systems Laboratory	4
MAE 342	Dynamics of Machines	3
MAE 411 & 411L	Advanced Mechatronics and Advanced Mechatronics Laboratory	3
MAE 460	Automatic Controls	3
ROBE 313	Fundamentals of Robotic Systems	3
ROBE 412	Mobile Robotics	3
ROBE 413	Robotic Manipulators	3
ROBE 414	Robot Autonomy	3
ROBE 471S	Principles of Engineering Design	3
ROBE 472S	Engineering Systems Design	3
Technical Elective (Choose two of the following):		6
CPE 442	Introduction to Digital Computer Architecture	
EE 327	Signals and Systems 1	
EE 355 & 355L	Analog Electronics and Analog Electronics Laboratory	
IENG 405	Design for Manufacturability	
IENG 445	Project Management for Engineers	
MAE 312	Introduction to Mechanical Design	
MAE 473 or BMEG 340 or BIOM 425	Bioengineering Biomechanics Bioengineering	
MAE 491 or MAE 495 or MAE 496	Professional Field Experience Independent Study Senior Thesis	
MATH 441	Applied Linear Algebra	
PHYS 314	Introductory Modern Physics	
PHYS 321	Optics	

PHYS 332

Theoretical Mechanics 2

Total Hours

78

## Suggested Plan of Study

### First Year

Fall	Hours	Spring	Hours
CS 110 & 110L		4 CS 111 & 111L	4
ENGL 101		3 MATH 156	4
ENGR 101		2 PHYS 111 & 111L	4
ENGR 191		1 GEF 5	3
MATH 155		4	
Lab Science		4	
		18	15

### Second Year

Fall	Hours	Spring	Hours
EE 221 & 221L		4 MAE 211 & 211L	3
MAE 202*		1 MAE 212L	1
MAE 241		3 MAE 242	3
MATH 251		4 MATH 261	4
PHYS 112 & 112L		4 ENGL 102	3
		16	14

### Third Year

Fall	Hours	Spring	Hours
MAE 243		3 ECON 201	3
MAE 244L		1 EE 251 & 251L	4
GEF 6		3 MAE 342	3
CS 350		3 ROBE 313	3
CPE 271 & 271L		4 CPE 310 & 310L	4
		14	17

### Fourth Year

Fall	Hours	Spring	Hours
MAE 411 & 411L*		3 MAE 460	3
ROBE 412*		3 GEF 7	3
ROBE 414*		3 ROBE 413*	3
ROBE 471S*		3 ROBE 472S*	3
Technical Elective		3 Technical Elective	3
		15	15

Total credit hours: 124

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Offered once per year in the semester shown.

## Major Learning Outcomes

### ROBOTICS ENGINEERING

Upon graduation, all Bachelor of Science students in Robotics Engineering will have acquired the:

- Students will be effective in the engineering design and production of robotics and autonomous systems solutions to lighten the burden of human work;
- Students will be able to apply a theoretical foundation of mechanical systems, electrical systems and computer engineering systems to integrate and devise robotics solutions;
- Student will be effective and planning the use of and participating in the development of robotics and autonomous systems; and
- Students will have the education and training to apply robotics solutions in concert with specialists who deal with robotic systems.