ROBOTICS ENGINEERING

With recent advances in computer hardware and software, as well as 3D printing, the field of robotics is entering a new phase where robots are smaller, faster, cheaper, and smarter. These next generation robots will have applications in a wide variety of fields, including manufacturing, medicine, education, entertainment, military applications, etc.

The Bachelor of Science in Engineering in Robotics Engineering program requires a total of 125 credit hours. The program is designed to provide students with an understanding of important concepts in Robotics, Electrical and Computer Engineering, Systems Engineering, and Mechanical Engineering, as well as an ability to apply these concepts to design robots and robotic systems for diverse applications.

The Bachelor of Science in Engineering in Robotics Engineering program is accredited by the Engineering Accreditation Commission of ABET (https://www.abet.org/).

Robotics Engineering 4+1 Option

The Robotics Engineering 4+1 Option allows students to earn both the BSE in RE and the MSE in RE in an accelerated format. Admitted students can double-count up to 9 credits of 500-level or above electrical engineering, computer engineering, and robotics engineering elective, core, or cognate courses taken during their junior or senior years. Of these, only one cognate course is allowed. Robotics Engineering 4+1 students must maintain 3.2 CGPA (for their undergraduate degree) and complete two 300-level courses with a B minimum. Applying to the 4+1/ Accelerated option is a two-stage process coordinated with both your undergraduate and graduate advising teams. For detailed instructions and application links, please visit the central 4+1 programs webpage (https://umdearborn.edu/academics/program/41-programs/).

Program Educational Objectives

The graduates who receive the Bachelor of Science in Engineering degree in Robotics Engineering from the University of Michigan-Dearborn are expected to achieve within a few years of graduation the high professional, ethical, and societal goals demonstrated by accomplishing one or more of the objectives described below.

- Achieve professional growth in an engineering position in regional and national industries. Growth can be evidenced by promotions and appointment in the workplace (management positions, technical specialization), entrepreneurial activities, and consulting activities.
- Success in advanced engineering studies evidenced by enrollment in graduate courses, completion of graduate degree programs, presentations and publications at professional events, and awards or licenses associated with advanced studies.
- Realization of impactful achievements in societal roles demonstrated by attainment of community leadership roles, mentoring activities, civic outreach service, and active roles in professional societies.

Student Outcomes

To achieve the educational objectives, the graduates of the program will have:

1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2. 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.
3. An ability to communicate effectively with a range of audiences.
4. 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.
5. 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.
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Dearborn Discovery Core (General Education)

All students must satisfy the University's Dearborn Discovery Core requirements (https://catalog.umd.umich.edu/undergraduate/gen_ed_ddc/), in addition to the requirements for the major

Major Requirements

In addition to completion of the Dearborn Discovery Core, the following courses are required to earn a BSE degree in Robotics Engineering from UM-Dearborn.

Code	Title	Credit Hours
Prerequisite Courses		
ENGR 100	Introduction to Engineering and Engineering Design	3
COMP 270	Tech Writing for Engineers (Also fulfills 3 credits of DDC Written and Oral Communication)	3
ECON 201	Prin: Macroeconomics (ECON 201 or 202 also fulfill 3 credits of DDC Social and Behavioral Analysis)	3
or ECON 202	Prin: Microeconomics	
MATH 115	Calculus I	4
MATH 116	Calculus II	4
MATH 215	Calculus III	4
MATH 228	Diff Eqns with Linear Algebra	4
IMSE 317	Eng Probability and Statistics	3
CHEM 134	General Chemistry IA	4
PHYS 150	General Physics I	3
PHYS 150L	General Physics I Lab/Dis	1
PHYS 151	General Physics II	3
PHYS 151L	General Physics II Lab/Dis	1
ECE 237	Energy Systems in Electric, Autonomous, and Robotic Vehicles	4
ECE 276	Discrete Math in Computer Engr	4
or MATH 276	Discrete Math Meth Comptr Engr	
ECE 273	Digital Systems	4
ECE 270	Computer Methods in ECE I	4

ECE 210	Circuits	4
Robotics Engineering Major Core		
ECE 311	Electronic Circuits I	4
ECE 347	Applied Dynamics	4
ECE 3731	Microproc and Embedded Sys	4
ECE 3641	Robotic Manipulation	4
ECE 3171	Analog & Discrete Sig & Sys	4
ECE 370	Adv Soft Techn in Comp Engr	4
IMSE 381	Industrial Robots	4
ECE 460	Automatic Control Systems	4
or ME 442	Control Systems Analysis and Design	
ECE 4641	Mobile Robots	4
ENT 400	Entrepreneurial Thinking&Behav	3
or ENGR 400	Appl Business Tech for Engr	
ECE 4987	Robotics Engineering Design I	2
ECE 4988	Robotics Engineering Design II	2
Professional and Approved Electives		**7**
Professional Electives - select 3-4 credits from the following list:		3-4
CIS 479	Intro to Artificial Intel	
or ECE 479	Artificial Intelligence	
ECE 434	Introduction to Machine Learning	
ECE 439	Battery Technologies and EV Applications	
ECE 4431	Vehicular Pwr Sys & Loads	
ECE 471	Comp Networks/Data Comm	
ECE 473	Embedded System Design	
ECE 480	Intro to Dig Signal Processing	
ECE 4881	Introduction to Robot Vision	
ECE 4951	Sys Desgn and Microcontrollers	
ECE 491	Directed Studies	
IMSE 489	Robotics Systems Simulation	
ME 3601	Design and Analysis of Machine Elements	
ME 472	Prin & Appl of Mechatronic Sys	
ENGR 492	Exper Honors Directed Research	
ENGR 493	Exper Hnrs Dir Dsgn	
Approved Electives - select additional 3-4 credits to total a minimum of 7 credits in Professional and Approved Electives:		3-4
ECE 319	Electromagnetic Compatibility	
ECE 375	Intro to Comp Architecture	
ECE 385	Elec Materials and Devices	
ECE 414	Electronic Systems Design	
ECE 415	Power Electronics	
ECE 428	Cloud Computing	
ECE 433	Intr to Multimedia Technolgies	
ECE 434	Introduction to Machine Learning	
ECE 435	Intro to Mobil/Smrt Dev & Tech	
ECE 4361	Electric Machines and Drives	
ECE 438	Web Engr: Prin & Tech	
ECE 439	Battery Technologies and EV Applications	
ECE 4431	Vehicular Pwr Sys & Loads	
ECE 4432	Renewable Elec Pwr Sys	
ECE 450	Analog and Digital Comm Sys	
ECE 475	Comp Hardware Org/Design	
ENGR 350	Nanoscience and Nanotechnology	
ENGR 299	Experiential Learning in Engineering & Computer Science 1	
ENGR 399	Experiential Learning in Engineering & Computer Science 2	
ENGR 492	Exper Honors Directed Research	
ENGR 493	Exper Hnrs Dir Dsgn	
ENGR 499	Experiential Learning in Engineering & Computer Science 3	
IMSE 3005	Intro to Operations Research	
IMSE 421	Eng Economy and Dec Anlys	
IMSE 4545	Information Systems Design	
ME 230	Thermodynamics	
ME 260	Design Stress Analyses	
or ME 265	Applied Mechanics	

Students admitted to the 4+1 Option may substitute ECE 528 for ECE 428, ECE 535 for ECE 435, ECE 532 for ECE 4431, ECE 560 for ECE 460, ECE 545 for ECE 4641, ECE 579 for ECE 479, ECE 580 for ECE 480, ECE 588 for ECE 4881, ECE 505 for ECE 473.

Learning Goals

1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2. 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.
3. An ability to communicate effectively with a range of audiences.
4. 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.
5. 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.
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.