

ROBOTICS AND AUTONOMOUS SYSTEMS MINOR (CMSC)

Center Director: Ryan Sochol, Ph.D.

For any questions, please see robotics.umd.edu/minor (<https://robotics.umd.edu/minor/>) or contact robotics-minor@umd.edu.

The Robotics and Autonomous Systems (RAS) minor is open to students majoring in Aerospace Engineering, Electrical and Computer Engineering, Mechanical Engineering, and Computer Science. The minor takes a multidisciplinary approach to robotics in which students gain knowledge about the design, control, programming, and integration of robotics and autonomous systems. With an emphasis on hands-on experiences, students will gain practical skills through coursework, group projects, and research. Students will have the opportunity to participate as peer mentors and tutors. The minor program will also include regular interactions with academic, corporate, and/or governmental leaders in robotics, who will serve as both mentors and professional contacts.

Student Learning Outcomes

1. Students will demonstrate the ability to apply advanced technical skills required to approach and resolve problems in the Robotics and Autonomous System (RAS) through upper-level RAS-related coursework in computer science and engineering disciplines.
2. Students will be able to apply the broad interdisciplinary aspects of RAS, such as the design, control, programming, and integration of complex robotic systems.
3. Students will obtain hands-on experience and demonstrate problem-solving skills in robotics through advanced coursework, experiential learning, and research.
4. Students will gain a sophisticated understanding of the range of professional opportunities available in RAS as a result of first-hand interactions with RAS faculty and professionals.

REQUIREMENTS

Prerequisites

Course	Title	Credits
Robotics and Autonomous Systems (RAS) Minor Prerequisites		
MATH246	Differential Equations for Scientists and Engineers or ENES221 Dynamics	
One of the following:		
CMSC131	Object-Oriented Programming I	
ENME202	Computing Fundamentals for Engineers	
ENAE202	Computing Fundamentals for Engineers	
ENEE150	Intermediate Programming Concepts for Engineers	

Requirements

A minimum grade of C- or better is required for all minor and all prerequisite courses. A maximum of 2 courses may be used to satisfy the requirements of both a major and a minor.

Course	Title	Credits
Required Courses		12
ENME480	Introduction to Robotics	

ENAE450	Robotics Programming	
ENEE467	Robotics Project Laboratory	
CMSC477	Robotics Perception and Planning	
Supporting Math Course (Required. Select one course. Must be completed prior to enrollment in CMSC477) ¹		3-4
MATH240	Introduction to Linear Algebra	
MATH340	Multivariable Calculus, Linear Algebra and Differential Equations I (Honors)	
MATH341	Multivariable Calculus, Linear Algebra, Differential Equations II (Honors)	
MATH461	Linear Algebra for Scientists and Engineers	
ENEE290	Introduction to Differential Equations and Linear Algebra for Engineers	
Electives (select two courses):		6
Course options will depend on the student's academic major and being able to meet course requirements/restrictions set by each Department. Other electives may be available. Contact minor advisor for assistance.		
ENME400	Machine Design	
ENME410	Design Optimization	
ENME413	Bio-Inspired Robotics	
ENME435	Remote Sensing Instrumentation	
ENME441	Mechatronics and the Internet of Things	
ENME461	Control Systems Laboratory	
ENME467	Engineering for Social Change	
	or ENES467 Engineering for Social Change	
ENME444	Assistive Robotics	
ENME476		
ENEE440	Microprocessors	
ENEE460	Control Systems	
ENEE461	Control Systems Laboratory	
ENEE425	Digital Signal Processing	
ENEE426	Communication Networks	
ENEE408	Capstone Design Project (ENEE408I Capstone Autonomous Robotics)	
ENAE380	Flight Software Systems	
ENAE403	Aircraft Flight Dynamics	
ENAE432	Control of Aerospace Systems	
ENAE441	Space Navigation and Guidance	
ENAE488	Topics in Aerospace Engineering (ENAE4880 Introduction to Autonomous Multi-Robot Swarms)	
CMSC421	Introduction to Artificial Intelligence	
CMSC422	Introduction to Machine Learning	
CMSC426	Computer Vision	
CMSC427	Computer Graphics	
CMSC451	Design and Analysis of Computer Algorithms	
CMSC498	Selected Topics in Computer Science (CMSC498E Robotics)	
Total Credits		21-22

¹ Students may waive this requirement if they complete the course for another minor or major.