ROBOTICS AND AUTONOMOUS SYSTEMS MINOR (CMSC)

For any questions, please 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.

Program 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

<table>
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<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
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<tr>
<td></td>
<td>Robotcs and Autonomous Systems (RAS) Minor Prerequisites</td>
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<tr>
<td>MATH246</td>
<td>Differential Equations for Scientists and Engineers</td>
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<tr>
<td>or ENES221</td>
<td>Dynamics</td>
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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

Electives (select two courses):

- ENME400   Machine Design
- ENME410   Design Optimization
- ENME461   Control Systems Laboratory
- ENME489   Special Topics in Mechanical Engineering (ENME489L Bioinspired Robotics, ENME489B Mechatronics and the Internet of Things)
- ENME467   Engineering for Social Change
- ENME444   Assistive Robotics
- ENME476   Micromechanical Systems (MEMS) I
- 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
- ENAE441   Space Navigation and Guidance
- ENAE403   Aircraft Flight Dynamics
- ENAE432   Control of Aerospace Systems
- CMSC421   Introduction to Artificial Intelligence
- CMSC422   Introduction to Machine Learning
- CMSC426   Computer Vision
- CMSC427   Computer Graphics
- CMSC451   Design and Analysis of Computer Algorithms

Total Credits: 21-22

Supporting Math Course (Required. Select one course. Must be completed prior to enrollment in CMSC477)

- MATH240   Introduction to Linear Algebra
- MATH461   Linear Algebra for Scientists and 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.

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<tr>
<th>Course</th>
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<tbody>
<tr>
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<td>Required Courses</td>
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<tr>
<td>ENME480</td>
<td>Introduction to Robotics</td>
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<tr>
<td>ENAE450</td>
<td>Robotics Programming</td>
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<tr>
<td>ENEE467</td>
<td>Robotics Project Laboratory</td>
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<tr>
<td>CMSC477</td>
<td>Robotics Perception and Planning</td>
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Total Credits: 21-22