Robotics and Autonomous Systems Minor (CMSC)

Center Director: Derek Paley, Ph.D.

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.

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

Robotics and Autonomous Systems (RAS) Minor Prerequisites

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH246</td>
<td>Differential Equations for Scientists and Engineers</td>
<td>3-4</td>
</tr>
<tr>
<td>ENES221</td>
<td>Dynamics</td>
<td>3-4</td>
</tr>
</tbody>
</table>

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):

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.

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
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<tbody>
<tr>
<td>ENME400</td>
<td>Machine Design</td>
</tr>
<tr>
<td>ENME410</td>
<td>Design Optimization</td>
</tr>
<tr>
<td>ENME413</td>
<td>Bio-Inspired Robotics</td>
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<tr>
<td>ENME435</td>
<td>Remote Sensing Instrumentation</td>
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<tr>
<td>ENME441</td>
<td>Mechatronics and the Internet of Things</td>
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<tr>
<td>ENME461</td>
<td>Control Systems Laboratory</td>
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<tr>
<td>ENME467</td>
<td>Engineering for Social Change or ENES467</td>
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<tr>
<td>ENME468</td>
<td>Assistive Robotics</td>
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<tr>
<td>ENME476</td>
<td>Microelectromechanical Systems (MEMS) I</td>
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<tr>
<td>ENEE440</td>
<td>Microprocessors</td>
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<tr>
<td>ENEE460</td>
<td>Control Systems</td>
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<tr>
<td>ENEE461</td>
<td>Control Systems Laboratory</td>
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<tr>
<td>ENEE425</td>
<td>Digital Signal Processing</td>
</tr>
<tr>
<td>ENEE426</td>
<td>Communication Networks</td>
</tr>
<tr>
<td>ENEE408</td>
<td>Capstone Design Project (ENEE408I Capstone Autonomous Robotics)</td>
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<tr>
<td>ENAE380</td>
<td>Flight Software Systems</td>
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<tr>
<td>ENAE403</td>
<td>Aircraft Flight Dynamics</td>
</tr>
<tr>
<td>ENAE432</td>
<td>Control of Aerospace Systems</td>
</tr>
<tr>
<td>ENAE441</td>
<td>Space Navigation and Guidance</td>
</tr>
<tr>
<td>ENAE488</td>
<td>Topics in Aerospace Engineering (ENAE488O Introduction to Autonomous Multi-Robot Swarms)</td>
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<tr>
<td>CMSC421</td>
<td>Introduction to Artificial Intelligence</td>
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<td>CMSC422</td>
<td>Introduction to Machine Learning</td>
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<tr>
<td>CMSC426</td>
<td>Computer Vision</td>
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<td>CMSC427</td>
<td>Computer Graphics</td>
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<tr>
<td>CMSC451</td>
<td>Design and Analysis of Computer Algorithms</td>
</tr>
<tr>
<td>CMSC498</td>
<td>Selected Topics in Computer Science (CMSC498E Robotics)</td>
</tr>
</tbody>
</table>

Total Credits: 21-22

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

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