

# ROBOTICS AND AUTOMATION ENGINEERING (APB)

## Exploration and Discovery

### Overview

The Robotics and Automation Engineering Applied Bachelor's degree at Plymouth State University emphasizes two primary areas:

The first area is Automation Engineering. Automation engineers design, develop and implement custom tools and programs to automate technical operations. Solutions can range from simple data acquisition protocols through design and programming of industrial robots and systems for manufacturing using Human Machine Interface/Supervisory Control and Data Acquisition (HMI/SCADA) interfaces, and Programmable Logic Controller (PLC) Programming.

The second area, Mobile Robotics, focuses on the application of sensory data acquisition, navigation, and mobility. This includes the operation of Autonomous Mobile Robots (AMRs), which utilize cameras, machine learning and vision, and sensors to navigate and function autonomously or with assistance. The integration of these technologies highlights the importance of robotics in enhancing operational efficiency and automation in various industries.

Our students work hands-on in a multidisciplinary field that combines computer science, engineering, and artificial intelligence to design, build, and utilize robots for various applications, including industrial automation, manufacturing and research processes, and includes autonomy and teleoperative capabilities.

### Degree Requirements

| Course                                                                                                                                          | Title                                     | Credits |
|-------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------|---------|
| CS 2010                                                                                                                                         | Computing Fundamentals (TECO)             | 3       |
| CS 2220                                                                                                                                         | Computer Hardware                         | 3       |
| CS 2370                                                                                                                                         | Introduction to Programming               | 4       |
| CS 2900                                                                                                                                         | Digital and Analog Circuits               | 4       |
| CS 2901                                                                                                                                         | Materials, Design and Fabrication         | 4       |
| CS 2905                                                                                                                                         | PLC Programming                           | 4       |
| CS 3690                                                                                                                                         | Applied Robotics                          | 4       |
| CS 3901                                                                                                                                         | Industrial Robotics                       | 4       |
| CS 3902                                                                                                                                         | Adaptive Control Systems                  | 4       |
| CS 4520                                                                                                                                         | CyberEthics (DICO,WRCO)                   | 3       |
| CS 4790                                                                                                                                         | Robotics Capstone                         | 4       |
| or CS 4920                                                                                                                                      | Computer Science Internship               |         |
| MA 2130                                                                                                                                         | Precalculus (QRCO)                        | 4       |
| MA 2550                                                                                                                                         | Calculus I (QRCO)                         | 4       |
| MA 2300                                                                                                                                         | Statistics I (QRCO)                       | 3       |
| or MA 3500                                                                                                                                      | Probability and Statistics for Scientists |         |
| PH 2510                                                                                                                                         | University Physics I                      | 4       |
| PH 2520                                                                                                                                         | University Physics II                     | 4       |
| General Education ( <a href="https://coursecatalog.plymouth.edu/general-education/">https://coursecatalog.plymouth.edu/general-education/</a> ) |                                           |         |
| IS 1115                                                                                                                                         | Tackling a Wicked Problem                 | 4       |
| EN 1400                                                                                                                                         | Composition                               | 4       |

|                                                                                                                                              |                               |           |
|----------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|-----------|
| CTDI ( <a href="https://coursecatalog.plymouth.edu/general-education/#CTDI">https://coursecatalog.plymouth.edu/general-education/#CTDI</a> ) | Creative Thought Direction    | 3-4       |
| PPDI ( <a href="https://coursecatalog.plymouth.edu/general-education/#PPDI">https://coursecatalog.plymouth.edu/general-education/#PPDI</a> ) | Past and Present Direction    | 3-4       |
| SIDI ( <a href="https://coursecatalog.plymouth.edu/general-education/#SIDI">https://coursecatalog.plymouth.edu/general-education/#SIDI</a> ) | Scientific Inquiry Direction  | 3-4       |
| SSDI ( <a href="https://coursecatalog.plymouth.edu/general-education/#SSDI">https://coursecatalog.plymouth.edu/general-education/#SSDI</a> ) | Self and Society Direction    | 3-4       |
| GACO ( <a href="https://coursecatalog.plymouth.edu/general-education/#GACO">https://coursecatalog.plymouth.edu/general-education/#GACO</a> ) | Global Awareness Connection   | 3-4       |
| IS 4220                                                                                                                                      | Signature Project (INCO,INCP) | 4         |
| Electives <sup>1</sup>                                                                                                                       |                               | 4-9       |
| <b>Total Credits</b>                                                                                                                         |                               | <b>96</b> |

<sup>1</sup> Students interested in pursuing advanced degrees in Robotics or Engineering could consider using their elective credits to complete the Technical Math Minor by adding MA 2560 Calculus II and MA 3600 Differential Equations and Linear Algebra to their list of courses.

### Recommended Course Sequence

| Course                                                                                                                                                                        | Title                             | Credits      |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|--------------|
| <b>Year One</b>                                                                                                                                                               |                                   |              |
| <b>Fall</b>                                                                                                                                                                   |                                   |              |
| CS 2010                                                                                                                                                                       | Computing Fundamentals (TECO)     | 3            |
| CS 2901                                                                                                                                                                       | Materials, Design and Fabrication | 4            |
| IS 1115                                                                                                                                                                       | Tackling a Wicked Problem         | 4            |
| EN 1400                                                                                                                                                                       | Composition                       | 4            |
| <b>Credits</b>                                                                                                                                                                |                                   | <b>15</b>    |
| <b>Spring</b>                                                                                                                                                                 |                                   |              |
| CS 2370                                                                                                                                                                       | Introduction to Programming       | 4            |
| CS 2900                                                                                                                                                                       | Digital and Analog Circuits       | 4            |
| MA 2550                                                                                                                                                                       | Calculus I (QRCO)                 | 4            |
| or MA 2130                                                                                                                                                                    | or Precalculus (QRCO)             |              |
| Directions (choose from CTDI, PPDI, SIDI, SSDI) ( <a href="https://coursecatalog.plymouth.edu/general-education/">https://coursecatalog.plymouth.edu/general-education/</a> ) |                                   | 3-4          |
| <b>Credits</b>                                                                                                                                                                |                                   | <b>15-16</b> |
| <b>Year Two</b>                                                                                                                                                               |                                   |              |
| <b>Fall</b>                                                                                                                                                                   |                                   |              |
| CS 3690                                                                                                                                                                       | Applied Robotics                  | 4            |
| CS 2220                                                                                                                                                                       | Computer Hardware                 | 3            |
| MA 2550                                                                                                                                                                       | Calculus I (QRCO)                 | 3            |
| or MA 2560                                                                                                                                                                    | or Calculus II (QRCO)             |              |

|                                                                                                                                                                                   |                                                                        |              |                                        |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------|--------------|----------------------------------------|
| PH 2510                                                                                                                                                                           | University Physics I                                                   | 4            | • Robotics programmer                  |
| <b>Credits</b>                                                                                                                                                                    |                                                                        | <b>14</b>    | • Industrial automation developer      |
| <b>Spring</b>                                                                                                                                                                     |                                                                        |              |                                        |
| CS 2905                                                                                                                                                                           | PLC Programming                                                        | 4            | • Robotics and automation specialist   |
| MA 2300<br>or MA 3500                                                                                                                                                             | Statistics I (QRCO)<br>or Probability and Statistics for<br>Scientists | 4            | • Automation platform architect        |
| PH 2520                                                                                                                                                                           | University Physics II                                                  | 4            | • Field Operations Engineer            |
| Directions (choose from CTDI, PPD, SIDI, SSDI) ( <a href="https://coursecatalog.plymouth.edu/general-education/">https://<br/>coursecatalog.plymouth.edu/general-education/</a> ) |                                                                        | 3-4          | • Control system designer / technician |
| Elective                                                                                                                                                                          |                                                                        | 3-4          | • Robotics engineer / technician       |
| <b>Credits</b>                                                                                                                                                                    |                                                                        | <b>18-20</b> | • Mechatronics technician              |
| <b>Year Three</b>                                                                                                                                                                 |                                                                        |              |                                        |
| <b>Fall</b>                                                                                                                                                                       |                                                                        |              |                                        |
| CS 3901                                                                                                                                                                           | Industrial Robotics                                                    | 4            |                                        |
| CS 4520                                                                                                                                                                           | CyberEthics (DICO,WRCO)                                                | 3            |                                        |
| Directions (choose from CTDI, PPD, SIDI, SSDI) ( <a href="https://coursecatalog.plymouth.edu/general-education/">https://<br/>coursecatalog.plymouth.edu/general-education/</a> ) |                                                                        | 4            |                                        |
| Elective                                                                                                                                                                          |                                                                        | 4            |                                        |
| GACO ( <a href="https://coursecatalog.plymouth.edu/general-education/#GACO">https://<br/>coursecatalog.plymouth.edu/<br/>general-education/<br/>#GACO</a> )                       | Global Awareness Connection                                            | 3-4          |                                        |
| <b>Credits</b>                                                                                                                                                                    |                                                                        | <b>18-19</b> |                                        |
| <b>Spring</b>                                                                                                                                                                     |                                                                        |              |                                        |
| CS 3902                                                                                                                                                                           | Adaptive Control Systems                                               | 4            |                                        |
| CS 4790                                                                                                                                                                           | Robotics Capstone                                                      | 4            |                                        |
| IS 4220                                                                                                                                                                           | Signature Project (INCO,INCP)                                          | 4            |                                        |
| Directions (choose from CTDI, PPD, SIDI, SSDI) ( <a href="https://coursecatalog.plymouth.edu/general-education/">https://<br/>coursecatalog.plymouth.edu/general-education/</a> ) |                                                                        | 3-4          |                                        |
| <b>Credits</b>                                                                                                                                                                    |                                                                        | <b>15-16</b> |                                        |
| <b>Total Credits</b>                                                                                                                                                              |                                                                        | <b>96</b>    |                                        |

## Learning Outcomes

Students who complete the Applied Robotics program at PSU will graduate with:

- A solid foundation in core robotics and automation concepts reinforced by studies in mathematics, physics, and computer science.
- An understanding of the basic dynamics of, and demonstrable familiarity with, numerous state-of-the-art automation technologies used within process and manufacturing industries. PLYMOUTH STATE UNIVERSITY | 2024 Pilot 96-Credit, Three-Year Programs
- The knowledge needed to design, analyze, model and simulate robotic and automation problems and develop solutions which increase productivity, well-being, improve resource utilization, and eliminate waste.
- An ability to apply current robotics and automation engineering concepts and theories to contemporary, real-world problems in manners which demonstrate comprehension of the tradeoffs involved in design choices.
- Proven professional and social skills needed to work both self-directed or in teams to succeed in careers in Automation Engineering or adjacent fields.

## Career Pathways

- Automation Engineer