

# ROBOTICS, MSE

The master's degree in Robotics (ROBO) is a multi-disciplinary program jointly sponsored by the Departments of Computer and Information Science, Electrical and Systems Engineering, and Mechanical Engineering and Applied Mechanics.

Housed and administered by the GRASP Lab, one of the top robotics research centers in the world, Penn's ROBO master's program educates students in the science and technology of robotics, vision, perception, control, automation, and machine learning. Our students hail from a variety of engineering, scientific, and mathematical backgrounds, united by a passion for robots and a desire to advance robotic technologies to benefit humanity. Our program provides an ideal foundation for jobs in a variety of industries including robotics, aerospace, automotive, industrial automation and defense; it also provides a solid basis for further graduate studies.

**For more information:** <https://www.grasp.upenn.edu/academics/masters> (<https://www.grasp.upenn.edu/academics/masters/>)

## Curriculum

Code	Title	Course Units
<b>Foundational Courses</b>		
Select 3 Foundational courses from 3 of the 4 following areas: <sup>1</sup>		3
<i>Artificial Intelligence</i>		
CIS 5190	Applied Machine Learning	
CIS 5200	Machine Learning	
CIS 5210	Artificial Intelligence	
ESE 6500	Learning in Robotics	
<i>Robot Design</i>		
MEAM 5100	Design of Mechatronic Systems	
MEAM 5200	Introduction to Robotics	
MEAM 6200	Advanced Robotics	
<i>Control</i>		
ESE 5000	Linear Systems Theory	
ESE 5050	Feedback Control Design and Analysis	
MEAM 5130	Feedback Control Design and Analysis	
MEAM 5170	Control and Optimization with Applications in Robotics	
ESE 6190	Model Predictive Control	
<i>Perception</i>		
CIS 5800	Machine Perception	
CIS 5810	Computer Vision & Computational Photography	
CIS 6800	Advanced Topics in Machine Perception	
<b>Technical Electives</b>		
Select 5 Technical electives (courses with Attribute=EMRT) ( <a href="http://catalog.upenn.edu/attributes/emrt/">http://catalog.upenn.edu/attributes/emrt/</a> ) <sup>2</sup>		5
<b>General Elective</b>		
Select 2 General electives (courses with Attribute=EMRE) ( <a href="http://catalog.upenn.edu/attributes/emre/">http://catalog.upenn.edu/attributes/emre/</a> ) <sup>3</sup>		2
<b>Total Course Units</b>		<b>10</b>

<sup>1</sup> 1 course from 3 out of the 4 areas (Artificial Intelligence; Robot Design & Analysis; Control; Perception); 3 courses total required. Details may be referenced here (<https://www.grasp.upenn.edu/academics/masters-degree-program/curriculum-information/>).

<sup>2</sup> 5 courses are required from the approved Technical Elective list (<https://www.grasp.upenn.edu/academics/masters-degree-program/curriculum-information/technical-electives/>).

<sup>3</sup> 2 graduate level courses are required; choose from:

- CIS, CIT, EAS (excluding EAS 8950, EAS 8960, EAS 8970), ENM, ESE, IPD, MATH or MEAM courses
- Foundational Course areas
- Technical Elective List
- Certain courses will only be considered general electives (such as EAS 5450 Engineering Entrepreneurship I, EAS 5460 Engineering Entrepreneurship II). A full list may be found here (<https://www.grasp.upenn.edu/academics/masters-degree-program/curriculum-information/general-electives/>).
- Courses from other disciplines with pre-approval of the Program Director.

The degree and major requirements displayed are intended as a guide for students entering in the Fall of 2024 and later. Students should consult with their academic program regarding final certifications and requirements for graduation.