

## Robotics

### Course Overview

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**Campus Location:** Summer Springboard Boston (class at MIT)

**Instructors:** John Keszler

**Outline:** Students will be introduced to the fundamentals of robotics through a hands-on, project-based approach. From circuit design, to programming robots, this course will cover all the fundamentals of designing, building and working with robotics systems. Students will gain exposure to the fundamentals of electronics, mathematical modeling, mechanical design, data and computer science, through the lens of robotics.

Throughout the two-week session, students will work on several laboratory-based projects that focus on each subsection of the broad field of robotics. These projects will provide experience with system modeling, real-time control, embedded software, and more. At the end of the course, students will design and fabricate a working robotics system in a group-based course project which will combine all elements of the lab projects.

#### Topics to cover

- Circuit design and debugging: How can you design a line sensor for a robot? How can we optimize our power delivery systems to extend our robot's battery? How does a circuit design change from prototype to production?
- Embedded programming: How do you program a robot to do what you want? Understanding the differences and optimizations needed for embedded systems.
- Mechanical Design: How to design, fabricate and optimize a part using CAD tools.
- Sensors and actuators: How robots perceive their environment? What sensors would they use? And how would they adjust their movements to avoid obstacles, navigate difficult terrains and accomplish complicated tasks?
- Data science: How we can observe and collect data using robotic systems, and then use modeling and optimization tools to improve our robots.

#### Learning Objectives

Students will be able to...

- Describe, analyze and critically think about the fundamental problems in robotics, such as how to change the position or configuration of a robot.
- Build, analyze and debug circuits, and learn how to incorporate them in a larger system.
- Go from idea, to 3D model, to a built component, by learning mechanical design with CAD.
- Design, write and optimize programs that will run on mobile robotics platforms.
- Collect and process data from robotics systems, learning the basics of data science.
- Discuss the ethical implications of the application of robotics systems in the world.

**Site Visit:** Students will visit a robotics company where roboticists will share their career experiences, what they do and reflect upon their successes, failures and learnings.



## Instructor

John Keszler is a Ph.D. candidate in Electrical Engineering and Computer Sciences (EECS) at Massachusetts Institute of Technology (MIT). John was part of the Harvard Undergraduate Robotics Club and led a team of 20 people to design and build the next generation of Mars rovers that will one day work alongside astronauts exploring the Red Planet. He has also implemented machine learning techniques for autonomous soccer playing robots. John graduated from Harvard University cum laude in S.B Electrical Engineering with Honors.

**Course Structure:** Students live and eat on the campus of Simmons University, and travel to class on the campus of MIT. There are 9 class sessions over the two-week course. During the first week, students have class from 9am-12pm, Monday through Friday. During the second week, students have class from 9am-12pm Monday through Thursday. Friday morning there is no class, students check out from the program and depart on that day.

## Tuition

- **Residential Students:** \$4,998
  - Includes: all meals, lodging, excursions, academic program, weekend excursions
  - Excludes: optional airport pickup and drop off service (available for an additional fee)
  
- **Commuter Students:** \$2,798
  - Includes: lunch, academic program, excursions, programming from 9am to 5pm, Monday-Friday
  - Excludes: lodging, breakfast, dinner, weekend excursions
  
- **Extended Commuter Students:** \$3,398
  - Includes: lunch, dinner, excursions, academic program, programming from 9am to 8pm, weekend excursions
  - Excludes: lodging, breakfast

*Note: Summer Springboard programs are not run by our campus partners. Universities and their affiliated departments are not responsible for the Summer Springboard program in any way.*