

MECH455: Robotics and Automation Capstone

Institution: Lakeside Polytechnic University

Term: Full Year (Fall 2020 - Winter 2021)

Instructor: Dr. Emily Smith

Email: esmith@lakeside.edu

Office Hours: Tuesday 3:00-5:00 PM, Thursday 1:00-3:00 PM

Class Time: Monday & Wednesday, 2:00-3:30 PM

Location: Engineering Building, Room 305

Course Description

The Robotics and Automation Capstone course is a full-year project-based course where students work in teams to design, prototype, and demonstrate a robotic system for an industrial automation task. This course integrates concepts from mechanical design, control systems, and sensor integration, culminating in a final project that is presented to a panel of industry experts. The course emphasizes practical design, team collaboration, and professional communication.

Learning Outcomes

By the end of this course, students will be able to:

1. **Design** a robotic system that meets specific industrial automation requirements.
2. **Integrate** mechanical, electrical, and software components into a functional prototype.
3. **Analyze** and **optimize** robotic systems for efficiency, reliability, and cost-effectiveness.
4. **Collaborate** effectively within a multidisciplinary team.
5. **Present** and **defend** design decisions and project outcomes to a professional audience.

Course Timeline and Deliverables

Date	Topics	Deliverables	Weight
Sept 21, 2020	Course Introduction, Team Formation	None	-
Oct 12, 2020	Project Proposal & Planning	Project Proposal Submission	10%
Nov 9, 2020	Conceptual Design Review	Conceptual Design Presentation	15%
Dec 7, 2020	Mechanical Design & Prototyping	Mechanical Design Report	15%
Jan 25, 2021	Electrical & Control Systems Design	Control Systems Integration Report	15%
Feb 22, 2021	System Integration & Testing	Interim Project Report	20%

Date	Topics	Deliverables	Weight
Mar 22, 2021	Final Design Review	Final Design Review Presentation	10%
Apr 12, 2021	Final Project Demonstration & Submission	Final Project Report and Prototype Demonstration	15%

Deliverable Descriptions

1. **Project Proposal Submission (10%)**

Due: October 12, 2020

Teams will submit a detailed project proposal outlining the project scope, objectives, timeline, and initial design concepts. This document will include a problem statement, proposed solutions, and a preliminary project plan.

2. **Conceptual Design Presentation (15%)**

Due: November 9, 2020

Teams will present their conceptual design to the class, including design alternatives, selected approach, and justification for design decisions. This presentation will be evaluated on the clarity of the design, feasibility, and innovation.

3. **Mechanical Design Report (15%)**

Due: December 7, 2020

Teams will submit a comprehensive report detailing the mechanical design of their robotic system, including CAD drawings, material selection, and manufacturing considerations. The report will also address any challenges encountered during the design process.

4. **Control Systems Integration Report (15%)**

Due: January 25, 2021

This report will focus on the design and integration of the electrical and control systems within the robotic system. Teams will discuss sensor selection, control algorithms, and the implementation of the control system.

5. **Interim Project Report (20%)**

Due: February 22, 2021

The interim report will document the progress made on the project, including system integration, testing results, and any modifications to the original design. This report should provide a clear overview of the current state of the project and outline the steps needed to complete it.

6. **Final Design Review Presentation (10%)**

Due: March 22, 2021

Teams will present their final design to a panel of industry experts, focusing on the system's functionality, reliability, and performance. The presentation should include a demonstration of the robotic system (if possible) and address any questions or concerns from the panel.

7. **Final Project Report and Prototype Demonstration (15%)**

Due: April 12, 2021

The final deliverable includes a detailed report documenting the entire design and development process, along with a functional prototype of the robotic system. The report should include an analysis of the system's performance, a discussion of the challenges faced, and recommendations for future improvements. The prototype will be demonstrated to the class and evaluated based on its functionality, innovation, and overall design.

Grading Scale

- **A+:** 90-100%
 - **A:** 85-89%
 - **A-:** 80-84%
 - **B+:** 75-79%
 - **B:** 70-74%
 - **B-:** 65-69%
 - **C+:** 60-64%
 - **C:** 55-59%
 - **C-:** 50-54%
 - **D:** 45-49%
 - **F:** 0-44%
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Academic Integrity

Students are expected to adhere to the highest standards of academic integrity. Plagiarism, cheating, or any form of academic dishonesty will not be tolerated and may result in severe penalties, including failure of the course.

Course Policies

- **Attendance:** Attendance is mandatory for all lectures and presentations. Absences must be communicated in advance and may require documentation.
 - **Late Submissions:** Late submissions will incur a penalty of 10% per day, up to a maximum of 3 days. After 3 days, the submission will not be accepted.
 - **Collaboration:** Collaboration is crucial for the success of the team project. All team members are expected to contribute equally, and individual contributions must be clearly documented.
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This syllabus outlines the structure, expectations, and key deliverables for the **MECH455: Robotics and Automation Capstone** course, providing students with a clear roadmap for the academic year.