

College of Engineering
Electrical and Computer Engineering

Syllabus

Course Number	EECE 5800
Course Title	Advanced Robotics in the Real-World
Credits	3
Semester/Class	Spring 2023 Semester Tue 6:30-9:20 PM
Faculty Name	Prof Robinette
Preferred Pronouns	he, him, his
Office Hours	Tue/Thu 1:00-2:30PM Ball 311
Phone/Email	paul_robinette@uml.edu (preferred contact) 978-934-3347

I. Course Description

This course covers advanced foundations and principles of robotic motion and manipulation including the study of robot motion planning, task level programming and architectures for building perception and control systems for intelligent robots. Topics include computational models of objects and motion, the mechanics of robotic manipulators, the structure of manipulator control systems, planning of robot actions, autonomous robot navigation and obstacle avoidance. This is a project-focused course with the goal of providing students with hands-on experience deploying real-world systems.

This course will be largely project-based. Class time will be composed of a lecture, discussion time, student presentations and/or time to work on projects. There is no assigned textbook for this course, but lecture notes will be provided online.

Prerequisite: EECE.5560 Fundamentals of Robotics, or permission of instructor.

II. Course Objectives

Upon completion of this course, students will be able to work on the following robotics applications:

- Real world robots
- Navigation
- Perception
- Mapping
- Manipulation

III. Textbook/Readings

There is no required text. Course notes will be provided by the instructor. Students will be expected to purchase their own robot kit. Links to purchase the kit and to reading material for the course will be provided in lectures or on Blackboard.

IV. Required Equipment

Ideally, all students will have their own laptop capable of running ROS in Linux. This could take many forms, including a laptop that dual-boots into Linux as well as Windows or MacOS, a laptop running a Linux Virtual Machine or a laptop using Docker or similar containers for ROS. **If this is not possible, please contact the instructor as soon as possible.**

V. General Information

This course is designed to be accessible to senior undergraduate students and graduate students of all levels. Students are expected to have strong programming skills (preferably in C++ or Python), good understanding of Linux, and knowledge of Robot Operating System.

A. Teaching Methods

The best way to learn robotics is to build and program a robot to accomplish tasks in a lab or real-world environment. Lectures and other formal material in this class are generally designed to take a portion but not all of the class time. The remainder of the class is for the student to work on the robots with the instructor on hand to answer questions and guide learning.

B. Attendance

Attendance is highly recommended but not required. Attendance will not be taken in class. Some assignments require an in-person demonstration which can occur in class or in a time scheduled with the instructor or teaching assistant. Attendance and interaction in class will count towards the participation grade.

Students are expected to attend class regularly, as regular attendance is one of the most important contributors to student success. However, students may occasionally need to miss class due to illness, emergency, or caring for a sick family member. In such cases, you are responsible for notifying me of your absences and working with me to arrange to make up any missed work. I will be try to be accommodating, but you must communicate your requests with me regularly and with as much advance-notice as possible. Likewise, if I should become ill or need to miss class, I will communicate with you via email as soon as possible with clear instructions.

C. Assessment and Evaluation Methods

Your final grade will be assessed based on one project completed over the course of the semester.

Grade Breakdown:

Project: 1000 points

- Brainstorming Report: 100 points
- Project Proposal: 100 points
- Midterm Report: 100 points
- Revised Project Goals: 100 points
- Ethics Report: 100 points
- Final Report: 200 points
- Final Presentation: 200 points
- Final Demo: 100 points

D. Grading Scale

Final grades will be rounded to the nearest percentage point and distributed as follows:

A+	97-100%
A	93-96%
A-	90-92%
B+	87-89%
B	83-86%
B-	80-82%
C+	77-79%
C	70-76%
F	<70%

E. Health and Safety

The safety and health of the UMass Lowell community is our shared priority. In seeking to provide the fullest academic and campus life experience possible, UMass Lowell will rely on all members of our community to act responsibly. For the latest updates on UMass Lowell's COVID policies, please visit www.uml.edu/coronavirus. [The Centers for Learning and Academic Support Services \(CLASS\)](#) provide tutoring services, including an online searchable tutoring schedules are available that include resources on all campuses. A [tutoring request form](#) is also available if there are no tutors listed for the class for which you need help.

F. Student Mental Health and Wellbeing

We are a campus that cares about the mental health and well-being of all individuals in our campus community, particularly during this uncertain time. If you or someone you know are experiencing mental health challenges at UMass Lowell, please contact [Counseling Services](#), who are offering remote counseling via telehealth for all enrolled, eligible UMass Lowell students who are currently residing in Massachusetts or New Hampshire. I am available to talk with you about stresses related to your work in my class.

G. Disability Services

If you have a documented disability that will require classroom accommodations, please notify me as soon as possible, so that we might make appropriate arrangements. Please speak to me during office hours or send me an email, as I respect, and want to protect, your privacy. Visit the [Student Disability Services webpage](#) for further information. Additionally, Student Disability Services supports software for ALL students. Read&Write Gold is literacy software that allows you to read on-screen text aloud, research and check written work, and create study guides. You can download the software from the IT Software webpage on the UML website: [IT Software page](#)

H. Diversity, Inclusion, and Classroom Community Standards

UMass Lowell—and your professor—value human diversity in all its forms, whether expressed through race and ethnicity, culture, political and social views, religious and spiritual beliefs, language and geographic characteristics, gender, gender identities and sexual orientations, learning and physical abilities, age, and social or economic classes. Enrich yourself by practicing respect in your interactions,

and enrich one another by expressing your point of view, knowing that diversity and individual differences are respected, appreciated, and recognized as a source of strength.

I. Student Feedback (Course Evaluations)

Student feedback on teaching is a highly valued and helpful mechanism for monitoring and improving the quality of College of Engineering programs and instructional effectiveness. To that end, course evaluations are administered during the last few weeks of classes. Students are encouraged to participate actively in this process.

J. Academic Integrity Policy

All students are advised that there is a [University policy regarding academic integrity](#). Students are responsible for the honest completion and representation of their work.

Most of the work in this class will be done in groups, but it is important to ensure that you are a contributing member of the group so that you can get the most benefit from this class.

Examples and solutions from the internet and other sources may be useful to you in learning this material but you cannot turn in something downloaded from the internet and claim it as your own. That would be plagiarism. If you use something from another source as a reference in one of your submissions, cite it clearly.

Cheating and plagiarism will not be tolerated. A first offense will result in a failing grade for the assignment/exam in question and a formal filing with the Office of Provost according to the Academic Integrity Policy. A second offense could lead to a failing grade in the course, suspension or expulsion, as detailed in the policy.

K. Classroom Conduct

Students are expected to exhibit professional and respectful behavior that is conducive to a mutually beneficial learning environment in the classroom. Examples of inappropriate behavior include: text messaging, listening to music, cell phone use (other than the campus alert system), late arrivals, early departures, use of laptops for other than class purposes, disrespectful comments or behavior, intentional disruptions, failure to follow faculty directives, etc. Students in violation of these standards may be asked to leave class and/or be referred to the Dean of Students for disciplinary action.

L. Credit Hour Policy

Federal definition of a credit hour requires that for every course credit awarded, a course must offer 15 hours of instructor-led course activities and 30 hours of out-of-class student work. This means that a standard 3 credit hour course requires 45 hours of instructor-led course activities and 90 hours of out-of-class student work.

M. Athletic Academic Policy

Student-athletes must adhere to the [Athletic Academic Policy](#).

N. University Privacy Statement

UMass Lowell recognizes the importance of mutual trust between students and faculty. Neither faculty nor students may record video or audio of a course or private conversation without all parties' consent. Massachusetts is a two-party consent state, which means it is illegal to record someone without their permission. Recordings of classroom lectures are the intellectual property of the instructor. Instructors have the right to prohibit audio and video recording of their lectures, unless the requesting student is registered with Disabilities Services and recording of class sessions is an approved accommodation. In addition, sharing of or selling recordings of classroom activity, discussions or lectures with any other person or medium without permission of the instructor is prohibited.

VI. Course Outline & Tentative Class Schedule:

Changes to the schedule below will be updated on Blackboard or the course website.

Num	Date	Topic	Assigned	Due
1	16-Jan	Introduction and Brainstorming	Brainstorming	
2	23-Jan	ROS2 and New Gazebo Tutorial		Brainstorming
3	30-Jan	Finalize Project proposals	Project Proposal	
4	6-Feb	Advanced Perception		Project Proposal
5	13-Feb	Simultaneous Localization and Mapping	Midterm Report	
X	20-Feb	NO CLASS Monday Schedule		
6	27-Feb	Midterm Project Review	Final Report	Midterm Report
7	5-Mar	Navigation		
8	12-Mar	Manipulation	Revised Project	
9	19-Mar	From Simulation to Reality		
10	26-Mar	Robotics Ethics	Ethics Report	Revised Project
11	2-Apr	Project Check-in		
12	9-Apr	TBD		Ethics Report
13	16-Apr	TBD		
14	23-Apr	Wrap-Up, Demos, Final Presentations		
F	TBD	Final Reports Due		Final Report