Boston University ENG EK 505:
Introduction to Robotics and Autonomous Systems
Fall 2024 Syllabus

Instructor:
Prof. Alyssa Pierson
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Class Times and Locations:
All times are listed in EST (GMT –5). Lectures, office hours, and all other meetings will be held in-person unless otherwise posted. Prof. Pierson will host office hours by appointment. Please check Blackboard regularly for any updates to these times and locations.

Lectures:	Mondays & Wednesdays	CAS 203	2:30pm – 4:15pm
Office Hours:	By appointment	730 Comm Ave, RM 207	
Course Website:	Blackboard	learn.bu.edu	

Prerequisites
All students should have familiarity with ordinary differential equations, linear algebra, and dynamics. Programming experience (such as Matlab or Python) is recommended.

Textbook
There is no required textbook for the course. Resources and supplemental reading will be distributed on the course website. Lectures are based off the following books:

1. *Principles of Robot Motion: Theory, Algorithms, and Implementations* by Choset, Lynch, Hutchinson, Kantor, Burgard, Kavraki, and Thrun.
2. *Introduction to Autonomous Robots: Mechanisms, Sensors, Actuators, and Algorithms* by Correll, Hayes, Heckman, and Roncone.
3. *Probabilistic Robotics* by Thrun, Burgard, and Fox.

Description
Welcome to EK 505! This syllabus contains important information about course resources, expectations, and goals. Please read this document carefully and familiarize yourself with its contents.

Within this course, we will cover a variety of foundational topics pertaining to robotics and autonomous systems. Topics include: modeling techniques, control and motion planning overview, and concepts of sensing and perception. This course will also discuss the basics of machine learning techniques in robotics and the ethical implications of the field as robotics and automation continue their progression into commonplace tools.

Assignments and Grading Criteria

Individual progress and evaluation for the course material will consist of weekly homework, a midterm paper, and a final group project. All work will be **submitted online through Gradescope**. The breakdown is:

Participation	10%	Midterm Paper	30%
Homework	30%	Final Project	30%

Homework

We will have weekly homework assignments that expand upon the material in lecture. These assignments provide reading of contemporary topics, as well as simulations in Python to illustrate key topics. Coding will not be required to complete the simulation exercises, but you will be expected to interact with the code provided. When working in groups, please keep in mind the Ethics Code and do not copy others' answers. All students are expected to submit individual assignments.

Midterm Paper

The midterm paper will be an individual report discussing a current research topic within robotics and autonomous systems. Students will select a recent journal paper and generate a written report that discusses the paper's background, contributions, strengths and weaknesses, relation to the state-of-the-art, and impact on the field. Further details and due date will be provided later in the semester.

Final Group Project

The final group project will consist of a short report and class presentation. Students will work in small teams to propose and outline a new research frontier in robotics. The project will investigate current limitations, present a new research topic or robot capability, outline the necessary knowledge to achieve this goal, and generate proof-of-concept simulations. Further details will be provided later in the semester.

Resources and Support

Accommodations for Students with Documented Disabilities

If you are a student with a disability or believe you might have a disability that requires accommodations, requests for accommodations must be made in a timely fashion to the Disability & Access Services, 25 Buick St, Suite 300, Boston, MA 02215; 617-353-3658 (Voice/TTY). Students seeking academic accommodations must submit appropriate medical documentation and comply with the established policies and procedures.

We will make every effort to accommodate such requests, so (a) please notify us at the beginning of the semester if you've received approved accommodations in previous semesters (even if you haven't received documentation for this semester yet) and (b) our policy is that we need at least one week's notification prior to each exam so we can make the necessary arrangements.

Student Wellbeing
Students may experience stressors that can impact both their academic experience and personal wellbeing. These may include academic pressure and challenges associated with relationships, mental health, alcohol or other drives, identities, finances, etc. If you are experiencing concerns, seeking help is a courageous thing to do for yourself and those who care about you. If the source of your stressors is academic, please contact the instructor so we can find solutions together. For personal concerns, Boston University offers many resources, including free and confidential mental health counseling through Student Health Services Behavioral Medicine.

Class and University Policies

Class Policy
We expect that if you are registered for EK505, you should attend class. The course faculty treat you as responsible adults with the ability to manage your priorities and therefore do not take attendance as a general rule.

We are also aware of and in agreement with Boston University's Policy on Religious Observance, whereby absences for any religious beliefs are understood and missed assignments on such occasions will be given a chance to be made up. Students are strongly encouraged to notify the instructor in advance, particularly if an accommodation must be made, for such occasions.

Assignment Completion & Late Work
Unless arranged in advance due to extraordinary circumstances, late work will not be accepted. It is your responsibility to contact the professor as soon as possible in the event of an unavoidable conflict or medical emergency.

Pandemic(s) Contingency Policy
All activities related to EK505 are expected to occur in-person, unless otherwise specified by changes in Boston University policy and local public health guidelines. In the event of an extended absence, please contact Prof. Pierson ASAP to determine a plan.

ChatGPT and other Generative AI Assistance Tools
Unless otherwise stated, work submitted to EK505 for grading should be produced independently by the student or student groups. We follow the CDS Policy for Using Generative AI Assistance, which can be found here:
https://www.bu.edu/cds-faculty/culture-community/gaia-policy/

Academic Conduct Statement
Cheating on any form of assignment may be a form of plagiarism and is an infringement of every code of engineering ethics. Plagiarism is a serious academic offense and should not be taken lightly. Understanding your ethical responsibilities is an integral part of becoming an engineer. Please recall that when you enrolled at Boston University, you agreed to an Academic Honesty Pledge. The Academic Conduct Code details your responsibilities as well as the results of code violations, and is posted at:
https://www.bu.edu/academics/policies/academic-conduct-code/

Tentative Class Schedule (check Blackboard for updates)

Week	Lecture	Dates	Topic
1		-	Overview and Scope
	1	4-Sep	
2	2	9-Sep	Mathematical Preliminaries
	3	11-Sep	
3	4	16-Sep	Potential Field Navigation
	5	18-Sep	
4	6	23-Sep	Cell Decompositions
	7	25-Sep	
5	8	30-Sep	Multi-Robot Systems
	9	2-Oct	
6	10	7-Oct	Mapping and SLAM
	11	9-Oct	
7	**12**	**15-Oct**	Probabilistic Methods
	13	16-Oct	
8	14	21-Oct	Bayesian Methods
	15	23-Oct	
9	16	28-Oct	Lagrangian Dynamics
	17	30-Oct	
10	18	4-Nov	Trajectory Planning
	19	6-Nov	
11	20	11-Nov	Soft Robotics
	21	13-Nov	
12	22	18-Nov	Machine Learning
	23	20-Nov	
13	24	25-Nov	Machine Learning
	-	-	
14	25	2-Dec	Formal Methods
	26	7-Dec	
15	27	9-Dec	Final Presentations
	28	11-Dec	