ME 625 Syllabus - Fall 2024

Introduction to Robotics

Instructor	Dr. Petras Swissler Office: ME326 Email: **Petras.swissler@njit.edu** Lecture: Thursday 6PM – 8:50 PM, FMH 321 Office Hours: Friday 10:00 – 12:00, ME326 (notice will be given for any deviations from these office hours)
Website	Canvas, Slack/Discord
Course Text	Lecture slides will generally be uploaded to Canvas after the lecture
Recommended Reading	No textbooks are required for this course, however there are several books that you may find useful to have access to: • Modern Robotics by Lynch and Park, 1st Edition. ISBN: 1107156300 • Probabilistic Robotics by Thrun, Burgard, and Fox, 1st Edition. ISBN: 0262201623 • Artificial Intelligence by Russel and Norvig, 4th Edition. ISBN: 9356063575
Purchases	For the final project, it may be necessary to purchase equipment.
Prerequisites	Matrix analysis, Dynamics, Matlab programming
Learning Objectives	By the end of this course, students should be able to: 1) Demonstrate the principles and concepts in robotics, encompassing robot manipulation, swarm behaviors, robot navigation, and robot control through applied projects 2) Communicate effectively about the principles, challenges, and applications of robotics. 3) Analyze and evaluate the performance of robotic systems using appropriate metrics and assessment methods. 4) Assess and select appropriate robotic platforms, sensors, and actuators for specific robotic applications or tasks. 5) Evaluate ethical, societal, and legal implications associated with the development and deployment of robotics technologies.
Grading	Weekly in-class quizzes: 5% Weekly Canvas quizzes: 5% Individual projects: 55% (10%, 15%, 15%, 15%) Project Exams: 15% (3 × 5%) Final collaborative project: 20%

Final grades will be based on a weighted average of the above.
See https://www5.njit.edu/registrar/policies/grading.php

- [90, 100] A
- [85, 90) B+
- [80, 85) B
- [75, 80) C+
- [70, 75) C
- [60, 70) D
- [0, 60) F

Late Assignment Policy

Late assignments will be graded as normal, but a penalty will be assessed to the maximum possible grade. Penalties will be applied per day and will increment by one per day. For example, if an assignment is turned in two days late, a 1 + 2 = 3 point penalty will be assessed. If an assignment is 7 days late, a 1+2+3+4+5+6+7 = 28 point penalty will be assessed. Any assignment turned in more than a week late will receive a grade of 0.
No late assignments will be accepted for the final project or for quizzes.

Projects

The projects in this course provide students an opportunity to apply classroom learnings in scenarios like those that might be encountered in their research or future work. These projects will be somewhat open-ended in how students can approach them, and students will generally be given several weeks to complete these projects. Project assignments will outline the requisite deliverables.

All work performed towards these projects shall be entirely your own work and should be unique to this class and section. i.e., if you are retaking the class, you are not permitted to re-use work from last year.

Project Exams

For projects 2, 3, and 4 there will be an associated exam of duration approximately 1 hour. Exams are planned to be administered the week of the due date of the project.

Final Project

The final project will be a group-based project where students will propose an extension of the material covered in class or other robot-related subject and deliver a presentation and final report detailing their work.

Academic Integrity

It is your responsibility to be familiar with NJIT expectations regarding what constitutes academic integrity within NJIT, which is available here: https://www5.njit.edu/policies/sites/policies/files/NJIT-University-Policy-on-Academic-Integrity.pdf

Any student that is assessed to have violated academic integrity policy during this course forfeits any and all extra credit opportunities during the semester, including extra credit previously earned.

Academic Integrity is the cornerstone of higher education and is central to the ideals of this course and the university. Cheating is strictly prohibited and devalues the degree that you are working on. As a member of the NJIT community, it is your responsibility to protect your educational investment by

knowing and following the academic code of integrity policy that is found at: http://www5.njit.edu/policies/sites/policies/files/academic-integrity-code.pdf. Please note that it is my professional obligation and responsibility to report any academic misconduct to the Dean of Students Office. Any student found in violation of the code by cheating, plagiarizing or using any online software inappropriately will result in disciplinary action. This may include a failing grade of F, and/or suspension or dismissal from the university. If you have any questions about the code of Academic Integrity, please contact the Dean of Students Office at dos@njit.edu.

Active Learning

This course incorporates active learning activities throughout the semester. These activities have been designed to promote holistic thinking about the material.

Policy Regarding Use of Generative AI

By default: the following policy applies regarding the use of AI tools:
This course expects students to work without artificial intelligence (AI) assistance in order to better develop their skills in this content area. As such, AI usage is not permitted throughout this course under any circumstance.

Deviation from this course policy is only permissible following written approval by the course instructor and only in circumstances outlined in the written approval. In such circumstances, the following policy takes effect:
If and when students use AI in this course, the AI must be cited as is shown within the NJIT Library AI citation page for AI. If you have any questions or concerns about AI technology use in this class, please reach out to your instructor prior to submitting any assignments.

Failure to comply with the above policy will be considered an academic integrity violation since it constitutes misrepresentation of the work performed

Tentative Course Outline:

WEEK	DATE	DUE	TOPICS
1	Sep 5		• Course Introduction • Matlab refresher • Degrees of freedom
2	Sep 12	Project 0	• Rotation and transformation matrices • Forward kinematics
3	Sep 19	Project 1.a	• Forward kinematics pt 2 • Joint torques
4	Sep 26	Project 1.b	• Inverse kinematics
5	Oct 3		• Kinematics software
6	Oct 10	Project 1.c	• **Exam: Kinematics** • Introducing Swarm robotics
7	Oct 17		• Swarm algorithms
8	Oct 24		• Swarm robot hardware
9	Oct 31	Project 2	• **Exam: Swarm robotics** • Path planning algorithms
10	Nov 7	Project Selection	• Sensor measurement • Information filtering
11	Nov 14	Project Proposal	• Sensor measurement in hardware
12	Nov 19	Project 3	• **Exam: Planning and Perception** • Special topics 1: Machine learning algorithms
13	Nov 26		• Special topics 2: ROS
14	Dec 5		• Final project presentations
15	Dec 12	Final report	• Reading day: no class