

ECE 387 Introduction to Robotic Systems

Syllabus

Instructor

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Course Goals and Objectives

Cadets shall:

- Apply forward and inverse kinematic analysis and dynamic analysis to planar manipulators and mobile robots
- Understand mobile robot odometry challenges and the purpose of Kalman Filters
- Understand the principles of operation and characteristics of various robot sensors
- Understand image capture with a CCD camera

Prerequisite Course:

Familiarity with any programming language, such as Matlab or C/C++, is all that is required.

Course Materials and Resources

| | |
|-------------|---|
| Course Text | None, various PDFs are provided for reading |
| Web Page | TBD |
| Software | Python 2.7 will need to be installed on your laptop |

Grades

The letter grades for this class follow the standard ECE cutoffs.

| Grade | Grade |
|--------------|--------------|
| 90 < A < 100 | 74 < C+ < 77 |
| 87 < A- < 90 | 70 < C < 74 |
| 84 < B+ < 87 | 67 < C- < 70 |
| 80 < B < 84 | 60 < D < 67 |
| 77 < B- < 80 | 0 < F < 60 |

This class is based on points with a majority of points available after prog.

| | Prog Pts | Final Pts |
|---------------|----------|-----------|
| HW | (5)25 | (6)30 |
| GRs | 100 | 100 |
| Labs | (2)40 | (3)60 |
| Quizzes | (2)20 | (2)20 |
| Final Project | | 100 |
| TOTAL | 185 | 310 |

Missing Class and the Late Policy:

Inform your instructor of absences in advance via email. Please include the reason for the absence and any relevant SCA. Check the SCA to see if instructor permission is required and if it is, make the request prior to the absence. You will be given an Unexcused Absence in CAS if you fail to get permission.

Due to the limited time to conduct labs and the fact they are executed in groups, you can not miss a labs unless you have a medical excuse due to unplanned illness.

If you are expecting to miss class on the day an assignment is due, you shall turn in your assignment prior to your departure. Your instructor may grant a no-penalty turn-in extension for absences resulting from illness or other legitimate extenuating circumstances. Cadets shall coordinate late submittals in advance. The late policy for the Department of Electrical and Computer Engineering is as follows:

| How Late? | Max Penalty | Max Grade |
|-----------|-------------|-----------|
| < 1 day | 25% | 75% |
| 2 day | 50% | 50% |
| 3 day | 75% | 25% |
| > 3 day | 100% | 0% |

Collaboration and Documentation Policy:

You may receive help from any DFEC faculty member or any student currently enrolled in ECE387. Document all help received on work submitted for grading IAW DF policies, or none if your work was completely individual effort.

Quizzes:

Short graded quizzes will be given periodically throughout the semester and are listed in the schedule. The quizzes are based on the previous lessons.

Labs and Final Project:

The labs are performed in groups of no more than 3 students. Each lab will build on the homework, in class lectures and readings. The purpose of the labs is to provide hands on experience with the topics discussed in the lectures. The final project will focus on the Roomba robot, controls, computer vision, and path planning.

Schedule

| Lsn | Topic | Quiz | HW | Due |
|-----|-------------------------------|------|----|-----------|
| 1 | Intro & Overview | | | |
| 2 | Linux | | | |
| 3 | Python | | 1 | |
| 4 | Python | | 2 | |
| 5 | Python | | 3 | |
| 6 | Lab 1: linux, git, and python | | | Lab1: EOC |
| 7 | Kinematics: Introduction | Y | | |
| 8 | Forward Kinematics | | | |
| 9 | Inverse Kinematics | | | |
| 10 | Robot Arm Control | | 4 | |
| 11 | Lab 2: Robot Arm | | 5 | |
| 12 | Lab 2: Robot Arm | Y | | Lab2 EOC |
| 13 | Roomba Overview | | | |
| 14 | Roomba Sensors | | | |
| 15 | Roomba Sensors | | | |
| 16 | Roomba Sensors | | | |
| 17 | Lab 3: Sensor Calibration | | | |
| 18 | GR 1 | | | |
| 19 | Image Processing | | | |
| 20 | Image Processing | | 6 | Lab3: BOC |
| 21 | Image Processing | | | |
| 22 | Computer Vision | | | |
| 23 | Computer Vision | | 7 | |
| 24 | Computer Vision | | | |
| 25 | Computer Vision | | 8 | |
| 26 | Kalman Filter | Y | | |
| 27 | Detection and Tracking | | | |
| 28 | Lab 4: Detection and Tracking | | 9 | Lab4: EOC |
| 29 | Mobile Robots | | | |
| 30 | Controls | | | |
| 31 | Path Planning | | 10 | |
| 32 | Path Planning | | | |
| 33 | INS | | 11 | |
| 34 | INS | | | |
| 35 | Lab 5: Roomba | Y | | |
| 36 | Lab 5: Roomba | | | Lab5: EOC |
| 37 | GR2 | | | |
| 38 | Final Project | | | |
| 39 | Final Project | | | |
| 40 | Final Project | | | |