

Introduction to ESE112 Lab

Lab Overview

Staff

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- Course Website:
<http://www.seas.upenn.edu/~ese112/>

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Introduction

- Introductory programming that is integrated with traditional engineering theory

- Involves 2 components:
 - Computer Programming Lecture with Java Programming Language (.5 cu)

 - Engineering Lab (.5 cu)

- You must enroll in both components
 - If you already know Beginner Level Java then you can take the **Placeout Exam** – details on website

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ESE112 vs. CIS110

- How is it different from CIS110?
 - Unique lab component that is geared towards building real-world applications

 - Hands-on approach to engineering design
 - Construction and Programming of robots allows a wide range of scientific and engineering principles to put into perspective and practice

 - Get perspective what you can see in future courses

 - Work with cutting-edge research technology

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Lab Goals

- Able to apply knowledge of mathematics, science, and engineering
- Develop problem solving and critical thinking skills
 - Investigate solutions by applying and evaluating information gathered from, or generated by observation, experience, and reasoning
 - Adapt to different thinking and working styles when working in a team

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ESE major overview

- Electrical/Electronics Engineering
 - Technology behind
 - Power & Energy
 - Gadgets: LCD displays, computers, phones, robots
 - Communication Devices : Radio, cell phones, WiFi, satellites
 - Electrical engineers concerned with:
 - electricity to transmit energy (power engineering)
 - using electric signals to sense, store and transmit information (electronics engineering)
- System Science and Engineering (SSE)
 - Aspects of engineering pertaining to a system

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ESE (contd..)

System

- An arrangement (pattern, design) of parts which interact with each other within the system's boundaries (form, structure, organization) to function as a whole



Ben Franklin – Urban Challenge

<http://www.benfranklinracingteam.org/>



Rhex

http://kodlab.seas.upenn.edu/~edubot/wiki/index.php/Main_Page

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ESE (contd..)

SSE

- Designing and developing a system requires integration of several scientific and technical fields
 - Math and Sciences (physics, chemistry)
 - Basis of Electrical Engineering
 - Computing (computer science)
 - Mechanical & Material Engineering
 - Biology/Bioengineering

Computer & Telecommunications Engineering (CTE)

- Computer Systems & Information Exchange (Internet)
 - Design & Building computers (embedded and general purpose) & networking systems

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Working on a Physical System

- ESE112 star attractor “EduBot”
 - Hexapedal robot
 - Independently moves forward or backward
 - Climbs over a variety of terrains
- Exemplifies Core ESE Disciplines
 - EE – electrical devices; electrical circuits
 - CE – embedded and distributed computation
 - SSE – composition, multiple hierarchies of subsystems



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Lab Logistics - Grading

- Grading (Lab is 0.5 cu)
 - Pre-lab exercise: 15%
 - Lab Report Write-ups: 70%
 - Final Exam: 15%
- Missing Labs
 - Due to the nature of the course, making up missed labs is not possible.
 - Unexcused absences will be resulting in a **15% penalty** for that lab

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Lab Logistics - Prelab

- Before lab period we will post lab with related background material
 - There is **no textbook** for this course
- Questions termed as “Pre-lab” are to be completed & turned in at the start of the lab
 - Work individually
 - Preferably typed (please write legibly)

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Lab Logistics - Lab Report

- Post-lab Write-ups
 - A technical report to communicate the findings of your lab experiments
 - Is to be done **individually**
 - The report must be typed
 - See report writing guidelines document on the  website
 - You may use course notes & lectures provided and any external source (properly cited) with exception of past years lab/students
 - Late report will incur penalty of 10% per day up to 4 days and then no credit

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Lab Logistics - Working in Lab

- Labs are to be done in groups of 2 or 3
 - You are encouraged to collaborate within your group and use any resources available to you
 - However, you may not discuss the lab with other groups



- Throughout the semester you may choose your *own* groups
 - HOWEVER, you may not work with the same person *twice* throughout the semester

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Lab Content

- Electrical Engineering concepts in Robotic System
 - Robots use sensors to get information and actuators for navigation
 - Both components convert one type of energy to or from electrical energy
 - Topic: Intro to Electrical Circuit Theory
 - Theory: Voltage, Current, Resistance, Electrical laws (Kirchhoff Laws)
 - Lab: Make changes Electro-mechanical Mouse system based on the theory
 - Topic: Build a Light Sensor
 - Theory: Electrical Components & Lab devices
 - Lab: Design, Implement and prototype a sensor that turns *off* when it is dark

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Lab Content (contd..)

- Math & Computing concepts
 - E.g. Robotic System : Idea is to built autonomous navigating robots
 - Robots are equipped processors that can command the robot sub-system
 - We can program the robot to evaluate its surrounding as it moves
 - Topic: Introduction to Linux Platform
 - Theory: Interact with robot hardware & software
 - Lab: Downloading program on robot hardware
 - Topic: Dance Lab
 - Theory: Kinematics and Leg movement
 - Lab: Write a Java program to choreograph the robot to a song
 - Topic: Optimize walking gait of the robot
 - Theory: Derivative, min/max, gradient descent
 - Lab: Write a Java program to would maximize the walking speed

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Lab Content (contd..)

- Communication & Writing Development
 - Work with TCP (Technical Communication Program) to improve proficiency in the skills of communication
- Effective use of Library Resources

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Edubot Demo

- Lets take a walk with the Edubot