

# Introduction to ESE112 Lab

Lab Overview

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## Staff

- Instructor:
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- Lab Co-ordinator:
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## Lab Logistics - Grading

- Grading (Lab is 0.5 cu)
  - Pre-lab exercise: 20%
  - Lab Report Write-ups: 60%
  - Quizzes: 20%
    - Announced a week in advanced
  
- Missing Labs
  - Due to the nature of the course, making up missed labs is not possible.
  - Unexcused absences will be result 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
  - <http://www.seas.upenn.edu/~ese112/>
  - 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

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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 (coming soon!)
  - You may use course notes & lectures provided and any external source (properly cited) with exception of past years lab/students



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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

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## Lab Logistics - Working in Lab (contd..)

- Throughout the semester you may choose your *own* groups
  - HOWEVER, you may not work with the same person *twice* throughout the semester
- Post-lab experience will ask what your and your group-mates contributions to the lab
  - In extreme cases your grade will be adjusted based on your effort
  - If you feel for any reason you cannot reasonably work with one or more of your group-mates, see the instructor immediately

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## Lab Goals

- Introduce you to Electrical and Systems Engineering (ESE)
  - Expose you to topics you will see in future courses
- 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

- Electrical Engineering
  - Technology behind
    - Power & Energy
    - Gadgets: LCD displays, computers, phones, robots
    - Communication Devices : Radio, cell phones, satellites
- 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](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)

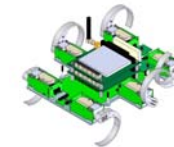
- Computer Systems & Information Exchange (Internet)
  - Design & Building computers (embedded and general purpose) & networking systems

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## Working on a Physical System

- In ESE112 we will use *Edubot*
  - hexapedal (six legs) 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 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
  - Lab1: Intro to Concepts
    - Theory: Voltage, Current, Resistance, Electrical laws (Kirchhoff Laws)
    - Lab: Make changes Electro-mechanical Mouse system based on the theory
  - Lab2: Build a Light Sensor
    - Theory: Electrical Components & Lab devices
    - Lab: Design and Implement sensor that turns *off* when it is dark

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## Lab Content (contd..)

- Math & Computing concepts in 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
  - Lab3: Interact with robot hardware & software
    - Theory: Linux Platform
    - Lab: Downloading program on robot hardware
  - Lab 4: Dance Lab
    - Theory: "Kinematics" and Leg movement
    - Lab: Write a Java program to choreograph the robot to a song
  - Lab 5: 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..)

- Concepts from Mechanical & Material Engineering and Biology
  - Lab 6: Tentative

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## Edubot Demo

- Lets take a walk with the Edubot

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