

# EE40: Introduction to Circuit Design

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Fall 2014

*(updated 8/19/2014 and likely will be updated once more before classes start)*

## Professor

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## Objectives

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Analyze, design, build and test electronic circuits, and understand their capabilities and limitations.

1. Understand fundamental circuit principles
  - Lumped circuit model (Kirchhoff's laws)
  - Energy storage (capacitors and inductors)
  - Time and frequency domain signal representations
  - Analog and digital signals, conversion
2. Design, build, and test electronic circuits
  - Circuit hierarchy and modularity
  - Laboratory practices (breadboarding, test equipment)
  - Guided laboratories + project
3. Understand circuit limitations
  - Circuit imperfections (e.g. component variations)
  - Power / accuracy / speed tradeoff
  - Moore's law (technology and economic implications)

## Textbook

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Ulaby and Maharbiz, *Circuits*, 2<sup>nd</sup> Edition, 2012

## Lecture

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- Monday, Wednesday, Friday
- 10 - 11 am
- Wheeler Auditorium

## Office Hours

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### Maharbiz

- Mon 1 -2 pm
- Fri 1 - 2 pm
- +1 TBA determined in first lecture
- Or, you can email me for an appointment if you aren't able to make regular office hours
  - go to <http://www.eecs.berkeley.edu/~maharbiz/schedule.htm>
  - Pick a free time on my schedule, email me and wait for confirmation

### GSI's:

- TBA and posted on the Piazza page

## Grading

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Grading is curved. The mean is usually set to a B; one standard deviation corresponds to one letter grade. (eg. If the class mean is 80 and the std dev is 10, then the boundary for a B is set to 80, the boundary to receive a C to 70, the boundary for an A to 90, etc.).

- Homework: 10 %
- Midterms (2): 30 %
- Final Exam: 30 %
- Labs: 30%

**Quizzes:** There are between 2 – 6 quizzes given in class throughout the semester with little or no notice, based on my whim and the whispers of the Great Old Ones. They usually last 10-15 minutes and are intended for practice and gauge what you are learning. They are not intended as individual assignments and working in teams of any size, involving any amount of chaotic activity is encouraged. These are NOT GRADED. Instead, if at the end of the class you wish to discuss why you deserve a B+ instead of a B (because you are 0.00001% away from the boundary), I will check to see if you've done the quizzes before listening to your sad/exciting/heroic story.

## Videos

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- Short MOOC-style videos on the majority of topics covered in EE40 are available via YouTube. These were recorded by Prof. Vivek Subramanian and me.
- For EE40, these videos are intended to function just as textbook reading does: you are expected to view chapter-relevant material ahead of discussion in lecture as a way to prepare for the material.
- I lecture in class, so the videos are not intended to entirely replace them. Having said that, if you find you are doing well watching only the videos, I have no problem with this. **I will endeavor to alert you to anything in lecture not covered in the videos but I do not guarantee this ahead of time: lectures are the standard, not the videos.**
- (see below for lab videos)

## Class Website

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- The class website is on piazza.com. All course material, announcements, etc. will be handled through Piazza
- I will create a BCourses site to manage grades; I will announce as we add grades to that site so you can check for errors

## Homework

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- Posted on M or F (TBD in class)
- Due one week later in the HW box labeled EE40 below the stairs on the 1<sup>st</sup> floor of Cory near the TI Lab
- Your lowest HW score is automatically dropped

## Tests

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- Missed exams will only be allowed for medical reasons or research-related travel and HAS TO BE APPROVED BY ME OVER EMAIL three (3) weeks in advance.

## Cheating

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- No excuses; I will seek the maximum penalty and fully follow the department policy (except, I don't allow repetition of work under \*any\* circumstance) <http://www.eecs.berkeley.edu/Policies/acad.dis.shtml>

## Labs and Final Project

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As of Fall 2014 (this semester!), we've once again re-vamped all of the labs.

### Why?

- The main reason is I'm bored of the old ones. We've asked students to build an EEG for 5 semesters. Time to try something new. ☺
- More substantively, the new lab experience will allow for much more individual design experience.
- Lastly, in previous semesters, students worked on an aggressive lab schedule that forced them to learn material on their own (using Google, Wikipedia, etc.). This frustrated some people.

### Building an customizing a vibrating walker robot

- The new labs are based around a set of videos prepared by Tom Zajdel and me. Incidentally, they are likely to be launched as a stand-alone MOOC.
- They gently introduce you to the basic concepts in the class while you build a popsicle-stick vibrating hopper robot.
- Although the basic skeleton is fixed (and pretty basic), there is tons of room to hack your own craziness into the robot (more on this below).

### Logistics

- You will work in pairs.
- In essence, the labs "are" the videos: you build stuff as you watch.
- You will be required to watch all of the videos for a given lab module in order to get checked off.
- There are questions with the videos you must answer.
- You can either:
  - Come to lab, watch the videos and do the work as you watch the videos.
  - Do as much as you want AT HOME (we will check out equipment to you) and come in to lab to finish or get checked out.

### Last 3 weeks

- Here's the fun part.
- We give you three weeks at the end to add, build, modify, enhance, add sentience to, wake up Skynet, etc. with/to your robot.
- This is, in essence, the final project and the GSI's will have detailed instructions on what is allowed, how it is graded.
- There will be a process of discussing your ideas with GSI's prior to this period.

## Lab schedule

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Soldering Basics	Tues 9/2 – Mon 9/8
Module 2: Resistors	Tues 9/9 – Mon 9/15
Module 3: Amplifiers	Tues 9/16 – Mon 9/22
<b>No labs (also, Midterm 1)</b>	<b>Tues 9/23 – Mon 9/29</b>
Module 4: Capacitors	Tues 9/30 – Fri 10/3
Module 5: Transistors *	Mon 10/6 – Fri 10/1
Module 6: Inductors *	Mon 10/13 – Fri 10/17
Module 7: Analog-to-Digital Conversion	Mon 10/20 – Fri 10/24
Module 8: Oscillators	Mon 10/27 – Fri 10/31
Hack 1 *	Mon 11/3 – Fri 11/7
<b>No labs (also, Midterm 2) *</b>	<b>Mon 11/10 – Fri 11/14</b>
Hack 2	Mon 11/17 – Fri 11/21
<b>Thanksgiving Week, no labs</b>	<b>Mon 11/24 – Fri 11/28</b>
Hack 3	Mon 12/1 – Fri 12/5
<b><i>Check off / show off</i></b>	TBA

## Exam schedule and rules

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### All exams:

- ONE 11" x 8.5" cheat sheet, anything on it
- Closed book
- NO comm enabled devices (no RF, no IR, etc.)

### Midterm 1

- Thursday 9/25
- evening [7or 7:30 pm],
- 1.5 hours long

### Midterm 2

- Thursday 11/13
- evening [7or 7:30 pm],
- 1.5 hours long

### Final

- Determined by University
- Monday 12/15/14 8-11am

**NO ALTERNATE EXAMS**