What is this class all about?

- Basic semiconductor device physics and analog integrated circuits.
- What will you learn?
  - Electrical behavior and applications of transistors
  - Analog integrated circuit analysis and design

Schedule

- Lectures:
  - TuTh 3:40-5:00 PM (102 Moffitt)

- Discussion Sections (beginning Monday 1/28):
  - Sec. 102 (293 Cory): Mon. 4-5PM, Eudean Sun
  - Sec. 103 (2305 Tolman): Wed. 10-11AM, Abhinav Gupta
  - Sec. 104 (293 Cory): Fri. 10-11AM, Sung Hwan Kim

Teaching Assistants

- Eudean Sun (eudeansun@berkeley.edu)
- Sung Hwan Kim (shpkim@eecs.berkeley.edu)
- Abhinav Gupta (agupta@eecs.berkeley.edu)
- Office Hours will be announced on the web


Lab Schedule

- Laboratory Sections (beginning Monday 1/28):
  - Section 10 (353 Cory): Monday 9AM-12PM; Wilson Ko
  - Section 11 (353 Cory): Wednesday 5-8PM; Eudean Sun
  - Section 12 (353 Cory): Wednesday 2-5PM; Abhinav Gupta
  - Section 13 (353 Cory): Thursday 5-8PM; Sung Hwan Kim
  - Students must sign up for one lab section outside 353 Cory by 5PM Friday 1/25, and regularly attend this lab section.

  - Switching lab needs consent from both TAs
  - All of the lab assignments (and tutorials) are posted online at http://inst.eecs.berkeley.edu/~ee105/sp08/#labs
  - Each pre-lab assignment is due at the beginning of the corresponding lab session. Post-lab assignments are due at the beginning of the following lab section.

Relation to Other Courses

- Prerequisite:
  - EECS40: KVL and KCL, Thevenin and Norton equivalent circuits, impedance, frequency response (Bode plots), semiconductor basics, simple pn-junction diode and MOSFET theory and circuit applications, analog vs. digital signals.

- Relation to other courses:
  - EE105 is a prerequisite for EE113 (Power Electronics) and EE140 (Linear Integrated Circuits).
  - It is also helpful (but not required) for EE141 (Introduction to Digital Integrated Circuits).

Class Materials

- Lecture Notes will be posted on the class website, but it is important that you read the corresponding sections in the textbook
- Lectures will be recorded and webcasted, however, this is not intended to replace attendance

Homework

- Weekly assignments will be posted online on Tuesdays
- Due the following Tuesday at 5:10 PM @EE105 Drop box in Undergraduate Lounge, Cory Hall.
- Late homework will not be accepted.
- Students are encouraged to discuss homework problems. However, the work which you submit for grading must be your own.
Grading

- **Homework** (posted online)
  - due Tu (5:10PM at Drop Box in Undergrad Lounge)
  - late homeworks not accepted
- **Laboratory assignments**
  - Prelab due at beginning of lab session
  - Report due at the beginning of the following lab
- **2 midterm exams**
  - 80 minutes each
  - closed book
  - (3 pages of notes allowed)
- **Final exam**
  - Th 5/22 from 12:30-3:30PM
  - closed book
  - (7 pages of notes allowed)
  - bring calculator

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Miscellany

- **Special accommodations:**
  - Students may request accommodation of religious creed, disabilities, and other special circumstances. Please make an appointment to discuss your request, in advance.
- **Academic (dis)honesty**
  - Departmental policy will be strictly followed
  - Collaboration (not cheating!) is encouraged
- **Classroom etiquette:**
  - Arrive in class on time!
  - Bring your own copy of the lecture notes.
  - Turn off cell phones, pagers, MP3 players, etc.
  - No distracting conversations

Getting Started

- **Assignment 1:**
  - To be posted later today
  - Due 1/29 (Tuesday) at 5 PM
- **NO discussion sessions, labs, or office hours this week.**
The Integrated Circuit (IC)

- An IC consists of interconnected electronic components in a single piece (“chip”) of semiconductor material.
- In 1958, Jack S. Kilby (Texas Instruments) showed that it was possible to fabricate a simple IC in germanium.
- In 1959, Robert Noyce (Fairchild Semiconductor) demonstrated an IC made in silicon using SiO$_2$ as the insulator and Al for the metallic interconnects.

The first planar IC (actual size: 0.06 in. diameter)

From a Few, to Billions

- By connecting a large number of components, each performing simple operations, an IC that performs very complex tasks can be built.
- The degree of integration has increased at an exponential pace over the past ~40 years.
  - The number of devices on a chip doubles every ~18 months, for the same price.

“Moore’s Law” still holds today.
EECS 105 in the Grand Scheme

- Example electronic system: cell phone

EECS 105: Emphasis on Analog IC’s

- Example: 14-bit analog-to-digital converter

Digital or Analog Signal?

- $x_1(t)$ is operating at 100Mb/s and $x_2(t)$ is operating at 1Gb/s.
- A digital signal operating at very high frequency is very “analog”.

Circuit Simulation using SPICE

- Read tutorial posted on EE105 lab website!

  - SPICE = Simulation Program with IC Emphasis
  - Invented at Berkeley (released in 1972)
  - .DC: Find the DC operating point of a circuit
  - .TRAN: Solve the transient response of a circuit (solve a system of 
    generally non-linear ordinary differential equations via adaptive time-
    step solver)
  - .AC: Find steady-state response of circuit to a sinusoidal excitation