Introduction

- **INSTRUCTOR:** Kenneth R. Laker
  1. Email: laker@seas.upenn.edu
  2. Office: 203E Moore Complex
  3. Office hours: M & W 4:00 to 5:00 PM
     Th 8:00 to 9:00 AM, 3:00 to 4:00 PM or by appointment
- **CLASS:** M, W & F 11:00 AM – 12:00 N, 305 Towne
- **LAB:** Th 12:00 – 3:00 PM or F 1:00 – 4:00 PM, Detkin Lab

- **TA:** TBD
  1. Email: TBD
  2. Office: TBD
  3. Office hours: TBD
- **TEXT:** Sedra/Smith **Microelectronic Circuits – 6th Ed. (New)**
- **COURSE WEBSITE:** http://www.seas.upenn.edu/~ese319/ + Blackboard
- **SOFTWARE:** National Instruments Multisim

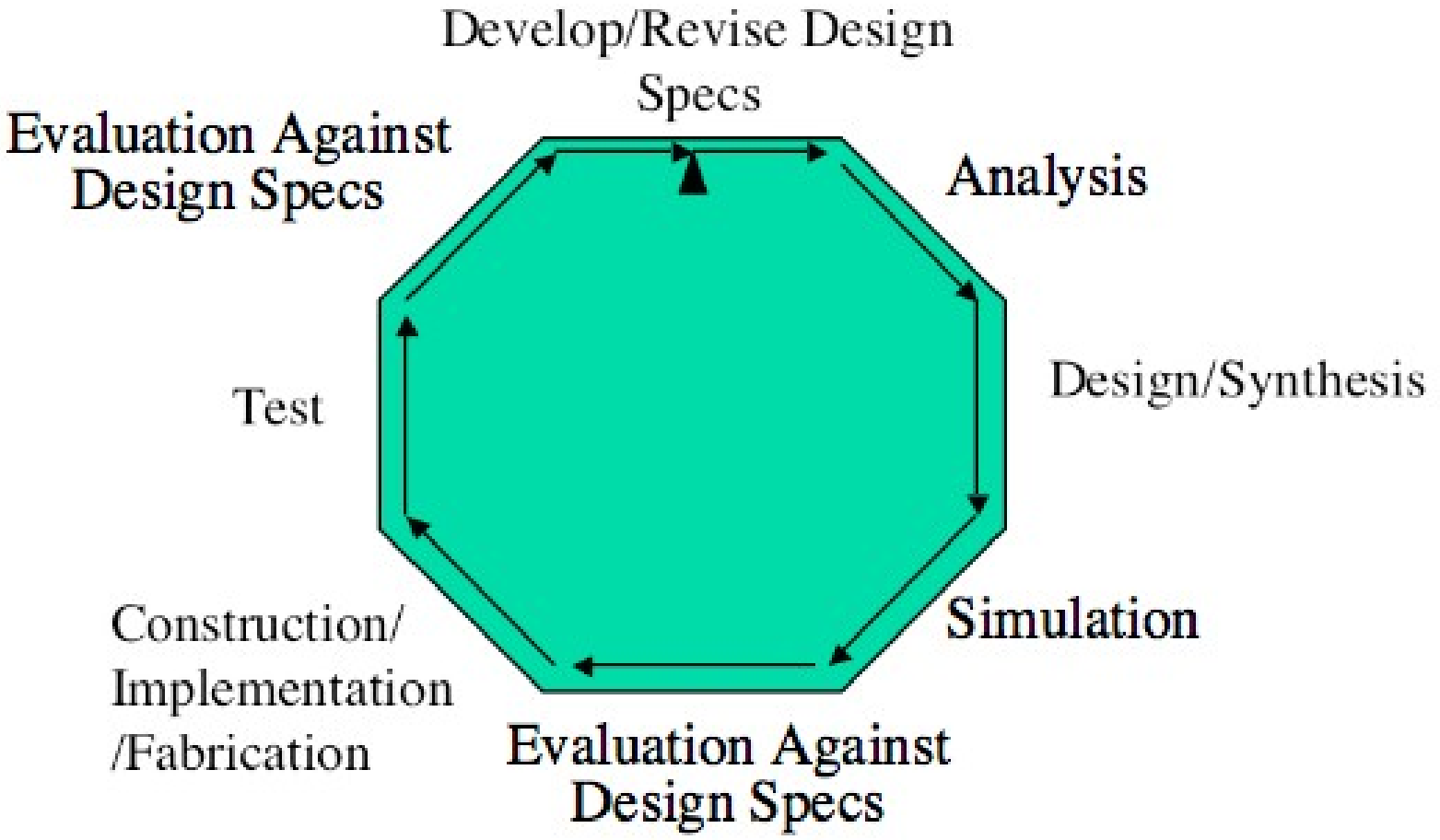
Course Outcomes

- **Theory and Analysis**
  - Demonstrate principles of component-insensitive design of semiconductor systems. (a1)
  - Demonstrate understanding principles of differential amplifier analysis. (a2)
  - Apply High freq models of BJT circuits to determine gain, freq response and BW of BJT amps. (a3)
  - Use concepts of fdbk and stability/instability to analyze and design an oscillator circuit. (a4)
  - Use concepts of fdbk and stability to determine gain and phase margins for a fdbk amplifier. (a5)
  - Demonstrate understanding of the principles of Class A, B, and AB power amps; and their application to amp circuits. (a6)
- **Design and Conduct Experiments**
  - Design an experiment to test an electronic system, make appropriate measurements and interpret the results. (b1)
- **Design and Practice**
  - Design, simulate, construct and test of circuits covered in class to relevant specs. (c1)
  - Design a basic operational amplifier circuit to specifications. (c2)
  - Demonstrate awareness of the causes of discrepancies between theoretical and practical circuit performance, and learn when these discrepancy causes are significant and when they are not. (c3)
- **Use of Computer Tools**
  - k1. Apply circuit CAD tools used to each of the design tasks in Outcomes c1, c2 & c3 above.

Analog Electronic Circuit Design

- Preliminary design inherently a cerebral and "back of the envelope" exercise.
- Followed by simulation using theoretical models for "real" components.
- If simulations show adequate performance, the designs are implemented and tested in the lab.
- The design process is usually iterative.
- We will follow this approach in the course.

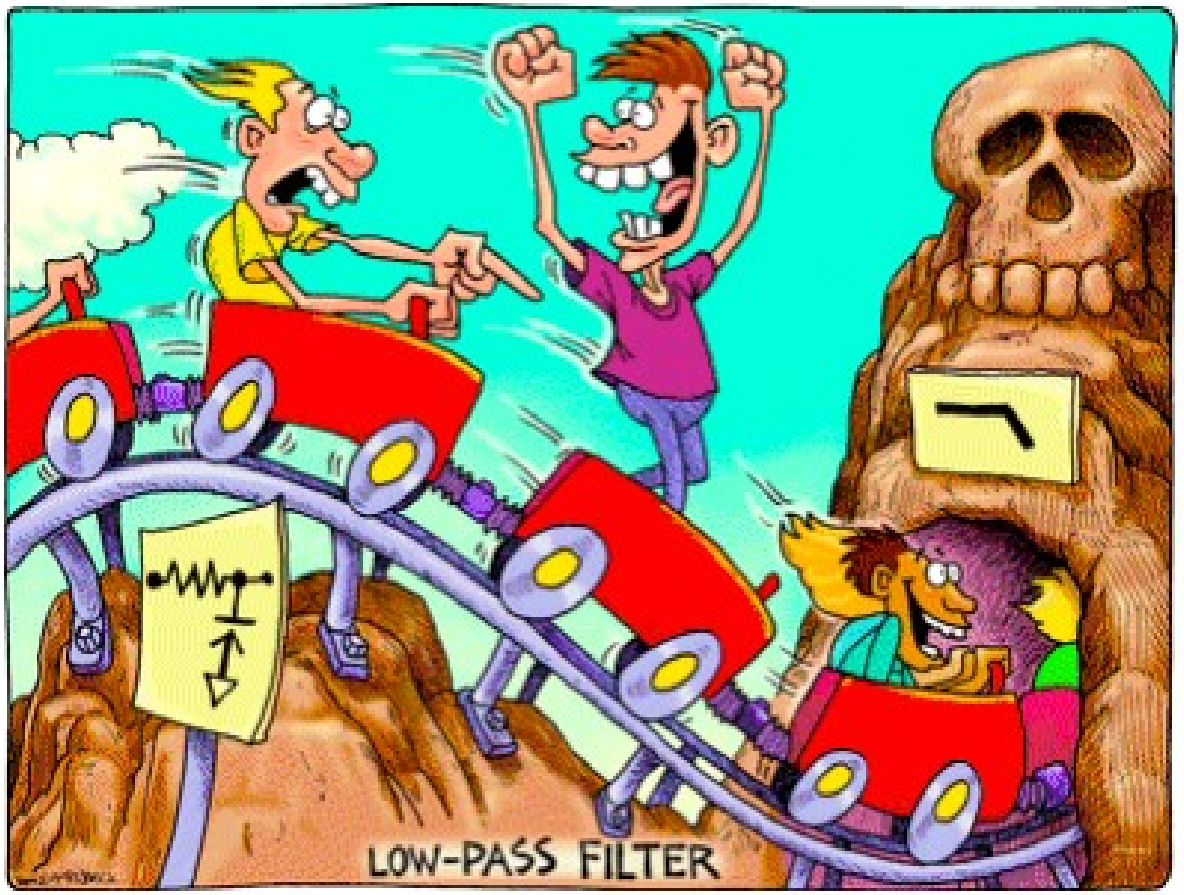
Design Cycle



Analog Circuit Design

- **Professional circuit designers**
  1. Minimize the use of expensive components.
  2. Maximize circuit robustness making it.
     I. Insensitive to component selection.
     II. Insensitive to its operating environment.
  3. Recognize that semiconductor devices.
     I. Are highly nonlinear in their behavior.
     II. Are sensitive to temperature.
     III. Vary widely in their performance characteristics from unit-to-unit.

Analog Low-Pass Filter Design



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Overall Course Grading Policies

- 2 Mid-term exams — 15 % each
- Final exam — 30 %
- Homework — 10 %
  1. See slide 10 for Homework Policy.
- Laboratory — 30 %
  1. See slides 11 - 13 for Lab Policy.

Actual Course Grading

Lecture Style

- Primarily Adobe Acrobat slides
- Classroom blackboard augmentation
- Student handouts
  - Download slides from ESE 319 website.
  - Suggestion: Print slides and bring to class for note-taking.

Homework Policy

1. Assigned by Friday of each week.
2. Due on Wednesday, the week after assigned.
3. Up to 2 late turn-ins (by the following Wednesday or one-week after the original due date) are permitted with no penalty.
4. All HW not turned in on-time, according to 2 & 3, will receive "0" grade.
5. Graded homework returned by Monday or 5 days after turned in.
6. Copying or plagiarism of homework is a violation of the Code of Academic Integrity and can result in a "0" grade for the course.

Lab Policy - General

1. **Each lab session lasts 3 hours and starts promptly.**
   I. Lab sessions missed due to legitimate absences must be made up.
2. **Student Groups: The standard lab group is 1 or 2 students.**
   I. Pre-lab and Lab Notebook – individual.
   II. Lab Report - group.
3. **Collaboration is OK, copying and plagiarism is NOT OK.**
   I. Any violation of the Code of Academic Integrity may result in zero grade for the course.
      a) Copying of pre-lab, data or report content from other lab groups.
      b) Submitting contrived or altered data.
      c) Copying material (other then schematics) from lab handouts or other sources into Lab Reports.
4. **Lab Report Turn-in Policy.**
   I. All Lab Reports are due the next lab session (usually 1 week).
   II. Up to 2 excused late Turn-Ins will be permitted without penalty.
      a) Late Lab Reports are due 1 week after original deadline.
   III. Lab Reports violating I. & II. will receive "0" grade.

Lab Policy – Pre-Lab Prep & Notebooks

1. **Individual Pre-Lab Preparation is very important.**
   I. Read lab assignment in advance.
   II. Read text sections relevant to the experiment.
   III. Do pre-lab assignment prior to the lab. Pre-Lab work will be spot checked in lab.
      a) Pencil and paper circuit design.
      b) Circuit simulation(s).
2. **Individual Lab Notebook for recording experimental data and observations is essential to preparing accurate Lab Reports.**
   I. Lab Notebooks will be kept as in ESE 206 http://www.seas.upenn.edu/~ese206/#NOTEBOOK. .
   II. Lab Notebooks will be spot checked in lab and collected for instructor review at the end of the course.

Lab Policy - Reports

5. Group Lab Reports (Reports due at start of next lab)

I. Lab reports are to be clearly written and word processor prepared.

II. Schematics may be computer drawn or **neatly** hand-drawn or copied/printed and pasted from circuit simulator created graphics.

III. Tables and graphs of measured data may be copied/printed and pasted from spreadsheet or some other math software.

IV. Each report is to be organized as follows:

a) Heading: Date, Title of Experiment, Authors Names and Lab Section.

b) Introduction: *very brief* summary description of experiment objectives.

c) Theory: ideal circuit behavior, pencil-and-paper design, relevant equations.

d) Experimental Setup: descriptions/schematics of actual circuit(s) tested, instrumentation used and setups for each test. Take photo(s) of your protoboard to show your experimental layout(s).

e) Experimental Data: present data results, including experimental and simulation data.

f) Discussion: discuss results and explain inconsistencies between design assumptions, theory, experimental results and simulation results.

Next Class/Lab Assignments

- Topic to be covered Friday, 09Sept11
  - BJT Introduction
    - S&S sections 6.1 and 6.2; pages 351 - 371
- Don't forget to download the handouts!
- No lab this first week of class.
- First Lab Meetings: Thursday 22Sep11, Friday 23Sep11 (3rd week of class)

Explore and Have Fun!

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