



Introduction

- **INSTRUCTOR:** **Kenneth R. Laker**
 1. Email: laker@seas.upenn.edu
 2. Office: 203D Moore Complex
 3. Office hours: M & W 5:00 to 6:00 PM;
Th 2:00 to 3:00 PM or by appointment
 - **CLASS:** M, W & F 11:00 AM – 12:00 N, 315 Towne
 - **LAB:** Th 12:00 – 3:00 PM or F 1:00 – 4:00 PM, RCA Lab
 - **TA:** **TBD**
 1. Email: TBD
 2. Office: TBD
 3. Office hours: TBD
 - **TEXT:** **Sedra/Smith Microelectronic Circuits – 5th Ed.**
 - **COURSE WEBSITE:** <http://www.seas.upenn.edu/~ese319/> + Blackboard
 - **SOFTWARE:**
 1. NI Multisim on all RCA Lab PCs (Student Edition available)
-



Course Outcomes

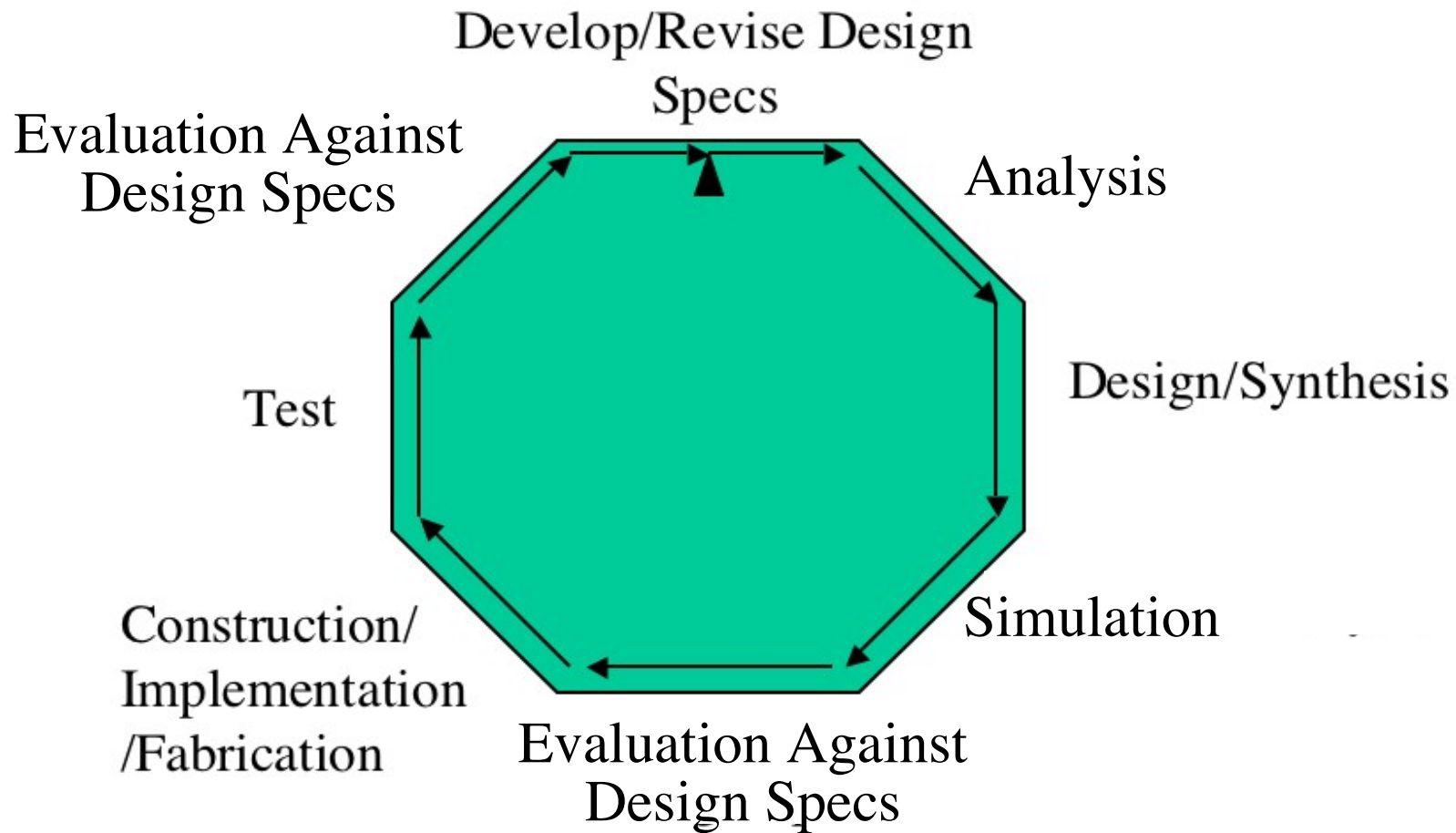
- **Theory and Analysis**
 - a1. Apply principles of component-insensitive design of semiconductor systems.
 - a2. Apply principles of differential amplifier analysis.
 - a3. Apply High frequency models of BJT circuits.
 - a4. Apply concepts of feedback, including stability, instability and oscillators.
 - a5. Apply basic analog filter concepts.
 - a6. Apply principles of Class A, B, and AB power amplifiers.
 - a7. Design an op amp to specs and experimentally evaluate its performance.
- **Design and Practice**
 - c1. Design, simulate, construct and test of semiconductor systems covered in class to relevant specs.
 - ♦ c2. Develop 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.
- **Use of Computer Tools**
 - k1. Apply circuit CAD tools used to each of the design tasks in Outcomes c1 & c2 above.



Analog Electronic Circuit Design

- Preliminary design inherently a pencil and paper 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 II

- **Real-world 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.

Analog Low-Pass Filter Design



<http://www.home.agilent.com/agilent/editorial.jspx?id=875011&NEWCCCLC=INeng>



The Design Experience

- **Took many engineers many years to develop the design techniques we will learn.**
- **These techniques**
 1. Amenable to pencil and paper solutions.
 2. Compensate for transistor temperature sensitivity and inherent variability.
 3. Give analytical results reasonably close to practice.



Overall Course Grading Policies

- **2 Mid-term exams** **15 % each**
- **Final exam** **30 %**
- **Homework** **10 %**
 1. See slide 11 for Homework Policy.
- **Laboratory** **30 %**
 1. See slides 12 - 14 for Lab Policy.



Actual Course Grading



<http://www.home.agilent.com/agilent/editorial.jspx?id=875011&NEWCCLC=INeng>



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 Friday the week after assigned) 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 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 than 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.
 - 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, 11Sept09**
 - **BJT Introduction**
 - **S&S pages 377 - 398**
- **Don't forget to download the handouts!**
- **No lab this first week of class.**
- **First Lab Meetings: Thursday 24Sep09,
Friday 25Sep09 (3rd week of class)**



Explore and Have Fun!



<http://www.home.agilent.com/agilent/editorial.jsp?id=875011&NEWCCLC=INeng>