Circuits, Devices, and Systems

Department of Electrical and Computer Engineering
University of California, Santa Barbara

Instructor: Dr. Ilan Ben-Yaacov, ilan@engineering.ucsb.edu
Office: Room 2213 Engineering Science Building (ESB)
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Lecture: Tues/Thurs 3:30 – 4:45 pm, NH 1006
Office hours: Tues 2:15-3:15pm and Wed 11am-12pm in ESB 2213
Course Website: http://my.ece.ucsb.edu/ECE2B_W2006

Teaching Assistants:

Adam Brill	AdamEtrnal@aol.com
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TA Office Hours: During Lab Hours

Lab/TA Office Hours and Location (Subject to change, updates posted on the website)

Section	*Day*	*Time*	*TA*	*Location*
11072	W	8:00- 10:50am	Andree Ng	ENGR 5162C
11080	T	7:00- 9:50pm	Eric Torkildson	ENGR 5162C
11098	W	7:00- 9:50pm	Kellen Gillispie	ENGR 5162C
11106	R	7:00- 9:50pm	Adam Brill	ENGR 5162C
11114	W	12:00-2:50pm	Jon Heilman	ENGR 5162C
11122	F	9:00- 11:50am	Thomas Shen	ENGR 5162C

Course Description:
This is the second course in the sequence entitled Circuits, Devices, and Systems. The content of this course focuses on the use of active devices, mainly in amplifier circuits that form the basis for most applications in electronics. This topic is a special application of the circuit theory that you learned in ECE2A or equivalent. You will find that nodal analysis, Thevenin and Norton theorems, principles of superposition, phasors, and other basic tools of network analysis will be used in this course.

Required Text:
Electronic Devices and Circuit Theory, 9th Edition, by R. L. Boylestad and L. Nashelsky, 2006
ISBN 0-13-118905-0

Course Format:
There will be approximately 6-7 **homework assignments**, 3-4 **lab assignments**, one in-class **midterm exam** on Tuesday, February 14th, and a **final exam** on Thursday, March 23rd from 4:00 – 7:00 pm. Homework, labs, midterm, and final will each contribute 15%, 25%, 25%, and 35% to your final grade.

Course Objectives:

- Develop a qualitative understanding of the operating principles of active devices
- Learn to analyze and design circuits based on diodes
- Learn to analyze and design single stage amplifier circuits using the bipolar transistor
- Students will be able to, by the end of the quarter:
    - Use the current-voltage characteristics of the diode and BJT as a guide for choosing proper DC bias (Q) point or for using the device to perform nonlinear circuit functions
    - Be able to design a stable bias circuit for the diode and BJT
    - Be able to use small signal model of the BJT to analyze and design single stage amplifier circuits
    - Understand the basic properties of the integrated circuit operational amplifier (opamp) and design simple op-amp based circuits.

Homework:

- Homework will be assigned weekly and will be due the week after it is assigned unless otherwise noted.
- ***Homework must be placed in the box labeled ECE2B before it is due.*** The TA will pick them up from the box at the start of class. The box is located in the stairwell opposite the elevators on the fifth floor of Engineering I. Homework turned in after this time will be considered late. ***Late homework will not be accepted or graded.***
- Graded homework will be returned to you during your lab session.
- Homework must be legible, stapled and written on one side of 8 1/2" by 11" standard-sized paper. **Unstapled homework will be returned un-graded.**
- Each problem must be clearly labeled and appear in sequence. Underline or circle key steps and final answer. Homework solutions will be posted on the class website.

Labs:

- Labs will begin during the second week of the quarter (week of Jan. 16th).
- The T.A. will inform you about lab requirements and grading.
- The labs are all posted on the Class Website. You must print them out and bring them to your lab sections. **You must attend the lab section you are registered for!**
- If you took ECE 2A last quarter, you should already have a toolkit (Toolbox, clip leads, pliers, wire strippers/cutters, breadboard). ***If you don't already have a kit, you must purchase one,*** either from the Electronics Shop (Engineering I, Room 5110) or from some other source. Your tool kit must be purchased prior to the first lab. See lab handout sheet for additional information.
- Your first lab will have two parts that are graded. The first is a complete checklist of all lab kit items (worth 15 points). The second is you will be asked by the TA to successfully construct a circuit and test it (worth 10 points). There will be no lab writeup for Lab 0. A partially incomplete lab kit will earn 0 points (no partial credit) and no chance for makeup.

Laboratory Information

Lab Notebooks

You are required to maintain a bound lab notebook. Each page must be numbered and dated. All data, measurements, sketches of experiments, etc., are to be entered in ink (not pencil) in the book. It is a complete record of the experiments performed and the data gathered. The contents of the book are used to generate the Lab reports. The TA will check your lab book periodically.

Lab Reports

Lab reports must be typed, stapled, and written clearly and concisely using good grammar and spelling. The cover page should include your name and that of your lab partner, the day and time of your lab, and the name of your TA. *Everyone does an individual lab report for each experiment.* The lab report should be handed in to your TA *during your lab, in the week following the completion of your lab.* (For example, if Lab 1 requires 2 weeks for completion, you will hand in the report for that lab in the 3rd week). Any reports that have clear copying or reuse of data, graphs, etc. from other students or reports will have points deducted.

In your report, the following must be done and points will be deducted if they are not done:

- All figures must be computer drawn
- All figures must be numbered and labeled with a descriptive figure caption.
- The figure number must be referenced in the text.
- All equations must be numbered (Equation #) and referred to by equation number in the text.
- Equations must be computer typeset.
- All figures and equations must be included in-line with the text.
- Any data used to generate figures should be included as an appendix and the appendix listed in the table of contents.
- All pages must be numbered

Each report must contain the following sections:

1. **Table of Contents:** Section and subsection and their corresponding page numbers.
2. **Abstract**. At most a few sentences long, this states the main purposes and conclusions of the lab.
3. **Introduction**. At most a couple of paragraphs long, this expands upon the abstract in communicating the main purposes and conclusions of the lab, and its relationship to the lecture material.
4. **Calculations**. This section contains the circuit diagrams, derivations of formulae, and the calculations leading to the component values chosen.
5. **Results**. The measurements you made in tabular or graphical format, or both; choose what is most appropriate. All tables and graphs should be clearly labeled, including units.
6. **Discussion and Analysis**. Perhaps the most important part of the report, this should contain a clear and concise interpretation of your results and a discussion of their implications. *Comparisons between measured and calculated values should be addressed here, and any discrepancies explained.*
7. **Conclusions**. A brief summary of what you learned in this lab experiment, and the principal ideas that were demonstrated.

A sample lab report is posted online so that you know what is expected.