University of California, Santa Cruz
Electrical Engineering Department
EE-101, Fall 2015

Introduction to Electronic Circuits

Lecture Room: Kresge Classroom 327 (MW 5-6:45pm)
Laboratory Room: JBE 150
Instructor: S.C. Petersen
Teaching Assistants: Patrick Ellis, William Crawford
Office: JBE 251 (x9-4782)

Course Description:

This is a foundation course in the discipline of electrical engineering. It draws on applied physics and requisite mathematical models necessary to understand fundamental electrical components and how to analyze their interconnected behavior in electronic circuits. A complete foundation in electric circuit theory is first developed. This includes ideal components and building blocks: resistors and the concept of resistance; energy storage devices, inductors and capacitors; voltage and current sources. These will be used to develop *engineering models* of non-ideal components and to analyze and design linear planar electric and electronic circuits. The necessary tools for this are an understanding of constant and sinusoidal signals and various elementary circuit theorems: Ohms Law, Thevenin and Norton equivalents, linearity and superposition, voltage and current dividers, maximum power transfer. Building on Ohm's Law, we will discuss two analysis techniques: node-voltage and mesh networks. To make use of all of this we need to develop two critically important concepts: electric *systems* provide us a means to naturally abstract complicated circuits into a "black-box" having only input and output *ports*. Although a system can have any number of ports, we will confine our treatment to *linear* 2-port "black-boxes" or *networks* having one input and one output port. This perspective enables us to comprehend the associated concepts of *source* and *load* impedances based on the idea of "looking into" a port. Later courses, like EE171, or EE103, require an intuitive understanding of these ideas. The system perspective will be employed to understand natural and forced response of linear circuits. This will first be done with DC, and then with AC or time-varying sinusoidal signals. From the latter topic we will introduce the invention of *phasors*, a technique that greatly simplifies the design and analysis of linear networks involving only sinusoids; it also enables us to understand the closely related concept of *impedance*. Finally, several topics from elementary electronics will be covered: basic analog wave filters (low-pass, high-pass, etc.) and an introduction to the operational amplifier or "op-amp" as an ideal electronic building block. Several pervasive simulation tools used in later courses will also be introduced, notably PSpice and Matlab.

Laboratory and lecture are closely related and concurrent enrollment is required. Refer to the EE101L e-commons project for details and lab coordination.

References:

Required: <u>Fundamentals of Electric Circuits</u> , 5th ed. by Alexander and Sadiku, McGraw Hill 2013
A special abbreviated lower cost edition is available in the UCSC Bookstore. It contains the chapters relevant to this course.

Lecture notes (generally handed out in class but always posted to our website)

Supplementary references will be discussed in lecture and posted to our website.

Homework:

Homework will be assigned and collected during class sessions, and will generally follow a weekly sequence; solutions will be handed out in sections for some questions (or posted to our web site) on the date of collection. Material will consist of problems from our text and other sources, supplementary and extra-credit problems. To receive full credit, your work must be college-level: it must be well organized, literately readable and show evidence of thoughtful attention to the problem itself. In particular, use of math equations should be justified with appropriate comments or discussions. *Sloppy, difficult to follow submissions will not be considered for grading*. Letter grades will be assigned for all homework as described following:

A: complete and thoughtful solution; numerical correctness is *not* the sole criterion, conceptual correctness is.
B: thoughtful solution displaying clear evidence of attention to problem but some conceptual errors present.
C: numerically correct result(s) without evidence of conceptual understanding or thoughtful solution.
… to each of the above, **+** or **-** as appropriate…
D: numerically incorrect result(s) without evidence of conceptual understanding or thoughtful solution.
NC: no credit.

Homework in this class is important. It is the only means students have to exercise their grasp of concepts and skill using mathematical techniques. That's why it's worth 1/3 of your grade. Take it seriously and resolve to spend considerable time on it well ahead of the due date. Evidence of copying between students will result in no credit for that assignment for all involved – regardless of who actually "worked" the problem(s). Note that I do not object to students studying together; I do object to plagiarism. Indicate on your homework any students you collaborated with and explain the degree of their contribution to your work.

Examinations: There will be one and possibly two midterm exams and a comprehensive final exam.

Evaluation: Letter grades will be assigned for all work. Averaging will follow the usual 4.0 point scale to determine a final grade point and associated letter grades.

Homework	1/3
Midterm(s)	1/3
Final	1/3

Academic Integrity:
The student-instructor relationship is based on imputed trust. Violations of this trust by deceptively offering the work of others as your own, cheating on examinations etc. will result in formal charges of academic dishonesty being brought against you.