EE 323 Microelectronic Circuits I

Designation: Required

Catalog Description:
EE 323 Microelectronic Circuits (3) Semiconductor structures, operating principles and characteristic of diodes and amplifying devices. Their application as circuit elements in building basic digital, analog, and integrated circuits subsystems.

Credits: 3

Pre-requisites: EE 213 “Basic Circuit Analysis II”

Class/Lab Schedule: 3 lecture hours per week.

Topics Covered:
- Introduction: Signals, amplifiers (circuit models, frequency response), circuit simulation. (1 week)
- Op amps: Ideal, inverting, non-inverting, difference, other effects (finite gain, BW, saturation, current limits, slew-rate, full-power BW, offset voltage, input bias, offset currents), integrators and differentiators. (2 weeks)
- Diodes: The pn junction, ideal diode, forward-bias, reverse-bias, breakdown, modeling forward-bias, zener diodes, rectifiers, schottky-barrier diode, varactors, photodiodes, LEDs. (3 weeks)
- MOSFETs: MOS capacitor, MOSFET, IV characteristics, MOSFET circuits at DC, MOSFET as an amplifier, and switch, biasing, small-signal operation and models, single-stage amplifiers, internal capacitances, frequency response, depletion-type MOSFET. (4 weeks)
- Bipolar Junction Transistors (BJT)s: Device structure and operation, IV characteristics, BJT as an amplifier and switch, BJT circuits at DC, biasing small-signal operation and models, single-stage amplifiers, internal capacitances, frequency response. (3 weeks)

Textbook and Other Required Materials:

Course Objectives and Relationship to Program Objectives:
A student should understand (i) Physical basics of semiconductor devices, (ii) the ideal and the more complex models, (iii) analyze and design discrete electronic circuits using op amps diode, BJT, and MOSFETS , (iv) consider the basic design of ic system.
[Program objectives this course addresses 1,3,4]

Course Outcomes and Their Relationship to Program Outcomes
- Physical basics of electronic semiconductor devices (1)
- Understand basic circuit models of devices and applications (1)
- Design circuits and systems to meet specified needs (3)
• Identify and formulate electronic circuits to solve engineering issues (5)
• Demonstrate knowledge of contemporary devices. (9, 11)

**Contribution of Course to Meeting the Professional Component**
Engineering Topics: 100%

**Computer Usage:**
Negligible.

**Design Credits and Features:**
EE 323 has one design credit. About 30% of the homework assignments are specified design problems in the text.

**Instructor(s):** Aaron Ohta, Olga Boric-Lubecke, David Garmire

**Person(s) Preparing Syllabus and Date:** K. Najita, February, 2003, Modified June, 2009 Aaron Ohta and Anthony Kuh