EE 326 Microelectronic Circuits II

Designation: Elective

Catalog Description: EE 326 Microelectronic Circuits II (3) Principles and design of linear electronic circuits including differential, operational, feedback, and tuned amplifiers; integrated circuits, current mirrors, signal generators, filters, and stability. Pre: 323.

Credits: 3
Pre-requisites: EE 323 “Microelectronic Circuits I”
Class/Lab Schedule: 3 lecture hours and one 3 hour laboratory per week (see EE 326L)

Topics Covered:

- Amplifier topologies including CS, CD, CG, CE, CC, and CB topologies.
- Differential and multistage amplifiers using bipolar and MOS devices
- Current mirrors: Basic, steering, Wilson, and Widlar sources. Input / output resistance, gain, transimpedance amplification
- Frequency response of amplifiers: Open- and short-circuit techniques, time constants
  Bode plots and techniques for rapid assessment of amplitude and phase
- Oscillators
- Feedback: Topology, characteristics, stability and frequency compensation
- Filters and Tuned Amplifiers: Signal generators and waveform-shaping circuits
- Analog Integrated Circuits: analysis of op amp integrated circuits and applications, slew rate and common-mode rejection
- Digital logic: Pull-up networks, pull-down networks, topology of NOT/AND/OR/ etc…
  logic circuits
- Noise: Types of noise and analysis of Johnson noise

Text Book and Other Required Materials: “Microelectronic Circuits”, A. S. Sedra and K. C. Smith

Course Objectives and Their Relationship to Program Objectives:
A student should understand (i) principles of operation of linear electronic circuits, (ii) the principles of analog circuit design, and (iii) develop skills for evaluating circuit performance. In addition, a student should master modern design methods for analog circuits, including appropriate computer-aided design (CAD) tools. [Program Objectives this course addresses: 1, 2, and 4.]

Course Outcomes and Their Relationship to Program Outcomes:
The following are the course outcomes and the subset of Program Outcomes (numbered 1-11 in square braces "[ ]") they address:

- Understand principles of operation of BJT and MOSFET differential and multistage IC amplifiers. [3,5,11]
- Understand principle of operation and applications of basic IC current sources and mirrors. [3,5,11]
• Characterize amplifier frequency response. [2,3,4,5,11]
• Understand operation of oscillators. [3,5]
• Analyze feedback effect on amplifier performance. [2,3,4,5,11]
• Understand filter operation and applications in tuned amplifiers. [3,5,11]
• Understand and evaluate op amp performance. [2,3,4,5,11]
• Understand and analyze noise performance of analog circuits. [3,5]

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

Computer Usage:
Students use Microsoft Excel for processing of data and presentation of charts and graphs, Pspice for simulation, and MATLAB for computing. The course also makes use of Internet services such as email for Q&A and the web for references, and web-based tutorials.

Grading:
25% Homework
20% Midterm
20% Project
35% Final

Design is incorporated into the final project for the course. Each student works in a team of 3 to 4 to design a microelectronic circuit using material from the course. Students give presentations on their work at the end of the semester and submit written final reports.

Instructors(s): D. Garmire

Person(s) Preparing Syllabus and Date: D. Garmire (9/2008), based on O. Boric-Lubecke and F. Koide, February 21, 2003