

EE 326L Microelectronic Circuits II Lab

Credits: 1

Categorization of credits: engineering topic

Instructors or course coordinator: Jeffrey Weldon

Textbook and Other Required Materials:

Sedra, Adel S., and Kenneth C. Smith. *Microelectronic Circuits Revised Edition*. Oxford University Press, Inc., 2007.

Designation: Elective (required for EP track students)

Catalog Description: EE 326L Microelectronic Circuits II Lab (1) (1 3-hr Lab) Laboratory for 326, experiments on linear and analog electronics. Pre: 323L. Co-requisite: 326. DY

Pre-and Co-requisites: Pre: EE 323 (Microelectronic Circuits I) and EE 323L; Co: EE 326

Class/Lab Schedule: one 3 hour laboratory per week

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

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 building, measuring, and 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 1-7 in square braces "[]") they address:

- Understand principles of operation of BJT and MOSFET differential and multistage IC amplifiers. [1, 2]
- Understand principle of operation and applications of basic IC current sources and mirrors. [1, 2]
- Characterize amplifier frequency response. [1, 2, 5, 6]
- Understand operation of oscillators. [1, 2]
- Analyze feedback effect on amplifier performance. [1, 2, 5, 6]
- Understand filter operation and applications in tuned amplifiers. [1, 2]
- Understand and evaluate op amp performance. [1, 2, 5, 6]
- Understand and analyze noise performance of analog circuits. [1, 2]
- Ability to fabricate or build circuits to meet specifications. [1, 2, 6]
- Ability to test and evaluate circuits in a professional manner. [1, 2, 6]
- Work in teams to effectively execute a research / experimentation plan. [1, 3, 5]
- Ability to produce professional quality final project report documenting design, approach, experimentation, results, and summarization of results to the community. [1-7]

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.

Design Credits and Features: 1 design credit

Design is incorporated into the laboratory exercises for the course.

Person Preparing Syllabus and Date: D. Garmire, 2014. Modified by A. Ohta, Jan. 12, 2021.