CALIFORNIA STATE POLYTECHNIC UNIVERSITY, POMONA

ETE 318

COURSE OUTLINE

Course Information	**ABET Unit Classification** (4 Quarter Units)	
Department: Engineering Technology	Math:	
Course Number: ETE 318/318L	Basic Science:	
Course Title: Linear Integrated Circuits/Lab	Engineering Topics:	4
Revision Date: 12/14/04	*Contains significant design content:*	Yes
Revised by: Lyle B. McCurdy	Other:	
Compliant: Catalog 2004/05	Curriculum Designation:	Required

I. Catalog Description

ETE 318/318L Linear Integrated Circuits/Lab (3/1)

Ideal op-amps and applications including basic integrators and differentiators; DC offsets and compensation; slew-rate limiting; open and closed-loop bandwidth, stability and compensation; active filters; op-amp applications including Schmitt triggers, oscillators, and wave shaping circuits, etc. 3 lectures/problem solving and 1 three-hour laboratory. Prerequisites: ETE 305, 310.

II. Prerequisites and Corequisites

ETE 305, ETE 310. Students are expected to have a working knowledge of basic idealized op-amp circuits and applications from ETE 310 and its lab. This includes idealized inverting and non-inverting amplifiers, adders, subtractors, integrators and differentiators.

III. Textbook and/or other Required Material

Bogart, T.F., J.S. Beasley and G, Rico, Electronic Devices and Circuits, Prentice Hall, 6th edition, or equivalent.

Keown, John, OrCAD PSpice and Circuit Analysis, Prentice Hall, 4th Edition or equivalent.

IV. Course Objectives

Upon successful completion of this course, each student will be able to:

1. Compute cm and dm output voltages of a differential amplifier and select components for classical inverting and non-inverting amplifiers, adders, subtractors, integrators and differentiators, etc. (review of ETE 305 and 310).
2. Work with non-ideal characteristics of op-amps including DC offsets and compensation, slew rate limiting, and frequency instability and compensation.
3. Work with classic op-amp switching circuits such as schmitt triggers, multivibrators, and triangle waveform generators using op-amp integrators and diode steering circuits, and classic op-amp active filters and sinusoidal oscillators such as RC phase shift oscillators, etc.
4. Simulate op-amp circuits using Pspice in lecture and lab.
5. Work effectively on teams in lab to gather data, assimilate results, and write formal laboratory reports that meet professional writing standards.

V. Expanded Course Description

1. **Idealized op-amp circuits** (2 weeks)
   Characteristics of ideal op amps. Classical inverting and non-inverting op-amp configurations including amplifiers, adders, subtractors, integrators and differentiators, etc. Use of Pspice simulations.
2. **DC Offsets and Compensation** (1 week)
   Modeling and compensation of DC offsets in op-amps including Ibo, Ios, and Vos.
3. **Frequency Response and Compensation** (3 weeks)
   Effects of slew rate limiting; op-amp frequency response, stability, and compensation using bode plots. Use of Pspice simulations.
4. **Switched-Mode Op-Amp Circuits** (2 weeks)

Analysis and design of classic op-amp switching circuits such as schmitt triggers, multivibrators, and triangle waveform generators using op-amp integrators and diode steering circuits. Use of Pspice simulations.

5. **Op-Amp Filters and Sinusoidal Oscillators** (2 weeks)
Analysis and design of classic op-amp active filters and sinusoidal oscillators such as RC phase shift oscillators, etc. Use of Pspice simulations.

VI. Class/Laboratory Schedule

Lecture: Two 75 minute sessions per week.
Lab: One 3 hour session per week.

VII. Contribution of Course to Professional Component

Lecture: Students learn to analyze, design, and to develop an understanding of the characteristics and limitations of operational amplifier circuits.

Lab: In lab, students learn to analyze, design, set up test apparatus, test, and record pertinent data associated with typical op-amp circuits. They also learn to assimilate and document comparisons of theoretical, experimental, and Pspice-simulated results into formal laboratory reports written to professional standards as specified by the laboratory instructor.

VIII. Evaluation of Students

The instructor evaluates outcomes using the following methods: homework assignment submittals, midterm and final exams, one-on-one discussions during office hours, laboratory experiments, and laboratory reports.

The student grades are typically based on the following factors: quizzes, homework, midterm exam and final Exam.

IX. Relationship of Course Objectives to Program Outcomes

Crse Obj	Program Outcomes										
	(a) **Use of modern tools of discipl**	***(b)*** **Use of math, science, Engg & Tech**	***(c)*** **Do experi -ments**	***(d)*** **Dsn of sys & compo nents**	***(e)*** **Work on teams**	***(f)*** **Do Tech probs**	***(g)*** **Eff Com**	***(h)*** **Life-long learn**	***(i)*** **Prof, ethics, social resps**	***(j)*** **Prof, soc, globl, diversity**	***(k)*** **Qual, Cont impr, timeliness**
1		X		X		X					
2		X		X		X					
3		X		X		X					
4	X					X					
5	X	X	X	X	X	X	X				

X. **Typical Laboratory Experiments.** Here, the students are expected work with linear integrated circuits in practical laboratory applications. Circuit simulations using Pspice is required. The following labs are oriented to achieve this purpose:

Lab 1. Basic operational amplifier circuits (review of ideal circuit applications for ETE 310).
Lab 2. DC Offsets and Compensation.
Lab 3. Slew rate limiting, frequency response, stability and compensation.
Lab 4. Characteristics and stability of op-amp integrators and differentiators.
Lab 5. Triangle-wave function generators -- use of schmitt triggers, integrators, and diode steering circuits.
Lab 6. RC phase shift oscillator
Lab 7. Butterworth high pass filter.