CALIFORNIA STATE POLYTECHNIC UNIVERSITY, POMONA

ETE 414

COURSE OUTLINE

Course Information	**ABET Unit Classification** (4 Quarter Units)	
Department: ECET	Math:	
Course Number: ETE 414	Basic Science:	
Course Title: Linear Amplifier Circuits/Laboratory	Engineering Topics:	4
Revision Date: 12/14/04	*Contains significant design content:*	yes
Revised by: Lyle McCurdy	Other:	
Compliant: Catalog 2004/05	Curriculum Designation:	Elective

I. Catalog Description

ETE 414/L Linear Amplifier Circuits/Laboratory (3/1)

Analysis of multistage and large signal amplifiers. Frequency response. Ideal and non-ideal negative feedback amplifiers and their characteristics. Oscillators. 3 lectures/problem-solving and 1 three-hour laboratory. Prerequisites: ETE 305, 310.

II. Prerequisites and Corequisites

Students are expected to have a working knowledge of BJT and FET CB/CG, CE/CS, and CC/CD amplifiers including biasing (h bias, one and two-power supply bias and self bias); DC and AC load lines and the Q-point, maximum signal swing; input/output impedance and gain calculations; and frequency response calculations including interelectrode capacitancance effects prior to registering for this course.

III. Textbook and/or other Required Material

Pierce, J. F. and J. Paulus, <u>Applied Electronics,</u> Techbooks, 1991, ISBN 1-878907-42-5, Williamsburg Court, Fairfax, VA, 1991.
Keown, <u>OrCAD PSpice & Circuit Analysis</u>, 4th ed., or equivalent

IV. Course Objectives

After completing this course the student will be able to:

1. Analyze/design negative feedback amplifiers using discrete active devices, to include voltage-voltage, current-current, voltage-current, and current-voltage feedback.
2. Analyze/design negative feedback systems, including sample/sum configurations, including loop gain calculations and idealized/true input/output impedance calculations.
3. Analyze/design negative feedback systems for gain-bandwidth and frequency stability, and be able to compensate said amplifiers using loop-gain and dominant-pole compensation techniques.
4. Analyze/design negative feedback audio power amplifiers including power requirements at the load, frequency response, stability, and thermal requirements.
5. Work in team settings to assemble and test representative negative feedback circuits and compare the results with theoretical and Pspice-simulated data, and document the results into formal laboratory reports that meet professional writing standards.

V. Expanded Course Description

1. Characteristics of idealized multistage transistor-circuit negative feedback (nfb) amplifiers. (2 weeks)
   Recognizing sample-sum circuits of V-V, I-I, V-I, and I-V nfb amplifiers and their ideal characteristics.
2. Loop gain and true input/output impedance calculations for non-idealized multistage nfb amplifiers. (1 week)
   Methods of loop-gain, including open-loop and closed-loop gain of nfb amplifiers.
3. Frequency response, stability, and compensation of negative feedback amplifiers. (3 weeks)
   Methods for calculating and plotting of the open and closed-loop frequency response of nfb amplifiers including gain-magnitude and phase response; determining stability, and using gain and dominant-pole compensation.
4. Associate characteristics of multistage nfb circuits to block-diagram control system counterparts. (2 weeks)
   Methods of modeling discrete multistage nfb amplifiers in block diagram form and determining system response.
5. Audio Power Amplifiers. (2 weeks)
   Power gain and stability in discrete nfb audio power amplifiers.

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 negative feedback amplifier circuits.

Lab: A wide range of measurement techniques are used in lab exercises. Students learn to design/analyze circuits, simulate test results with PSpice, set-up test apparatus, gather data and to prepare technical reports.

VIII. Evaluation of Students

The instructor evaluates outcomes using the following methods: homework assignment submittals, written in-class midterm and final exams, one-on-one discussions during office hours, laboratory experiments, laboratory reports. Student grades are typically based on the following factors: quizzes, homework, midterm exam and final Exam.

IX. Relationship of Course 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, timeli ness**
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 single and multi-stage BJT and JFET amplifiers in the frequency domain in practical laboratory applications. Circuit simulations using Pspice is required. The following labs are oriented to achieve this purpose:

Lab 1. Analysis/design of a CS-CE nfb amplifier, considering mid-band loop gain. Pspice simulation and formal laboratory report required.

Lab 2. Analysis/design of a CS-CE nfb amplifier, considering frequency and transient response. Pspice simulation and formal laboratory report required.

Lab 3. Analysis/design of a CS-CE nfb amplifier, considering frequency stability and compensation. Pspice simulation and formal laboratory report required.

Lab 4. Analysis/design of a three-stage RC-coupled nfb amplifier, considering gain, frequency response, stability and compensation. Pspice simulation and formal laboratory report required.

Lab 5. Analysis/design of a closed-loop audio power amplifier with diff-amp input and complementary output, considering power, gain, frequency response, stability and compensation. Pspice simulation and formal laboratory report required.