CALIFORNIA STATE POLYTECHNIC UNIVERSITY, POMONA

ETE 210

COURSE OUTLINE

Course Information	**ABET Unit Classification** (4 Quarter Units)	
Department: Engineering Technology	Math:	
Course Number: ETE 210/210L	Basic Science:	
Course Title: Electrical Circuit Analysis/Lab	Engineering Topics:	4
Revision Date: 05/27/05	*Contains significant design content:*	Some
Revised by: Lyle B. McCurdy	Other:	
Compliant: Catalog 2004/05	Curriculum Designation:	Required

I. Catalog Description

ETE 210/210L Electrical Circuit Analysis/Lab (3/1)

RLC circuits, transfer functions, frequency response, Bode plots, passive filters, and resonance. 3 lectures/problem-solving and 1 three-hour laboratory. Prerequisites: ETE 103.

II. Prerequisites and Co-requisites

Students are expected to have a working knowledge of DC and AC circuit analysis including phasors for AC impedance calculations of series, parallel and series-parallel circuits. They are also expected to have a basic knowledge of transients in simple RC and RL circuits.

III. Textbook and/or Other Required Material

Boylstad, <u>Introductory Circuit Analysis 10/ed,</u> Prentice-Hall, 2003. ISBN 0-13-097417-X, or equivalent.
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. Compute the time response of typical RC and RL circuits and RC integrators and RC differentiators to pulses of varying width. This will include knowing how and why compensation of 10x scope probes is required.

2. Write transfer functions for high and low-pass RC filters in radians and hertz. Mathematically separate transfer functions into gain-magnitude and phase components using complex conjugates and plot gain-magnitude and phase response bode plots on semilog axes using the four standard bode-plot response forms.

3. Compute center and half-power frequencies of series and parallel RLC resonant circuits.

4. Solve two-port network problems using impedance and hybrid parameters. And be able to obtain hybrid parameters from typical active-device curves of base-emitter and collector characteristics.

6. Utilize Pspice in lecture/lab and work in teams to compare theoretical, measured, and simulation data and write formal reports to professional standards.

V. Expanded Course Description

1. Time and frequency response of RC integrators and RC differentiators (2 weeks)

Time and frequency response of RC integrators and differentators, including pulse testing techniques. Simulate circuit response using Pspice.

2. Frequency response of low, high, and band-pass RC filters (2 weeks)

Techniques for writing first-order high and low-pass RC filter transfer functions in frequency-domain form, including the process of using complex conjugates to separate functions into their gain-magnitude and phase components, and how to make corresponding bode plots of these functions on suitable semi-log charts, including mid-band gain. Simulate circuit response using Pspice.

3. Series and parallel RLC resonance (2 weeks)

Techniques for writing the transfer function in frequency-domain form for series and parallel resonant circuits. And, compute the maximum, center and half-power frequencies. Simulate circuit response using Pspice.

4. Hybrid parameters and use for gain and input/output impedance calculations (2 weeks)

Use of graphical techniques to determine hib, hie, hoe, and hfe from BJT characteristic curves. Use h and equivalent hybrid-pi parameters in suitable models of active-devices to compute input/output impedance and gain expressions.

5. Characteristics of Ideal Amplifiers (2 weeks)

Impedance and gain characteristics of ideal VV, II, VI, and IV amplifiers. Simulation of circuits using Pspice.

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 write transfer functions of low, high, and band pass RC filters; phase lead and lag RC networks; and use complex conjugates to separate functions into gain-magnitude and phase components and sketch bode plots on semilog axes. Write transfer functions of series and parallel RLC resonant circuits and plot their response. Determine h-parameters from device curves and convert them into small signal models to compute input/output impedance and gain. Work with four idealized forms of amplifiers -- VV, VI, IV, and II.

Lab: Numerous measurement techniques are used in lab. Students learn to analyze passive RC, RC, and RLC 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, midterm and final exams, one-on-one discussions during office hours, laboratory experiments, and 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

	Program Outcomes										
Crse Obj	***(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		x		x					
5	x	x	x	x		x					
6	x				x		x				

X. Typical Laboratory Experiments. Here, the students are expected work with simple RC filters and resonant circuits in the frequency and time domains in practical laboratory applications. Circuit simulations using Pspice is required. The following labs are oriented to achieve this purpose:

Lab 1. Introduction to pulse waveforms and measurements. Need and use of 10X probes; probe compensation. Pspice simulation and formal laboratory report required.

Lab 2. Time and frequency response of high-pass and low-pass RC filter circuits; techniques for making bode plots of respective gain-magnitude and phase. Pspice simulation and formal laboratory report required.

Lab 3. Time and frequency response of band-pass RC filter circuits; techniques for making bode plots of band-pass gain-magnitude and phase. Pspice simulation and formal laboratory report required.

Lab 4. Time and fequency response of phase lead and lag RC circuits; techniques for making bode plots of lead and lag circuit gain-magnitude and phase response. Pspice simulation and formal laboratory report required.

Lab 5. Frequency response of series and parallel RLC resonant circuits. Pspice simulation and formal laboratory report required.