CALIFORNIA STATE POLYTECHNIC UNIVERSITY, POMONA

ETE 350

COURSE OUTLINE

Course Information		**ABET Unit Classification** (4 Quarter Units)	
Department:	Engineering Technology	Math:	
Course Number:	ETE 350/350L	Basic Science:	
Course Title:	Feedback Systems Technology	Engineering Topics:	4
Revision Date:	3/18/05	*Contains significant design content:*	Yes
Revised by:	Massoud Moussavi	Other:	
Compliant:	Catalog 2004/05	Curriculum Designation:	Required

I. Catalog Description

Modeling of continuous systems in frequency and time domains, block diagrams, first and second order system response, reduction of multiple subsystems, feedback control systems including; phase- locked-loop and PID, transient response, steady state behavior of feedback systems, sensitivity, stability analysis using criteria of Routh-Hurwitz and root locus technique, Computer methods utilized. 3 lectures/problem-solving and 1 three-hour laboratory Prerequisites: ETE 310 and MAT 132.

II. Prerequisites and Co-requisites

ETE 310/310L and MAT 132; Students are expected to have a good theoretical, analytical, and practical knowledge of first and second order passive/active networks in frequency domain, laplace transform, Transfer function, frequency responses.

III. Textbook and/or other Required Material

Norman S. Nise, Control Systems Engineering, 4th Edition, John Wiley & Sons Pub. Co.,
ISBN: 0-471-44577-0

IV. Course Objectives

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

1. Understanding of electrical, mechanical, and electromechanical transfer functions.
2. Understanding of poles, zeros, stability of first and second order systems.
3. Understanding of block diagrams, reduction of block diagram, analysis and design of feedback systems.
4. Analysis of the stability of a system using Routh Hurwitz criterion.
5. Analysis of steady-state error for; unity and non-unity feedback systems, disturbances, and static error constants and system type and sensitivity.
6. Understanding and analysis of phase-locked-loop and PID.
7. Understanding of stability and transient response and Root Locus techniques.

V. Expanded Course Description

A. Expanded Description of the Course

1. Transfer function analysis
Study of passive and active first and second order electrical, mechanical, and electromechanical systems through their transfer functions. (2 weeks)

2. **Poles, zeros, and stability**
   Study of poles, zeros, and stability; stable (over-damped, under-damped, and critically-damped), unstable, and semi-stable, of first, second, and higher order systems including phase-locked-loop and PID. (2 weeks)

3. **Block diagram and feedback systems**
   Study of open-loop and closed-loop (feedback) systems, block diagram representation of feedback systems, reduction of multiple subsystems, and development of block diagram for electronic networks. (2 weeks)

4. **Stability and Routh-Hurwitz criterion**
   Study of poles and stability of the feedback control systems using Routh-Hurwitz criterion (1 week).

5. **Steady state error and static error constants**
   Study of the steady state error for unity feedback systems: non-unity feedback systems; and disturbances; static error system type. (2 weeks)

6. **Stability, transient response, and Root Locus techniques**
   Study of stability, transient response, and Root Locus techniques in feedback control systems. (1 Week)

B. Typical Laboratory Experiments

First laboratory project: Motor speed control by position controller.

Second laboratory project: Motor speed control by pulse-width modulator.

Third laboratory project: Voltage-to frequency and frequency-to-voltage controllers in motor speed control.

Fourth laboratory project: Closed-loop proportional temperature controller.

Fifth laboratory project: Phase-lock-loop.

Sixth laboratory project: Design and analysis of a second order control system using MTLAB and SIMULINK

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 about analyze of feedback control systems including unity, non-unity, and disturbances. Using variety of methods for stability and error analysis.

Lab: Students learn how to build, simulate, test, and troubleshoot the variety of control systems including motor speed control; phase-lock-loop, and temperature controller. A wide range of measurement techniques is used in lab exercises including Program CC, MATLAB, and SIMILINK software tools.

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 & components**	***(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					X
2		X	X		X	X					X
3	X	X	X	X	X	X					X
4	X	X	X	X	X	X					X
5	X	X	X	X	X	X					X
6	X	X	X	X	X	X					X