EC402 Control Systems

2008/2009 Catalog Data:
Analysis of linear feedback systems, their characteristics, performance, and stability. The Routh-Hurwitz, root-locus, Bode, and Nyquist techniques. Design and compensation of feedback control systems.

Class/Lab Schedule:
LEC: 4 hrs/week Lab:Var

Status in the Curriculum: Elective

Coordinator: Alan Pisano

Textbooks and other required materials:
"Modern Control Systems", 11th edition, by Dorf and Bishop (Prentice Hall), 2008.

Prerequisites by topic:
EC401 Signals and Systems

Goals:
To provide students with:
1. An understanding of the methodology for modeling mechanical, electrical, and other types of dynamic systems using both frequency domain and state-space techniques.
2. An understanding of the fundamental analytical methods and tools used in control system design.
3. Ability to use MATLAB and SIMULINK to analyze and design control systems and compensators.
4. Ability to design feedback controllers and compensators to meet desired performance specifications.
5. Ability to apply the principles of feedback control to a variety of scientific disciplines (engineering, manufacturing, economics, etc.)

Course Outcomes:
As an outcome of completing this course, students should be able to:

1. Understand the methodology for modeling dynamic systems (electrical, mechanical, etc.)
2. Understand the transfer function approach to represent linear systems using Laplace transforms.
3. Understand state-space models and their relation to frequency domain models.
4. Understand the fundamental characteristics and properties of feedback control systems.
5. Understand methods of Routh-Hurwitz, Bode, Nyquist, Nichols, and root-locus in the analysis and design of control systems.
6. Understand the use of MATLAB and SIMULINK computer tools.
7. Understand the basics of "digital" control systems and how they differ from "analog" control systems.
8. Design feedback controllers and compensators to achieve desired performance specifications.
9. Laboratory investigation and discovery of the behavior and properties of feedback control systems.
10. Communicate the results of laboratory investigations in formal reports.

11. Collaborate with classmates in control system design assignments and laboratory investigations.
12. Understand how the methodology of feedback control can be broadly applied in society to such areas as economics, biology, manufacturing, aeronautics, etc

Course Outcomes mapped to Program Outcomes:

Program Outcomes	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**
Course Outcomes	**1-7**	**9**	**8,11**	**9-11**	**1-7**	**11,12**	**10**	**12**	**9**	**12**	**6**
Emphasis (1-5)	**5**	**4**	**4**	**3**	**5**	**2**	**3**	**2**	**3**	**2**	**4**

1=not at all; 5=a great deal;

Topics in Project Assignments (lab):
Dynamic models of electro-mechanical systems; transient response characteristics; performance specifications; properties of feedback control; stability; control system analysis and design using MATLAB and SIMULINK; controller design; compensation.

Contribution of Course to Meeting the Professional Component:
Engineering topics: 75%
Math & Basic Science: 20%
General Education: 5%

Prepared by: Alan D. Pisano, Adjunct Professor **Date:** June 5, 2009