George Mason University
School of Information Technology and Engineering
Department of Electrical and Computer Engineering

ECE 421 **Classical Systems & Control Theory** **SPRING 2005**
Professor Beale **Science & Technology II – 257** **703-993-1596**
http://ece.gmu.edu/~gbeale/ece_421/syl_421.html gbeale@gmu.edu

OFFICE HOURS: Tuesday and Thursday: 1:30 – 2:45 p.m.
Wednesday: 5:30 – 7:00 p.m.
Other hours by appointment only.

PREREQUISITES: Grade of C or better in ECE 220 or POI.

COURSE TEXT: *Modern Control Systems*, 10th Edition,
R.C. Dorf and R.H. Bishop, Prentice Hall, 2005,
Chapters 1, 2, 4 – 10.

HONOR AND EXAM POLICY:

All students are expected to abide by the George Mason University Honor Code. Sharing of ideas and comparison of answers on homework is acceptable, but copied work will not be accepted. All tests and the final exam will be closed book and closed notes unless specifically stated otherwise by the Instructor. All work must be your own. Any reasonable suspicion of an honor violation will be reported.

Students must arrive in class within 15 minutes of the scheduled starting time for all tests and exams. Students arriving later than 15 minutes after the scheduled starting time will not be allowed to take the test/exam and will receive a grade of 0 for the test/exam.

OBJECTIVES:

1. Learn the purposes, advantages and disadvantages, terminology, and configurations of feedback control systems.
2. Learn ways of classifying, measuring, and analyzing the stability and performance properties of feedback control systems.
3. Learn various classical frequency domain and time domain techniques for designing compensators in order to improve performance in feedback systems.

GRADING:

2 Tests	50%
Homework	10%
Design Project	15%
Final Exam	25%

The lower test grade will count 20%, and the higher test grade will count 30%. Late homework will not be accepted. The lowest **non-zero** homework grade will be dropped in determining a student's homework average.

A student requesting a grade change for a homework or test problem must provide me with the following information in writing within two class periods after the work is returned: (1) the number(s) of the problem(s) to be considered; (2) a description of your mistakes made in the problem(s); and (3) the reason that you feel that you should receive additional points for the work.

COURSE OUTLINE

Chapter 1	Introduction, what control systems are, types of control systems, examples of control systems, what feedback is and why it is used – 1 class period.
Chapter 2	Block diagrams and their manipulation, signal flow graphs, Mason's gain formula – 4 class periods.
Chapter 4	Advantages of feedback systems, reduction of sensitivity to parameter changes, reduction in the effects of disturbances – 2 class periods.
Chapter 5	Transient analysis for systems, model and characteristics of second-order systems, steady-state errors in systems – 4 class periods.
Chapter 6	Stability of linear systems, stability analysis from the Routh array – 2 class periods.
Chapter 7	Closed-loop poles and their movement, concept of the root locus magnitude and phase criteria, constructing the root locus plot, properties of the root locus – 3 class periods.
Chapter 8	Frequency response analysis, review of Bode plots, gain and phase margins – 3 class periods.
Chapter 10	Specifications for control systems, designing compensators with root locus and in the frequency domain, phase lag and phase lead compensators, lag-lead compensation – 7 class periods.

TEST SCHEDULE:

Test 1	Tuesday, February 22	Chapters 1, 2, 4
Test 2	Tuesday, April 5	Chapters 5, 6, 7
Final Exam	Tuesday, May 17 1:30 – 4:15 p.m.	Comprehensive, with Chapter 10 emphasized

Last Day to Drop without Dean's Permission: Friday, February 25
No classes the week of March 13–20, due to **SPRING BREAK!!!**

References

[1] J.J. D'Azzo and C.H. Houpis, *Linear Control System Analysis and Design*, McGraw-Hill, New York, 4th edition, 1995.

[2] C.L. Phillips and R.D. Harbor, *Feedback Control Systems*, Prentice Hall, Upper Saddle River, NJ, 4th edition, 2000.

[3] Katsuhiko Ogata, *Modern Control Engineering*, Prentice Hall, Upper Saddle River, NJ, 4th edition, 2002.

[4] William A. Wolovich, *Automatic Control Systems*, Holt, Rinehart, and Winston, Fort Worth, TX, 3rd edition, 1994.

[5] Graham C. Goodwin, Stefan F. Graebe, and Mario E. Salgado, *Control System Design*, Prentice Hall, Upper Saddle River, NJ, 2001.