

**ECE-320 Linear Control Systems
Fall 2005**

Dr. Bob Throne
x-8414, Room D-221

Text: There is no single textbook that works for all topics. For most of the topics we cover, I will put some notes on the class website. These notes are similar to the notes I will be using in class but will generally will have different examples than those I use in class. However, these notes are not complete yet.

GRADING POLICY

Midterm Exam	20%
Final Exam	30%
Labs	25%
Homework/Matlab/Simulink	15%
Quizes	10%

Notes:

- (1) You must have a passing average (greater than or equal to 60%) on the exams to pass the class!
- (2) Homework assignments are **due at 1 PM on Tuesday**. No late homework will be accepted without prior approval.
- (3) You must acceptably complete each lab to pass the class.
- (4) For the majority of the labs, you will be required in the preceding homework to derive some relationships we will be using in lab or simulate a system (or systems). If you understand the homework the lab should not be a problem. You will be told which parts of the homework are required for the lab. You will receive a 0 on the corresponding lab if you have not done this acceptably! However, you must still complete the homework and do the lab to pass the course.
- (5) Many of the homework problems will require you to use Matlab or Simulink as part of the problem. If you do not do these parts of the problem, do not expect to receive credit for any parts of the problem.
- (6) You are expected to do your own work. You can certainly talk with each other and help each other, but the work you hand in should be your own. As an example, if two people hand in the same Simulink plot and both came from the same directory, neither will receive any points!
- (7) Unless specifically told otherwise on a particular problem, you are expected to work out the problem by hand (or use Matlab). *If you write on your assignment that you used Maple and are copying the answer, expect to get no points.* You can use Maple to check your answers. You cannot turn in any Maple code or plot as part of the solution to a problem.

Labs:

- 1) **You cannot use your laptop during the lab except for transferring files or running simulations.** I am sick and tired of people surfing the web and instant messaging during lab time, instead of paying attention to the lab. Points will be deducted for inappropriate behavior.
- 2) You will work in groups of two.
- 3) **Your lab must be printed out before coming to lab each week.** I reserve the right to deduct half of the lab points if you don't have your lab printed out at the time the bell rings. There are no prelabs (except for homework problems), so this is not all that much to ask. The printer in C-116 hardly ever works, so don't depend on it!
- 4) You need to read the lab before you come to lab. If you read through the lab you will (hopefully) get the *big picture* and understand what we are trying to do. If you just blindly follow the steps in the lab with no thought as to where you are going, you will get little from the labs.
- 5) You must write a short memo summarizing your results. This memo is due before your next lab period. You should include **as attachments** in the memo the plots and you made for the lab. The lab write up is generally to be computer generated and each graph needs to be labeled as a figure (with a caption). Usually students find it easier to just copy and paste all the figures they need into a document and explain the figure or answer questions as they are doing the lab.

SYLLABUS

Class 1 (9/1) - Laplace Transforms/Partial Fractions

Class 2 (9/5) – Laplace Transforms/Partial Fractions

Class 3 (9/6) – Laplace Transforms, Final Value Theorem

Lab 1 - Matlab, Simulink, the ECP systems

Class 4 (9/8) – Steady State Errors

Class 5 (9/12) - Response of 2nd Order Systems, Performance Specifications

Class 6 (9/13) - Characteristic Polynomial and Modes, Stability

Lab2 - Time and Frequency Domain System Identification (two 1 dof systems)

Class 7 (9/15) – Block Diagram Manipulation

Class 8 (9/19) – Model Matching (ITAE, Deadbeat)

Class 9 (9/20) - Quadratic Optimal Systems

Lab 3 – ITAE, Deadbeat, and Quadratic Optimal Systems

Class 10 (9/22) – Quadratic Optimal Systems

Class 11 (9/26) – Steady State Errors, System Type

Class 12 (9/27) – The Root Locus

Lab 4 – Root Locus Design (Matlab's sisotool)

Class 13 (9/29) – Root Locus for Compensator Design

Class 14 (10/3) -- Root Locus for Compensator Design

Class 15 (10/4) – Lag Compensators

Lab 5 – Root Locus (PID) Design

Class 16 (10/6) – **Midterm Exam**

Class 17 (10/10) - Coefficient Matching - Diophantine Equations

Class 18 (10/11) – Coefficient Matching - Diophantine Equations

Lab 6 - PI-D and I-PD Configurations

Fall Break

Class 19 (10/17) - State Variable Systems

Class 20 (10/18) – State Variable Systems

Lab 7 – Coefficient Matching- Diophantine Equations

Class 21 (10/20) – State Variable Systems

Class 22 (10/24) – System Sensitivity

Class 23 (10/25) – System Sensitivity

Lab 8 – State variable control for 1degree of freedom systems, regulator systems

Class 24 (10/27) – Routh Array

Class 25 (10/31) - Routh Array

Class 26 (11/1) - Bode Plots, Phase and Gain Margins

Lab 9 - State Variable Control of an Inverted Pendulum

Class 27 (11/3) - Bode Plots, Phase and Gain Margins

Class 28 (11/7) - Bode Plots, Phase Lead Compensators

Class 29 (11/8) - Nyquist Plots

Class 30 (11/10) - Nyquist Plots