Syllabus for ME6703
Linear Control Theory and Design I
Spring, 2007

Course Information

Instructor:	Dr. Maurizio Porfiri	
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	Office Hours: Tuesday 12:00-12:55	
Lecture:	Thursday 6:00-8:30	RH704
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Course Goals

This course presents the theory of time-varying linear systems with frequent specialization to time-invariant systems, and application to mechanical systems. Topics include stability, controllability, observability, realizability, and subspace methods. Students will develop a basic knowledge of linear systems theory that is of sufficient depth to begin reading the subject literature.

Prerequisites

It is assumed that all students have a working familiarity with matrix/vector analysis, transfer functions, and with state space representations of systems. ME6003 (Applied Mathematics in Mechanical Engineering) is a highly recommended corequisite, although it is not required.

Required Text

W. J. Rugh, Linear Systems Theory, 2nd edition, Prentice-Hall, 1996.

Homework

Homework will be assigned periodically. Each homework assignment must be typed on a word-processor. Use of LaTeX is encouraged, although other word processing platforms are certainly acceptable. Students must hand-in their own work. Students are permitted to discuss homework questions with other students, although they are not permitted to discuss solutions except in general terms. No late homework will be accepted except for exceptional and documented circumstances. Solutions for all assigned problems will be provided, although not all assigned problems will necessarily be graded. Significant weight in grading will be placed on clarity of presentation.

There are four homework assignments due at the start of class on:

1. Thursday, 27 September
2. Thursday, 18 October
3. Thursday, 15 November

4. Thursday, 13 December (This may vary due to final exam schedule)

Exams

There will be one mid-term, and one final exam. Exams will be administered in class and will test the student's comprehension and ability to apply material learned in class and through assignments. All tests are in-class, open book, closed notes. Formula sheets prepared by students will not be allowed. During exams, before beginning to solve assigned problems, students should briefly restate the problem and list the data given. Also, students should list the important concepts and formulae used to arrive at the final solution along with detailed work. Every page of every exam submission should have the student full name and section number. Illegible work and loose sheets will not be graded. Students must complete all exams on their own. If a student cannot attend an exam due to a medical condition, certified by a doctor, he/she must notify the instructor in advance. Unexcused absence from an exam will result in a grade of 0 for that exam.

Grading policy

Homework:	40%
Midterm Exam:	30%
Final Exam:	30%

Extra credit

There are no opportunities for extra credit. The grading policy allows for a "bad score".

Class attendance and absences

There are no formal requirements for attendance, and there is no direct penalty for missing class. Students are strongly encouraged to attend class since some course material will only appear in lectures. Students that miss class are responsible for obtaining class notes from a classmate.

Honor system

The honor system is in force for this course. It is assumed that all work submitted by a student is done so under the honor system code. **Homework questions may be discussed with students. Homework solutions may not be discussed.** The final exam must be completed individually.

ABET a-k criteria compliance

	a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*
ME6703	✓		✓	✓	✓	✓	✓		✓	✓	✓

(a) an ability to apply knowledge of mathematics, science, and engineering
(b) an ability to design and conduct experiments, as well as to analyze and interpret data
(c) an ability to design a system, component, or process to meet desired needs
(d) an ability to function on multi-disciplinary teams
(e) an ability to identify, formulate, and solve engineering problems
(f) an understanding of professional and ethical responsibility
(g) an ability to communicate effectively

(h) the broad education necessary to understand the impact of engineering solutions in a global and societal context

(i) a recognition of the need for, and an ability to engage in life-long learning

(j) a knowledge of contemporary issues

(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Tentative Lecture Schedule

Lecture	**Reading**	**Topic of the day**
Lecture 1 9/6/07	R 1, pages 1-16	Review of relevant mathematics
Lecture 2 9/13/07	R 2, pages 23-34	State equation representation
Lecture 3 9/20/07	R 3, pages 40-52	State equation solution
Lecture 4 9/27/07	R 4-5, pages 58-68	Transition matrix properties
Lecture 5 10/4/07	R 5, pages 74-92	Transition matrix properties: two important cases
Lecture 6 10/11/07	R 6, pages 99-110. R 8, 131-135	Internal stability
Lecture 7 10/18/07	R 7, pages 114-125	Lyapunov stability criteria
Lecture 8 10/25/07		**Midterm exam**
Lecture 9 11/1/07	R 9, pages 142-153	Controllability and observability
Lecture 10 11/8/07	R 10, pages 158-177	Realizability
Lecture 11 11/15/07	R 12, 203-214	Input-output stability
Lecture 12 11/29/07	R 13, pages 218-234	Controller and observer forms
Lecture 13 12/6/07	R 14, pages 240-257	Linear feedback
Lecture 14 12/13/07	R 15, pages 265-284	State observation