UNIVERSITY OF TEXAS

Department of Mechanical Engineering

DYNAMIC SYSTEMS AND CONTROLS

ME 344 (Unique #18230); Spring 2010

TTH 930-1100; ETC 2.114

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Office Hours
TTH 2:30-4:00

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Office Hours
MW 1:00-3:00

TENTATIVE SCHEDULE

WEEK	TOPICS	READING
1/18(HW Due)	Introduction; Energy/power concepts; Lumped parameters; power/energy variables	C 1, 2
1/25	One-port elements and sources: electrical, mechanical, fluid systems; Two-port components; introduction to bond graphs	C* 3, 4
2/1 (HW1)	Bond graph modeling and state variables; dependent/indep.	C* 5
2/8	State variables, derivation of state equations	
2/15(HW2)	Electrical & mechanical systems	
2/22	Thermal & electromagnetic systems (Review 1)	
3/1(HW3)	Operation for linear systems (Quiz 1)	C 7, 8
3/8	Solution of state equations: analytical and numerical	C 9
3/15	Spring Break	
3/22(HW4)	First- and second-order system, unforced, forced responses	
3/29	Eigenvalue/eigenvector solutions	
4/5(HW5)	Transfer functions and analysis (Review 2)	C 12, 14
4/12	Bode plots, system identification (Quiz 2)	
4/19(HW6)	Introduction to closed-loop automatic control	
4/26	Control design & applications	
5/3(HW7)	Modeling complex system, review	

Prerequisites: M472K, ME218 (or 318), ME324 and credit/registration in EE331K (ME340)

Text: D. Rowell & D.N. Wormley, *System Dynamics: An Introduction*, Prentice-Hall, 1997
Copy of Chapter 3 from the reference book

Ref*: D. Karnopp, D. Margolis & R. Rosenberg, *System Dynamics*, Wiley, 2000
Brief version of *System Dynamics* from the University Coop ((including Chapters 3, 4, &5)

Grading:	Homework	15%	No late HW accepted w/o prior approval/excuse
	2 Quizzes	50%	
	Final Exam	35%	

Course Evaluation: MEC form Scholastic dishonesty policy strictly enforced

Disabilities: The University of Texas at Austin provides upon request appropriate academic adjustments for qualified students with disabilities. For more information, contact the Office of the Dean of Students at 471-6259, 471-4241 TDD or the College of Engineering Director of Students with Disabilities at 471-4321.

OBJECTIVES

• Represent dynamical systems in mathematical terms (differential equations) using bond graphs
• Assess characteristic behavior of dynamic systems in the time and frequency domains
• Synthesize automatic controllers to achieve desired behavior

COURSE CATALOG DESCRIPTION

Lumped physical system models; electrical, fluid, mechanical, and thermal system analysis; linear system transient, steady-state behavior; introduction to feedback control.
Three lecture hours a week for one semester.

HOMEWORK POLICY

Homework will be assigned to support lecture material and reading assignments-approximately seven homework assignments plus one optional homework assignment. No late homework will be accepted except for illness or other extenuating circumstances. Students should bring a signed excuse from a health professional (if ill) or other authoritative professional (other extenuating circumstances).

EXAMINATION and LABORATORY POLICY

Two quizzes and one final examination will be given in the course. The material covered in the final examination is comprehensive and the two quizzes will test material covered in prior lectures. Final exam is scheduled at the end of the term. Quizzes will be given in March and April. The format of the exams will be discussed prior to the exam.

Make-up quizzes will not be provided. Signed excuses from appropriate professionals (i.e. doctors for illness, etc) must be turned in if an examination is not taken—otherwise a grade of zero will be assessed for that examination.

There will be no lab projects during the semester.

CLASS FORMAT

Lecture style.

ATTENDANCE

Regular class attendance is expected but roll will not be taken. Class participation will be noted.

IMPORTANT DATES

Refer to course catalogs.

KNOWLEDGE, SKILLS, AND ABILITIES STUDENTS SHOULD HAVE BEFORE ENTERING THIS COURSE

All materials covered in courses M 427K, ME 218 (318), and ME 324. Completion or co-registration in EE 331K (ME340) is required and basic knowledge of heat transfer and fluid mechanics. Special emphasis will be on mathematical modeling, solution of differential equations, and complex numbers.

KNOWLEDGE, SKILLS, AND ABILITIES STUDENTS GAIN FROM THIS COURSE

Students will gain experience in mathematical modeling of dynamics systems to determine response characteristics to design parameters, an appreciation for applied mathematics (using differential equations, complex numbers, etc.) and math applications (MatLab), and the ability to control the dynamic performance of dynamic systems.

IMPACT ON SUBSEQUENT COURSES IN CURRICULUM

This is a technical elective. It should help in the senior design projects course and mechatronics courses.

ABET EC2000 PROGRAM OUTCOMES ACHIEVED

1. Knowledge of and ability to apply engineering and science fundamentals to real problems
2. Ability to solve open-ended problems
3. Ability to design mechanical components, systems, and processes
5. Ability to use modern computer tools in mechanical engineering
8. Ability and desire to lay a foundation for continued learning beyond the baccalaureate degree.

ASME PROGRAM CRITERIA OUTCOMES ACHIEVED

b. Ability to apply advanced mathematics through multivariate calculus and differential equations.
d. Ability to work professionally in both the thermal and mechanical systems areas including the design and realization of such systems.

DESIGN ASSIGNMENTS

No special design assignments will be given. Students will be asked to design controllers in homework.

PROFESSIONALISM TOPICS

Not specifically covered.