ME 364L/397: Automatic Control System Design
Fall 2022, Unique No. 19429/19694

Instructor:	Prof. Raul G. Longoria
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Lectures:	TTH 11-12:30p, ETC 3.142
Office/hours:	TTH 1-2 pm and by appt (zoom)
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1. Course aims / objectives: The main goal of this course is to understand how to model and analyze linear controlled systems. This will require studying how feedback is used and how it influences system response and stability. Classical Routh, Nyquist, Bode, and root locus methods will be reviewed for these purposes, including essential mathematical tools for time and frequency domain design and analysis. State-space control principles will also be introduced, as they are used in many practical applications and form a basis for studying more advanced control methods.

2. Prerequisites: It is expected that you have familiarity with topics covered in ME 344 or an equivalent course (if you are a graduate student). ME 344 is a required prerequisite for undergraduates in this course. It is also expected that you are familiar with and can use Matlab or Python for analysis and simulation.

3. Format and procedures: This course is delivered using lecture-based presentation. Exercises and case studies will be completed in the form of homework assignments. Class discussion, in-class examples, and frequent short quizzes will be used to encourage engagement.

4. ME 364L vs 397: Graduate students should be registered for ME 397 (especially students in the ME Integrated BS/MSE program). As required by the graduate school, there will be explicit differences in assignments, quizzes, and expectations for students enrolled in the undergraduate (364L) section versus the graduate (397) section.

5. Course Schedule: This syllabus conveys current plans and objectives. Adjustments may be made based on how the class is progressing. *Always* refer to the *Home Page* on Canvas. A proposed schedule of topics is provided in Table 1 on the last page of this syllabus.

6. Course Readings/Materials:

(a) **Textbook**: No text required. Handouts, slides, and excerpts from selected textbooks will be provided on Canvas. It is expected you will read suggested sections and seek out other resources as needed.

(b) **Primary references**: The course will primarily draw from: 1) Ogata, Modern Control Engineering, Prentice-Hall (3rd ed or later) and 2) Franklin, Powell, and Emami-Naeini, Feedback Control of Dynamic Systems, Pearson Publishing (6th ed)

7. Course Readings/Materials:

(a) **Assignments and Submissions**: Homework will be assigned on Canvas with specified due dates and requirements. **A single pdf file should be uploaded to Canvas.**

(b) **Preparation and submission of assignments**: All submitted work must be neatly prepared and organized. **Handwriting must be legible and dark enough to appear on scanned documents.** Any submission that is not legible or reasonably organized will not be graded. Late penalties may apply.

(c) **Late policy**: Late submissions will be dealt with on a case by case basis, and penalties will

be applied if late submissions become common.

(d) **Make-ups**: Make-ups on HW or Quizzes will be handled on a case by case basis, however *prior* notice should be given except in cases of emergency.

(e) **Quizzes**: Short quizzes will be given in class at least every other week (short answer/analysis, conceptual, closed-book)

(f) **Exams**: Dates for any exams appear on proposed schedule (see last page); all exams are closed book/notes

(g) **Final exam**: Per University schedule

8. Grading Policy: Quizzes=20%, Homework=10%, Exams =10,15,15%, Final Exam = 30%

9. Attendance and Behavior: Class attendance and completing homework assignments is expected. You are also expected to show respect and civility in all discourse with fellow students, administrators, and the course instructor.

10. Academic Integrity: University of Texas Honor Code - The core values of The University of Texas at Austin are learning, discovery, freedom, leadership, individual opportunity, and responsibility. Each member of the university is expected to uphold these values through integrity, honesty, trust, fairness, and respect toward peers and community. Each student in this course is expected to abide by this honor code. Any work submitted for academic credit must be the student's own work.

11. Course Outcomes: This course addresses the following ABET program outcomes: 1, 6, 7. In particular, attention by the student should be given to Outcome 4, "Ability to set up and conduct experiments, and to present the results in a professional manner."

12. Other University Notices and Policies: Be familiar with the University's official e-mail student notification policy. It is your responsibility to keep the University informed of changes in e-mail address. Students are expected to check Canvas and e-mail on a frequent and regular basis in order to stay current with University-related communications, recognizing that certain communications may be time-critical. (see http://www.utexas.edu/its/help/utmail/1564).

Documented Disability Statement. 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. Notify the course instructor or TA as quickly as possible if the material being presented in class is not accessible (e.g., instructional videos need captioning, course slides are not readable, etc.).

Behavior Concerns Advice Line (BCAL). If you are worried about someone's behavior, use the Behavior Concerns Advice Line to discuss your concerns. This service is provided through a partnership among the Office of the Dean of Students, the Counseling and Mental Health Center (CMHC), the Employee Assistance Program (EAP), and The University of Texas Police Department (UTPD). Call 512-232-5050 or visit http://www.utexas.edu/safety/bcal.

Religious Holy Days: University policy requires students to notify their instructors as far in advance of the absence as possible so that arrangements can be made. You will be given an opportunity to complete missed work within a reasonable time after the absence.

Drop Policy. Contact the ME department Undergraduate Office about drop policy.

13. Proposed schedule of topics: The schedule provided in Table 1 is a guide. Changes and/or adjustments may be made based on the pace of the class and on changes in content.

Table 1: Proposed schedule of topics and assignments

Week	Day	Topic(s)	Assignment(s)
1	8/23	Introduction, definitions, models & feedback	
	8/25	Model formulations and conversions	HW 1
2	8/30		
	9/1	Equilibrium and linearization	
3	9/6	Time-domain response	
	9/8	Time-domain specifications	
4	9/13	Feedback control relations	
	9/15		Exam 1
5	9/20	Poles, zeros, and stability	
	9/22		
6	9/27	Error and performance analysis	
	9/29	PID control	
7	10/4	Root locus	
	10/6	Root locus; compensator design	
8	10/11	Design applications	
	10/13		Exam 2
9	10/18	Frequency domain response (using Bode)	
	10/20	Nyquist stability criterion	
10	10/25	Compensation, loop shaping	
	10/27	Application examples	
11	11/1	State-space analysis and design	
	11/3	Pole placement	
12	11/8	Optimal control	
	11/10	Estimation/observers	
13	11/15	Compensation in state-space	
	11/17	Application examples	Exam 3
14	11/22	Fall break	
	11/24	Thanksgiving Holiday	
15	11/29	Application studies	
	12/1	Review	
–		Final exam period, 12/8-12	–

AM2 = Feedback Control Systems (Aström and Murray, 2nd ed.)
FPE6 = Feedback Control of Dynamic Systems (Franklin, Powell, and Emami-Naeini, 6th ed.)
LB = Modeling of Physical Systems (Longoria and Beaman, draft notes)
O3 = Modern Control Engineering (Ogata, 3rd ed.)