EE 362K – Intro to Automatic Control
Summer 2020

Course: EE W362K; Unique Number 75570
Lecture: MWF 10a – 1130a
Final Examination: Monday, August 17, 2020 7-10p

Instructor
Dr. Al Cuevas

Graduate Teaching Assistant

Required Text
Feedback Control of Dynamic Systems, by Franklin, Powell, Emami-Naeini, 8e, Pearson, 2019. (Electronic version).

CHAPTERS PLANNED TO BE COVERED

Chapter 1 Overview of Feedback Control
Chapter 2 Dynamic Models
Chapter 3 Dynamic Response
Chapter 4 Analysis of Feedback
Chapter 5 Root-Locus Design Method
Chapter 6 Frequency-Response Design Method
Chapter 7 State-Space Design
Chapter 8 Digital Control

Software
You will be required to use MATLAB in this course. MATLAB is available through the University.

Course Website
Use of the cloud-hosted learning management system, Canvas, will be used throughout this course. In addition, Piazza will be used for Q/A and student discussions.

Course Objectives:
The concept of feedback is central in the study of systems and control. Feedback loops are common in nature, even in the most basic biological phenomena from the macroscopic (i.e. population dynamics, climate, etc.) to microscopic (i.e. regulation of glucose levels, temperature regulation, etc.) scales. In engineering, feedback plays a critical role in mechanical, electronic, chemical and digital systems. More generally, systems theory and feedback are central to understanding, analyzing, and designing systems with interconnected components. It is important to understand not only if a system can be controlled, but in what frequency range and under what conditions.

The purpose of this class will be to gain a basic intuition for and understanding of linear feedback systems and develop the mathematical tools to understand the basics of design and analysis of single-input single-output (SISO) feedback control systems.

Catalog Description
Analysis of linear automatic control systems in time and frequency domains; stability analysis; state variable analysis of continuous-time and discrete-time systems; root locus; Nyquist diagrams; Bode plots; sensitivity; lead and lag compensation.

Prerequisites
Electrical Engineering 313 and Mathematics 340L with a grade of at least C- in each.

Grading Policy
The numerical course grade is computed by weighting the raw scores as indicated above. A final course grade may be adjusted on a curve rather than an absolute scale. Final grades will be assigned using plus and minus increments. A course/instructor survey will be conducted at the end of the semester via the standard MEC form for the Instructor and the Teaching Assistant.

Homework & MATLAB Assignments	20%
Semester Exams (about four online exams)	50%
Final Exam (online exam)	30%

Grade Cutoffs

	A: 94%	A-: 90%
B+: 87%	B: 84%	B-: 80%
C+: 77%	C: 74%	C-: 70%
D+: 67%	D: 64%	D-: 60%
F: <60%		

Lectures
The lectures will take place at the normally scheduled time. It is anticipated each lecture will be recorded for those that may not have Internet access at the normal lecture time. These recordings should generally be available later in the same day as lecture. Attendance and participation during lecture is expected and required for examinations (see below). Questions and feedback during lecture is important.

Homework & MATLAB assignments
There will be about 10 homework assignments during the semester. Homework is completed and submitted through Canvas. No late submission will be graded. Homework will be made available on Canvas, generally, a week before the due date. Announcements will be made in class and on Canvas regarding changes. You are responsible for checking the due dates on Canvas.

Examinations
There will be about four semester examinations and a final examination, all administered and proctored online. The examinations will test your knowledge of the material presented during lecture, your homework assignments, PowerPoint slides, and the book's material. In addition, I will test your ability to apply the material presented. The four semester exams are scheduled during normal class times. The Final Exam will be scheduled per the University's Final Exam schedule and will be administered and proctored online.

The examinations will consist of a number of questions to be answered in a given time period. The exams are closed-book, closed-notes, no additional resources are to be used. All exams will be administered via Canvas and will be proctored using online monitoring resources. You must have your laptop/computer video active during the examinations. There are no make-up examinations. Excused absence from an examination must be approved in advance. Absence is excused only in extreme circumstances (serious illness, death in the immediate family, etc.). Requests for excused absences should be made in writing and must be supported by appropriate documentation. Unexcused absence from an examination will result in a grade of zero for that examination.

There is no re-grading of examinations, unless you feel that there is an error. In this case, you should submit a written (email) request. Verbal requests will not be considered. An examination grade will not be changed one week after the exam has been graded.

A basic, non-programmable, scientific calculator (e.g., TI-30Xa, TI-30X IIS, or equivalent), will be needed during the exams. You are not allowed to use a programmable or graphing calculator. For example, the TI-83, TI-84, TI-Nspire or the like, will not be permitted for use during exams.

Proposed Schedule

#	Date	Lecture Topic	Homework	Reading Assignment
1	6/05	Overview		1.1-1.5
2	6/08	Dynamics of Mechanical Systems		2.1
3	6/10	Models of Electric Circuits	HW 1	2.2
4	6/12	Review of Laplace Transforms		3.1
5	6/15	Partial Fraction Expansion. Final Value Theorem.		3.1
6	6/17	System Modeling Diagrams	HW 2	3.2
7	6/19	Effect of Pole Locations		3.3
8	6/22	Time-Domain Specifications	HW 3	3.4
9	6/24	Effects of Zeros and Additional Poles– **Exam 1**		3.5
10	6/26	Stability, Part 1		3.6
11	6/29	Stability, Part 2		3.6
12	7/01	Control Equations/Control of Steady-state Error		4.1-4.2
13	7/03	Three-Term Controller: PID Control		4.3
14	7/06	Feedforward Control by Plant Model Inversion		4.4
15	7/08	Root Locus – **Exam 2**		5.1-5.2
	7/10	**No class (Final Exam for 6-week courses)**		
16	7/13	Root Locus. Selected Illustrative Root Loci		5.2-5.3
17	7/15	Dynamic Compensation and Examples		5.4-5.6
18	7/17	Frequency Response/Neutral Stability		6.1-6.2
19	7/20	Nyquist Stability Criterion/Stability Margins		6.3-6.4
20	7/22	Bode's Gain-Phase Relationships/Closed-Loop Frequency Response		6.5-6.6
21	7/24	Compensation – **Exam 3**		6.7
22	7/27	State-Space Overview/System Descriptions		7.1-7.2
23	7/29	Block Diagrams ans State-Space/Analysis of State Eqns		7.3-7.4
24	7/31	Control Law Design		7.5
25	8/03	Selection of Pole Locations		7.6
26	8/05	Estimator Design		7.7
27	8/07	Compensator Design		7.8
28	8/10	Intro of the Reference Input w/Estimator/Integral Control and Robust Tracking – **Exam 4**		7.9-7.10
29	8/12	Digitization/Dynamic Analysis of Discrete Systems		8.1-8.2
30	8/14	Design using Discrete Equivs/Hardware Characteristics		8.3-8.4
	8/17	**Final Exam as scheduled per the University calendar**		

UNIVERSITY POLICIES

Religious Holy Days
Students shall be excused from attending classes or other required activities, including examinations, for the observance of a religious holy day, including travel for that purpose. A student whose absence is excused will not be penalized for that absence and shall be allowed to take an examination or complete an assignment from which the student is excused within a reasonable time after the absence. University policy required students to notify each of their instructors as far in advance of the absence as possible so that arrangements can be made.

Policy on Academic Integrity
Each student in the course is expected to abide by the University of Texas Honor Code: "As a student of The University of Texas at Austin, I shall abide by the core values of the University and uphold academic integrity." Plagiarism is taken very seriously at UT. Therefore, if you use words or ideas that are not your own (or that you have used in previous class), you must cite your sources. Plagiarism applies to all assignments in this course including software/firmware source codes.

Students who violate University rules on academic dishonesty are subject to disciplinary penalties, including the possibility of failure in the course and/or dismissal from the University. Since such dishonesty harms the individual, all students, and the integrity of the University, policies on academic dishonesty will be strictly enforced. For further information, please visit the Student Conduct and Academic Integrity website at:http://deanofstudents.utexas.edu/conduct.

You are responsible for understanding UT's Academic Honesty and the University Honor Code.

Q Drop Policy
If you want to drop a class after the 12th class day, you'll need to execute a Q drop before the Q-drop deadline, which typically occurs near the middle of the semester. Under Texas law, you are only allowed six Q drops while you are in college at any public Texas institution. For more information, see: http://www.utexas.edu/ugs/csacc/academic/adddrop/qdrop

University Resources for Students
Your success in this class is important to me. We will all need accommodations because we all learn differently. If there are aspects of this course that prevent you from learning or exclude you, please let me know as soon as possible. Together we'll develop strategies to meet both your needs and the requirements of the course. There are also a range of resources on campus:

Services for Students with Disabilities
This class respects and welcomes students of all backgrounds, identities, and abilities. If there are circumstances that make our learning environment and activities difficult, if you have medical information that you need to share with me, or if you need specific arrangements in case the building needs to be evacuated, please let me know. I am committed to creating an effective learning environment for all students, but I can only do so if you discuss your needs with me as early as possible. I promise to maintain the confidentiality of these discussions. If appropriate, also contact Services for Students with Disabilities, 512-471-6259 (voice) or 1-866-329- 3986 (video phone). http://diversity.utexas.edu/disability/about/

Counseling and Mental Health Center
Do your best to maintain a healthy lifestyle this semester by eating well, exercising, avoiding drugs and alcohol, getting enough sleep and taking some time to relax. This will help you achieve your goals and cope with stress.

All of us benefit from support during times of struggle. You are not alone. There are many helpful resources available on campus and an important part of the college experience is learning how to ask for help. Asking for support sooner rather than later is often helpful.

If you or anyone you know experiences any academic stress, difficult life events, or feelings like anxiety or depression, we strongly encourage you to seek support.
http://www.cmhc.utexas.edu/individualcounseling.html

The Sanger Learning Center
Did you know that more than one-third of UT undergraduate students use the Sanger Learning Center each year to improve their academic performance? All students are welcome to take advantage of Sanger Center's classes and workshops, private learning specialist appointments, peer academic coaching, and tutoring for more than 70 courses in 15 different subject areas. For more information, please visit https://ugs.utexas.edu/slc or call 512-471-3614 (JES A332).

Undergraduate Writing Center: http://uwc.utexas.edu/
Libraries: https://www.lib.utexas.edu/
ITS: https://it.utexas.edu/
Student Emergency Services: http://deanofstudents.utexas.edu/emergency/

Important Safety Information
If you have concerns about the safety or behavior of fellow students, TAs or Professors, call BCAL (the Behavior Concerns Advice Line): 512-232-5050. Your call can be anonymous. If something doesn't feel right – it probably isn't. Trust your instincts and share your concerns.

The following recommendations regarding emergency evacuation from the Office of Campus Safety and Security, 512-471-5767, https://financials.utexas.edu/avp-campus-safety

Occupants of buildings on The University of Texas at Austin campus are required to evacuate buildings when a fire alarm is activated. Alarm activation or announcement requires exiting and assembling outside.

- Familiarize yourself with all exit doors of each classroom and building you may occupy. Remember that the nearest exit door may not be the one you used when entering the building.

- Students requiring assistance in evacuation shall inform their instructor in writing during the first week of class.

- In the event of an evacuation, follow the instruction of faculty or class instructors. Do not re-enter a building unless given instructions by the following: Austin Fire Department, The University of Texas at Austin Police Department, or Fire Prevention Services office.

- Link to information regarding emergency evacuation routes and emergency procedures can be found at: https://emergency.utexas.edu