ASE 381P.1 Linear Systems Analysis
Unique Number: 13200, Fall 2020

Class Meets: Tuesdays and Thursdays, 9.30 – 11.00am (online via Canvas/Zoom)

Course Mode: Online/Internet. An online class is a class designed from the ground up assuming that all students will attend the main class experience online. Material in these classes may be presented synchronously or asynchronously.

Instructor:

Dr. Maruthi R. Akella (pronouns: he; his; him)
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Office Hours: Mon/Wed 3.00-4.00pm (via Canvas/Zoom)
(Other times by e-mail and appointment)

Text:
We will not be using any formal textbook for this class. Lecture notes and relevant journal articles will be periodically handed out via Canvas. You may use your UT EID to login to the Canvas website at the link below:

https://canvas.utexas.edu

Other Suggested Books:

1. Wilson J. Rugh. *Linear System Theory*, Upper Saddle River, NJ: Prentice-Hall, 1996.
2. Chi-Tsong Chen, *Linear System Theory and Design*, Oxford Press, Third Edition, 1999.
3. Thomas Kailath, *Linear Systems*, Prentice-Hall, Englewood Cliffs, 1980.
4. Bernard Friedland, *State Space Methods*, Mc-Graw Hill Publishing Company.
5. Gene H. Golub and Charles F. Van Loan, *Matrix Computations*, Johns Hopkins Studies in Mathematical Sciences, 3rd edition.

Prerequisites:
ASE 370C Feedback Control Systems or equivalently, undergraduate level competence in ordinary differential equations, matrix methods, classical linear control systems (frequency-domain) and complex variables. Talk to me after the first class in case you are not sure of your prior academic preparation.

Course Objectives:
This course builds up all necessary tools for analyzing linear systems. The importance of appreciating linear system theory can never be over-emphasized even if "pure" linear systems are rarely seen in the real world. We begin with a quick review of linear algebra basics that are necessary for this course. Our efforts involve creation of models for systems, analysis (both qualitative and quantitative) of such models, stability studies and some basic aspects of feedback control. Specifically, we shall deal with linear spaces and linear operators, modeling techniques, state-space realizations, the important issues of controllability and observability, stability theory, model-order

reduction methods, an finally, an introduction to pole-placement, state-feedback control and observer design techniques.

Classes and Course Administration:
The class meets online every Tue/Thu 9.30-11.00am through Canvas/Zoom. For obvious reasons, class attendance is essential. A very useful guideline to do well in the course is to invest around 3 hours at home for every one lecture hour. Approximately 4-5 homework-style drill problem sets will be handed out evenly spread over the course of the semester. These problems are for practice only and they aren't required to be formally turned in. Solution keys to the drill problems will be provided. There is no teaching assistant assigned for this class. All instructions, assignments, readings, rubrics and essential information will be on the Canvas website. Check this site regularly and use the same to ask questions about the course materials. Changes to the course sequence may be made at my discretion and if circumstances require. It is your responsibility to note these changes when announced.

Exam Schedule:
We expect to organize two mid-term exams for this class that will be evenly distributed over the semester. The exams will be held in take-home, open-book format. More specific information concerning the mid-term exams will be provided approximately two-weeks prior to the exam date. The end of semester final exam will be comprehensive and cover the entire syllabus covered during the semester. The final exam will also be conducted in a take-home open-book format. The final exam will be administered in accordance with the University scheduled date and time as posted on the Registrar's website.

Computer Usage:
Some of the homework problems could involve use of computers. While Matlab is convenient, choice of the programming language/environment is left to the student. It is expected that the computers available within the ASE/EM Computing Center in ASE 1.112A would be sufficient for the purpose of this course. I am not planning on setting up any separate computers/accounts.

Grading:

Mid-semester exam(s):	60%
Final Exam:	40%
Total:	100%

Important Dates:
Please refer to: `https://registrar.utexas.edu/calendars`

Policy on Academic Integrity:
Students who violate University rules on scholastic 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

Judicial Services web site: `http://deanofstudents.utexas.edu/sjs/`

Policy on Sharing of Course Materials:
No materials used in this class, including, but not limited to, lecture hand-outs, videos, assessments (quizzes, exams, papers, projects, homework drill problems), in-class materials, review sheets, and additional problem sets, may be shared online or with anyone outside of the class unless you have the instructor's explicit, written permission. Unauthorized sharing of materials promotes cheating. It is a violation of the University's Student Honor Code and an act of academic dishonesty. The instructor is well aware of websites used for sharing materials, and any materials found online that are associated with you, or any suspected unauthorized sharing of materials, will be reported to Student Conduct and Academic Integrity in the Office of the Dean of Students. These reports can result in sanctions, including failure in the course.

Policy on Class Recordings:
Class recordings and discussions during office hours are reserved only for students in this class for educational purposes and are protected under FERPA. The recordings should not be shared outside the class in any form. Violation of this restriction by a student could lead to Student Misconduct proceedings.

COVID-19 Guidance:
To help keep everyone at UT Austin and in our community safe, it is critical that students report COVID-19 symptoms and testing, regardless of test results, to University Health Services, and faculty and staff report to the HealthPoint Occupational Health Program (OHP) as soon as possible. In addition, to help understand what to do if a fellow student in the class (or the instructor) tests positive for COVID-19, please use the Coronavirus exposure action chart posted at the University Health Services website: `https://healthyhorns.utexas.edu/`

Evaluation Plan:
The university Course Instructor Surveys will be electronically administered during the last week of class. Additionally, from time to time, and especially if the lecture that day has dealt with a difficult concept, I may ask you to provide me some feedback on the lecture material in the form of a questionnaire. That way, when we do a "recap" at the beginning of the next class I can focus on what you had difficulty with. In addition, comments on how improvements can be made are welcome at anytime.

A notice regarding accommodations for religious holidays:
By UT Austin policy, a student must notify the instructor of his/her pending absence at least fourteen days prior to the date of observance of a religious holiday. If the student must miss a class, an examination, a work assignment, or a project in order to observe a religious holiday, he/she will be given an opportunity to complete the missed work within a reasonable time after the absence.

Students with 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 Stu-

dents at 471-6259, 471-4641 TDD or the Cockrell School of Engineering Director of Students with Disabilities at 471-4321.

Prepared by Maruthi Akella on August 20, 2020