

EECS 444: Control Systems
Spring 2024, Tu-Th 4:00-5:15pm, LEEP2 2300

Course Description:

EECS 444: Control Systems (3 hours). An introduction to the modeling, analysis, and design of linear control systems. Topics include mathematical models, feedback concepts, state-space models, time response, and system stability in the time and transform domains.

Prerequisites: EECS 212 and EECS 361.

Instructor: Dr. Amir Farakhor, a.farakhor@ku.edu

Office Hours: 3:00 to 3:45 pm Tuesday, Thursday, (2032 Eaton Hall) or via email/Zoom

Grader: TBD

Recommended Textbooks: No textbook is required. Some recommended textbooks include:

1. [Control Systems Engineering by Norman S. Nise, Wiley, 6th or 7th edition.](#)
2. [Linear System Theory and Design, Chi-Tsong Chen, 3rd edition.](#)

Grading:

- **Attendance: 5 points**
Course attendance is required, and attendance will be taken randomly during the semester. You have up to two grace times (no need to ask for permission of your absence). 1 point will be deducted for each absence after the two grace times (up to 5 points in total).
- **Homework: 35 points**
There will be weekly homework. Late submission (up to 1 day) will receive a 10-point penalty. Late submission beyond 1 day is not accepted.
- **Exams: 60 points**
Four exams will be taken throughout the semester; the first three exams are taken during the class meeting time, and the last one during the exam week. Each exam accounts for 15 points. No make-up will be given. If a student missed an exam and had uncontrollable reasons, the test would be dropped, and the final exam will count more.
- **Final grading scale**
The course will utilize +/- grading, and the final grades will be assigned according to the total points you earned: 93% - 100% (A = 4.0 pts), 90% - 92% (A- = 3.7 pts), 87% - 89% (B+ = 3.3 pts), 83% - 86% (B = 3.0 pts), 80%-82% (B- = 2.7 pts), 77% - 79% (C+ = 2.3 pts), 73% - 76% (C = 2.0 pts), 70% - 72% (C- = 1.7 pts), below 70% (D = 1.0 pt).

Other Instructions:

- Students with disabilities or special needs should see me for proper accommodation.
- Students are encouraged to work together on problem sets, however, submit for grading only homework you have personally worked. Copying is considered academic misconduct.
- I encourage you to take class notes. Taking class notes is a good learning habit for better understanding. There are proven psychological research results demonstrating students taking class notes outperform others who don't.
- Lecture notes will be posted on the Canvas after each class to help your review.
- Sample homework solutions of the current lecture will be posted on the Canvas after submission (unless otherwise notified) for your reference. You are responsible for checking the solutions by yourself.
- Around 50% of the exams will come directly (with small variations) from the assignment and in-class examples. Around 50% of the exams will be applied questions.
- Class announcements will be made in class to change the above instructions at any time.

Academic Integrity (Important)

Fundamental values: honesty, trust, fairness, respect, and responsibility. Students are responsible for all academic honesty policies.

The University of Kansas, the School of Engineering, and in particular, the Department of Electrical Engineering & Computer Science (EECS) have zero tolerance for academic dishonesty and academic misconduct.

Students are asked to sign off on an *Honor Pledge* statement similar to:

I declare that I did not obtain from anyone by any means (in writing, speaking or via digital communications, or exploring the Internet for possible answers) any information about the exam other than reviewing my course textbook(s) and classroom notes. By signing this statement, I declare that the answers to the exam questions are entirely my own (i.e., they are my synthesis, my words, my writings, my solutions).

As implied above, a student is expected to do their exam or homework individually without any collaborative efforts with anyone else by any means (in writing, speaking, via digital communications, or exploring the Internet for possible answers).

If a student is caught violating the above, their case will be forwarded to the Graduate Studies committee for appropriate disciplinary measures.

The IEEE's code of ethics. As engineers, you should be familiar with the IEEE's codes of ethics and apply them during your academic and professional careers. These are lifelong commitments to integrity and professional conduct.

- [IEEE Code of Ethics](#)

From the IEEE's preamble: *We, the members of the IEEE, in recognition of the importance of our technologies in affecting the quality of life throughout the world, and in accepting a personal obligation to our profession, its members and the communities we serve, do hereby commit ourselves to the highest ethical and professional conduct and agree.*

EdTech Services Use and Academic Misconduct

The number of cases of academic misconduct has increased significantly, especially those in which students use EdTech services (e.g., Chegg).

With the switch to online teaching as a result of the Coronavirus pandemic, professors and instructors at the KU School of Engineering are aware that some students are actively posting homework, laboratory, and exam questions and responses to EdTech services (e.g., Chegg) even during exam time frames.

Keep in mind that when a person signs up to participate by either uploading, and/or downloading, and/or using posted material from these sites, the “*terms of service*” that are agreed to ***do not protect the person when KU and/or the School of Engineering decide to conduct investigations related to academic misconduct (e.g., plagiarism and/or cheating).***

In fact, EdTech services, like Chegg, retain contact information of students who use their services and will release that information, which is traceable, upon request. Using these services constitutes ***academic misconduct***, which is not tolerated in the School of Engineering. It violates Article 3r, Section 6 of its Rules & Regulations, and may lead to grades of F in compromised course(s), transcript citations of academic misconduct, and expulsion from the University of Kansas.

If unsure about assignments, it is important that students use the allowable available resources, such as instructor office hours, graduate teaching assistants, and/or tutoring. The School of Engineering wants students to be successful; cheating is not the way to attain that success.

Religious Observances

If any examination schedules conflict with mandated religious observances, such students must speak with me privately for proper accommodation.

Commercial Notetaking

Pursuant to the University of Kansas’ Policy on Commercial Note-Taking Ventures, commercial notetaking is not permitted in EECS 444 Control Systems. Lecture notes and course materials may be taken for personal use, for the purpose of mastering the course material, and may not be sold to any person or entity in any form. Any student engaged in or contributing to the commercial exchange of notes or course materials will be subject to discipline, including academic misconduct charges, in accordance with University policy. Please note: note-taking provided by a student volunteer for a student with a disability, as a reasonable accommodation under the ADA, is not the same as commercial note-taking and is not covered under this policy. All the written instructions here are subject to changes based on our discussion during class.

Tentative Course Schedule for Spring 2024

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|-------------|------------------------------------|---------------------|
| Jan 16 (Tu) | Introduction | HW1 (review of 360) |
| Jan 18 (Th) | Laplace Transform | |
| Jan 23 (Tu) | Modeling in frequency domain | HW2 |
| Jan 25 (Th) | Modeling in frequency domain | |
| Jan 30 (Tu) | Modeling in time domain | HW3 |
| Feb 1 (Th) | Review and Modeling in time domain | |
| Feb 6 (Tu) | Stat-space Model | |
| Feb 8 (Th) | Exam #1 | |
| Feb 13 (Tu) | State-Space Model | HW4 |
| Feb 15 (Th) | State-Space Model | |
| Feb 20 (Tu) | Time Response | HW5 |
| Feb 22 (Th) | Time Response | |
| Feb 27 (Tu) | State-Space Solution | HW6 |
| Feb 29 (Th) | State-Space Solution | |
| Mar 5 (Tu) | Review and System Reduction | |
| Mar 7 (Th) | Exam #2 | |
| Mar 12 (Tu) | Spring Break | |
| Mar 14 (Th) | Spring Break | |
| Mar 19 (Tu) | System Reduction | HW7 |
| Mar 21 (Th) | Mason's Rule | |
| Mar 26 (Tu) | Alternative Representation | HW8 |
| Mar 28 (Th) | Similarity Transformation | |

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| Apr 2 (Tu) | Stability | HW9 |
| Apr 4 (Th) | Stability | |
| Apr 9 (Tu) | Stability and Routh Table | |
| Apr 11 (Th) | Exam #3 | |
| Apr 16 (Tu) | Stability and Routh Table | HW10 |
| Apr 18 (Th) | Controllability | |
| Apr 23 (Tu) | Controllability | |
| Apr 25 (Tu) | State Feedback | |
| Apr 30 (Tu) | State Feedback | |
| May 2 (Th) | State Estimation | |
| May 10 (Fri) | Final (1:30 – 4:00 pm) | |