Course and Instructor Information

Course Title: Linear Systems Theory
Credits: 3
Mode/Format: In person
Location: Biology/Physics Building (BPB) 130
Time: 9:05 AM – 9:55 AM Monday, Wednesday and Friday, 2025/01/21 - 2025/05/02
Prerequisites: CE 2120; MATH 2410Q. May not be taken out of sequence after passing ME 3220.

Professor/Instructor/Facilitator: Chang Liu
Email: chang_liu@uconn.edu
Telephone: (410) 369-6999
Office Hours/Availability: Thursday 4-5 pm and Friday 10-11 am at EII 200A.

Teaching Assistant/Grader: Jino George
Office Hours: Friday 1:30-2:30 pm at EII 201A (Mechanical Engineering TA office)

Course Materials

Recommended but not required textbook:

System Dynamics, by K. Ogata, 4th Edition, Prentice Hall, 2004
A hard copy of this textbook is available for students who enrolled in Husky Book Bundle.

Required software: MATLAB. Please follow the instructions on https://software.uconn.edu/software/matlab/ to install.

Course Description

Review of ODE Solutions, mathematical modeling of dynamic systems, linearization of nonlinear behavior, Laplace domain representation of dynamics, transfer functions, block diagram algebra, signal-flow graphs, Mason's rule, transient analysis of system response, convolution integral, Duhamel's integral, Green's function, stability of linear systems, Routh-Hurwitz method, root locus, frequency response, Bode and polar representations, introduction to feedback systems.

Course Objectives

After completing ME 3253, students should be able to:
1. Model first- and second-order linear dynamic systems such as mechanical and electrical systems, and analyze the linear responses.
2. Perform Laplace and inverse Laplace transformation, and to use Laplace transforms to solve ordinary differential equations.
3. Identify key characteristics of first- and second-order systems, and use block diagrams to analyze linear system performance.
4. Perform stability analysis for a dynamic system.

Course Requirements and Grading

Summary of Course Grading:

Course Components	Weight
Homework	30%
Midterm Exam	35%
Final Exam	35%

Homework (30%)
Homework will mainly contain theoretical questions and a small amount of coding questions. HW will be submitted

through HuskyCT. It is expected to have one HW assignment every other week, with five HWs in total. The HW due will be on Friday 11:59pm at HuskyCT. HW will be assigned at least one week before the due date. Students can do HW in a group, but each HW submission from each student should be their own work.

Midterm Exam (35%)
The tentative date of the midterm exam will be Friday, March 7th during class time 9:05-9:55 am at the lecture classroom BPB 130. No book, no internet. One cheat sheet in letter size with both front and back sides is allowed. There is no need to hand in cheat sheet and the cheat sheet will not be graded.

Final Exam (35%)
The date and location of the final exam will be scheduled by the university. No book, no internet. One cheatsheet in letter size with both front and back sides is allowed. There is no need to hand in cheat sheet and the cheat sheet will not be graded.

Grading Scale:

The overall grade will be rounded UP as the final grade to obtain the letter grade using the table below. For example, 92.1 will be rounded up to 93 leading to an A letter grade.

Grade	Letter Grade	GPA
93-100	A	4.0
90-92	A-	3.7
87-89	B+	3.3
83-86	B	3.0
80-82	B-	2.7
77-79	C+	2.3
73-76	C	2.0
70-72	C-	1.7
67-69	D+	1.3
63-66	D	1.0
60-62	D-	0.7
<60	F	0.0

Due Dates and Late Policy: All homework due dates will be identified in HuskyCT. Deadlines are based on Eastern Time. The instructor reserves the right to change dates accordingly as the semester progresses. Please feel free to contact me if you need an extension to the homework and **I will extend the due date for ALL students if I get at least two requests for an extension**. Please let me know how long the extension is needed to complete the HW. The extension for all students is at most for two days (Sunday midnight). Beyond this, a careful justification of extension is required and the approval will be determined case by case. For late HWs, the grade will be reduced by X*15%, where X is the number of days within which your HW is late. For homework that is late for more than **_four_** days, it will NOT be graded. Multiple attempts of HW will be allowed in HuskyCT and the grade will be based on the most recent attempt before the due date. For late HW, the grade will be based on the one closest to the due date.

Weekly Time Commitment: 10 hours outside of the classroom every two weeks.

Course Outline
The tentative outline of the class is below, and they are subject to change based on progress. The midterm is expected to cover Chapters 1-5. The final exam is expected to cover everything throughout the class.

Dates	Sections in the textbook (Ogata)	Course content
Week 1	Chapter 1	Introduction of Linear Systems Theory
Week 2	Chapters 2-1, 2-2, 2-3, 2-4, 2-5	The Laplace transform
Week 3	Chapters 3-1, 3-2, 3-3	Modeling of Mechanical Systems
Week 4	Chapters 4-1, 4-2, 4-3, 4-4	Transfer function approach to modeling dynamical systems
Week 5-6	Chapters 5-1, 5-2, 5-3, 5-4, 5-5, 7-4	State-space approach to modeling dynamic systems Linearization of nonlinear differential equations
Week 7	Chapters 8-1, 8-3, 8-5	Time-domain analysis of dynamic systems
Week 8-9	Chapters 9-1, 9-2, 9-3, 9-4	Frequency-domain analysis of dynamic systems
Week 10-11	Chapters 10-1, 10-2, 10-3, 10-4, 10-7, 10-8, 10-9	Time-domain analysis and design of control systems
Week 12	Chapters 11-1, 11-2, 11-3, 11-4, 11-5	Frequency-domain analysis and design of control systems
Week 13	Chapters 6-1, 6-2, 6-3, 6-4	Electrical Systems and Electromechanical Systems
Week 14	Chapter 7-1, 7-2 and Review (TBD)	Fluid Systems and Thermal Systems Review (TBD)

Calendar and/or Class Meeting Schedule

09:05 AM – 09:55 AM Monday, Wednesday, and Friday at BPB 130, 2025/01/21 - 2025/05/02

AI Policy

You are welcome to use AI writing tools such as ChatGPT on most assignments (I'll alert you when you can't) but whenever you use them, you must include an acknowledgment statement that briefly shares that and how you used them. For example, "I used ChatGPT when I was struck at the start and retained substantial parts of what it produced, including X and Y ideas and most of the wording in paragraphs 3 and 4" or "After I wrote my first 2 paragraphs, I used GPT-3 playground to extend the text for another 200 words but then edited…" Please also note that all large language models still tend to make up incorrect facts and fake citations. You will be responsible for any inaccurate, biased, offensive, or otherwise unethical content you submit, regardless of whether it originally comes from you or an AI tool.

Evaluation of Course Experience

Students will be given an opportunity to provide feedback on their course experience and instruction using the University's standard procedures, which are administered by the Office of Institutional Research and Effectiveness (OIRE). The University of Connecticut is dedicated to supporting and enhancing teaching effectiveness and student learning using a variety of methods. The Student Evaluation of Teaching (SET) is just one tool used to help faculty enhance their teaching. The SET is used for both formative (self-improvement) and summative (evaluation) purposes. Additional informal formative surveys and other feedback instruments may be administered within the course.

Academic Integrity

Cheating of any kind on examinations and/or plagiarism of homework is strictly prohibited. Students may work together on homework but submitted work should be your own. Any student work that is found to be in violation of the university policy regarding academic misconduct will be assigned a grade of zero. Read and understand The UConn Student Code of Conduct [Academic, Scholarly, and Professional Integrity and Misconduct Policy.](.).

How to Succeed in this Course

All students can succeed in this course and we are here to help you along the way. Please do not hesitate to ask questions or attend office hours. All questions are important here. Success in this course program depends heavily on your personal health and well-being. Recognize that stress is an expected part of the college experience, and it often can be compounded by unexpected setbacks or life changes outside the classroom. Your teaching assistants and I strongly encourage you to reframe challenges as an unavoidable pathway to success. Reflect on your role in taking care of yourself throughout the semester, before the demands of exams and projects reach their peak. Please feel free to reach out to me about any difficulty you may be having that may impact your performance in your courses or campus life as soon as it occurs and before it becomes too overwhelming. In addition to your academic advisor, I strongly encourage you to contact the many other support services on campus that stand ready to assist you.

Accommodations for Illness or Extended Absences

Please stay home if you are feeling ill and please go home if you are in class and start to feel ill. If illness prevents you from attending class, it is your responsibility to notify me as soon as possible. You do not need to disclose the nature of your illness, however, you will need to work with me to determine how you will complete coursework during your absence. If life circumstances are affecting your ability to focus on courses and your UConn experience, students can email the Dean of Students at dos@uconn.edu to request support. Regional campus students should email the Student Services staff at their home campus to request support and faculty notification.

Students with Disabilities

The University of Connecticut is committed to protecting the rights of individuals with disabilities and assuring that the learning environment is accessible. Students who require accommodations should contact the Center for Students with Disabilities, Wilbur Cross Building Room 204, (860) 486-2020 or http://csd.uconn.edu/.

Resources for Students Experiencing Distress

The University of Connecticut is committed to supporting students in their mental health, their psychological and social well-being, and their connection to their academic experience and overall wellness. The University believes that academic, personal, and professional development can flourish only when each member of our community is assured equitable access to mental health services. The University aims to make access to mental health attainable while fostering a community reflecting equity and diversity and understands that good mental health may lead to personal and professional growth, greater self-awareness, increased social engagement, enhanced academic success, and campus and community involvement.

Students who feel they may benefit from speaking with a mental health professional can find support and resources through the **Student Health and Wellness-Mental Health** (SHaW-MH) office. Through SHaW-MH, students can make an appointment with a mental health professional and engage in confidential conversations or seek recommendations or referrals for any mental health or psychological concern.

Mental health services are included as part of the university's student health insurance plan and also partially funded through university fees. If you do not have UConn's student health insurance plan, most major insurance plans are also accepted. Students can visit the **Student Health and Wellness-Mental Health located in Storrs on the main campus in the Arjona Building, 4th Floor,** or contact the office at **(860) 486-4705, or https://studenthealth.uconn.edu/** for services or questions**.**