ME 305: Introduction to System Dynamics

1) Instructor's Contact Information

- Dr. Adeel Akhtar
- Office: Fenster 253
- Phone: 973-642-4945
- Email: adeel.akhtar@njit.edu

- Office Hours: **Tuesdays 12:30 PM to 1:30 PM**
- Students may email Dr. Akhtar for help or guidance with the course's subject matter. Please allow a reasonable time to respond.

2) Lectures

Time: Tuesdays 6:00 pm to 8:50 pm

3) Course Description

- Principles of dynamic system modeling and response emphasize mechanical, electrical, and fluid systems. Application of computer techniques.
- Prerequisites: Math 222 (Differential Equations), Mech 236 (Dynamics), ME 231 (Kinematics of Machinery).

4) Course Objectives

Students are expected to:

1. Develop models of mechanical, electrical/electromechanical, and fluid systems.
2. Analyze dynamic systems through the application of the Laplace transform, block diagram, and transfer functions.
3. Determine the transient and steady-state response of dynamic systems.
4. Calculate the frequency response and use the results for vibration isolation.
5. Perform basic calculations related to automatic controllers and system response specifications.
6. Use MATLAB in analyzing dynamic systems and control systems.

5) Required Textbook and Software

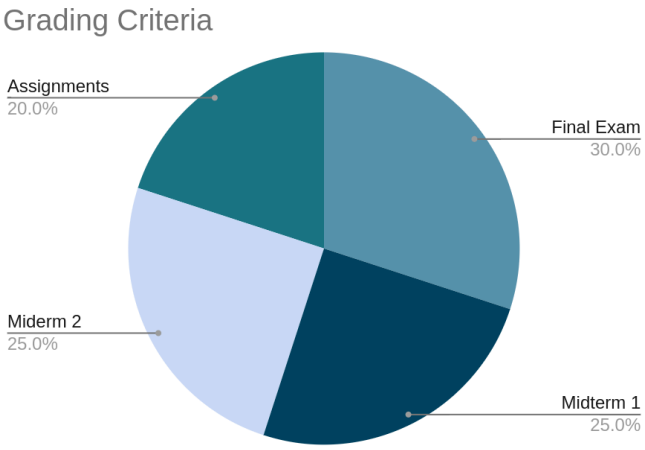
- Book: Katsuhiko Ogata, SYSTEM DYNAMICS, 4th Ed. 2004, ISBN: 0-13-142462-9, Prentice-Hall
- Optional Reference: Esfandiari, R.S., Lu, B., & Lu, B. (2018). Modeling and Analysis of Dynamic Systems (3rd ed.). CRC Press. https://doi.org/10.1201/b22138
- Software: MATLAB

6) Lectures

Schedule: Tuesdays 6:00 – 8:50 in the Lecture Hall

Week	Description	Reading	Problems
1	Introduction, Complex Algebra, Laplace Transforms, Inverse Laplace Transforms	Ch.1 Ch.2.1-2.4	B-2-1, B-2-2(b), B-2-3, B-2-5, B-2-10, B-2-15, B-2-19, B-2-20
2	Linear Differential Equations, review	Ch. 2.5	B-2-24, B-2-25
3	Modeling of Mechanical Systems	Ch. 3.1-3.3	B-3-7, B-3-8, B-3-10, B-3- 12, B-3-13, B-3-14
4	Mechanical Systems: Work, Energy, Energy Method	Ch. 3.4	B-3-12 (energy method) B-3-17, B-3-20 **(Midterm 1)**
5	Block Diagrams, Transfer Functions	Ch. 4	B-4-1, B-4-3, B-4-13, B-4-16
6	Electromechanical Systems	Ch. 6.1-6.3, 6.5	B-6-19
7	Transient Response Analysis	Ch. 8.1-3	B-8-4, B-8-7
8	Impulse Response	Ch. 8.3	B-8-10, B-8-11
9	Analysis in the Frequency Domain, Frequency Response, Vibration Isolation	Ch. 5	B-5-4, B-5-6 B-5-7, B-5-8 **(Midterm 2)**
10	State Space Approach to Modeling Dynamical Systems	Ch. 9.4-5	B-9-9, B-9-10
11	Control Systems, Introduction	Ch. 10.1	B-10-1
12	Control Systems, Automatic Controllers	Ch. 10.1-3	B-10-5
13	Transient Response Analysis System Response Specification B-10-8,	Ch. 10.4-5	B-10-10 B-10-9, B-10-11
14	Advanced Topics (Control of a UAV) / Review		

7) Grading Criteria



Grades will be determined by performance on assignments and exams in terms of total points. The homework assignments (due in one week) will be worth 20% of the total points. One or two questions from each homework will be randomly selected for grading. There is a 25% penalty per day for late submission. Two midterms will each be worth 25% of the total points. The final exam will be worth 30% of the total points. You will be allowed to bring one single-sided handwritten formula sheet in the midterms and one double-sided handwritten formula sheet final exam. Class attendance and participation might be considered if your grade is on a grade-transition margin.

8) Make-up Exams:

If you have a serious reason for missing an exam, you must notify me BEFORE the scheduled exam period for prior approval. You are then responsible for arranging with me to make up the test within three days.

9) Attendance

Students are expected to attend all of their classes. Absence at examinations is tolerated only in serious circumstances that have been properly documented according to university policy, and any imputed grade, make-up examination, or zero grade might be given as considered appropriate to the case at hand.

10) Academic Integrity

Academic Integrity is the cornerstone of higher education and is central to the ideals of this course and the university. Cheating is strictly prohibited and devalues the degree to which you are working. As a member of the NJIT community, it is your responsibility to protect your educational investment by knowing and following the academic integrity policy at: http://www5.njit.edu/policies/sites/policies/files/academic-integrity-code.pdf.
Please note that it is my professional obligation and responsibility to report any academic misconduct to the Dean of Students Office. Any student found in violation of the code by cheating, plagiarizing, or using any online software inappropriately will result in disciplinary action. This may include a failing grade of F, and/or suspension or dismissal from the university. If you have any questions about the Code of Academic Integrity, please contact the Dean of Students Office at dos@njit.edu.

11) Disclaimer

This is not the offer of a contract. The syllabus, assignment sheet, textbook, grading, and all other policies and procedures are subject to change at any time and without notice. The scheduling of classes and examinations is subject to change because of weather and other conditions.