Fall 2020

ME 305-001: Introduction to System Dynamics

Ian Fischer

Supplement to Syllabus and Assignment Sheet for Dr. Fischer's Sections of ME 305

Syllabus and Assignment Sheet. The syllabus and assignment sheet for all ME prefix courses are posted in the department website at link https://mie.njit.edu/students/me-required.php.

Textbook. K. Ogata, *System Dynamics*, 4th Ed., Prentice-Hall, 2004, ISBN 0-13-142462-9.

First Examination. The first examination will be primarily concerned with Laplace transforms and equations of motion. The first examination will be held shortly after the lectures on those topics have been concluded.

Second Examination. The second examination will be concerned with vibrations and other topics including those which were on the first examination. The second examination will be held shortly after the lectures on those topics have been concluded.

Third Examination. The third examination will be concerned with control theory and other topics including those which were on the first examination and second examination. The third examination will be held at the time and place scheduled by the Registrar for the "final" examination.

Final Grade. The final grade for the course will be based on the average grade of the three examinations weighted equally.

Appeals. All appeals of grades must be submitted by email during the week after the examination has been returned. The appeal of examination and course grades is discouraged.

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

Online. Classes will be online using presentations on Webex. During the classes students are expected to be well rested and alert, and to take notes. The presentations will not be available outside of the classes.

Cheating. Students are expected to abide by the university policy on academic integrity.

Conduct. Students are expected to conduct themselves in a manner consistent with the civility objective of the 2020 plan.

Office Hour. Students may email Dr. Fischer for help or guidance with the subject matter of the course. Please allow reasonable time for response.

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.

ME 305
Introduction to System Dynamics

Text-Book: **K. Ogata, *SYSTEM DYNAMICS*, Prentice-Hall, 4th Ed. 2004.**

Prerequisites: ME 231, Mech 236 and Math 222

Topic	Reading	Problems
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-220
Linear Differential Equations, review	Ch. 2.5	B-2-24, B-2-25
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
Mechanical Systems: Work, Energy, Energy Method	Ch. 3.4	B-3-12 (energy method) B-3-17, B-3-20
Block Diagrams , Transfer Functions	Ch. 4	B-4-1, B-4-3, B-4-13, B-4-16
Electromechanical Systems	Ch. 6.1-6.3, 6.5	B-6-19
Transient Response Analysis	Ch. 8.1-3	B-8-4, B-8-7
Impulse Response	Ch. 8.3	B-8-10, B-8-11
Analysis in Frequency Domain, Frequency Response, Vibration Isolation	Ch. 9.1-4	B-9-4, B-9-1 B-9-7
Vibration Isolation (contd.)	Ch. 9.4-5	B-9-9, B-9-10
Control Systems, Introduction	Ch. 10.1	B-10-1
Control Systems, Automatic Controllers	Ch. 10.1-3	B-10-5
Transient Response Analysis System Response Specification	Ch. 10.4-5	B-10-8, B-10-10 B-10-9, B-10-11

Not all topics will be covered in every section.

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COURSE NUMBER	**ME 305**
COURSE TITLE	**Introduction to System Dynamics**
COURSE STRUCTURE	(3-0-3) (lecture hr/wk - lab hr/wk – course credits)
COURSE COORDINATOR	Z. Ji
COURSE DESCRIPTION	Principles of dynamic system modeling and response with emphasis on mechanical, electrical, and fluid systems. Application of computer simulation techniques.
PREREQUISITE(S)	Mech 236 – Dynamics ME 231 – Kinematics Math 222 – Differential Equations
COREQUISITE(S)	None
REQUIRED, ELECTIVE OR SELECTED ELECTIVE	Required
REQUIRED MATERIALS	1. Katsuhiko Ogata, System Dynamics, 4th Ed., Pearson Prentice-Hall, 2004, ISBN: 0-13-142462-9 2. Software: MATLAB
Supplemental materials (not Required)	None
COMPUTER USAGE	MATLAB software

COURSE LEARNING OUTCOMES/ EXPECTED PERFORMANCE CRITERIA:

Course Learning Outcomes	SOs*	Expected Performance Criteria
1 develop models of mechanical, electrical/electromechanical and fluid systems.	1	**Exam Question** (80% of the students will earn a grade of 70% or better on this question)
2. analyze dynamic systems through the application of the Laplace transforms, block diagrams, and transfer functions.	1	**Exam Question** (80% of the students will earn a grade of 70% or better on this question)
3. determine transient and steady state response of dynamic systems.	1	**Exam Question** (80% of the students will earn a grade of 70% or better on this question)
4. calculate frequency response and use the results for vibration isolation	1, 2	**Exam Question** (80% of the students will earn a grade of 70% or better on

			this question)
	5. perform basic calculation related to automatic controllers and system response specification.	1, 2	**Exam Question** (80% of the students will earn a grade of 70% or better on this question)
	6. use computer software (MATLAB) in analyzing dynamics systems and control systems	1	**Homework Problems** (80% of the students will earn a grade of 80% or better on these problems)

CLASS TOPICS	1. Complex Algebra, Linear Algebra, Laplace Transforms, Inverse Laplace Transforms. 2. Linear Differential Equations. 3. Modeling of Mechanical Systems. 4. Block Diagrams, Transfer Functions. 5. Electrical Systems, Electromechanical Systems. 6. Transient Response Analysis. 7. Impulse Response. 8. Analysis in Frequency Domain, Frequency Response, Vibration Isolation. 9. Feedback Control Systems and Automatic Controllers. 10. System Response Analysis and Specification.

STUDENT OUTCOMES (SCALE: 1-3)	1	2	3	4	5	6	7
	3	2					

3 – Strongly supported 2 – Supported 1 – Minimally supported

* Student Outcomes