ME 383Q: Modeling of Physical Systems - WB
Fall 2020, Unique No. 18290

Instructor:	Prof. Raul G. Longoria
Office:	Via zoom (Fall 2020)
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Class meeting:	TTH 2-3:30 pm via zoom
Office hours:	TTH 4-5 pm (via zoom)

1. Course summary: This course reviews principles used to model physical systems and introduces methods for building mathematical and simulation models of engineering systems. Emphasis is placed on development of dynamic system models for understanding and predicting behavior of systems, making decisions about model development for application studies, models for efficient data reduction or test development, models for design, and models for effective prediction using nonlinear simulation methods. Bond graph methods are emphasized for analysis of systems having combinations of mechanical, electrical, magnetic, electromechanical, fluid, and thermodynamic effects.
2. Course aims / objectives: The aim is to build insight and confidence in developing mathematical models of simple and complex engineering systems, using time and frequency response analysis tools for prediction, and using models to specify and design system behavior. The course also aims to build skill in using simulation and linear analysis tools in Matlab.
3. Format and procedures: The course meets twice weekly via zoom. A *course log* (or 'clog') will appear on the UT Canvas home page to convey projected and actual class progress. Canvas will be used to distribute all course materials and to assign and grade all submitted assignments. All assignments and quizzes/exams must be submitted via Canvas as PDF documents, and it is expected that you will adopt a suitable smart phone app for this purpose.

Table 1: Planned schedule of topics and assignments

Week(s)	Topics(s)	Homework / Quizzes
1	Introduction	HW 1
2-3	Kirchhoff systems	HW 2
3-5	Bond graph methods	HW 3
5	Model formulation and evaluation	HW 4; Quiz 1
6-7	Linear system analysis	HW 5
7-9	Transfer functions and frequency response	HW 6; Quiz 2
10-11	Multiports / energy methods	HW 8
11-12	Lagrange formulations	HW 9
12-13	Thermal / thermodynamic systems	HW 10
14-15	Distributed-parameter systems	HW 11

4. Course Schedule: This syllabus represents planned topics and objectives. More or less time may be required to cover certain topics, and adjustments may be made. Given these expected changes, the exact dates for quizzes or exams will be scheduled once the semester begins, with sufficient time given for preparation. Refer to the Canvas course page and *course log*. See Table **??** for planned schedule of topics and assignments.

5. Assumptions: You have some background in engineering, especially dynamics, fluid mechanics, thermodynamics, and electrical/electromechanical concepts. It is expected that you are familiar with differential equations and their solutions, have knowledge of linear algebra concepts and familiarity with computer programming, either using Mathworks/Matlab or Python. You are prepared to engage in this course in a manner that is expected of a graduate-level engineering student at UT-Austin, meaning you are resourceful, engaged, and take responsibility for learning.

6. Course Requirements and Policies:

Course progress and participation policy:

(a) **Progress**: It is expected you will do any independent study required to keep pace with the course, and communicate with me if there are any problems in doing so.

(b) **Participation**: Participate in class discussions and in other ways to make this course useful to you and to others enrolled. Perception of your engagement can factor into the overall impression you give about your understanding of the course topics and objectives.

(c) **Behavior**: Civility statement and code of conduct - you are expected to show respect and civility in all discourse with fellow students, administrators, and the course instructor.

Course Readings/Materials:

(a) **Textbook**: Course notes and lecture slides will be provided on the course Canvas site. Given the breadth of topic areas covered, selected handouts may also be provided. It is expected you will find additional materials as needed to supplemental your individual needs.

(b) **Supplemental references**: In addition to the course notes, you may consider acquiring a book on system dynamics. If you want a published book that discusses bond graphs, seek out any edition of System Dynamics, D. Karnopp, D. Margolis, and R. Rosenberg (Wiley-Interscience). Other references will be indicated on particular topics throughout the course.

(e) **Computational skills**: Familiarity with computational methods is expected. It is expected that you will seek out tutorials and access either to Matlab, through the site-license available to UT-Austin
(https://intranet.engr.utexas.edu/it/software), or to Python-based open-source tools. Some guidance will be provided throughout the course.

Assignments, Assessment, and Evaluation:

(a) **Assignments**: All homework assignments and case studies are assigned on Canvas with specified due dates and submission requirements. Unless otherwise indicated, these are to be submitted as PDF documents via Canvas.

(b) **Preparation**: it is expected that all submitted work will be prepared in a professional, legible manner. Illegible work, either do to unorganized work, poor scanning, etc., will not be graded and resubmissions will be subject to a late policy. You are expected to know how to scan your work for upload into Canvas. Improperly prepared assignments will not be graded.

(c) **Late policy**: No late homework or case study submissions will be accepted without good cause. Any late submissions will be penalized as follows: 1 day late (10%), 2 days late (30%), beyond 2, not accepted.

(d) **Make-ups**: Any make-ups on quizzes or exams will be handled on a case by case basis however there must be *prior* notice given for consideration.

(e) **Grading style**: Any grading by the instructor will be completed online, with feedback indicated directly on the submitted PDF documents. Note: given the size of the class, expect general marks and refer to solutions.

(f) **Quizzes**: Dates for quizzes: to be posted on Canvas course site schedule

(g) **Final exam**: Date and time of Final Exam will be posted on Canvas course log.
7. Grading Policy: Homework (30%), 2 Quizzes (40%), Final Exam (30%).
8. Academic Integrity: University of Texas Honor Code - The core values of The University of Texas at Austin are learning, discovery, freedom, leadership, individual opportunity, and responsibility. Each member of the university is expected to uphold these values through integrity, honesty, trust, fairness, and respect toward peers and community.
Each student in this course is expected to abide by the University of Texas Honor Code. Any work submitted by a student in this course for academic credit will be the student's own work. For this course, collaboration is allowed when specified in the assignment.
9. Other University Notices and Policies: Be familiar with the University's official e-mail student notification policy. It is your responsibility to keep the University informed of changes in e-mail address. Students are expected to check Canvas and e-mail on a frequent and regular basis in order to stay current with University-related communications, recognizing that certain communications may be time-critical. (see http://www.utexas.edu/its/help/utmail/1564).

Documented Disability Statement. 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 Students at 471-6259, 471-4241 TDD. Notify the course instructor or TA as quickly as possible if the material being presented in class is not accessible (e.g., instructional videos need captioning, course slides are not readable, etc.).

Behavior Concerns Advice Line (BCAL). If you are worried about someone's behavior, use the Behavior Concerns Advice Line to discuss your concerns. This service is provided through a partnership among the Office of the Dean of Students, the Counseling and Mental Health Center (CMHC), the Employee Assistance Program (EAP), and The University of Texas Police Department (UTPD). Call 512-232-5050 or visit http://www.utexas.edu/safety/bcal.

Religious Holy Days: University policy requires students to notify their instructors as far in advance of the absence as possible so that arrangements can be made. You will be given an opportunity to complete missed work within a reasonable time after the absence.

Drop Policy. Contact the graduate advisor's office for information about drop policy.