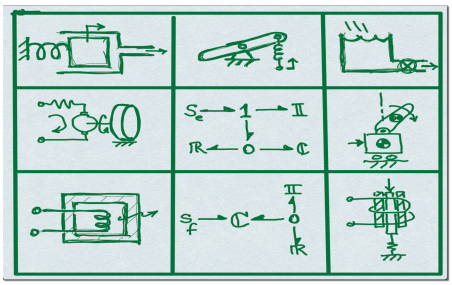

ME 383Q: Modeling of Physical Systems
Fall 2025, Unique No. 20435
Class meeting: MW 3:00-4:30, ETC 4.150
https://utexas.instructure.com/courses/1430940
Instructor: Prof. Raul G. Longoria
Contact info: `r.longoria@mail.utexas.edu`
Office hours: TTH 1-2 via zoom or by appt;
https://utexas.zoom.us/my/r.longoria

1. Course summary: This is a graduate-level course that introduces and reviews principles and methods used to model physical systems, including formulation of mathematical representations. Bond graph methods are introduced to enable modeling of multienergetic systems that include mechanical, electrical, magnetic, electromechanical, fluid, and thermodynamic effects. An emphasis is placed on making decisions about the development of models for application studies, efficient data reduction or test development, design, and for guiding development of non-linear simulation.

2. Learning outcomes: The aim is to **review** and **extend** your ability to build mathematical models of simple and complex engineering systems, use time- and frequency-response analysis tools, and apply models to evaluate, specify, and design system behavior. The course also aims to build skill in using simulation and linear analysis tools in Matlab and/or Python.

3. Format and procedures: Lecture meetings take place twice a week, and Table 1 shows a general schedule of topics and assignments. Details 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.

4. Textbook: Modeling of Physical Systems: Simulation and Control, R.G. Longoria and J.J. Beaman, Wiley-Interscience, 2025. You can choose to take advantage of the Longhorn Textbook Access program on Canvas in the 'My Textbooks' tab.

5. Grading policy: Homework / case studies (40%), Quizzes (2, 30%), Final Exam (30%)

Table 1: Projected topics and assignments, relevant chapters in '()'

	Topics(s)	HW / Quizzes	Objective(s)
I	Introduction and Kirchhoff systems (1,2) Bond graph methods (3) Model formulation and evaluation (4)	HW 1 HW 2, Quiz 1	Review / orient Bond graph proficiency Model use / study
II	Linear systems / TFs (5) Impedance, frequency response (6) Models for control (7)*	 HW 3 	Review Extend Application study
III IV	Multiports / energy methods and Lagrange formulations (8) Complex system modeling	 HW 4; Quiz 2 HW 5	 Extend Application study
V	Thermodynamic systems (9)	HW 6 Final exam	Extend

6. Purpose of syllabus: This syllabus conveys the planned topics and objectives. More or less time may be required to cover certain topics, and adjustments may be made based on the interests of the class. The exact dates for any quizzes will be scheduled once the semester begins, with sufficient time given for preparation.

7. Assumptions: You have some background in engineering, especially dynamics, fluid mechanics, thermodynamics, and electrical/electromechanical concepts. You are expected to be familiar with differential equations and their solutions, have knowledge of linear algebra concepts, and familiarity with computer programming, either using 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, which means that you are resourceful, engaged, and take responsibility for learning.

8. Course Requirements and Policies

(a) **Progress**: It is expected that 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 other ways to make this course useful to you and others enrolled.

(c) **Behavior**: You are expected to show respect and civility in all discussion with fellow students, administrators, and the instructor of the course.

(d) **Supplemental references**: In addition to the course notes, you should refer to any references listed on Canvas (and available in the library online).

(e) **Computational skills**: Familiarity with computational methods is expected. You should be comfortable using Python or Matlab for analysis and simulation. Examples will be provided in both.

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

(g) **Preparation**: it is expected that all submitted work will be prepared in a professional, legible manner. Illegible work, either due 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 on Canvas. Improperly prepared assignments will not be graded.

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

(i) **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.

(j) **Grading style**: Any grading by the instructor will be completed online, with feedback indicated directly on the submitted PDF documents.

(k) **Quizzes**: The dates of the quizzes will be posted on Canvas.

(l) **Final exam**: Date and time of Final Exam is given by UT: Saturday, December 13, 7:00 pm-9:00 pm

9. Academic Integrity: University of Texas Honor Code. 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. Suspected cases of academic misconduct will be referred to the Office of the Dean of Students.

10. 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).

•*Accessibility Services.* UT provides, upon request, appropriate academic adjustments for qualified students with disabilities. Any student with a documented disability (physical or cognitive) who requires academic accommodations should contact the Division of Campus and Community Engagement, Disability and Access (D&A), 512-471-6259, https://community.utexas.edu/disability.

•*Mental Health and Wellness* UT also provides resources to support the well-being of your academic life and mental health, as well as counseling services.

•*Longhorn Wellness Center.* Creating a culture of student and campus well-being through programs, education, health messages, student engagement and collaboration. https://healthyhorns.utexas.edu/lwc/index.html

•*Counseling and Mental Health Center.* https://healthyhorns.utexas.edu/cmhc/ *Providing mental health support through assessment and referral, group and individual counseling, psychiatry, and well-being services to the students of UT Austin.

•*Behavior Concerns Advice Line (BCAL).* If you are concerned about someone's behavior, use the Behavior Concerns Advice Line to discuss your concerns. 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 absence as possible so that arrangements can be made. You will have the opportunity to complete missed work in a reasonable time after your absence.

•*Drop Policy.* Contact the Graduate Advisor's office for information about drop policy.