

ME 383Q: Modeling of Physical Systems
Fall 2024, Unique No. 19204

<https://utexas.instructure.com/courses/1398654>

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Class meeting:	MW 3:00-4:30, ETC 4.150
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- 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. Learning outcomes:** 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 and/or Python.
- 3. Format and procedures:** The course meets twice weekly. A detailed schedule 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: Projected topics and assignments

	Topics(s)	Homework / Quizzes
I	Introduction, Kirchhoff systems, Bond graph methods	HW 1 (5%)
II	Model formulation and evaluation, Linear system analysis, transfer functions, Impedance, frequency response	HW 2 (5%), Quiz 1 (15%) HW 3 (5%)
III	Models for control Multiports / energy methods and Lagrange formulations	HW 4 (5%); Quiz 2 (15%)
IV	Complex system modeling	Project (25%)
V	Thermal / thermodynamic systems	Final exam (25%)

- 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 will be scheduled once the semester begins, with sufficient time given for preparation. See Table 1 for planned 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.

(c) **Behavior:** 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 other resources will be provided on the course Canvas site. It is expected you will find additional materials as needed to supplemental your individual needs and will [read](#).

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

(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.

Assignments, Assessment, and Evaluation:

(a) **Assignments:** All assignments are via 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 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 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.

(f) **Quizzes:** Dates for quizzes will be posted on Canvas

(g) **Final exam:** Date and time of Final Exam is given by UT: Friday, 5/3/24, 7-9 pm

7. Grading Policy: Homework (20%), 2 Quizzes (30%), Case study(s) (25%), Final Exam (25%).

8. 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.

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>).

- *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 worried 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 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.