ME 360/398: Vehicle System Dynamics and Controls - WB
Spring 2022, Unique Nos. 18880/19210

Instructor:	Prof. Raul G. Longoria
Contact info:	r.longoria@mail.utexas.edu
Class meeting:	TTH 12:30-2:00 pm, ECJ 1.314
Office hours:	MW 1-2 pm (via Zoom) - see Canvas for link

1. Course rationale: This is an *elective* course that reviews and applies concepts in dynamics, system dynamics, and feedback controls to ground vehicle systems. Typical models used to analyze and predict handling, performance, and ride are introduced, including models for how tires interact with surfaces.

2. Course goals / objectives:

  a. Review and reinforce understanding of dynamics, system dynamics, and controls, as applied to problems in ground vehicle systems

  b. Gain familiarity with modeling and analysis for performance, handling, and ride behavior in ground vehicles

  c. Gain familiarity for static and dynamic properties and performance of tires on different terrain types

  d. Learn how to assess vehicle stability in various modes of operation

  e. Gain familiarity with vehicle control methods for traction/braking, handling/steering, and suspension of vehicle systems

  f. Develop skill in formulating and using computer-based models and implementing methods for analysis and simulation using either Matlab or Python

3. Format and procedures: A weekly schedule on Canvas conveys topics with links to lecture summaries, reference materials, and assignments. Canvas is used for all assignment submissions.

4. Course Topics: Tentative course topics will likely follow in this order: basic vehicle dynamics & control, ground vehicle concepts, lateral dynamics & stability, longitudinal dynamics & performance, vehicle control systems, vehicle ride dynamics, and human v. machine control. These are initial plans and adjustments may be made based on how the courses progresses and based on class interests.

5. Prerequisites: For undergraduate engineering majors (in ME 360), Mechanical Engineering 344 with a grade of at least C-; for others, upper-division standing and written consent of instructor. For graduate students (in ME 390), a graduate understanding of dynamics and systems is expected. Familiarity with Matlab or Python programming is expected of all participants.

6. Course Readings/Materials: No textbook is required. Content will be provided through lecture slides and/or handouts via Canvas. Examples of useful supplemental texts include: a) J.Y. Wong, Theory of Ground Vehicles, any edition, John Wiley and Sons, b) D. Karnopp, Vehicle Dynamics, Stability, and Control, CRC Press. Any other reference that emphasizes model development and simulation usage can be helpful. You may also find texts from past dynamics, system dynamics, and introductory controls courses useful.

7. Grading Policy: Homework (30%), Quizzes (30%), Projects (10, 10, 20%)

8. Expectations:

(a) **This is an elective course.** Since you have chosen to enroll, it is expected that you will attend lectures, participate in classroom discussions, and keep up with readings and assignments.

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

(c) **Preparation and submission of assignments**: Always include your name and indicate section (ME 360 or 390) on every assignment. All submitted work must be prepared neatly and organized. Writing must be neat and legible. Unacceptable assignments including uploaded unreadable scans will be returned without grade.

(d) **Quizzes**: Short in-class quizzes will be used to assess how well you are keeping up with material covered in lectures and assignments.

(e) **Late policy**: Late homework will be accepted on a case-by-case basis.

(f) **Final exam**: A final project replaces a final exam.

(g) **360 vs 390**: If you are a graduate student, you will be expected to complete elements in each assignment intended only for 390 students. The distinction between ME 360 and ME 390 requirements is mandated by the UT Graduate School.

9. Course Outcomes: This course addresses the following program outcomes of the ABET Engineering Curriculum 2000: 4, 5, 6, 7. In particular, attention by the student should be given to Outcome 4, "Ability to set up and conduct experiments, and to present the results in a professional manner."

10. 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.

11. 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 ME department Undergraduate Office about drop policy.