Prerequisites: A second (or senior level) course in dynamics/vibration (i.e., MEAM 440 or equivalent courses at other universities). If you have never taken a first course in dynamics or vibrations, then you should not enroll in this course.

It is useful, but not necessary to have taken ME458.


Email/Phone/Office Hours:

Email: For both off-site and on-site students, we first encourage the use of email (addresses provided above). This will generally provide the quickest response from either the instructor or the teaching assistant.

Phone Hours: For off-site students, in cases where email is inconvenient, we will provide phone-in office hours (numbers above). These will be reserved for offsite students only.

Office Hours: TBD

Assignments: Approximately five homework assignments will be set during the term. You may find it convenient to use Matlab to complete some assignments although this is not required. Assignments will be distributed in class with due dates listed specific for on-site and off-site students. On-site students will return all assignments in class on the due date. Off-site students will mail assignments by the posted due date. For off-site students, please address your assignments to:

Examinations: TBD

Course Summary: This course provides a fundamental understanding of vehicle handling and ride performance through the development, analysis and critical interpretation of vehicle/system models. Central to understanding vehicle handling and ride is the understanding of tire mechanics which is surveyed at the start of the course.

Related Courses/Sequencing: ME458 Automotive Engineering emphasizes the vehicle as an engineering system and reviews design considerations associated with all major systems including the vehicle structure, powertrain, suspension, steering, and braking. ME568 Vehicle Control Systems covers control issues for all major vehicle control systems including engine control, cruise control, ABS/traction control, four-wheel steering, active suspensions and advanced control systems supporting Intelligent Transportation Systems. The three courses in this series are offered sequentially. For students entering in the Fall term, a complete sequence would be Fall - ME458, Winter - ME542, followed by Fall - ME568. Similarly, for those students entering in the Winter term, the sequence can be Winter - ME458, Fall - ME568, Winter - ME542. A new course in Power Train Control (ME599) is being introduced for the first time this Winter (02) term. The course covers the essential aspects of electronic engine control for both spark ignition (gasoline) and compression ignition (diesel) engines as well as recent developments for advanced engines with direct injection, camless actuation, active boosting technologies and modern powerplants with hybrid-electric and fuel cell power generation.
ME542 Course Outline:

Part 1: Introduction
1.1 Motivation and Background
1.2 Review of Rigid Body Dynamics

Part 2: Tire Mechanics
2.1 Overview, Terminology, Definitions
2.2 Slip, Skid, Rolling Resistance
2.3 Elastic Band Model for longitudinal slip
2.4 Simple model for lateral slip
2.5 Combined longitudinal/lateral slip (friction ellipse)
2.6 Taut string model for lateral slip
2.7 Magic Tire Formula

Part 3: Vehicle Handling
3.1 Ackerman Steering Geometry
3.2 Steady Handling (2 DOF steady-state model)
3.3 Understeer and Oversteer
3.4 Effect of Tire Camber and Vehicle Roll (3 DOF steady-state model)
3.5 Transient Handling and Directional Stability (2 DOF unsteady model)
3.6 Effect of Vehicle Roll on Transient Handling (3 DOF unsteady model)
3.7 Steady-State and Transient Handling of Articulated Vehicles
3.8 Case Study 2: On-Center Steering of Passenger Vehicles

Part 4: Vehicle Ride
4.1 Review of Vibration Principles
4.2 Human Perception of Vibration
4.3 Road Excitation and Vehicle Ride Models (low frequency)
4.4 Suspension Characteristics: Ride versus Handling
4.5 Overview of Random Vibrations
4.6 Analysis of Vehicle Ride
4.7 Case Study 3: Influence of Seat Dynamics on Vehicle Ride
4.8 Case Study 4: Computer Simulation of Ride – Tracked Vehicles