

1. Course number and name
EML 4288 Vehicle Design
2. Credits and contact hours
3 cr, 2.5 contact hours (2 hrs. 30 min. lecture)
3. Instructor's or course coordinator's name
Instructor: Dr. Patrick Hollis, Coordinator: Dr. Jonathan Clark
4. Text book, title, author, and year
Automotive Engineering Fundamentals, Stone, R. and Ball, J. K., 2004
 - a. *References, Additional Resources*
 - Tires, Suspension and Handling, Dixon, J. C., 1996
 - Fundamentals of Vehicle Dynamics, Gillespie, T. D., 1992
 - Race Car Vehicle Dynamics, Milliken, W. F., Milliken, D. L., and Metz, L. D., 1994
 - Theory of Ground Vehicles, Wong, J. Y., 2008
 - Electric and Hybrid Vehicles: Design Fundamentals, Husain, I., 2010
5. Specific course information
 - a. *brief description of the content of the course (catalog description)*
This introductory course in vehicle design emphasizes vehicle dynamics. Content covers the primary performance related features of vehicle design (suspension, steering, chassis, and tires). Using the latest industry-standard software, the course examines various design parameters that influence vehicle performance and handling.
 - b. *prerequisites or corequisites*
Prerequisites: EML 3014C and EML 3018C
 - c. *indicate whether a required, elective, or selected elective course in the program*
Selected Technical Elective course
6. Specific goals for the course
The goal of this course is to produce a student capable of designing and analyzing the handling characteristics of simple vehicles. The student should be able to synthesize a reasonable solution to a given design problem, analyze the proposed solution, and judge its suitability.
 - a. *Course Outcomes*
 1. Explain the various contributing factors to tire forces [1]
 2. Explain and find tire lateral forces given slip angles [1]
 3. Use a bicycle model to analyze neutral steer, understeer and oversteer [2]
 4. Calculate dynamic responses to simple inputs [3]
 5. Find the various instant centers in vehicle suspension systems [4]
 6. Explain the important geometric aspects of major suspension systems [4]
 7. Explain the geometry factors in a steering system [5]
 8. Calculate the loads that act on the wheels due to acceleration, braking and cornering [6]
 9. Use ADAMS to model vehicle behavior [7]

Numbers refer to Course Objectives below, e.g. for course outcome 1, [1] refers to course objective 1.
 - b. *Course Objectives and Relation to Student Outcomes*
 1. To introduce the important aspects of tires and their effects on vehicle performance [1, 3, 5, 10]

2. To introduce steady state stability and control aspects of vehicle handling [1, 3, 5, 10]
3. To introduce transient stability and control aspects of vehicle handling [1, 3, 5, 10]
4. To introduce suspension geometry and how it influences behavior [1, 3, 5, 10]
5. To introduce steering systems [1, 3, 5, 10]
6. To examine the various effects that affect wheel loads [1, 3, 5, 10]
7. To provide computational tools to assist in the design, modeling, and simulation of vehicle systems [1, 3, 5, 10]

Numbers refer to Departmental Student Outcomes, e.g. for course objective 1, [1, 3, 5, 10] refers to student outcomes 1, 3, 5, 10.

7. Brief list of topics to be covered

- Acceleration Performance
- Braking Performance
- Road Loads
- Ride
- Steady State Stability and Control
- Transient Stability and Control
- Suspensions
- Steering
- Tires
- Adams Software for Vehicle Design and Simulation