

**MECHANICAL ENGINEERING PROGRAM**  
**ABET COURSE SYLLABUS**

**ME 441: Single Track Vehicle Design (4) Elective**

**Course Description:** (2019-20 Catalog) Design of single track vehicles, including handling characteristics, ergonomics and human power, strength and stiffness considerations, braking and suspension. Laboratory focus on designing a single track vehicle, including fabrication of a handling prototype. 3 lectures, 1 laboratory.

**Prerequisite Courses:** ME 318, ME 329, or consent of instructor

**Prerequisites by Topic:**

1. Mechanical Vibrations
2. Intermediate Design

**Textbook:** (and/or other required material) None

**References:**

Lords of the Chainring, Bill Patterson  
Bicycling Science 3<sup>rd</sup> Edition, Wilson, MIT Press  
High-Tech Cycling 2<sup>nd</sup> Edition, Edmond Burke, Human Kinetics  
Bicycle Design, Mike Burrows, Open Road  
The Stability of Bicycles, J. Lowell, H.D. McKell, American Journal of Physics Dec. 1982.

**Course Coordinator/Instructor:** John Fabijanic, Lecturer, Mechanical Engineering

**Course Learning Outcomes:** The student will be able to:

1. Construct a complete free body diagram of a single track vehicle and determine the appropriate equations of motion.
2. Evaluate the effects of geometry changes on the controllability of a single track vehicle.
3. Justify appropriate geometry and gearing choices for a human powered single track vehicle.
4. Design vehicle frame for strength and stiffness considerations.

**Relationship of Course to Mechanical Engineering Student Outcomes:**

SO 1: Mastered (M)  
SO 2:  
SO 3: Mastered (M)  
SO 4:  
SO 5: Mastered (M)

SO 6:  
SO 7: Mastered (M)

**Topics Covered:**

1. Patterson Control Model (Stability with rider intention)
2. Ergonomics – Human Power Output and Considerations
3. Powertrain – Gearing
4. Frame Design – External Loads, Materials and Loads
5. Braking – Performance and Stability
6. Suspension Design – Kinematic and Vibration

**Laboratory Projects:**

Various single track vehicles are ridden to get a physical feel of the parameters discussed in lecture. A single track vehicle is designed with consideration of all aspects discussed in lecture and a handling prototype is built and ridden to demonstrate the handling qualities of the proposed design. Techniques for accurately measuring all necessary geometry are demonstrated.

**Class/Lab Schedule:**

Three 50-minute lectures per week; One 170-minute lab per week.

**Contribution of Course to Meeting the Professional Component:**

- (a) College-level mathematics and basic sciences:
- (b) Engineering Topics (Science and/or Design): 4 units or 100%
- (c) General Education:
- (d) Other:

**Prepared by:** Fabijanic

**Date:** 10/21/19

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