Approved in 44th BoA Meeting (24-11-2021)

Course number	**:** ME 521
Course Name	**:** Vehicle Design and Dynamics
Credit Distribution	**:** 3-0-0-3
Intended for	**:** M.Tech, MS, PhD, B.Tech 3rd/4th year students or consent of faculty
Prerequisite	**:** Basic Engineering Mathematics and Mechanics
Mutual Exclusion	**:** None

1. Preamble:

The course is a combination of basic concepts as well as advanced concepts of automobile engineering. Since it is designed for interdisciplinary program, an introduction to basic kinematics and dynamics is provided. This is followed by specific application in overall vehicle as well as specific parts or machines such as gears, differentials, suspensions etc.

2. Course Modules with quantitative lecture hours:

Unit 1: Basic Vehicle Mechanics (6 hours)

Kinematics, Dynamics - Equation of motion, acceleration, effect of grade, drag. Air flow around the vehicle, tire models, rolling resistance. Load and energy calculations in electric vehicle over drive cycle.

Unit 2. Vehicle Design (6 hours)

Roll cage design, camber and caster angle, Stability analysis.

Unit 3. Transmission (8 hours)

Manual gear box, gear ratio, automatic gear box. Torque speed characteristics. Torque convertors, clutch, brakes.

Unit 4. Road handling (8 hours)

Differentials system, Torque vectoring, Suspension. Double wishbone suspension system,

Unit 5. Steering (6 hours)

Rack and Pinion steering system, Ackermann Steering, power steering.

Unit 6. Vehicle Dynamics (10 hours)

Lumped mass modelling, Basics of vibration, Quarter car model, Longitudinal and Lateral dynamics.

3. Text books:

1. Gillespie, Thomas D. *Fundamentals of vehicle dynamics*. Vol. 400. Warrendale, PA: Society of automotive engineers, 1992.
2. Rill, Georg, and Abel Arrieta Castro. *Road Vehicle Dynamics: Fundamentals and Modeling with MATLAB®*. CRC Press, 2020.

4. References:

1. Husain, Iqbal. *Electric and hybrid vehicles: design fundamentals*. CRC press, 2021.
2. Heisler, Heinz. *Advanced vehicle technology*. Elsevier, 2002.

5. Similarity with the existing courses:

(Similarity content is declared as per the number of lecture hours on similar topics)

S. No.		Course Code	Similarity Content	Approx. % of Content
1.	nil			

6. Justification of new course proposal if cumulative similarity content is >30%: NA