

# NIRMA UNIVERSITY

<b>Institute:</b>	<b>Institute of Technology</b>
<b>Name of Programme:</b>	<b>M. Tech. in Electrical Engineering (Electric Vehicular Technology)</b>
<b>Semester:</b>	<b>I</b>
<b>Course Code:</b>	<b>6EE105</b>
<b>Course Title:</b>	<b>Vehicle Dynamics</b>
<b>Course Type:</b>	( <input checked="" type="checkbox"/> Core/ <input type="checkbox"/> Value Added Course / <input type="checkbox"/> Department Elective / <input type="checkbox"/> Institute Elective/ <input type="checkbox"/> University Elective/ <input type="checkbox"/> Open Elective / <input type="checkbox"/> Any other )
<b>Year of Introduction:</b>	<b>2022 – 23</b>

L	T	Practical component				C
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### Course Learning Outcomes (CLOs):

At the end of the course, the students will be able to -

1. analyze mechanics involved in vehicle operation (BL4)
2. interpret by evaluating forces as well as moments working and affecting vehicle operation and performance (BL5)
3. analyze the effect on the steering dynamic and predict stability of vehicles in various conditions (BL4)
4. select appropriate suspension as well as braking and evaluate parameters with its properties (BL6)

### Syllabus:

**Teaching Hours: 45**

#### UNIT-1: Vehicle Mechanics and Stability

**08**

Overview on forces and moments, types of vehicle resistance, mathematical representation for tractive effort, force relations on various surfaces, vibration analysis, concept of load distribution in vehicles, stability analysis of vehicles in various running conditions, maximum acceleration and reaction forces for different drives.

#### UNIT-2: Performance Characteristics of Vehicles

**07**

Equation of motion and maximum tractive effort, aerodynamic forces and moments, vehicle power plant and transmission characteristics, prediction of vehicle performance, operating fuel economy, engine and transmission matching, braking performance.

#### UNIT-3: Handling Characteristics of Vehicles

**15**

Types of chassis, consideration of forces on chassis design, Steering geometry, steady state handling characteristics and steering input, testing of handling characteristics, transient response characteristics, directional stability.

#### UNIT-4: Ride Characteristics of Vehicles

**15**

Human response to vibration, vehicle ride models, introduction to random vibration, active and semi active suspensions, roll center, roll axis and vehicle under side forces, influence of suspension stiffness, suspension damping, and tire stiffness, air suspension system and their properties.

**Self-Study:**

The self study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self study contents.

**Suggested Readings:**

1. T. D. Gillespie, Fundamentals of Vehicle Dynamics, SAE International
2. J. Y. Wong, Theory of Ground Vehicles, John Wiley & Sons
3. R. Rajamani, Vehicle Dynamics and Control, Springer
4. H. B. Pacejka, Tyre and Vehicle Dynamics, Butterworth-Heinemann Ltd
5. R. N. Jazar, Vehicle Dynamics: Theory and Application, Springer
6. M. Zhu, Integrated Vehicle Dynamics and Control, Wiley.
7. Recent papers from reputed journals.

L = Lecture, T = Tutorial, P = Practical, C = Credit

w.e.f. academic year 2022 - 23 and onwards