

AE 326**VEHICLE DYNAMICS****Course Description & Objectives:**

Students undergoing this course are expected to apply fundamental knowledge of the students in automotive field in the areas of vehicle vibrations and describe the skills of the students in stability of vehicles and their effects, related with longitudinal, vertical & lateral dynamics.

Course Outcomes:

Upon the successful completion of the course, learners will be able to:

1. describe the basic fundamental of vibration.
2. analyze multi degree freedom system for mode shape in transmission linkages.
3. analyze the vehicle directional stability and roll behavior
4. enumerate the suspension systems, tyre dynamics & directional stability of the vehicle.
5. *analysis the vehicle dynamic by using statistical methods*

UNIT I: Basics of Vibration:

Classification of vibration, definitions, mechanical vibrating systems, mechanical vibration and human comfort. Modeling and simulation studies. Single degree of freedom, multi degree freedom systems, free, forced and damped vibrations. Magnification factor and transmissibility. Vibration absorber. Two degree of freedom system. Modal analysis.

UNIT II: Dynamics of Suspension & Tyres:

Requirements of suspension system. Spring mass frequency, wheel hop, Wheel wobble, wheel shimmy, choice of suspension spring rate. Calculation of effective spring rate. Vehicle suspension in fore and aft & roll axis. Human response to vibration, vehicle ride model. Tire forces and moments, rolling resistance of tires, relationship between tractive effort and longitudinal slip of tyres, cornering properties of tyres, ride properties of tyre.

UNIT III: Stability of Vehicles

Resistance, types of resistance, Load distribution, stability on a curved track slope and a banked road, calculation of tractive effort and reactions for different drives.

UNIT IV: Performance & Handling Characteristics of Vehicles:

Equation of motion and maximum tractive effort. Aerodynamics forces and moments. Power plant and transmission characteristics. Prediction of vehicle performance. Braking performance. Steering geometry. Steady state handling characteristics. Steady state response to steering input. Transient response characteristics. Directional stability of vehicle.

UNIT V: Basics of Car Aerodynamics:

Objects — Vehicle types of drag. Various types of forces and moments. Effects of forces and moments. Various body optimization techniques for minimum drag. Principle of wind tunnel technology. Flow visualization techniques. Test with scale models.

TEXT BOOKS:

1. Giri N.K – Automotive Mechanics, Khanna Publishers, 2002.
2. Rao J.S and Gupta. K “Theory and Practice of Mechanical Vibrations”, Wiley Eastern Ltd., New Delhi -2, 2002.
3. J. Y. Wong, “Theory of Ground Vehicles”, 3rd ed., John Willey & Sons, New York, 1997.

REFERENCES:

1. Heldt.P.M -”Automotive Chassis”- Chilton Co., New York- 1992
2. Ellis.J.R - “Vehicle Dynamics”- Business Books Ltd., London- 1991
3. Giles.J.G.Steering - “Suspension and Tyres”, Illiffe Books Ltd., London- 1998
4. Ham B, Pacejka - Tyre and Vehicle Dynamics - SAE Publication - 2002