

AMAE-23 VEHICLE DYNAMICS

UNIT-1 CONCEPT OF VIBRATION

- 1.1 Definitions, Modeling and Simulation, Global and Vehicle Coordinate System, Free, Forced,
- 1.2 Undamped and Damped Vibration, Response Analysis of Single DOF, Two DOF,
- 1.3 Multi DOF, Magnification factor, Transmissibility, Vibration absorber,
- 1.4 Vibration measuring instruments, Torsional vibration, Critical speed.

UNIT-2 TIRES

- 2.1 Tire forces and moments, Tire structure, Longitudinal and Lateral force at various slip angles, rolling resistance, Tractive and cornering property of tire.
- 2.2 Performance of tire on wet surface. Ride property of tires.
- 2.3 Magic formulae tire model, Estimation of tire road friction.
- 2.4 Test on Various road surfaces. Tire vibration.

UNIT-3 VERTICAL DYNAMICS

- 3.1 Human response to vibration, Sources of Vibration. Design and analysis of Passive, Semi-active and Active suspension using Quarter car, half car and full car model.
- 3.2 Influence of suspension stiffness, suspension damping, and tire stiffness.
- 3.3 Control law for LQR, H-Infinite, Skyhook damping.
- 3.4 Air suspension system and their properties.

UNIT-4 LONGITUDINAL DYNAMICS AND CONTROL

- 4.1 Aerodynamic forces and moments. Equation of motion.
- 4.2 Tire forces, rolling resistance, Load distribution for three wheeler and four wheeler.
- 4.3 Calculation of Maximum acceleration, Reaction forces for Different drives.
- 4.4 Braking and Driving torque.
- 4.5 Prediction of Vehicle performance. ABS, stability control, Traction control.

UNIT-5 LATERAL DYNAMICS

- 5.1 Steady state handling characteristics.
- 5.2 Steady state response to steering input.
- 5.3 Testing of handling characteristics.
- 5.4 Transient response characteristics, Direction control of vehicles.
- 5.5 Roll center, Roll axis, Vehicle under side forces.
- 5.6 Stability of vehicle on banked road, during turn. Effect of suspension on cornering.

References Books:

1. Dean Karnopp, "Vehicle Stability", 1st edition, Marcel Dekker, 2004
2. Nakhaie Jazar. G., "Vehicle Dynamics: Theory and Application", 1st edition, Springer, 2008
3. Michael Blundell & Damian Harty, "The Multibody Systems Approach to Vehicle Dynamics", Elsevier Limited, 2004