

AT8604 VEHICLE DYNAMICS

DETAILED SYLLABUS

OBJECTIVE:

- To know about the application of basic mechanics principles for dynamic analysis of vehicles.

UNIT I CONCEPT OF VIBRATION

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

UNIT II TIRES

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

UNIT III VERTICAL DYNAMICS

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. Influence of suspension stiffness, suspension damping, and tire stiffness. Control law for LQR, H-Infinite, Skyhook damping. Air suspension system and their properties.

UNIT IV LONGITUDINAL DYNAMICS AND CONTROL

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

UNIT V LATERAL DYNAMICS

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

TEXT BOOKS:

1. Rajesh Rajamani, "Vehicle Dynamics and Control", 1st edition, Springer, 2005
2. Singiresu S. Rao, "Mechanical Vibrations", 5th Edition, Prentice Hall, 2010
3. Thomas D. Gillespie, "Fundamentals of Vehicle Dynamics", Society of Automotive Engineers Inc, 1992
4. Wong. J. Y., "Theory of Ground Vehicles", 3rd Edition, Wiley-Interscience, 2001

REFERENCES:

1. Dean Karnopp, "Vehicle Stability", 1st edition, Marcel Dekker, 2004
2. Hans B Pacejka, "Tire and Vehicle Dynamics", 2nd edition, SAE International, 2005
3. John C. Dixon, "Tires, Suspension, and Handling", 2nd edition, Society of Automotive Engineers Inc, 1996
4. Jan Zuijdijk, "Vehicle dynamics and damping", Author House, 2009
5. Michael Blundell & Damian Harty, "The Multibody Systems Approach to Vehicle Dynamics", Elsevier Limited, 2004
6. Nakhaie Jazar. G., "Vehicle Dynamics: Theory and Application", 1st edition, Springer, 2008