



C. U. SHAH UNIVERSITY
Wadhwan City

FACULTY OF: - Technology and Engineering
DEPARTMENT OF: - Automobile Engineering
SEMESTER: -VII
CODE: - 4TE07VDY1
NAME: – Vehicle Dynamics

Teaching and Evaluation Scheme:-

Subject Code	Name of the Subject	Teaching Scheme (Hours)				Credits	Evaluation Scheme							
		Th	Tu	Pr	Total		Theory				Practical (Marks)			Total
							Sessional Exam		University Exam		Internal		University	
							Marks	Hrs	Marks	Hrs	Pr/Viva	TW	Pr	
4TE07VDY1	Vehicle Dynamics	4	0	2	6	5	30	1.5	70	3	---	20	30	150

Objectives:

- To impart knowledge to students in various impact of the movements of vehicle on a road surface.
- Students will be able to know about effects of various unbalanced forces, its effects on the various components of vehicle and method to balance that unbalanced forces for getting smooth operation and long life of the vehicle.
- This course also aims to build higher level cognitive skill of future engineers for analyzing vehicle performance against various resistances acting on it during automotive operation and its effects with respect to ergonomics of the vehicle.

Prerequisite:

- Fundamental of Vehicle Dynamics.

Course Outline:

Sr. No.	Course Content	Hours
1	Introduction: Introduction to vehicle dynamics, lumped mass, vehicle fixed coordinate system, motion variables, earth fixed coordinate system, Euler angles, force system acting on a rigid vehicle, Newton’s second law application in dynamics, Dynamics axle loads: static loads on level ground, low speed acceleration, loads on grades, rigid body translation and rotational dynamics.	07
2	Tires: Tire Type, construction, size and load rating, terminology and load rating, mechanism of force generation, tractive properties, cornering properties, camber thrust, aligning moment, combined braking and cornering, conicity and ply steer, durability forces, performance of tires on wet surfaces.	07
3	Vehicle Performance: Acceleration Performance: Power limited acceleration; Traction limited acceleration, Braking Performance: Basic braking equations, Braking forces, Tire-Road Friction, Brake Proportioning, Anti-lock Brake System (ABS), Cruise Control and Adaptive Cruise Control (ACC).	10

4	Road Loads: Aerodynamics(Mechanics of air flow around a vehicle, Pressure distribution on a Vehicle, Aerodynamic Forces, Drag Components, Aerodynamics Aids, Drag, Side Force, Lift Force, Pitch Moment, Yawing moment, Rolling Moment, Crosswind Sensitivity), Rolling Resistance(Factors affecting rolling resistance, Typical coefficient), Total road Loads and effect of Road loads on Fuel economy.	10
5	Suspension system: Solid axles (Hotchkiss, Four Link, DeDion), Independent suspensions (SLA Front Suspension, Macpherson Strut, Trailing-Arm Rear Suspension, Semi- Trailing Arm, Swing Axle, Multi link rear suspension), Anti-Squat, Anti-pitch and Anti-Dive Suspension Geometry (Equivalent Trailing Arm Analysis, Rear Solid Drive Axle, Independent Rear Drive, Front Solid Drive Axle, Independent front- Drive Axle, four-Wheel Drive), Active suspension, Roll Center Analysis.	10
6	Steering system: Steering linkages, steering geometry error, Front wheel geometry, Forces and moments, Steering system models and its effects - Steering ratio, Understeer, Influence of front-wheel drive (Driveline Torque about the steer axis, Influence of tractive force on tire cornering stiffness and Aligning moment, Fore/ Aft load Transfer, FWD understeer influences), Four-Wheel steer (Low-speed Turning, high speed cornering). Force analysis during steering, steering oscillation, tramp, shimmy, wobble, directional stability.	10
7	Cornering: Introduction, low speed turning, high speed turning, Suspension effects on cornering, Methods for measurement of understeer gradients: Constant radius method, Constant Speed Methods	06

Learning Outcomes:

- The knowledge of this subject is understand to design aerodynamics shapes of car body, to calculate equivalent weight and maximum acceleration, desired power to propel the vehicle.

Books Recommended:

1. Fundamentals of Vehicle Dynamics, by **Thomas D. Gillespie** , 2013, Society of Automobile Engineers Inc., ISBN: 978-1560911999
2. Vehicle dynamics, by **R. V. Dukhopati**, Narsova Publications.

Reference Books:-

1. Mechanics of Road vehicles, by **Stead**, Tata McGraw Hill
2. Vehicle Dynamics, by **S. R. Ellise**, East West Press.
3. Automotive Mechanics, by **N. K. Giri**, Khanna Publishers,
4. Motor Vehicles, by **Khovak**, Mir Publishers
5. Automotive mechanics by **Crouse**, Tata McGraw Hill
6. Automobile system by **Anil Chikara, Satya Prakashan**