

B.E Semester: VII
Automobile Engineering
Subject Name: Vehicle dynamics (AE705)

Course Objective:

- To present a problem oriented in depth knowledge of vehicle dynamics.
- To address the underlying concepts and methods behind vehicle dynamics.

Teaching / Examination Scheme:

SUBJECT		Teaching Scheme				Total Credit	Evaluation Scheme					Total Marks
		L	T	P	Total		THEORY		IE	CIA	PR. / VIVA	
CODE	NAME	Hrs	Hrs	Hrs	Hrs		Hrs	Marks	Marks	Marks	Marks	
AE705	Vehicle dynamics	3	0	2	5	4	3	70	30	20	30	150

Detailed Syllabus:

Topic no	Details
1	INTRODUCTION: Introduction to vehicle dynamics, Vehicle coordinate system, Earth fixed coordinate system, Longitudinal, lateral and vertical vehicle dynamics, vehicle springing system - requirements, sprung mass and unsprung mass.
2	FORWARD VEHICLE DYNAMICS (ONE DIMENSIONAL VEHICLE DYNAMICS) : Parked car on a level road, parked car on an inclined road, Accelerating car on a level road, Accelerating car on an inclined road, parked car on a banked road, vehicles on crest and dip.
3	FLYWHEEL FOR ENGINE: Turning moment diagram of IC engine, coefficient of fluctuation of speed and energy, size of flywheel, cross section of flywheels, cyclic-torque and flywheel effect, multicylinder cyclic torque, relation between linear and angular motion of a flywheel.
4	Ride Characteristics : Vibrations due to road roughness, vehicle ride model, Human response to vibrations, Two degree freedom model for sprung & unsprung mass, Two degree freedom model for pitch & bounce, Motion of vehicle on undulating road & Compensated suspension systems, roll centre & roll axis. Introduction to random vibrations, Evaluation of vehicle, vibration in relation to ride comfort criterion.
5	GOVERNORS: Centrifugal governors: Watt, Porter, Hartnell; stability criterion, controlling force, and sensitiveness.
6	GYROSCOPE: Precisional motions and gyroscopic stability, gyroscopic couple, effect on stability of four

	wheelers, critical speed Stability of vehicle: Analysis of stability when vehicle moving on plane road, inclined road, curved and banked road.. Effect of centrifugal force and subsequent distribution of load.
7	<p>Handling Characteristics: Pitching, bouncing, yawing & rolling, wheel wobbling, Steering geometry, Fundamental condition for true Rolling.</p> <p>Steady State Handling: Slip angle, cornering power, Neutral steer, Under steer and over steer, Steady state response, Yaw velocity, Lateral Acceleration, Curvature response & Directional stability.</p> <p>Transient Handling: Basic principles, differential equations of motions.</p> <p>Vehicle Test for handling performance: Steady state testing, constant speed test, constant steer angle test. Constant radius test.</p>

Lesson Planning:

Sr. No.	Date/Week	Unit No.	% Weightage	Topic No
1	1 st , 2 ^{ed} , 3 ^{ed}	Unit 1	20 % .	1,2
2	4 th , 5 th , 6 th	Unit 2	20 %	3
3	7 th , 8 th , 9 th	Unit 3	20 %	4
4	10 th , 11 th , 12 th	Unit 4	20 %	5,6
5	13 th , 14 th , 15 th	Unit 5	20 %	7

Instructional Method & Pedagogy:

- At the start of course, the course delivery pattern , prerequisite of the subject will be discussed.
- Lecture may be conducted with the aid of multi-media projector, black board, OHP etc. & equal weightage should be given to all topics while teaching and conduction of all examinations.
- Attendance is compulsory in lectures and laboratory, which may carries five marks in overall evaluation.
- One/Two internal exams may be conducted and total/average/best of the same may be converted to equivalent of 30 marks as a part of internal theory evaluation.
- Assignment based on course content will be given to the student for each unit/topic and will be evaluated at regular interval. It may carry an importance of ten marks in the overall internal evaluation.
- Surprise tests/Quizzes/Seminar/Tutorial may be conducted and having share of five marks in the overall internal evaluation.
- The course includes a laboratory, where students have an opportunity to build an appreciation for the concept being taught in lectures.
- Experiments shall be performed in the laboratory related to course contents.
 - Experiment on Hartnell governor.
 - Experiment on watt governor.
 - Experiment on porter governor.
 - Experiment on proell governor.
 - Experiment on gyroscope pick effect
 - Study of ride characteristics of automobile
 - Tutorial on quarter car model

- Tutorial on bicycle vibration model
- Tutorial on half car vibration model

Students Learning Outcomes

- The student can identify different areas of vehicle dynamics.
- Can find the applications of all the areas in day to day life.

Recommended Study Materials

Text & Reference Books:

- Vehicle dynamic by Reza N Jazar
- Vehicle dynamics, by R.V.Dukhopati,Narsova Publications.
- Mechanics of Road vehicles , by Stead,TMH.
- Vehicle Dynamics, by S.R.Ellise,East West Press.
- Automotive Mechanics, by N.K.Giri, Khanna Publishers,
- Motor Vehicles, by Khovak, Mir Publishers
- Automotive mechanics by Crouse,TMH
- Automobile system by Anil Chikara, Satya Prakashan

