

**M.E Semester: 1 M.E Mechanical (Automobile Engineering)**  
**Subject Name: Vehicle Dynamics MEA102**

**A. Course Objective**

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

**B. Teaching / Examination Scheme**

SUBJECT		Teaching Scheme				Total Credit	Evaluation Scheme					Total Marks
		L	T	P	Total		THEORY		IE	CIA	PR. / VIVO	
CODE	NAME	Hrs	Hrs	Hrs	Hrs		Hrs	Marks	Marks	Marks	Marks	
MEA102	Vehicle Dynamics	4	0	2	6	5	3	70	30	20	30	150

**C. Detailed Syllabus**

1. SUSPENSION SYSTEM - requirements, types, air suspension, rubber suspension, Shock absorbers; compensated suspension systems; design of leaf spring; coil spring and torsion bar; types of drives-Hotchkiss and torque tube.
2. WHEEL ALIGNMENTS- wheel wobble; wheel shimmy; pitching; bouncing and rolling; roll centre and roll axis; anti-roll bar; road holding.
3. HANDLING CHARACTERISTICS: Steering geometry; Fundamental condition for true Rolling; Ackerman's Steering Gear; Davis Steering gear; Steady state Handling; Neutral steer; Under steer and over steer; Steady state response; Yaw velocity; Lateral Acceleration; Curvature response & directional stability; jackknifing in articulated vehicle; loading of automobile chassis due to road irregularities; comfort criteria; load transferred while braking and cornering; equivalent weight of vehicle..
4. RIDE CHARACTERISTICS: Human response to vibrations; Single degree & Two degree freedom; Free & Forced vibrations; Vehicle Ride Model; Quarter car suspension model; Half car suspension model; Full car suspension model; Two degree freedom model for sprung & unsprung mass; Two degree freedom model for pitch & bounce; Vibrations due to road roughness and engine unbalance; Transmissibility of engine mounting; Motion of vehicle on undulating road.
5. STABILITY OF VEHICLES: Load distribution, calculation of tractive effort and reactions for different drives, stability of a vehicle on a slope, on a curve and a banked road.

#### D. Lesson Planning

<u>SR.NO</u>	<u>DATE/WEEK</u>	<u>UNIT NO</u>	<u>%WEITAGE</u>	<u>TOPIC NO</u>
1	1 <sup>ST</sup> , 2 <sup>ND</sup> , 3 <sup>RD</sup>	1	20	1
2	4 <sup>TH</sup> , 5 <sup>TH</sup> , 6 <sup>TH</sup>	2	20	2
3	7 <sup>TH</sup> , 8 <sup>TH</sup> , 9 <sup>TH</sup>	3	20	3
4	10 <sup>TH</sup> , 11 <sup>TH</sup> , 12 <sup>TH</sup>	4	20	4
5	13 <sup>TH</sup> , 14 <sup>TH</sup> , 15 <sup>TH</sup>	5	20	5

#### E. 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.  
List of Experiments.

1. Experiments based on suspension system.
2. Design of leaf spring used in suspension system.
3. Design of coil spring used in suspension system.
4. Experiment based on single degree and two degree freedom.
5. Experiment based on free and forced vibrations.
6. Experiments based on quarter, half and full car suspension system.
7. Experimental study of wheel alignments light weight motor vehicle.
8. Experimental study of tractive effort and reactions for different drives of automobile.
9. Experimental investigation of vibration in light weight motor vehicle in dynamic condition.
10. Stress analysis of ladder chassis frame in static condition.

## F. 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.

## G. commended Study Materials

### • **Text & Reference Books:**

1. Theory of Ground Vehicles - J. Y. Wong - John Willey & Sons, NY
2. Steering, Suspension & Tyres – J. G. Giles, Ilete Books Ltd., London
3. Mechanics of Road Vehicles – W. Steed, Ilete Books Ltd. London
4. Automotive Chassis – P. M. Heldt, Chilton Co. NK
5. Gillespie.T.D., "Fundamental of vehicle dynamic society of Automotive Engineers ",USA, 1992.
6. Vehicle dynamics and control by Rajesh Rajamani , Springer publication
7. Vehicle Dynamics : Theory and Application by Reza N Jazar, Springer publication.

