SRI VENKATESWARA COLLEGE OF ENGINEERING

COURSE DELIVERY PLAN - THEORY

Department of Automobile Engineering			LP: AE18702
B.E/B.Tech/M.E/M.Tech : Automobile Engineering		Regulation: 2018	Rev. No: 00
PG Specialisation	: Not Applicable		Date: 26.07.2021
Sub. Code / Sub. Name	: AE18702 VEHICLE DYNAMICS		
Unit	: I		

Unit Syllabus:

LONGITUDINAL DYNAMICS AND CONTROL **12**

Definitions, Modeling and Simulation, Global and Vehicle Coordinate System, Aerodynamic forces and moments, Equation of motion, 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, Anti-lock Braking System (ABS), Stability control, Traction control, Development of linear model using computer software.

Objective:

Students learn about the basics of Vehicle Coordinate system, Aerodynamic forces and moments, stability and traction control.

Session No *	Topics to be covered	Ref	Teaching Aids
1	Fundamentals of vibration	1- Ch 1, Pg 01-13	PPT
2	Modeling and Simulation	1- Ch 1, Pg 18-22	PPT
3	Global and Vehicle Coordinate System	3- Ch 2, Pg 41-43 4- Ch 1, Pg 7-10	PPT
4	Aerodynamic forces and moments	2- Ch 3, Pg 209-220 3- Ch 4, Pg 95-98	PPT
5	Equation of motion	2- Ch 3, Pg 203-209	PPT
6	Load distribution for three wheeler and four wheeler	9- Ch 20, Pg 880-883 4- Ch 1, Pg 11-13	PPT
7	Calculation of Maximum acceleration, Reaction forces for Different drives	9- Ch 20, Pg 884-885 4- Ch 1, Pg 14-19	PPT
8	Braking and Driving torque	2- Ch 3, Pg 265-270 2- Ch 4, Pg 265-270	PPT
9	Prediction of Vehicle performance	2- Ch 3, Pg 250-255	PPT
10	ABS	2- Ch 3, Pg 282-287 3- Ch 5, Pg 137-148	PPT
11	Stability control, Traction control	2- Ch 3, Pg 221-289	PPT
12	Development of linear model using computer software	2- Ch 3, Pg 250-289	PPT

Content beyond syllabus covered (if any):

Methods of finding the Centre of Gravity

* Session duration: 50 minutes

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COURSE DELIVERY PLAN - THEORY

Sub. Code / Sub. Name : AE18702 VEHICLE DYNAMICS

Unit : II

Unit Syllabus:

CONCEPT OF VIBRATION **12**

Free, Forced, Undamped and Damped Vibration, Response Analysis of Single Degrees of Freedom (DOF), Two DOF, Multi DOF, Magnification factor, Transmissibility, Vibration absorber, Vibration measuring instruments, Torsional vibration, Critical speed, Development of linear model using computer software.

Objective:

Students learn the basics of vehicle vibrations - free, forced and damped vibrations.

Session No*	Topics to be covered	Ref	Teaching Aids
13	Free and Undamped Vibration	1- Ch 2, Pg 129-150	PPT
14	Forced and Damped Vibration	1- Ch 3, Pg 263-300	PPT
15	Response Analysis of Single Degrees of Freedom	1- Ch 2, Pg 151, 1- Ch 3, 263-28	PPT
16	Response Analysis of Two Degrees of Freedom	1- Ch 5, Pg 467-552	PPT
17	Response Analysis of Multi Degrees of Freedom	1- Ch 6, Pg 553-617	PPT
18	Magnification factor	1- Ch 3, Pg 260-279	PPT
19	Transmissibility	1- Ch 3, Pg 283-284	PPT
20	Vibration absorber	1- Ch 9, Pg 832-837	PPT
21	Vibration measuring instruments	1- Ch 10, Pg 870-927	PPT
22	Torsional vibration	1- Ch 2, Pg 146-147	PPT
23	Critical speed	1- Ch 9, Pg 785-791	PPT
24	Development of linear model using computer software	1- Ch 2, Pg 151, 1- Ch 3, 263-28	PPT

Content beyond syllabus covered (if any):

Modal analysis studies of vibration

* Session duration: 50 minutes

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COURSE DELIVERY PLAN - THEORY

Sub. Code / Sub. Name : AE18702 VEHICLE DYNAMICS

Unit : III

Unit Syllabus:

VERTICAL DYNAMICS **12**

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 Linear Quadratic Regulator (LQR), H-Infinite, Skyhook damping, Air suspension system and their properties, Development of linear model using computer software.

Objective:

Students learn about the sources of Vibration and the Control law for damping.

Session No *	Topics to be covered	Ref	Teaching Aids
25	Human response to vibration	2- Ch 1, Pg 431-436	PPT
26	Sources of Vibration	2- Ch 1, Pg 431-436	PPT
27	Design and analysis of Passive and Semi-active suspension using Quarter car model	3- Ch 10, Pg 287-295	PPT
28	Design and analysis of Active suspension using half car and full car model	3- Ch 10, Pg 287-295	PPT
29	Design and analysis of Passive and Semi-active suspension using half car and full car model	3- Ch 10, Pg 287-293	PPT
30	Design and analysis of Active suspension using half car and full car model	3- Ch 10, Pg 287-293	PPT
31	Influence of suspension stiffness	3- Ch 10, Pg 308-313	PPT
32	Suspension damping	3- Ch 10, Pg 308-313	PPT
33	Tire stiffness	3- Ch 10, Pg 308-313	PPT
34	Control law for LQR, H-Infinite, Skyhook damping	3- Ch 11, Pg 328-339	PPT
35	Air suspension system and their properties	2- Ch 8, Pg 485-510	PPT
36	Development of linear model using computer software	3- Ch 10, Pg 287-295	PPT

Content beyond syllabus covered (if any):

Choice of suspension spring rate

* Session duration: 50 minutes

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COURSE DELIVERY PLAN - THEORY

Sub. Code / Sub. Name : AE18702 VEHICLE DYNAMICS

Unit : IV

Unit Syllabus:

TIRES **12**

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 of tire model, Estimation of tire road friction, Test on Various road surfaces, Tire vibration, Development of linear model using computer software.

Objective:

Students will familarise with the basics of tires, forces and its moments, performance of tire and estimation of tire - road friction.

Session No *	Topics to be covered	Ref	Teaching Aids
37	Tire forces and moments	2- Ch 1, Pg 7-8	PPT
38	Tire structure	2- Ch 1, Pg 3-7 3- Ch 13, Pg 390	PPT
39	Longitudinal and Lateral force at various slip angles	2- Ch 1, Pg 18-30	PPT
40	Rolling resistance	2- Ch 1, Pg 8-18 4- Ch 4, Pg 110-116	PPT
41	Tractive and cornering property of tire	2- Ch 1, Pg 30-43	PPT
42	Performance of tire on wet surface	2- Ch 1, Pg 65-72	PPT
43	Ride property of tires	2- Ch 1, Pg 73-87	PPT
44	Magic formulae tire model	2- Ch 1, Pg 58-67 3- Ch 13, Pg 421-425	PPT
45	Estimation of tire road friction	3- Ch 14, Pg 433-442	PPT
46	Test on Various road surfaces	2- Ch 1, Pg 77-	PPT
47	Tire vibration	4- Ch 10, Pg 371	PPT
48	Development of linear model using computer software	3- Ch 13, Pg 421-425	PPT

Content beyond syllabus covered (if any):

Power consumed by a tire

Reason for uneven tire wear

* Session duration: 50 minutes

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COURSE DELIVERY PLAN - THEORY

Sub. Code / Sub. Name : AE18702 VEHICLE DYNAMICS

Unit : V

Unit Syllabus:

LATERAL DYNAMICS **12**

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 and during turn, Effect of suspension on cornering, Development of linear model using computer software.

Objective:

Students learn the basics of steady and transient state response characteristics, direction control of vehicles.

Session No *	Topics to be covered	Ref	Teaching Aids
49	Steady state handling characteristics	2- Ch 5, Pg 336-349	PPT
50	Problems in Steady state handling characteristics	2- Ch 5, Pg 349-350	PPT
51	Steady state response to steering input	2- Ch 5, Pg 350-354	PPT
52	Testing of handling characteristics	2- Ch 5, Pg 355-358	PPT
53	Transient response characteristics	2- Ch 5, Pg 359-362	PPT
54	Direction control of vehicles	2- Ch 5, Pg 362-368	PPT
55	Roll center, Roll axis, Vehicle under side forces	9- Ch 21, Pg 920-926	PPT
56	Stability of vehicle on banked road	9- Ch 20, Pg 888	PPT
57	Stability of vehicle during turn	9- Ch 20, Pg 891	PPT
58	Problems in Stability of vehicle - banked road, during turn	9- Ch 20, Pg 892,893	PPT
59	Effect of suspension on cornering	4- Ch 6, Pg 209-230	PPT
60	Development of linear model using computer software	2- Ch 5, Pg 376-385	PPT

Content beyond syllabus covered (if any):

* Session duration: 50 minutes

Sub. Code / Sub. Name : AE18702 VEHICLE DYNAMICS

REFERENCES:

1. Singiresu S. Rao, "Mechanical Vibrations", 5th Edition, Prentice Hall, 2010.
2. Wong. J. Y., "Theory of Ground Vehicles", 3rd Edition, Wiley-Interscience, 2001.
3. Rajesh Rajamani, "Vehicle Dynamics and Control", 1st edition, Springer, 2005.
4. Thomas D. Gillespie, "Fundamentals of Vehicle Dynamics", Society of Automotive Engineers Inc, 1992.
5. NakhaieJazar. G., "Vehicle Dynamics: Theory and Application", 1st edition, Springer, 2008.
6. Hans B Pacejka, "Tire and Vehicle Dynamics", 2nd edition, SAE International, 2005.
7. Dean Karnopp, "Vehicle Stability", 1st edition, Marcel Dekker, 2004.
8. Michael Blundell & Damian Harty, "The Multibody Systems Approach to Vehicle Dynamics", Elsevier Limited, 2004.
9. Giri N.K, Automotive Mechanics, Khanna Publishers, 2007.
10. Giles.J.G.Steering - "Suspension and Tyres", Illiffe Books Ltd., London- 1998.

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Remarks *:	The same lesson plan can be followed for this odd semester for the Academic year 2022-23. 27/7/22	27/07/2022
Remarks *:	The same Lesson plan can be followed for this odd semester for the Academic year 2023-24 26/7/23	26/07/2023

* If the same lesson plan is followed in the subsequent semester/year it should be mentioned and signed by the Faculty and the HOD