Lok Jagruti Kendra University
University with a Difference

Diploma
in
Automobile Engineering

LJ Polytechnic

Course Code: 025010601

Vehicle Dynamics

Programme / Branch Name	Diploma in Automobile Engineering					
Course Name	Vehicle Dynamics				**Course Code**	025010601
Course Type	HSSC	BSC	ESC	PCC	OEC	PEC

Legends: HSSC: Humanities and Social Sciences Courses BSC: Basic Science Courses
ESC: Engineering Science Courses PCC: Program Core Courses
OEC: Open Elective Courses PEC: Program Elective Courses

1. Teaching and Evaluation Scheme

Teaching Hours / Week					**Evaluation Scheme**				
L	**T**	**P**	**Total Teaching Hours**	**Total Credit**	**CA**	**CCE**	**SEE (TH)**	**SEE (PR)**	**Total**
4	0	0	4	4	10	40	50	-	100

Legends: L: Lectures T: Tutorial P: Practical
CA: Continuous Assessment (Attendance + Activity)
CCE: Continuous & Comprehensive Evaluation
SEE (Th): Semester End Evaluation (Theory)
SEE (Pr): Semester End Evaluation (Practical)

2. Prerequisite

- ✓ Physics
- ✓ Engineering Materials and Mechanics of Solids
- ✓ Automobile Design

3. Rationale

Vehicle Dynamics is the engineering subject about vehicle motion in relevant user operations. It is an applied subject, applied on a certain group of products, namely vehicles. Vehicle Dynamics always uses theories and methods from Mechanical engineering/Machine design, but often also from Control/Signal engineering and Human behavioural science.

4. Objectives

- ✓ To develop the knowledge on various aspects of Theory of Machine and Vehicle Dynamics.
- ✓ To provide an understanding to students on the balancing of various machine elements.
- ✓ To develop the knowledge on Steering Dynamics of a Vehicle.
- ✓ Study about various aspects Vehicle Performance related to dynamic conditions of the vehicle.

5. Contents

Unit No.	Topics	Sub-Topics	Learning Outcome	% Weightage	Hours
1.	**Theory of Machine and Vehicle Dynamics**	1.1 Definition of theory of machine 1.2 Sub-division of Theory of Machines 1.3 Definition of machine 1.4 Kinematic Link or Element 1.5 Types of Links 1.6 Structure and Difference between a Machine and a Structure 1.7 Kinematic Pair 1.8 Types of Constrained Motion 1.9 Classification of Kinematic Pairs 1.10 Kinematic Chain 1.11 Mechanism 1.12 Inversion of Mechanism 1.13 Types of Kinematic Chain 1.14 Four Bar Chain or Quadric Cycle Chain 1.15 Single Slider Crank Chain 1.16 Double Slider Crank Chain 1.17 Cam and Follower Mechanism with their types 1.18 Introduction to vehicle dynamics-Drag, Lift, Side force, rolling moment, pitching moment, Yawing moment.	• Understand basic concept of Theory of Machines and Kinematics.	25	10
2.	**Balancing of Rotating Masses**	2.1 Introduction 2.2 Balancing of Rotating Masses 2.3 Balancing of a Single Rotating Mass by a Single Mass Rotating in the Same Plane 2.4 Balancing of a Single Rotating Mass by Two Masses Rotating in Different Planes 2.5 Balancing of Several Masses Rotating in the Same Plane 2.6 Balancing of Several Masses Rotating in Different Planes.	• Understand balancing of rotating masses in different condition.	15	6
3.	**Balancing of Reciprocating Masses**	3.1 Introduction 3.2 Primary and Secondary Unbalanced Forces of Reciprocating Masses 3.3 Partial Balancing of Unbalanced Primary Force in a Reciprocating Engine	• Understand balancing of reciprocating masses in different condition.	15	6

		3.4 Partial Balancing of Locomotives 3.5 Effect of Partial Balancing of Reciprocating Parts of Two Cylinder Locomotives 3.6 Variation of Tractive Force 3.7 Swaying Couple 3.8 Hammer Blow 3.9 Balancing of Primary Forces of Multi-cylinder In-line Engines 3.10 Balancing of Secondary Forces of Multi-cylinder In-line Engines			
4.	**Steering Dynamics**	4.1 Introduction 4.2 Steering Gears 4.3 Steering Linkages 4.4 Steering Gear Ratio 4.5 Wheel Alignment – Camber, King Pin Inclination or Steering Axis Inclination, Caster and Toe-In & Toe-Out 4.6 Fundamental Equation for Correct Steering 4.7 Steering Mechanisms 4.8 Davis Steering Gear 4.9 Ackerman steering Mechanism 4.10 Turning Circle Radius	• Understand steering geometry and concept of real-world steering system.	15	8
5.	**Vehicle Performance**	5.1 Resistance to the Motion of The Vehicle 5.2 Traction and Tractive Effort 5.3 Acceleration 5.4 Gradeability 5.5 Drawbar Pull 5.6 Relation between Engine Revolution (N) & Vehicle Speed (V). 5.7 Distribution of weight in three wheeled and four wheeled vehicles 5.8 Stability of vehicle on slope 5.9 Factors affecting braking efficiency. 5.10 Calculation of stopping distance. (When brakes are applied to front wheel, rear wheels and four wheels)	• Evaluate vehicle performance in various conditions.	30	12
				Total Hours	**42**

6. Suggested Specification Table with Hours

Unit No.	Chapter Name	Teaching Hours	Distribution of Topics According to Bloom's Taxonomy					
			R %	U %	Ap %	C %	E %	An %
1	Theory of Machine and Vehicle Dynamics	10	20	40	20	0	20	0
2	Balancing of Rotating Masses	6	10	30	30	0	20	10
3	Balancing of Reciprocating Masses	6	10	30	30	0	20	10
4	Steering Dynamics	8	25	25	30	0	20	0
5	Vehicle Performance	12	10	30	30	0	20	10

Legends: R: Remembering U: Understanding
App: Applying C: Creating
E: Evaluating An: Analyzing

7. Reference Books

1) Automobile Engineering Body Repair Technique Vol 4, By Anil Chikara; Satya Prakashan
2) Automobile Engineering Paint Technique Vol 5, By Anil Chikara; Satya Prakashan
3) Jnusz Pawlowski, "Vehicle Body Engineering", Business books limited
4) Automotive Refinishing, By Harry T Chuddy; Prentic Inc.
5) Vehicle Body Layout by John Fanton, Mechanical Engineering Publications
6) The Haynes Automotive Body Repair & Painting Manual, Haynes, Delmar Cengage Learning, 1 Edition

8. Open Sources (Website, Video, Movie)

1) https://www.youtube.com/watch?v=powT52Isd-Q
2) https://www.youtube.com/watch?v=LZ82iANWBL0
3) https://www.youtube.com/watch?v=IGkUsyIANvE
4) https://www.youtube.com/watch?v=mHc1u5mw2Yg
5) https://www.youtube.com/watch?v=cOsJxlEwns0
6) https://alison.com/topic/learn/112512/vehicle-dynamics-learning-outcomes
7) https://iversity.org/en/courses/vehicle-dynamics-i-accelerating-and-braking-october-2015?r=2548d
8) https://iversity.org/en/courses/vehicle-dynamics-ii-cornering-january-2016?r=2548d