

Devi Ahilya Vishwavidyalaya, Indore, India Institute of Engineering & Technology				II Year B. Tech. (Mechanical Engineering) (Full Time)		
Course Code & Name	Instructions Hours per Semester and Credits					
4RMPC2 THEORY OF MACHINES	Classroom Instruction (CI)		Lab Instruction (LI)	Term Work (TW) and Self Learning (SL)	Total no. of Hours Per semester	Total Credits (Total Hours/30)
	L	T	P	TW+SL	120	4
	30	10	20	60		

Course Learning Objectives:

The course is designed:

1. To provide fundamental knowledge of mechanisms, including gears, cams, and degrees of freedom.
2. To develop understanding of velocity and acceleration analysis in various mechanisms.
3. To explain the basic principles of cams and followers and enable drawing of cam profiles for specified motions.
4. To enhance analytical skills for understanding the behavior and applications of different gear trains.
5. To introduce the concept and effects of gyroscopic motion and its engineering applications.

Pre-requisites: Basics knowledge of Kinematics, motions & 2D analysis.

COURSE CONTENTS

UNIT-I

Basics of Theory of Machines: Degree of Freedom (Grubler's criterion), Concept of mechanism, Inversions of Quadric cycle chain, single and double slider crank mechanism. Grashof's criterion, Types of kinematic synthesis, Synthesis of four bar function generator, Study of Straight line mechanisms (Paucellier, Tchebicheff's mechanisms), Steering Mechanisms (Ackerman's mechanism, Devi's Steering Gear mechanism). Hooke's joint and engine indicators.

UNIT-II

Velocity and Acceleration Analysis: Determination of velocity and acceleration by analytical and/or graphical methods of various mechanisms. Study of Coriolis components, Klein's construction.

UNIT-III

Cams and Followers: Types of Cams and followers, Cam profiles with specified follower motion e.g. simple harmonic, constant velocity and acceleration and deceleration, cycloidal types, Cams with specified contours. Tangent Cams, Displacement, Velocity and Acceleration of followers.

UNIT-IV

Gears and Gear Trains :Types of gears, Terminologies of various gears (Spur. Bevel gear, Helical gear, Worm and Worm wheel), Condition for correct gearing, Basics of gear meshing, Tooth profiles (cycloidal and involute). Gear trains, Epicyclic gear trains and their analysis.

UNIT-V

Gyroscopes: Product of Inertia, Principle Axis, Gyroscopic Motion, Gyroscopic Torque, Gyrostabilizer, Gyrocompass. Application to Ships and Aero planes. Stability of Two & Four Wheelers.

BOOKS RECOMMENDED:

1. Thomas, B., Theory of Machines, CBS Publications & Distributions, 2000
2. Shigley, J., Theory of Machines and mechanisms, Oxford University, 2006.
3. Ambekar, A.G., Mechanism and Machine Theory, Jain Brothers, 2005
4. Singh Sadhu, Theory of Machines, Pearson's Education, 2006.
5. Rattan, S.S., Theory of Machines, Tata McGraw Hill Education (P) Ltd., 2011

LIST OF PRACTICAL ASSIGNMENT

1. Study of cam and follower and finding velocity and acceleration of follower.
2. Study of slider crank mechanism.
3. Study of different kinematic pairs.
4. Generation of involute teeth profile for different gears.
5. Performance of interference and undercutting of tooth (by plotting).
6. Study of gyroscopic effect using gyroscope.
7. Reducing and enlarging drawings using pantograph, study of straight-line mechanisms.
8. Study of Double Hooks joint.
9. Study of Oldham's coupling.
10. Verification of Grashof's law.
11. Study of automobile steering gears.

Course Outcome:

Students earned credits will develop ability to

Course Out Come (CO)	After completion of the course, students will be able to:
CO1	Analyze various mechanisms, their inversions, and mobility using kinematic principles.
CO2	Determine velocity and acceleration of different mechanisms using analytical and graphical methods.
CO3	Design cam profiles for specified follower motions and evaluate follower kinematics.
CO4	Explain gear geometry, analyze gear trains (including epicyclic), and determine speed ratios.
CO5	Apply gyroscopic principles to study the stability and control of vehicles and rotating bodies.

CO-PO- PSO Relationship

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PSO-1	PSO-2	PSO-3
CO 1	3	3	3	2	2	1	0	0	0	0	1	3	2	0
CO 2	3	1	1	3	3	1	0	0	0	0	1	3	2	0
CO 3	3	2	2	3	3	0	0	0	0	0	2	3	2	0
CO 4	3	3	1	1	1	2	2	0	0	0	1	3	1	0
CO 5	3	3	1	1	1	0	0	0	0	0	1	3	2	1

* CO (rows) mention nil/very small/insignificant contribution to the PO(column)

1 → relevant and small significance 2 → medium or moderate and 3 → strong