MECHANISM DESIGN AND SYNTHESIS

Course Code	22MEMD2T1	**Year**	I	**Semester**	II
Course Category	Programme core	**Branch**	ME	**Course Type**	Theory
Credits	4	**L-T-P**	4-0-0	**Prerequisites**	Kinematics of Machinery
Continuous Internal Evaluation:	40	**Semester End Evaluation:**	60	**Total Marks:**	100

Course outcomes: At the end of the course, the student will be able to:

CO	Statement	BTL	Units
CO1	Build up critical thinking and problem solving capacity of various mechanical engineering problems related to kinematics of mechanisms	L3	1
CO2	Analyze design related problems of function, path, motion generation, dimensional synthesis, Coordinate transformation, and the four bar slider crank position solution.	L4	2
CO3	Asses various concepts of two position motion, three position motion generated by analytical synthesis, precision point methods	L4	3
CO4	Velocity and acceleration analysis of Fourbar pin jointed linkage, Coriolis acceleration, working principles of cams	L4	4

Contribution of Course outcomes towards achievement of programme outcomes & Strength of correlations (High:3, Medium: 2, Low:1)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	3	2		2					1			3	1
CO 2	3	3	2		2					1			3	1
CO 3	3	3	2		2					1			3	1
CO 4	3	2	2		2					1			3	1

Syllabus		
Unit	**Contents**	**Mapped CO**
1	**Kinematics of Mechanisms**: Introduction – kinematics and kinetics - Mechanisms and machines- applications of kinematics- identification of need,	**CO1**

	background research, Detailed design prototyping and testing, production. **Kinematics fundamentals**: Introduction, Degrees of Freedom (DOF), types of motion, links, joints and kinematic chains, Determining Degree of Freedom in Planar Mechanisms and in Spatial Mechanisms. Mechanisms and structures.	
2	**Graphical linkage synthesis**: Introduction synthesis, Function, path, and motion generation, Dimensional synthesis, two position synthesis, three position synthesis with specified moving pivots. Quick return mechanisms, Fourbar quick return, Straight line mechanisms, Designing optimum straight line Fourbar linkages. **Position Analysis**: Introduction, coordinate systems, position and displacement – Coordinate transformation. Translation, and rotation, Graphical position Analysis of linkages, The Fourbar slider crank position solution, Position of any point on a linkage, Transmission angles, extreme values of the transmission angle.	**CO2**
3	**Analytical linkage synthesis**: Introduction, types of kinematic synthesis, Precision points, Two position motion generation by analytical synthesis, Three position motion generation by analytical synthesis, Synthesis for a specified fixed pivot location, Center point and circle point circles, Four and five position analytical synthesis, Analytical synthesis of a path generator with prescribed timing, analytical synthesis of Fourbar function generator, Precision point methods, Coupler curve equation methods, Optimization methods.	**C03**
4	**Velocity Analysis**: Introduction-definition of velocity, Graphical velocity analysis, instant centers of velocity, velocity analysis with instant centers, angular velocity ratio, Mechanical Advantage, using instant centers in linkage Design, The Fourbar inverted slider crank. **Acceleration Analysis**: Introduction definition of Acceleration Graphical Acceleration analysis, Analytical solutions for acceleration analysis, and the Fourbar pin jointed linkage the Fourbar slider-crank, Coriolis acceleration. The Fourbar inverted slider crank. **Cam Design**: Introduction cam terminology, type of follower motion, type of follower, type of cam, type of motion constraints, SVAJ Diagrams. The fundamental law of cam design, Simple Harmonic Motion (SHM), Cycloidal displacement.	**CO4**

Learning Resources
Text Book(s): 1. Kinematics and Dynamics of Machinery - RL. Norton, Tata McGraw Hill, 2009 2. Machine Design an Integrated Approach - RL. Norton, Pearson , 2004
References: 1. Mechanical Engineering Design - Shigley et al., Tat McGraw Hill, 2011 2. Mechanism Design –Arthur g Erdman Prentice hall of india,1988 3. Amitabh Ghosh and Ashok Kumar Mallik, Theory of Mechanisms and Machines. E.W.P.Publishers.