ME205: KINEMATICS OF MACHINES
CREDITS = 6 (L=4, T=0, P=2)

Course Objective:
To analyze the motions of mechanisms and synthesis the mechanisms for given desired motions.

Teaching and Assessment Scheme:

Teaching Scheme			Credits	Assessment Scheme				
L	T	P	C	Theory		Practical		Total Marks
				ESE	CE	ESE	CE	
4	0	2	6	70	30	30	20	150

Course Contents:

Unit No.	Topics	Teaching Hours
1	**Introduction of Mechanisms and Machines:** Concepts of Kinematics and Dynamics, Mechanisms and Machines, Planar and Spatial Mechanisms, Kinematic Pairs, Kinematic Chains, Kinematic Diagrams, Kinematic Inversion, Four bar chain and Slider Crank Mechanisms and their Inversions, Degrees of Freedom, Mobility and range of movement - Kutzbach and Grubler's criterion, Grashof's criterion. Special Mechanisms: Straight line mechanism, Indicator diagrams, Hooke's Joint, Steering Mechanisms.	06
2	**Analysis of Mechanisms:** Velocity and Acceleration Diagrams, Instantaneous Centre of Velocity, Rubbing Velocity, Corioli's component of acceleration, Different methods for Velocity and Acceleration analysis, and concept of computer aided analysis of mechanisms.	08
3	**Synthesis of Mechanisms:** Position synthesis (Analytical Techniques): Loop closure (Vector Loop) representation of linkages, Position analysis of Four bar, slider crank and inverted slider crank mechanisms, Coupler curves, Toggle and Limit Position, Transmission angle, Mechanical Advantage. Dimensional Synthesis: Definitions of Type, Number and Dimensional Synthesis, Definitions of Motion, Path and Function generation, precision position, Chebychev spacing, structural error, Freudenstein's equation, two and three position synthesis (function generation only) of four bar and slider crank mechanisms by graphical and analytical methods and concept of computer aided analysis of mechanisms.	08 08

Unit No.	Topics	Teaching Hours
4	**Belts, Ropes and Chains:** Introduction, belt and ropes drives, selection of belt drive, types of belt drives, materials used for belt and rope drives, slip and creep of belt, tensions for flat belt drive, angle of contact, centrifugal tension, maximum tension of belt, classification of chains.	06
5	**Gears and Gear Trains:** Gears: Terminology, Law of Gearing, Characteristics of involute and cycloid action, Interference and undercutting, center distance variation, minimum number of teeth, contact ratio, spur, helical, bevel and worm gears. Gear Trains: Synthesis of Simple, compound and reverted gear trains, Analysis of epicyclic gear trains.	06 06
6	**Cams and Followers:** Introduction: Classification of cams and followers, nomenclature, displacement diagrams of follower motion, kinematic coefficients of follower motion. Cams with specified contours: Tangent and circular arc cam, Synthesis of cam profile with specified contours.	08
	TOTAL	**54**

List of References:

1. Rattan S. S *"Theory of Machines",* Tata McGraw-Hill.
2. Singh V P *"Theory of Machines",* Dhanpat Rai & Co (P) Ltd.
3. Singh Sadhu, *"Theory of Machines",* Pearson Education.
4. Ambekar, A G *"Mechanism and Machine Theory",* Prentice Hall.
5. Jagdishlal, *Theory of Machines,* Metropolitan book.
6. Uicker J J Jr., Pennock G R, Shigley J E *"Theory of Machines and Mechanisms",* Oxford Press.

Course Outcomes (COs):

At the end of this course students will be able to …

1. Identify different types of motions and determine Degrees of Freedom.
2. Analyze the position, velocity, and acceleration of mechanisms
3. Synthesize the mechanisms.
4. Interpret belts, ropes and chain drives.
5. Evaluate kinematics of gears and gear trains
6. Analyze cam-follower mechanisms.