KINEMATICS OF MACHINES
B.E, IV Semester, Mechanical Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	**17ME42**	**CIE Marks**	**40**
Number of Lecture Hours/Week	**04**	**SEE Marks**	**60**
Total Number of Lecture Hours	**50(10 Hours per Module)**	**Exam Hours**	**03**

Credits – 04

Course Objectives:

1. Familiarize with mechanisms and motion analysis of mechanisms.
2. Understand methods of mechanism motion analysis and their characteristics.
3. Analyse motion of planar mechanisms, gears, gear trains and cams.

Module – 1

Introduction: Definitions: Link, kinematic pairs, kinematic chain, mechanism, structure, degrees of freedom, Classification links, Classifiction of pairs based on type of relative motion, Grubler's criterion, mobility of mechanism, Groshoff's criteria, inversions of Grashoff's chain.

Mechanisms: Quick return motion mechanisms-Drag link mechanism, Whitworth mechanism and Crank and slotted lever Mechanism. Oldham's coupling, Straight line motion mechanisms, Peaucellier's mechanism and Robert's mechanism. Intermittent Motion mechanisms: Geneva wheel mechanism, Ratchet and Pawl mechanism, toggle mechanism, pantograph, condition for correct steering, Ackerman steering gear mechanism.

Module – 2

Velocity and Acceleration Analysis of Mechanisms (Graphical Method): Velocity and acceleration analysis of four bar mechanism, slider crank mechanism. Mechanism illustrating Corioli's component of acceleration. Angular velocity and angular acceleration of links, velocity of rubbing.

Velocity Analysis by Instantaneous Center Method: Definition, Kennedy's theorem, Determination of linear and angular velocity using instantaneous center method.

Klein's Construction: Analysis of velocity and acceleration of single slider crank mechanism.

Module – 3

Velocity and Acceleration Analysis of Mechanisms (Analytical Method): Velocity and acceleration analysis of four bar mechanism, slider crank mechanism using complex algebra method.

Freudenstein's equation for four bar mechanism and slider crank mechanism. **Function Generation** for four bar mechanism.

Module – 4

Spur Gears: Gear terminology, law of gearing, path of contact, arc of contact, contact ratio of spur gear. Interference in involute gears, methods of avoiding interference, condition and expressions for minimum number of teeth to avoid interference.

Gear Trains: Simple gear trains, compound gear trains.

Epicyclic gear trains: Algebraic and tabular methods of finding velocity ratio of epicyclic gear trains, torque calculation in epicyclic gear trains.

Module – 5

Cams: Types of cams, types of followers. displacement, velocity and acceleration curves for uniform velocity, Simple Harmonic Motion, Uniform Acceleration, Retardation and Cycloidal motion.

Cam profiles: disc cam with reciprocating followers such as knife-edge, roller and flat-face followers, inline and offset.

Analysis of Cams: Analysis of arc cam with flat faced follower.

Course outcomes:

1. Identify mechanisms with basic understanding of motion.

2. Comprehend motion analysis of planar mechanisms, gears, gear trains and cams.

3. Carry out motion analysis of planar mechanisms, gears, gear trains and cams.

TEXT BOOKS:

1. Rattan S.S, Theory of Machines, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 4th Edition, 2014.
2. Ambekar A. G., Mechanism and Machine Theory, PHI, 2009.

REFERENCE BOOKS

Michael M Stanisic, Mechanisms and Machines-Kinematics, Dynamics and Synthesis, Cengage Learning, 2016.

2. Sadhu Singh, **Theory of Machines,** Pearson Education (Singapore)Pvt. Ltd, Indian Branch New Delhi, 2nd Edi. 2006.