ME4T4   **KINEMATICS OF MACHINERY**   **Credits: 3**

Lecture:- 3 periods/week   **Internal assessment: 30marks**
Tutorial: - 1 period/week   **Semester end examination: 70 marks**

Course Objectives:
- Comprehend the concept of machines, mechanisms and related terminologies. Discriminate mobility (number of degrees-of-freedom) of the member and enumeration of rigid links and types of joints within mechanisms.
- Formulate the concept of synthesis and analysis of different mechanisms. Distinguish a mechanism for displacement, velocity and acceleration at any point in a moving link.
- To analyze Principles and working of various straight line motion mechanisms and understand Steering gear mechanisms and working of hooks joint.
- Perceive the working principles in power drives which includes theory of gears, gear trains and cams

Course outcomes:
Upon completion of this course the student will be able to:

1. Build up critical thinking and problem solving capacity of various mechanical engineering problems related to kinematics of machines.
2. Analyze design related problems of straight line motion mechanisms effectively.
3. Asses various concepts of Steering gear mechanisms and working principles of gears and cams
4. velocity and acceleration analysis of simple four bar mechanisms

Pre-Requisite subjects: Engineering Graphics, Engineering Mechanics.

UNIT – I
INTRODUCTION:
Elements or Links – Classification – Rigid Link, flexible and fluid link – Types of kinematic pairs – sliding, turning, rolling, screw and spherical pairs – lower and higher pairs – closed and open pairs – constrained motion – completely, partially or successfully constrained and incompletely constrained .
MACHINES : Mechanism and machines – classification of mechanisms – kinematic chain – inversion of mechanism – inversions of quadric cycle chain – single and double slider crank chains.

UNIT – II
KINEMATICS: Velocity – Motion of link in machine – Determination of Velocity diagrams- Graphical
method – Application of relative velocity method four bar chain. Analysis of slider crank chain for displacement, velocity.
ACCELERATION ANALYSIS:

Angular acceleration of Links, Acceleration of Intermediate and offset points- Four Link Mechanism- Slider Crank Mechanism, Corrilies component of acceleration.
PLANE MOTION OF BODY: Instantaneous center of rotation, Three centres in line theorem – Graphical determination of instantaneous centre for Four Bar Mechanism.

UNIT – III
STRAIGHT LINE MOTION MECHANISMS:
Exact and approximate copiers and generated types –Peaucellier, Hart and Scott Russul – Grasshopper – Watt T. Chebicheff and Robert Mechanisms and Straight line motion, Pantograph.
STEERING MECHANISMS:
Conditions for correct steering – Davis Steering gear, Ackermans steering gear. HOOKE'S JOINT: Single and double Hooke's joint – velocity ratio –application – simple problems.

UNIT-IV
CAMS:
Definitions of cam and followers – their uses – Types of followers and cams – Terminology – Types of follower motion - Uniform velocity – Simple harmonic motion and uniform acceleration. Maximum velocity and maximum acceleration during outward and return strokes in the above 3 cases.

UNIT-V
GEARS :
Introduction, Classification of gear terminology, Law of Gearing, Velocity of Sliding, Forms of Teeth, Cycloidal Profile Teeth, Involute Profile Teeth, Path of contact, Arc of contact, Number of pairs of Teeth in contact, Interference in Involute Gears.
GEAR TRAINS:
Introduction, simple Gear Train, Compound Gear Train, Reverted Gear train, Planetary or Epicyclic Gear Train, Analysis of Epicyclic Gear Train, Torques in Epicyclic Trains. Tabular Method.

Learning Resources
Text Books:
1. Theory of Machines, (3 ed Edition) by S.S.Rattan, Tata Mc-Graw Hill, New Delhi, 2012.
2. Theory of machine and Mechanisms, 2 nd Edition by J.E. Shigley, Mc-Graw Hill, New Delhi,1994.
Reference Books:
1. Theory of Mechanisms and Machines, (I st Edition) by C S Sharma and Kamlesh Purohit , Prentice Hallof India pvt.ltd, , New Delhi, 2006.
2. Theory of Machines, (3 ed edition), by Ballaney, P.L, Khanna Publishers, New Delhi 2002.
3. Theory of Mechanisms and Machines, (2 nd Edition), by A. Ghosh and ak Mallik, East-West Press (P) Ltd., New Delhi, , 1988.