

2/4B.Tech FOURTH SEMESTER

AE4T4

KINEMATICS OF MACHINERY

Credits: 3

Lecture:- 3 periods/week

Internal assessment: 30marks

Tutorial: - 1 period/week

Semester end examination: 70 marks

Course Outcomes:

At the end of course the students 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. Assess various concepts of Steering gear mechanisms and working principles of power elements (Gears, gear trains, Cams)
4. Draw velocity and acceleration diagrams of simple four bar mechanisms
5. Utilize analytical, mathematical and graphical aspects of kinematics of Machines for effective design.

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, Coriolis 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 Russel – 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 machines, (4 th Edition), by R.S. Khurmi, S.chand Publications, 2011.
3. 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, (1 st Edition) by C S Sharma and Kamlesh Purohit , Prentice Hall of 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.