KINEMATICS OF MACHINES

Sub Code

: 06 ME 44

IA Marks

: 25

Hrs/week

: 04

Exam Hours

: 03

Total Lecture Hrs

: 52

Exam Marks

: 100

PART – A

UNIT 1:□□□□□□□□□□□□□□□

INTRODUCTION: DEFINITIONS: Link or element, kinematic pairs, degrees of freedom, Grubler's criterion (without derivation), Kinematic chain, Mechanism, structure, Mobility of Mechanism, Inversion, Machine.

KINEMATIC CHAINS AND INVERSIONS: Inversions of Four bar chain; Single slider crank chain and Double slider crank chain.

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UNIT 2:□□□□□□□□□□□□□□□□

MECHANISMS: Quick return motion mechanisms-Drag link mechanism, Whitworth mechanism and Crank and slotted lever Mechanism.

Straight line motion mechanisms –Peaucellier's mechanism and Robert's mechanism. Intermittent Motion mechanisms –Geneva mechanism and Ratchet and Pawl mechanism. Toggle mechanism, Pantograph, Ackerman steering gear mechanism.

 1 Hours

UNIT 3:

VELOCITY AND ACCELERATION ANALYSIS OF MECHANISMS (GRAPHICAL METHODS)

 Velocity and acceleration analysis of Four Bar mechanism, slider crank mechanism and Simple Mechanisms by vector polygons: Relative velocity and acceleration of particles in a common link, relative velocity and accelerations of coincident Particles on separate links- Coriolis component of acceleration. Angular velocity and angular acceleration of links, velocity of rubbing.

 7 Hours

UNIT 4:

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.

 6 Hours

PART – B

UNIT 5:

VELOCITY AND ACCELERATION ANALYSIS OF MECHANISMS (ANALYTICAL METHODS):

Analysis of four bar chain and slider crank chain using analytical expressions. (use of complex algebra and vector algebra)

6 Hours

UNIT 6:

SPUR GEARS: Gear terminology, law of gearing, Characteristics of involute action, Path of contact, Arc of contact, Contact ratio, Interference in involute gears, Methods of avoiding interference, Back lash, Comparison of involute and cycloidal teeth.

6 Hours

UNIT 7:

GEAR TRAINS: Simple gear trains, Compound gear trains for large speed reduction, Epicyclic gear trains, Algebraic and tabular methods of finding velocity ratio of epicyclic gear trains. Tooth load and torque calculations in epicyclic gear trains.

7 Hours

UNIT 8:

CAMS: Types of cams, Types of followers, Displacement, Velocity and Acceleration time curves for cam profiles. Disc cam with reciprocating follower having knife-edge, roller and flat-faced follower, Disc cam with oscillating roller follower, Follower motions including SHM, Uniform velocity, uniform acceleration and retardation and Cycloidal motion.

7 Hours

<u>Text Books:</u>

1. **"Theory of Machines"**, Rattan S.S, Tata McGraw-Hill Publishing Company Ltd., New Delhi, and 2nd edition -2005.

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

Reference books:

1.   **"Theory of Machines & Mechanisms**" , Shigley. J. V. and Uickers, J.J., OXFORD University press.2004

2.   "**Theory of Machines -I**", by A.S.Ravindra, Sudha Publications, Revised 5th Edi. 2004.

Scheme of Examination:

One Question to be set from each chapter. Students have to answer any FIVE full questions out of EIGHT questions, choosing at least 2 questions from part A and 2 question from part B.

Graphical Solutions may be obtained either on the Graph Sheets or on the Answer Book itself.