

PAU4I103 Kinematics and Dynamics of Machines

Theory L/T (Hours per week): 3/1, Credit: 3

Module – I : (10 Lectures)

1. Kinematic fundamental: Basic Kinematic concepts and definitions, Degrees of freedom, Elementary Mechanism : Link, joint, Kinematic Pair, Classification of kinematic pairs, Kinematic chain and mechanism, Grübler's criterion, Inversion of mechanism, Grashof criteria, Four bar linkage and their inversions, Single slider crank mechanism, Double slider crank mechanism and their inversion. Transmission angle and toggle position, Mechanical advantage.

2. Kinematic Analysis : Graphical analysis of position, velocity and acceleration of four bar and Slider crank mechanisms. Instantaneous centre method, Aronhold-Kennedy Theorem, Rubbing velocity at a Pin-joint. Coriolis component of acceleration.

Module – II : (10 Lectures)

3. Mechanism Synthesis : Graphical methods of synthesis, Chebychev spacing for precision positions, Freudenstein's equation applicable to four bar linkages.

4. Mechanism Trains: Gear Terminology and definitions, Analysis of mechanism Trains: Simple Train, Compound train, Reverted train, Epicyclic train and their applications.

Module – III : (8 Lectures)

5. Combined Static and Inertia Force Analysis: Inertia forces analysis, velocity and acceleration of slider crank mechanism by analytical method. engine force analysis - piston effort, force acting along the connecting rod, crank effort. dynamically equivalent system, compound pendulum, correction couple.

6. Friction Effects: Screw jack, friction between pivot and collars, single, multi-plate and cone clutches, anti friction bearing, film friction, friction circle, friction axis.

Module – IV : (8 Lectures)

7. Flexible Mechanical Elements: Belt, rope and chain drives, initial tension, effect of centrifugal tension on power transmission, maximum power transmission capacity, belt creep and slip.

8. Brakes & Dynamometers : Classification of brakes, Analysis of simple block, Band and internal expanding shoe brake, Braking of a vehicle. Absorption and transmission dynamometers, Prony brake, Rope brake dynamometer, belt transmission, epicyclic train, torsion dynamometer.

Text Books

1. Kinematics and Dynamics of Machinery by R L Norton, Tata MacGraw Hill
2. Theory of Machines and Mechanisms by John J. Uicker Jr., Gordon R. Pennock and Joseph E. Shigley, Oxford University Press
3. Theory of Machines by S.S.Rattan, Tata MacGraw Hill

Reference

1. Theory of Machines by Thomas Bevan, CBS Publications
2. Kinematics and Dynamics of Machinery by Charles E. Wilson and J.Peter Saddler, Pearson Education
3. Mechanism and Machine Theory by J.S.Rao and R.V.Dukipatti, New Age International.
4. Theory of Mechanisms and Machines by A. Ghosh & A. K. Mallick, East West Press.
5. Kinematics and Dynamics of Machines by G.H. Martin, McGraw-Hill.
6. Theory of Machines and Mechanisms by P.L.Ballaney, Khanna Publishers
7. Theory of Mechanisms and Machines by C.S.Sharma and K.Purohit, PHI.