

AU/IP/ME-403 Theory of M/C and Mechanism

Unit 1:

Mechanisms and Machines: Mechanism, machine, plane and space mechanisms, kinematic pairs, kinematic chains and their classification, degrees of freedom, Grubler's criterion, kinematic inversions of four bar mechanism and slider crank mechanism, equivalent linkages, pantograph, straight line motion mechanisms, Davis and Ackermann's steering mechanisms, Hooke's joint.

Unit 2:

Kinematic analysis of plane mechanisms using graphical and Cartesian vector notations: Planar kinematics of a rigid body, rigid body motion, translation, rotation about a fixed axis, absolute general plane motion. General case of plane motion, relative velocity method, velocity and acceleration analysis, instantaneous center and its application, Kennedy's theorem, relative motion, Coriolis component of acceleration; velocity and acceleration analysis using complex algebra (Raven's) method.

Unit 3 :Gears: Classification of gears, nomenclature, involutes and cycloidal tooth profile properties, synthesis of tooth profile for spur gears, tooth system, conjugate action, velocity of sliding, arc of contact, path of contact, contact ratio, interference and undercutting, helical, spiral, bevel and worm gears.

Unit 4:

Cams: Classification of followers and cams, radial cam nomenclature, analysis of follower motion (uniform, modified uniform, simple harmonic, parabolic, cycloidal), pressure angle, radius of curvature, synthesis of cam profile by graphical approach, cams with specified contours.

Gear Trains: Simple, compound, epicyclic gear trains; determination of gear speeds using vector, analytical and tabular method; torque calculations in simple, compound and epicyclic gear trains.

Unit 5:

Gyroscopic Action in Machines: angular velocity and acceleration, gyroscopic torque/ couple; gyroscopic effect on naval ships; stability of two and four wheel vehicles, rigid disc at an angle fixed to a rotating shaft.

References:

1. Rattan SS; Theory of machines; TMH
2. Ambekar AG; Mechanism and Machine Theory; PHI.
3. Sharma CS; Purohit K; Theory of Mechanism and Machines; PHI.
4. Thomas Bevan; Theory of Machines; Pearson/ CBS PUB Delhi.
5. Rao JS and Duggipati; Mechanism and Machine Theory; NewAge Delhi.
6. Dr.Jagdish Lal; Theory of Machines; Metropolitan Book Co; Delhi –
7. Ghosh,A.,Mallik,AK; Theory of Mechanisms & Machines, 2e,;East West Press, Delhi.

List of experiments (expandable)

- 1.To study all inversions of four-bar mechanisms using models
- 2.Draw velocity and acceleration polygons of all moving link joints in slider crank mechanism
- 3.Determination of velocity and acceleration in above using method of graphical differentiation
- 4.To study working of differential gear mechanism.
- 5.To study working of sun and planet epicycle gear train mechanism using models
- 6.To plot fall and rise of the follower versus angular displacement of cam and vice versa.
- 7.Study of universal gyroscope
- 8.Analytical determination of velocity and acceleration in simple mechanism using Raven's M.