# MECHANISMS AND MACHINE DESIGN

## PROFESSIONAL ELECTIVE - II

**VI Semester**

| Course Code | Category | Hours / Week | | | Credits | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|
| | | L | T | P | C | CIE | SEE | Total |
| A5AE43 | PCC | 3 | 0 | 0 | 3 | 30 | 70 | 100 |

**COURSE OBJECTIVES:**

1. The primary objective of the course is to study the basic concepts about machines and mechanisms.
2. The other objective of the course is to study the kinematic analysis of mechanisms.
3. The next object is to understand the Acceleration diagram for a given mechanism, Kleins construction, Coriolis acceleration, determination of Carioles component of acceleration.
4. The focus is on to plane motion of body, the objective is to know the gyroscopic motion-precession 5. The object is to know the cams and followers. Also to know the Simple harmonic motion and uniform acceleration. Maximum velocity and Maximum acceleration during out ward and return strokes in all the above three cases.
6. The object is to know the Davis steering gear, Ackerman's steering gear, Velocity ratio, Hooks joint- Single and double hooks joint, Universal coupling and its applications. Four bar Mechanism, Fraud stein equation, Precession point synthesis, Chebyshev's method, Structural error

### UNIT-I BASICS OF MECHANISMS

Classification of mechanisms – Basic kinematic concepts and definitions – Degree of freedom, Mobility – Kutzbach criterion, Gruebler"s criterion – Grashof"s Law – Kinematic inversions of four-bar chain and slider crank chains – Limit positions – Mechanical advantage – Transmission Angle – Description of some common mechanisms – Quick return mechanisms, Straight line generators, Universal Joint – rocker mechanisms.

### UNIT-II KINEMATICS OF LINKAGE MECHANISMS

Displacement, velocity and acceleration analysis of simple mechanisms – Graphical method– Velocity and acceleration polygons – Velocity analysis using instantaneous centres – kinematic analysis of simple mechanisms – Coincident points – Coriolis component of Acceleration – Introduction to linkage synthesis problem. Effect of Precission on Stability of moving vehicles such as Aero planes and ships.

### UNIT-III KINEMATICS OF CAM MECHANISMS

Classification of cams and followers – Terminology and definitions – Displacement diagrams –Uniform velocity, parabolic, simple harmonic and cycloidal motions – Derivatives of follower motions – Layout of plate cam profiles – Specified contour cams – Circular arc and tangent cams – Pressure angle and undercutting – sizing of cams..

### UNIT-IV GEARS AND GEAR TRAINS

Law of toothed gearing – Involutes and cycloidal tooth profiles –Spur Gear terminology and definitions –Gear tooth action – contact ratio – Interference and undercutting. Helical, Bevel, Worm, Rack and Pinion gears [Basics only]. Gear trains – Speed ratio, train value – Parallel axis gear trains – Epicyclic Gear Trains.

### UNIT-V FRICTION IN MACHINE ELEMENT

Surface contacts – Sliding and Rolling friction – Friction drives – Friction in screw threads –Bearings and lubrication – Friction clutches – Belt and rope drives – Friction in brakes- Band and Block brakes.

**Text Books:**

1. *Dr Jagdish Lal, J. M. Shaw* (2003), Theory of Mechanisms and Machines, Metropolitan Book Co-Ltd, New Delhi.
2. *P. L. Ballaney* (2003), Theory of Machines and Mechanisms, Khanna Publisher, New Delhi.

**Reference Books:**

1. *Amithab Ghosh, Asok Kumar Malik* (2001), Theory of Mechanisms and machines, East West Press Private Limited, New Delhi.
2. *J. E. Shigley, Charles, R. Mischk*e (2009), Theory of Machines and Mechanisms, Tata McGraw Hill, New Delhi

**COURSE OUTCOMES:**

1. Develop a kinematic chain to produce the required motion.
2. Calculate the velocity and acceleration of the kinematic chain member for given input motion.
3. Predict the cam profile for required motion of follower.
4. Suggest gear type and parameters for given requirement.
5. Estimate the Torque and Power transmitted by Belt drives .