AU/IP/ME-3003 THEORY OF MACHINES & MECHANISMS

Objectives :
To expose the students to learn the fundamentals of various laws governing rigid bodies and its motions.

Outcomes : At the completion of this course, students should be able to know Basic mechanisms, velocity and acceleration of simple mechanisms Drawing the profile of cams and its analysis Gear train calculations , Gyroscopes Inertia force analysis and flywheels Balancing of rotating and reciprocating masses

Mechanisms and Machines: Links, Pairs, Chains, Structure, Mechanism, Machine, Equivalent linkage, Degrees of freedom, Gruebler's & Kutzback's criterion, Inversions of four bar chain, Mechanism with lower pairs Pantograph, Straight line motion mechanisms, Davis and Ackermann's steering mechanisms, Hooke's joint, Numerical problems based on above topics..

Motion: Plane motion, Absolute & Relative motion, Displacement, Velocity and Acceleration of a point, Velocity and Acceleration Analysis by Graphical & Analytical methods, Velocity image, Velocity of rubbing, Kennedy's Theorem, Acceleration image, Acceleration polygon, Coriolis acceleration component, Klein's construction, Velocity and Acceleration Analysis using Complex Algebra (Raven's Approach), Numerical problems based on above topics

Gears: Classification of gears, Helical, Spiral, Bevel, Worm and Spur Gear, Spur Gear Terminology, Law of gearing, Tooth profiles, , velocity of sliding, Path of contact, Arc of contact, Contact Ratio, Interference and Undercutting, , Conjugate action, Numerical problems based on above topics

Gear Trains : Simple, compound, reverted and epi cyclic gear trains . Velocity ratio and torque calculation in gear trains

Cams: Classification of Cams and Followers, Radial Cam Terminology, Analysis of Follower motion (uniform, modified uniform, simple harmonic, parabolic, cycloidal), Pressure Angle, Radius of Curvature, Cam Profile for radial and offset followers Synthesis of Cam Profile by Graphical Approach, Cams with Specified Contours.

Gyroscope: 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.

Belt Rope & Chain Drive : Types of Belts, Velocity ratio of a belt drive, Slip in belts, Length of open belt and crossed belt, Limiting ratio of belt-Tensions, Power transmitted by a belt, Centrifugal tension, Maximum tension in a belt, Condition for maximum power transmitted, Initial tension in a belt, Creep in belt, Applications of V-Belt, Rope and Chain drives.

EVALUATION
Evaluation will be continuous an integral part of the class as well through external assessment.

Reference :
1. Thomas Bevan; Theory of Machines; Pearson Education
2. Rattan SS; Theory of machines; MC Graw Hills
3. Ambekar AG; Mechanism and Machine Theory; PHI. Eastern Economy Edition 2015
4. Uicker & Shigley, Theory of machines & Mechanism Second Edition Oxford University Press
5. Dr.Jagdish Lal; Theory of Machines; Metropolitan Book Co; Delhi
6. Rao J S and Dukkipati; Mechanism and Machine Theory; New Age Delhi.
7. Abdulla Shariff , Theory of Machines .

List of Experiments:

1 To finds out gyroscopic couple .

2 To Find out velocity & acceleration of slider crank mechanism by Klin''s Construction

3 To find out velocity ratio of various gear trains

4 To study various types of belt drives & find out the velocity ratio of the drive .

5 To Draw the cam profile .

6 Study of working models of various popular mechanisms like quick return mechanism etc .

7 To draw Involute profile of a gear by generating method .

8 Study of the mechanisms like Pantograph mechanism , Davis & Ackerman's steering mechanisms etc .