Semester	**6**
Course	**Major-4**
Paper Code	
Paper Title	**Mechanics-1**
No. of Credits	**4**
Theory / Practical / Composite	**Theory**
Minimum No. of preparatory hours per week a student has to devote	**4**
Number of Modules	**Nil**
Syllabus	**Motion in One dimension (main stress will be laid on problems) [13]:** Motion in a straight line under variable acceleration, Motion of a particle under gravity in a resisting medium-concept of terminal velocity, Simple Harmonic motion- definition, properties, damped oscillation, damped forced oscillation, motion of a particle tied to an elastic string or elastic spring. **Motion in Two dimensions (main stress will be laid on problems) [25]:** Introduction to different coordinate systems—Cartesian, Polar, and Tangent–Normal—chosen according to the symmetry of the problem under consideration, each interpreted as a different choice of basis of $\mathbb{R}^2$, Deduction of expressions of velocity & acceleration of a moving particle in Cartesian, Polar, Tangent-normal and rotating coordinate systems, Inertial Cartesian co-ordinate system in 2D and motion of a projectile under gravity in a resisting medium-concept of terminal velocity, Motion of a particle described by plane polar co-ordinate system in 2D, Central force & central orbits, Central orbit is a plane orbit, Stability of central orbit-Apses & Apsidal angle, Central orbit in a resisting medium, Constrained motion in 2D-motion of a particle on a rough or smooth plane curve, specially cycloid and parabola and circle, Motion under Inverse square law and classification of conical orbits. **Forces in 2D and 3D [14]:** Coplanar forces and astatic equilibrium, forces in 3D: Poinsot's central axis and its uniqueness, wrench, pitch, intensity, and invariant of a given system of forces, simple problems.

Learning Outcomes	**On successful completion of the course, a student will be able to:** • Analyse motion in one dimension under variable acceleration, motion in a resisting medium with terminal velocity, and oscillations, including simple harmonic, damped, and forced oscillations, as well as motion in elastic systems. • Work with different coordinate systems (Cartesian, Polar, Tangent–Normal, rotating) and deduce expressions for velocity and acceleration of a particle in each system. • Solve problems on two-dimensional motion, such as projectile motion with resistance, central force motion and central orbits, stability of central orbits, apses and apsidal angle, and constrained motion on plane curves (cycloid, parabola, circle). • Understand motion under the inverse square law and classify conical orbits. • Apply principles of equilibrium of forces in 2D and 3D, including coplanar forces, astatic equilibrium, Poinsot's central axis and its uniqueness, and related concepts such as wrench, pitch, intensity, and invariants.	
Reading/Reference Lists	1. **Classical Mechanics**: N. C. Rana & P. S. Joag. 2. **An Elementary Treatise on the Dynamics of a Particle and of Rigid Bodies**: S. L. Loney. 3. **Analytical Dynamics**: Saha & Ganguly. 4. **Analytical Statics**: Sinha & Pradhan.	
Evaluation	**End Sem**: 70 **CIA**: 30(20(MidSem)+5(Assignment)+5(Attendance))	
Paper Structure for Theory Semester Exam	7 questions each carrying 10 marks out of 13/14 questions.	