SEMESTER - I

Paper - I   :   Classical Mechanics

Max. Marks : 55
Time : 3 Hrs

Note :   Nine questions will be set and students will attempt 5 questions. Question No. 1 will be compulsory consisting of 4 parts based on the conceptual aspects of the whole syllabus. The answers should not be in yes/no. In addition to Question No. 1 there will be four Units in the question-paper each containing two questions belonging to four Units in the syllabus. Students will select one question from each unit.

UNIT - I

Hamilton's variational principle - Derivation of Lagrange's equations from this principle, extension of the non-holonomic systems - method of undetermined multiplier, velocity dependent forces and dissipation function, conservation laws - some illustrative applications (like simple pendulum, coplanar double pendulum, pendulum with moving support).

UNIT - II

Two-body central forces problems - Classification of orbits, differential equations for orbits, Virial theorem, Kepler's laws of planetary motion and their derivation. Scattering : scattering in laboratory and centre of mass frames, scattering cross sections, Rutherford scattering (derivation of differential and total cross section).

UNIT - III

Kinematics and dynamics of rigid body - Orthogonal transformations, Euler angles, Euler theorem, angular momentum, rotational K.E., principle axis transformations, Euler equations, force free motion of a rigid body, symmetric top.

UNIT - IV

Legendre transformations and Hamilton's equations, cyclic coordinates and conservation theorems, Ruth's Procedure, canonical transformations, Poisson brackets (with illustrative evaluations), Poincare invariants,

Hamilton-Jacobi method and example of harmonic oscillator problem, action angle variables and its applications to harmonic oscillator problem.

References

1. Classical Mechanics - H. Goldstein, Addison - Wesley

2. Classical Mechanics - N.C. Rana and P.S. Jog, Tata - McGraw Hill

3. Classical Mechanics - T.L. Chow, John - Wiley.

4. Classical Mechanics - Sankara Rao, Prantice Hall

5. Mechanics - L.D. Landau and E.M. Lifshitz, Pergamon