

MP-02
CLASSICAL AND STATISTICAL MECHANICS
 (Questions will be set from each unit/section with internal choice)

Units	Topics
I	<p>Lagrangian Mechanics</p> <p>Constraints, Generalised coordinates, D'Alembert Principle and derivation of Lagrangian equation, velocity dependent potentials and Rayleigh's dissipation function.</p> <p>Variational Principle, Euler-Lagrange equation, Derivation of Lagrange's equation from Hamilton's principle.</p> <p>Two-body central force problem, Kepler's problem, inverse square law of force. Scattering in a central force field.</p>
II	<p>Hamiltonian Mechanics and Rigid Body</p> <p>Derivation of Hamilton's equation from variational principle, principles of least action, Equations of canonical transformation, Lagrangian and Poisson brackets, Angular momentum and Poisson bracket relation, Equation of Motion in Poisson bracket notation.</p> <p>Euler's equations of motion for a rigid body and its applications to torsion free symmetric rigid body.</p>
III	<p>Hamilton-Jacobi Theory</p> <p>Hamilton-Jacobi equation for Hamilton's principle function. Harmonic oscillator problem using Hamilton Jacobi method. Hamilton-Jacobi equation for Hamilton's characteristics functions. Separation of variables in the Hamilton-Jacobi equation. Action-angle variables. Kepler's problem in action angle variables.</p>
IV	<p>Classical Statistical Mechanics</p> <p>A priori probability, phase, space, Liouville's theorem; Statistical equilibrium, Maxwell Boltzmann distribution law of velocity, Equation of Energy Micro Canonical and Grand Canonical ensembles Canonical Partition function thermodynamic functions in different ensembles.</p>
V	<p>Quantum Statistical Mechanics</p> <p>Bose-Einstein Statistics, Blackbody radiation energy, and pressure of an ideal Bose Gas, Einstein condensation, theory of liquid helium, Fermi-Dirac Statistics, Energy and pressure of ideal Fermi Gas, Free Electron theory of solids, Landau Theory of Phase transition, critical indices, scale transformation, dimensional analysis, Density and Energy function with electron spin in hydrogen like atom.</p>