Course 2: Classical Mechanics (modified)
Course code: MSCPH502   **Credit: 3**
BLOCK – 1 Lagrangian Dynamics
UNIT 1: **Mechanics of a system of particles:** System of particles, Degrees of freedom,
constraints and generalized coordinates, D'Alemberts principle, Lagrange's
equations,applications to simple system involving one and two degree of freedom, Dissipation
function cyclic coordinates, Applications of lagrangian formulation.
UNIT 2: **Hamilton's and Variational principle**:Hamilton's principle, Variational
principle,calculus of variation, examples, Derivation of Lagrange Equation from Hamilton's
principle, advantage of Variational principle, Conservation laws, Noether's theorem and
symmetries.
BLOCK – 2: Central force problem and Rigid body motion
UNIT 3:**Central force motions**: Dynamical systems, Phase space dynamics, Reduction to One
body problem, Central force, Equations of motion, equation of orbits, condition for closed orbit,
Virial theorem, Kepler laws of planetary motion and inverse square law,Geostationary orbits,
Orbital transfers and interplanetary trajectories.
UNIT 4:**Central force motions**:2
UNIT 5:**Scattering**: Two body collision, Scattering in laboratory and central of mass frame, two
body central force problem, scattering in a central force field, scattering in laboratory
coordinates.
UNIT 6: **Rigid body dynamics:** Rigid body, rigid body equation of motion, angular momentum
and kinetic energy, moment of inertia, inertia tensor, Non-inertial frames and pseudo forces,
Coriolis force, orthogonal transformations, Euler angles.

BLOCK –3:   Hamiltonian formulation
UNIT 7: **Hamilton's equations of motion:** Hamilton's equations of motion and their
applications, cyclic coordinates and conservation theorems, Routh's procedure, Derivation of
Hamilton's equations from variational principle, principle of least action. .
UNIT 8:**canonical transformations**:Equation of canonical transformations, example of
canonical transformations, canonical transformations of Harmonic Oscillator, Poisson brackets,
properties of Poisson bracket, Poisson bracket theorem and formulation, Lagrange Bracket
UNIT 9: **Hamilton-Jacobi theory:** Hamilton-Jacobi theory and equation, Harmonic oscillator in
Hamilton-Jacobi theory, Action-angle variables, applications.

BLOCK – 4   Small oscillation
UNIT 10: **Small Oscillations:** Potential energy, Equilibriums, Formulation of small oscillation,
determination of normal frequencies and eigen value problem, frequencies of free vibrations,
Theory of small Oscillations, Normal modes, forced vibrations, dissipation.