PPH101 CLASSICAL MECHANICS

L	T	P	Cr
3	1	0	3.5

Course Objectives: To apprise the students of Lagrangian and Hamiltonian formulations and their applications.

Newtonian Mechanics: One and many particle system; conservation of linear and angular momentum, work energy theorem,

System of Particles: Constraints, D'Alembert principle, Principle of virtual work, Degree of freedom, Generalized coordinates and momenta, Lagrange's equation and application of linear harmonic oscillator, Simple pendulum and central force problems, Cyclic coordinate, Symmetries and conservation laws, Hamiltonian, Lagrange's equation from Hamilton's Principle, Principle of least action derivation of equation of motion; variation and end points.

Central Force: Reduction of two body problem into single body problem. Definition and characteristics of central force; Closure and stability of circular orbits. General analysis of orbits: bounded and unbounded orbits, Kepler's law of motion, Scattering in center of mass and laboratory frame of reference, Rutherford scattering.

Rigid Body Dynamics: Euclerian angle, Inertia tensor, principal moment of inertia. Euler's equation of motion of a rigid body, Force free motion of a symmetrical top.

Canonical Transformation: Canonical transformation, Legendre Transformation, Generating functions. Conditions for a transformation to be canonical, Hamilton-Jacobi equation, Hamilton's principle and characteristics functions, Action and action angle variables

Wave Motion: Small oscillations, Normal modes and normal coordinates. Examples: Two coupled pendulums and Vibration of linear tri-atomic molecule, Dispersion relation.

Course learningoutcomes: Students will have achieved the abilityto:

1. describeLagrangian and Hamiltonian formulations.

2. solve problems on motion under central force, rigid body dynamics, and periodic motions.

3. apply the theory of small oscillations in different areas of physics e.g., molecular spectra, acoustics, vibrations of atoms in solids, coupled mechanical oscillators and electrical circuits.

Recommended Books

1. *Rana, N.C. and Joag, P.S., Classical Mechanics, Tata McGraw-Hill, (1991).*

2. *Goldstein, H., Classical Mechanics, Pearson Education, (2007).*

Evaluation Scheme:

Sr. No.	Evaluation Elements	Weightage (%)
1	MST	30
2	EST	45
3	Sessionals (May include assignments/quizzes)	25