**PH 405: Classical Mechanics (3-1-0:4)**

**Lagrangian and Hamiltonian Formulations of Mechanics**

Calculus of variations, Hamilton’s principle of least action, Lagrange’s equations of motion, conservation laws, Noether’s theorem, systems with a single degree of freedom, Hamilton’s equations of motion, phase plots, fixed points and their stabilities.**[9L+3T]**

**Rigid Body Dynamics**

Euler equations, heavy symmetrical top, precession, nutation.**[3L+1T]**

**Two-Body Central Force Problem**

Equation of motion and first integrals, classification of orbits, Kepler problem, scattering in central force field, Laboratory and centre of mass frames, Scattering cross section, Rutherford scattering.

**[9L+3T]**

**Small Oscillations**

Linearization of equations of motion, normal modes and normal coordinates, forced oscillations.

**[3L+1T]**

**Canonical Transformations**

Poisson brackets, Hamilton Jacobi theory, Action-angle variables.**[3L+1T]**

**Special Theory of Relativity**

Postulates of special theory of relativity, Lorentz transformation, Length contraction, Time dilation, Simultaneity, Relativistic kinematics and dynamics, Minkowski Space.**[9L+3T]**

**Textbooks and References**:

1. H. Goldstein, “Classical Mechanics”, 3rd edition, Pearson Education India, 2011.
2. L. D. Landau and E. M. Lifshitz, “Mechanics”, 3rd edition, Butterworth-Heinemann, 1982.
3. I. C. Percival and D. Richards, “Introduction to Dynamics”, Cambridge University Press, 1982.
4. J. V. Jose and E. J. Saletan, “Classical Dynamics: A Contemporary Approach”, Cambridge University Press, 1998.
5. J .R. Taylor, “Classical Mechanics”, California University Science Books, 2004.
6. R. Resnick ,”Introduction to Special Relativity”, 1st edition, Wiley, 2007.
7. R. Takwale and P. Puranik, “Introduction to Classical Mechanics “, 1st edition, McGraw Hill, 2017.
8. M. R. Spiegel, “Schaum's Outline of Theory and Problems of Theoretical Mechanics: with an Introduction to Lagrange's Equations and Hamiltonian Theory”,1st edition, New Delhi McGraw Hill Education (India) Private Limited, 1980.