

Details of Course

Course Title	Course Structure			Pre-Requisite
Classical Mechanics -B.Tech. EP III Sem Lesson Plan	L	T	P	
	3	1	0	

Course Objectives

This course is designed to provide students with a foundational understanding of Lagrangian and Hamiltonian canonical equations of motion and their applications to solve some complex mechanical problems. Students will acquire a fundamental grasp of central forces, Kepler's problem, and orbit equations in this course. Overall students will demonstrate proficiency in classical mechanics and effectively apply their knowledge to analyse various physical phenomena.

Course Outcomes (CO)

1. To understand fundamental concept of Newtonian mechanics.
2. Apply classical mechanics equations to solving practical problems.
3. Ability to use the Lagrange and Hamilton equations to solve complex mechanical problems.
4. To Grasp the basic concepts of frame of references and related problems, including the analysis of scattering in laboratory and centre of mass frames.
5. To analyse rigid body dynamics and explore their applications in various contexts.

S. No.	Content	Contact Hours
Unit 1	Basic Principles of classical dynamics, Newton's laws and symmetries, constraint of motion, generalised coordinates D'Alembert Principle, Lagrangian Function and Lagrangian equation of motion: Derivation and applications, Conservation Theorems	8
Unit 2	Hamilton's variational principle, The Hamiltonian (H), Canonical equation of motion, Physical significance of H, cyclic coordinates, Poisson brackets Derivation of Hamiltonian equations from variational principle and their applications	8
Unit 3	Hamilton-Jacobi's equation for Hamilton's principal function, The harmonic oscillator, Hamilton's characteristic function, Action-angle variable, Jacobi's action integral, transition to quantum mechanics.	10
Unit 4	Non inertial frames, Rotating frames, Centrifugal and Coriolis force, Foucault's pendulum, Trade winds. Periodic motion: small oscillations, normal modes	8
Unit 5	Two body Collisions - scattering in laboratory and Centre of mass frames. Rigid body dynamics- moment of inertia and Euler angle Eulerian Coordinates and equation of motion for a rigid body, motion of the symmetrical top.	8
	Total	42

Books:

S. No.	Name of Books/Authors/Publisher
1.	Introduction to Classical Mechanics by David Morin (Cambridge university Press 2008)
2.	CLASSICAL MECHANICS by Herbert Goldstein, Charles P. Poole and John L. Safko (Pearson Education 3 rd Edition 2011)
3.	Classical Mechanics: N C Rana and P S Joag (Tata McGraw, 1991).