Sem.	Subject code	Course title	No. of hours	Credits	Paper type
IV	17U4PMC4	Introduction to classical mechanics	2	2	Major Core

Objectives:

(i) To make the students understand the mechanics of system of particles, and (ii) The basics of Lagrangian dynamics. The formulation of Lagrangian equations of motion to different systems will help the students to understand the theory involved in motion of relatively massive bodies.

Learning outcome:

(i) The students will understand the mechanics of system of particles (ii) They will also understand the role of constraints in the formation of equation of motion (iii) They will understand the Lagrangian dynamics from D'Alembert's principle (iii) Acquiring the knowledge of formation of Lagrange's equation and applying it to systems like simple pendulum and compound pendulum (iv) They will understand the application of Lagrangian mechanics to two body central force problems.

Unit I: Mechanics of a system of particles

External and internal forces–Centre of mass–Conservation of kinetic energy–Conservation of potential energy–Conservation theorem–Examples–Box train–Atwood's machine–Harmonic oscillator.

Unit II: Constraints

Coordinate systems–Degrees of freedom–Holonomic constraints–Non holonomic constraints–Examples–Rigid body–Simple pendulum–Rolling disc–Forces of constraints–Difficulties introduced by the constraints and their removal.

Unit III: Lagrangian dynamics

Generalised coordinates–Principle of virtual work–D'Alembert's principle–Procedure for formation of Lagrange's equations from D'Alembert's principle–Formation of Lagrange's equations–Newton's equation of motion from Lagrange's equations.

Unit IV: Applications of Lagrangian dynamics

Equation of motion of simple pendulum–Atwood's machine–Compound pendulum– Langrange's equation for LC circuit–Motion under central force.

Unit V: Two body central force problem

Reduction of two body central force problem to equivalent one body problem–Central force and motion in a plane–Kepler's laws of planetary motion–Deduction of Kepler's first , second and third laws-Artificial satellites.

Text book(s):

1. Classical Mechanics, J.C. Upadhyaya, Himalaya Publishing House Pvt. Ltd., India, (2015).

Unit I: Chapters 1.7.1, 1.7.2, 1.7.8.
Unit II: Chapters 2.2, 2.3.1, 2.3.2, 2.3.3, 2.3.4, 2.3.5.
Unit III: Chapters 2.4, 2.5, 2.6, 2.7, 2.8.
Unit IV: Chapters 2.8 (Examples 1 to 8).
Unit V: Chapters 4.1, 4.2, 4.6, 4.8.

Books for reference:

1. Classical Mechanics, Leonard Susskind & George Hrabovsky, Penguin Books Ltd., USA, (2014).
2. Classical Mechanics, G.Aruldhas, Prentice - Hall of India Pvt. Ltd., India, (2008).
3. Classical Mechanics, S.L. Gupta, V.Kumar & H.V.Sharma, 21st edition, Pragati Prakashan Pvt. Ltd., India, (2003).
4. Classical mechanics, H. Goldstein, II nd Edn., Nagroga Publishing House, India (2001)

Websites:

1. https://ocw.mit.edu/courses/physics/8-09-classical-mechanics-iii-fall-2014/index.htm