Physics

APPH100	Physics	3L:1T:0P	4 credits

Module I

Transformation of scalars and vectors under Rotation transformation; Forces in Nature; Newton's laws and its completeness in describing particle motion; Form invariance of Newton's Second Law; Solving Newton's equations of motion in polar coordinates; Problems including constraints and friction; Extension to cylindrical and spherical coordinates.

Module II

Potential energy function; F = - Grad V, equipotential surfaces and meaning of gradient; Conservative and non- conservative forces, curl of a force field; Central forces; Conservation of Angular Momentum; Energy equation and energy diagrams; Elliptical, parabolic and hyperbolic orbits; Kepler problem; Application: Satellite maneuvers;

Module III

Non-inertial frames of reference; Rotating coordinate system: Five-term acceleration formula. Centripetal and Coriolis accelerations; Applications: Weather systems, Foucault pendulum;

Module IV

Harmonic oscillator; Damped harmonic motion – over-damped, critically damped and lightly- damped oscillators; Forced oscillations and resonance.

Module V

Definition and motion of a rigid body in the plane; Rotation in the plane; Kinematics in a coordinate system rotating and translating in the plane; Angular momentum about a point of a rigid body in planar motion; Euler's laws of motion, their independence from Newton's laws, and their necessity in describing rigid body motion; Examples.

Module V

Introduction to three-dimensional rigid body motion — only need to highlight the distinction from two-dimensional motion in terms of (a) Angular velocity vector, and its rate of change and (b) Moment of inertia tensor; Three-dimensional motion of a rigid body wherein all points move in a coplanar manner: e.g. Rod executing conical motion with center of mass fixed — only need to show that this motion looks two-dimensional but is three-dimensional, and two-dimensional formulation fails.

Laboratory - Introduction to Mechanics

1. Suggested list of experiments from the following:
2. Coupled oscillators;
3. Experiments on an air-track;
4. Experiment on moment of inertia measurement,
5. Experiments with gyroscope;
6. Resonance phenomena in mechanical oscillators.

TEXTBOOKS/REFERENCES:

1. AICTE Prescribed Textbook: Physics (Introduction to Mechanics), A.B. Bhattacharya, Khanna Book Publishing Co., 2023.
2. Engineering Mechanics, 2nd ed. – D.S. Bedi, M.P. Poonia
3. Basic Mechanical Engineering – S.C. Sharma, M.P. Poonia
4. Engineering Mechanics, 2nd ed. — MK Harbola
5. Introduction to Mechanics — MK Verma
6. An Introduction to Mechanics — D Kleppner & R Kolenkow
7. Principles of Mechanics — JL Synge & BA Griffiths
8. Mechanics — JP Den Hartog
9. Engineering Mechanics - Dynamics, 7th ed. - JL Meriam
10. Mechanical Vibrations — JP Den Hartog
11. Theory of Vibrations with Applications — WT Thomson

Alternative NPTEL/SWAYAM Course:

S. No.	NPTEL Course Name	Instructor	Host Institute
1	ENGINEERING MECHANICS	PROF. MANOJ HARBOLA	IIT KANPUR

EXPERIMENTS THAT MAY BE PERFORMED THROUGH VIRTUAL LABS:

S. No.	Experiment Name	Experiment Link(s)
1	Experiment on moment of inertia measurement.	https://vlab.amrita.edu/?sub=1&brch=74&sim=571&cnt=1