Semester	**I**
Course	Major
Paper Code	C1PH230121T
Paper Title	Mechanics, General Properties of Matter and Thermal Physics 1
No. of Credits	**4**
Theory / Practical / Composite	Theory
Minimum No. of preparatory hours per week a student has to devote	4
Number of Modules	2
Syllabus	Module A: Mechanics 1 & General properties of matter [24L] Classical Mechanics: Definition of dynamical state of a particle, dynamical variables, inertial frames and Galilean transformation. Newton's laws: Equations of motion. [2L] Conservation theorems: Work-energy theorem, potential energy and conservative forces, conservation of linear and angular momentum. Variable mass systems: Rocket motion, Applications. Multi-particle systems: Linear momentum, center of mass, kinetic energy and angular momentum for several particles. [6 L] Central forces: Two-body problem and its reduction to one-body problem and its solution. The energy equation & energy diagram. Newton's law of gravitation, Kepler's law of planetary motion, motion of body near the surface of earth. [6L] Surface tension: Molecular theory, surface tension & surface energy, capillary phenomena, pressure difference across a curved surface. Viscosity: Coefficient of viscosity, streamline flow, critical velocity, Reynolds number & its significance, Newtonian and Non-Newtonian fluids, Bernoulli's theorem, Poiseuille's equation for the flow of liquid through a tube.

	Elasticity: Hooke's Law, moduli of elasticity, Poisson's ratio, torsion of a cylinder/wire, torsional pendulum, bending of beam, bending moment, cantilever, depression of a beam supported at the ends and loaded at the centre. [10L] Module B : Thermal Physics1 [24L] Thermodynamic limit, ideal gas, large numbers and combinatorial problems, definition of heat and heat capacity, probability, temperature and the Boltzmann factor. [4 L] Kinetic theory of gases: Maxwell Boltzmann distribution, Molecular distributions and pressure, Collisions: Mean free path and cross sections, Transport phenomena – thermal conduction and diffusion in gases. [6 L] Thermodynamics: State variables, exact differentials and related theorems. Formulation of Thermodynamics: Ideal thermodynamic processes, zeroth and the first law of thermodynamics, isothermal and adiabatic processes, Adiabatic atmosphere. [6 L] The second law of thermodynamics, heat engines, reversibility, Carnot's theorem, equivalence of Clausius and Kelvin statements. Thermodynamic definition of entropy, Clausius inequality, entropy changes in reversible and irreversible processes, restatement of the first law, Joule expansion. Statistical basis of entropy. [8 L]
Learning Outcomes	(1) Extend the idea of classical mechanics to multi-particle systems, higher dimensions and Non Inertial Frames (module A) (2) Reinforce ideas related to material properties in extended form (module A) (3) Gain an understanding of the origin of thermal energy and its manifestations (module B)

<table>
<tr><td></td><td colspan="2">(4) Enable students to undertake independent projects related to the Green Planet, Energy flow, Robotics and Game Physics.(module B)</td></tr>
<tr><td>Reading/Reference Lists</td><td colspan="2">Reference Books:
Module A

1. Classical Mechanics & General Properties of Matter, S.N. Maiti & D.P. RoyChaudhuri
2. Classical Mechanics , John R. Taylor, University Science Books
3. An introduction to mechanics, D. Kleppner, R.J. Kolenkow, 1973, McGraw-Hill.
4. Feynman Lectures, Vol. I, R.P.Feynman, R.B.Leighton, M.Sands, 2008, Pearson Education
5. Classical Mechanics, N.C. Rana & P.S. Joag, Tata McGraw-Hill Education Pvt. Ltd.
6. Classical Mechanics, H. Goldstein, Narosa Publication.
7. Classical Dynamics of particles and systems, S. Thornton & J. Marion. Cengage India Private Limited; 5th edition

Module B
1. Concepts in Thermal Physics, S.J. Blundell and K.M. Blundell, 2nd Ed., 2012, Oxford University Press
2. Heat and Thermodynamics, M.W. Zemansky, Richard Dittman, McGraw-Hill.
3. A treatise on Heat, Saha & Srivastava.</td></tr>
<tr><td>Evaluation</td><td>Theory
CIA: 30 (2 x 10 + 5/assgn.+ 5/attn.)
Semester Exam:70</td><td>Practical (if applicable)
CA:
Semester Exam:</td></tr>
<tr><td>Paper Structure for Theory Semester Exam</td><td colspan="2">For each module of 35 Marks:
15 Marks from 3 marks questions (5 out of 7)
20 Marks from 10 marks questions (2 out of 3)</td></tr>
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