Semester	**V**
Course	**Physics(Major)**
Paper Code	**C3PH230521T**
Paper Title	**Mechanics II and Thermal Physics II**
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	**Group A** Mechanics of a system of particles, constraints, generalized coordinates with examples, Principle of virtual work and D' Alembert's principle: Lagrange's equation. Calculus of Variations, Lagrange's equation from Hamilton's principle of least action. Legendre Transformations, Hamiltonian, Hamilton's Canonical equation of motion. **[16 lectures]** Central force: Statement of Virial theorem, application to scattering problem. **[4 lectures]** Non-inertial frames of reference and Pseudo forces: Infinitesimal rotations, rate of change of vector, Coriolis force. **[4 lectures]** **Group B** Thermodynamic Potentials: Internal Energy, Enthalpy, Helmholtz Free Energy, Gibb's Free Energy; Applications - Magnetic work, cooling due to adiabatic demagnetization; First and second order phase transitions with examples, Clausius Clapeyron Equation. **[10 Lectures]** **Statistical Mechanics:** Objective of statistical mechanics, specification of the state of a many particle system, phase space, counting the number of microstates in phase space, phase points, statistical ensemble, density of phase points, postulate of equal a priori probability, Liouville's theorem, ergodic hypothesis, H-theorem, probability calculation, thermal, mechanical and general interaction. Microcanonical and Canonical Ensembles: applications – Paramagnetic Salt and Classical Ideal Gas. **[14 lectures]**

Learning Outcomes	**Group A** 1. To gain an understanding of the principle of virtual work and Lagrange's Formulation of Mechanics. 2. To understand the principle of Least Action (Hamilton's principle) leading to the derivation of Lagrange's equation. 3. To understand the two-body central force problem and its solution for an inverse square law of force. 4. To describe the motion of a rigid body. **Group B** 1. The 2nd law of thermodynamics, the concept of entropy and third law of thermodynamics is discussed. 2. Thermodynamic Potentials and 1st and 2nd order phase transitions is discussed 3. Establish the relation between Statistical Mechanics and Thermodynamics.

	4. Ergodic hypothesis and the concept of equal a-priori probability as fundamental hypothesis 5. The student will be exposed to the idea of macro and microstates, the idea of ensembles and their suitable choice to describe systems 6. Maxwell -Boltzmann Statistics and its applications to different systems
Reading/Reference Lists	**Group A** **Reference Books:** 1. Classical Mechanics by H. Goldstein, J. P. Poole and C. Safko (Pearson) 2. Classical Dynamics of Particles and Fields by Thornton and Maion (Cengage) 3. Foundations of Classical Mechanics by A, B, Gupta (Books & Allied) 4. Classical Mechanics, John R. Taylor, CUP **Group B** **Reference Books:** 1. Concepts in Thermal Physics, S.J. Blundell and K.M. Blundell, Oxford University Press 2. Heat and Thermodynamics, M.W. Zemansky, Richard Dittman, McGraw-Hill. 3. A treatise on Heat, Saha & Srivastava, Indian Press. 4. Thermodynamics, Kinetic Theory & Statistical Thermodynamics, Sears & Salinger, Narosa. 5. Fundamentals of Statistical and Thermal Physics, F. Reif , McGraw-Hill Company 6. Statistical Mechanics, R.K. Pathria, Butterworth Heinemann, Oxford University Press. 7. Elementary Statistical Physics, Charles Kittel, Dover Publications. 8. An Introduction to Thermal Physics, Daniel Schroeder, Oxford Univ. Press 9. Statistical Mechanics, Kerson Huang, John Wiley & Sons

Evaluation	Theory CIA: 30 (2 x 10 + 5/assignment+ 5/attn.) Semester Exam:70	Practical (if applicable) CA: Semester Exam:
Paper Structure for Theory Semester Exam	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)	