PPH102 STATISTICAL MECHANICS

L	T	P	Cr
3	1	0	3.5

Course Objectives: To understand the properties of macroscopic systems using the knowledge of the properties of individual particles.

The Statistical Basis of Thermodynamics: The macroscopic and microscopic states, contact between statistics and thermodynamics, classical ideal gas, Gibbs paradox and its solution.

Ensemble Theory: Phase space and Liouville's Theorem, The microcanonical ensemble theory and its application to ideal gas of monatomic particles, Partition function, Classical ideal gas in canonical ensemble theory, Energy fluctuations, Equipartition and virial theorems, A system of harmonic oscillators as canonical ensemble, Thermodynamics of magnetic systems and negative temperatures, The grand canonical ensemble and significance of statistical quantities. Classical ideal gas in grand canonical ensemble theory. Density and energy fluctuations.

Ideal Bose Systems: Basic concepts and thermodynamic behavior of an ideal Bose gas, Bose-Einstein condensation, Discussion of gas of photons (the radiation fields) and phonons (The Debye field), Liquid helium and super fluidity.

Ideal Fermi Systems: Thermodynamic behavior of an ideal Fermi gas, Discussion of heat capacity of a free-electron gas at low temperatures, Pauli paramagnetism

Course learningoutcomes: Students will have achieved the ability to:

1. find the connection between statistics and thermodynamics.
2. differentiate between different ensemble theories used to explain the behavior of the systems.
3. differentiate between classical statistics and quantum statistics.
4. explain the statistical behavior of ideal Bose and Fermi systems.

Recommended Books

1. *Pathria, R.K., Statistical Mechanics, Butterworth-Heinemann, (1996).*
2. *Reif, F., Fundamentals of Statistical and Thermal Physics, Waveland, (2008).*

Evaluation Scheme:

Sr. No.	Evaluation Elements	Weightage (%)
1	MST	30
2	EST	45
3	Sessionals (May include assignments/quizzes)	25