

In.M.Sc. Applied Physics, 5 years

8TH SEMESTER

FPYC-802: STATISTICAL MECHANICS

Marks-100

UNIT-I

Classical Statistical Mechanics:

Classical probabilities: Binomial distribution of probability, variance,

mean value; Poisson's distribution, fluctuation, variance, mean value; Gaussian distribution, variance, mean value and applications. Basic principles and application of classical statistical mechanics, Liouville's theorem, micro canonical ensemble, Review of thermodynamics, equipartition theorem, classical ideal gas, Gibb's paradox, Canonical ensemble and energy fluctuation, grand canonical Ensemble and density fluctuation, Equivalence of Canonical and grand canonical ensemble. (14 classes)

UNIT-II

Quantum Statistical Mechanics:

The density matrix, ensembles in quantum mechanics, Ideal gas in micro canonical and grand canonical ensemble; equation of state for ideal Fermi gas, Theory of white dwarf stars. Ideal Bose gas, photons and Planck's law, statistics of photon and phonon gas, Bose-Einstein condensation. Distribution function for Fermi-Dirac system, Equation of states for ideal Fermi gas, The theory of White Dwarf star; Landau Diamagnetism; The quantised Hall effect, Pauli Paramagnetism, The De Haas-Van Alphen Effect.

Ising model: Definition of Ising model, One dimensional Ising model, application to Ferromagnetism. (20 classes)

UNIT-III

Phase Transition: Thermodynamics description of Phase Transitions,

Phase Transitions of second kind, Landau theory of phase transition beyond mean field,

Gaussian fluctuation and Ginzburg criteria, Discontinuity of specific heat, change in symmetry in Phase transition of second kind. (10 classes)

Books:

1. Statistical physics - K. Huang
2. Statistical Physics- B B Laud
3. Statistical physics - R. K. Pathria
4. Statistical physics - F. Mohling
5. Elementary Statistical physics - C. Kittel

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6. Statistical physics - Landau and Lifshitz
7. Physics Transitions & Critical Phenomena – H. E. Stanley
8. Fundamentals of statistical & Thermal physics- F. Reif