

PHYSICS-DSC 3A:
THERMAL PHYSICS AND STATISTICAL MECHANICS

(Credits: Theory-04, Practicals-02)

Theory: 60 Lectures

Laws of Thermodynamics:

Thermodynamic Description of system: Zeroth Law of thermodynamics and temperature. First law and internal energy, conversion of heat into work, Various Thermodynamical Processes, Applications of First Law: General Relation between C_P & C_V , Work Done during Isothermal and Adiabatic Processes, Compressibility & Expansion Coefficient, Reversible & irreversible processes, Second law & Entropy, Carnot's cycle & theorem, Entropy changes in reversible & irreversible processes, Entropy-temperature diagrams, Third law of thermodynamics, Unattainability of absolute zero.

(22 Lectures)

Thermodynamic Potentials: Enthalpy, Gibbs, Helmholtz and Internal Energy functions, Maxwell's relations & applications - Joule-Thompson Effect, Clausius-Clapeyron Equation, Expression for $(C_P - C_V)$, C_P/C_V , TdS equations.

(10 Lectures)

Kinetic Theory of Gases: Derivation of Maxwell's law of distribution of velocities and its experimental verification, Mean free path (Zeroth Order), Transport Phenomena: Viscosity, Conduction and Diffusion (for vertical case), Law of equipartition of energy (no derivation) and its applications to specific heat of gases; mono-atomic and diatomic gases.

(10 Lectures)

Theory of Radiation: Blackbody radiation, Spectral distribution, Concept of Energy Density, Derivation of Planck's law, Deduction of Wien's distribution law, Rayleigh-Jeans Law, Stefan Boltzmann Law and Wien's displacement law from Planck's law.

(6 Lectures)

Statistical Mechanics: Phase space, Macrostate and Microstate, Entropy and Thermodynamic probability, Maxwell-Boltzmann law - distribution of velocity - Quantum statistics - Fermi-Dirac distribution law - electron gas - Bose-Einstein distribution law - photon gas - comparison of three statistics.

(12 Lectures)

Reference Books:

- ⊛ Thermal Physics, S. Garg, R. Bansal and C. Ghosh, 1993, Tata McGraw-Hill.
- ⊛ A Treatise on Heat, Meghnad Saha, and B.N. Srivastava, 1969, Indian Press.
- ⊛ Thermodynamics, Enrico Fermi, 1956, Courier Dover Publications.
- ⊛ Heat and Thermodynamics, M.W.Zemasky and R. Dittman, 1981, McGraw Hill
- ⊛ Thermodynamics, Kinetic theory & Statistical thermodynamics, F.W.Sears & G.L.Salinger. 1988, Narosa
- ⊛ University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.
- ⊛ Thermal Physics, A. Kumar and S.P. Taneja, 2014, R. chand Publications.