Paper: MJ-PH (TH) – 305 (4 Credits)

UNIT 1 Mathematical Physics

Complex variables:

Functions of complex variable (10), mapping (11), limits (12), theroems on limits (13), continuity (14), the derivative (15), differntiataion formulas (16), the Cauchy-Riemann conditions (17), sufficient conditions (18), analytic functions (19), harmonic functions (20).

Fourier Series:

Definition (7.1), Dirichlet's condition (7.2), Graphical representation of a function (7.3), Extension of the interval (7.4), Complex form of Fourier series (7.5), Advantages of Fourier series (7.6), Properties of Fourier series (7.7).

UNIT 2 Wave Properties of Particles and Atomic Structure

de Broglie waves (3.1), waves of what? (3.2), describing a wave (3.3), phase and group velocities (3.4), particle diffaraction (3.5), particle in a box (3.6), uncertainty principle-I (3.7), uncertainty principle-II (3.8)

The nuclear atom (4.1), electron orbits (4.2), atomic structure (4.3), the Bohr atom (4.4), energy levels and atomic spectra (4.5), correspondence principle (4.6), nuclear motion (4.7), atomic excitation (4.8).

UNIT 3 Kinetic Theory of Gases and Thermodynamics

Classical theory of heat capacities of gases (1.4), distribution of molecular velocities in a perfect gas (1.5), energy distribution of a maxwellian gas (1.6), experimental verification of maxwell's distribution law (1.7).

The Maxwell relations (8.2), thermodynamic relations involving heat capacities (8.3), the TdS equations (8.4), the energy equations (8.5), heat of reaction: Gibbs, Helmholtz equation (8.6).

UNIT 4 Nuclear Physics

Historical developments (1.2), proton–electron hypothesis (1.3.1), proton–neutron hypothesis (1.3.2), terms associated with the nucleus (1.3.3), quantitative facts about nucleus (1.4), size (1.4.1), mass (1.4.2), density (1.4.3), energy (1.4.4), charge (1.4.5), binding energy (1.5), mass defect (1.5.1), packing fraction (1.5.2), fusion and fission (1.5.3), binding energy per nucleon (1.5.4), nuclear angular momentum (1.6), nature of nuclear forces (1.9).

Reference books:

1. Complex variables and applications by R. V. Churchill, 2nd Ed. McGraw-Hill Book Co.
2. Mathematical Physics by B. S. Rajput, Pragati Prakashan, India, 2013.
3. Concepts of Modern Physics by A. Beiser, 6th Ed., McGraw-Hill Higher Education.
4. Thermal Physics by Garg, Bansal and Ghosh, 2nd Ed., McGraw Hill Education (India) Pvt. Ltd. Chennai, 2012.
5. Introduction to Nuclear and Particle Physics by Mittal, Verma and Gupta, 3rd Ed., PHI Learning Pvt. Ltd.