PHYSICS

PAPER—I (Marks-100)

I. Mechanics

- Vectors: Dots, Cross and triple products, Gradient, divergence, curl and applications.
- Newtonian laws of motion: calculus based approach to kinematics, forces and dynamics, conservation law of energy; conservation of linear and angular momentum; Dynamics of rigid body; spin and precession; gyroscope; Gravitation; planetary motion and satellites; Kepler's laws; centripetal forces
- Special theory of relativity: Michelson-Morley experiment and Einstein's postulates; Lorentz transformation; time dilation and length contraction; equivalence of mass and energy.

II. Fluid Mechanics

- Surface tension; Viscosity; Elasticity; fluid motion and Bernoulli's theorem.

III. Waves and Oscillations, Optics

- Free oscillation with one and two degrees of freedom; forced and damped oscillations and phenomenon of resonance; Simple harmonic motion; Traveling waves and transmission of energy; Phase and Group velocity; standing waves; Basics of sound waves.
- Reflection, Refraction, Interference, Diffraction and Polarization of waves; interfero meter and Newton's rings; Diffraction Gratings and their resolving power; spectro meters. Electromagnetic wave equation; normal and anamolous dispersion; coherence, lasers and applications.

IV. Heat and Thermodynamics

- Perfect gas, real gas and Van der Waals equation; Three Laws of Thermodynamics; internal energy; temperature; entropy; Thermal properties of simple systems; kinetic theory of gases; Maxwellian distribution of molecular velocities; Brownian motion; Transport phenomena. Classical Maxwell-Boltzmann Statistics and its application; Bose-Einstein and Fermi-Dirac Statistics.

PAPER—II (Marks-100)

I. Electricity and Magnetism

- Electric field due to point charges; Gauss' law; Electric potential; Poisson and Laplace's equations; Dielectric medium and Polarization; Capacitance; Moving charges and resulting magnetic field; Ampere's law; Magnetic properties of matter; Faraday's law of electromagnetic induction; Alternating current and RLC circuit; Poynting theorem and Poynting Vector. Maxwell's equations in integral and differential form; scalar and vector potential.

II. Modern and Quantum Physics

- Waves and particles and De Broglie's Hypothesis; Operators and quantum states; observables; time dependent and independent Schrodinger equation; angular momentum; spin-1/2 particle in a magnetic field; wave mechanics; particle in a box; tunneling; one-dimensional harmonic oscillator; Heisenber's uncertainty relationship and indeterminacy based on commutation properties of operators; Bohr's theory and quantum numbers including electron spin; Pauli's exclusion principle; Spectra of simple systems with one or two valence electrons; photo electric effect; Compton scattering; pair production; Lande's g factor and Zeeman effect. Raman effect;

III. Solid State Physics

- Crystal lattice and structure, Bravais lattice, free electron model, Band theory and electron in a periodic potential, Fermi energy and density of states, n and p type semiconductors, physics of the transistor and MOSFET, dielectric properties, magnetic properties and origin of magnetism.

IV. Nuclear Physics

- Structure of Nuclei; Radioactivity,α, β and γ decay; Methods of detection of nuclear radiation, Mass Sepectrometer; Accelerators; Phenomenon of fission; reactor and nuclear power; nuclear fusion and its applications; Elementary particles and their properties.

SUGGESTED READINGS

S. No.	Title	Author
1	Perspectives of Modern Physics.	A. Beiser.
2	Fundamentals of Physics.	Halliday & Resnick
3	Introduction to Electromagnetic Fields and Waves.	D. Corson & P. Lorrain.
4	Heat and Thermodynamics.	D. Zemansky
5	Introduction to Quantum Mechanics	D. Griffiths
6	Modern Physics	Serway, Moses, Moyer.
7.	Solid State Physics	C. Kittel