

COURSES OF STUDY
for
B.Sc. (Honours) Part II Examination
PHYSICS (HONOURS)

Paper III
(OPTICS)

Time - 3 hours

Full Marks - 75

Twelve questions to be set. Six to be answered (taking atleast two from each group)

Group A

Geometrical Optics (Two questions to be set)

Fermat's Principle : Principle of extremum path; the aplanatic points of a sphere and other applications.

General Theory of Image formation : Cardinal Points of an optical system; general relationship, thick lens and lens combinations.

Group B

Physical Optics (Eight question to be set)

Interference of light : Division of wavefront and division of amplitude, Michelson Interferometer, Fabry - Perot Interferometer and etalon.

Fresnel diffraction : Half - period zones, circular apertures and obstacles, straight edge, explanation of rectilinear propagation of light.

Fraunhofer diffraction : Diffraction at a slit, a circular aperture.

Diffraction grating : Diffraction at N parallel slits; plane diffraction grating.

Resolution of images : Rayleigh criterion, resolving power of a telescope, microscope, grating and prism.

Double Refraction and optical rotation : Double refraction in uniaxial crystals, explanation in terms of electromagnetic theory, phase retardation plates, Rotation of plane of polarisation, origin of optical rotation in liquids and in crystals.

Dispersion and Scattering : Theory of dispersion of light; absorption bands

and anomalous dispersion. Theory of Rayleigh Scattering.

Group C

Laser System (Two questions to be set)

Purity of Spectral Line : Coherence length and coherence time, Spatial coherence of a source, Einstein's A and B Coefficients; coherence of induced emissions, Conditions for laser action, existence of a metastable state, population inversion by pumping and cavity, Ruby Laser, He-Ne Laser.

Books Recommended :-

1. A. K. GHATAK - "Physical Optics".
2. D. P. Khandelwal - OPTics and Atomic Physics , (Himalaya Publishing House, Bombay, 1988)
3. Jenkins and White - "Fundamentals of Optics" (McGraw-Hill)
4. B. K. Mathur - "Optics".
5. P. K. Srivastava - "Optics"

PHYSICS (HONOURS)

Paper IV

(Electrostatics, Magnetism, Current Electricity & Atomic Physics)

Time - 3 hours

Full Marks - 75

Twelve questions to be set. Six to be answered (taking atleast two from each group)

Group A

Electrostatics and Magnetism (Two questions to be set)

Electric Field : Field due to quadrupole, Torque on a dipole in non-uniform fields.

Electric Potential : Potential energy of a system of charges, Poisson's equation, Laplace's equation, Boundary conditions and uniqueness theorems.

Diamagnetism, Paramagnetism due to free ions and conduction electrons; Concept of Domains and Ferromagnetism, Langevin's and Weiss theories, Curie's Law, Hysteresis loop, Energy loss per cycle of magnetisation, Simple idea of anti-ferro and ferimagnetism, Ferrites.

Group B

Current Electricity (Four questions to be set)

Varying Current : Rise and decay of currents in LR and CR circuits, Time constant, Integrating and differentiating circuits.

Alternating Current : Skin effect for resistance at high frequencies; Complex impedance, Reactance, Impedances of LCR series and parallel circuits, resonance, Q factor, Power dissipation and Power factor, A.C. bridges, Anderson's and Owen's bridges, Rotating magnetic field, Polyphase and single phase induction motors.

Group C

Nuclear & Particle Physics (Six questions to be set)

Nuclear Models : Liquid drop model and mass formula, the shell model.

Radioactivity : Decay constant and half-life, Beta-decay, Fermi's theory, Neutrino and anti-neutrino.

Artificial radioactivity : Nuclear fission, Neutron reaction, Fermi and transuranic elements, Chain reaction, Criticality, Moderators, Nuclear Fusion.

Accelerators : Need for accelerators; Cyclic accelerators, Cyclotron, Synchrocyclotron, variable energy cyclotron, Phase stability.

Cosmics rays : Primary and secondary cosmic rays, Hard and soft components, cosmic ray showers, Effect of earth's magnetic field on cosmic ray trajectories, Resonant Particles-discovery and important properties, Strangeness, conservation of strangeness in particle interactions, quark hypothesis.

Books Recommended :-

1. **A. S. Mahajan and A. A. Rangwala** - "Electricity and Magnetism (Tata Mcgraw Hill)
2. **Kaplan** - "Nuclear Physics"
3. **Cohen** - "Concept of Nuclear Physics"
4. **Segree** - "Nuclei and Particles"

5. Rossi - "Cosmic Rays"

PHYSICS (HONOURS)**Practical**

(One experiment to be performed in examination)

Time - 6 hours

Full Marks -50

(Expt.- 30, viva-12, NB- 8)

The course shall include the following experiments:-

1. Study of characteristics of a Ballastic galvanometer through discharge of Condensor.
2. Study of magnetic field using a vibration magnetometer.
3. Obtaining the B-H curve of a ferromagnetic material (any method)
4. Low resistance measurement; (i) C.F. Bridge (2) Wheat Stone's bridge.
5. Response curve for LCR circuits, series resonances
6. Measurement of L using Anderson's bridge.
7. Measurement of C using Scheering bridge.
8. Study of NAND and NOR circuits (discrete and integrated circuits)
9. Dispersive power of material and linear dispersion in a prism spectrum using a graticule in the eyepiece.
10. Use of Newton's rings to determine the radii of curvature of surfaces.
11. Resolving limit of the eye and a telescope with a variable aperture
12. Study the spectra produced by a plane transmission grating using (a) minimum deviation setting and (b) first order spectra for two wavelengths.