New College

PHYSICS

B.Sc. 2nd Year
FOURTH SEMESTER
PAPER I & II

CHRONICLE BOOKS (INDIA)
(An imprint of JEEVANSONS PUBLICATIONS)

SYLLABUS

Kurukshetra University, Kurukshetra

B.Sc. II – Semester-IV

Physics : PH-401

PAPER-VII : STATISTICAL PHYSICS

Time : 3 Hours *Max. Marks : 40*
Internal Assessment : 10

Note :

1. *The syllabus is divided into 4 units. Nine Questions will be set.*
2. *Question No. 1 will be compulsory, it contains 6 parts (from all the four units) and answer should be brief but not in Yes / No.*
3. *Four more questions are to be attempted, selecting one question from each unit.*
4. *Questions 2-9 may contain two or more parts. All questions carry equal marks.*
4. *20% numerical problems are to be set.*
5. *Use of scientific (non-programmable) calculator is allowed.*

UNIT-I

Statistical Physics I : Microscopic and Macroscopic systems, events-mutually exclusive, dependent and independent. Probability, statistical probability, A priori probability and relation between them, probability theorems, some probability considerations, combinations possessing maximum probability, combination possessing minimum probability, Tossing of 2, 3 and any number of Coins, Permutations and combinations, distributions of N (for N = 2, 3, 4) distinguishable and indistinguishable particles in two boxes of equal size, Micro and Macro states, Thermodynamical probability, Constraints and Accessible states, Statistical fluctuations, general distribution of distinguishable particles in compartments of different sizes, Condition of equilibrium between two systems in thermal contact-β parameter, Entropy and Probability (Boltzmann's relation).

UNIT-II

Statistical Physics II : Postulates of statistical physics, Phase space, Division of Phase space into cells, three kinds of statistics, basic approach in three statistics. M.B. statistics applied to an ideal gas in equilibrium-energy distribution law (including evaluation of α and β), speed distribution law and velocity distribution law. Expression for average speed, r.m.s. speed, average velocity, r.m.s. velocity, most probable energy and mean energy for Maxwellian distribution.

UNIT-III

Quantum Statistics : Need for Quantum Statistics : Bose-Einstein energy distribution law, Application of B.E. statistics to Planck's radiation law B.E. gas, Degeneracy and B.E. Condensation, Fermi Dirac energy distribution law, F.D. gas and Degeneracy, Fermi energy and Fermi temperature, Fermi Dirac energy distribution law, Fermi Dirac gas and degeneracy, Fermi energy and Fermi temperature, Fermi Dirac energy distribution law for electron gas in metals, Zero point energy, Zero point pressure and average speed (at 0 K) of electron gas, Specific heat anomaly of metals and its solution. M.B. distribution as a limiting case of B.E. and F.D. distribution, Comparison of three statistics.

UNIT-IV

Theory of Specific Heat of Solids: Dulong and Petit law. Derivation of Dulong and Petit law from classical physics. Specific heat at low temperature, Einstein theory of specific heat, Criticism of Einstein theory, Debye model of specific heat of solids, success and shortcomings of Debye theory, comparison of Einstein and Debye theories.

Physics : PH-402

PAPER-VIII : WAVE AND OPTICS II

Time : 3 Hours

Max. Marks : 40
Internal Assessment : 10

Note :

1. *The syllabus is divided into 4 units. Nine Questions will be set.*
2. *Question No. 1 will be compulsory, it contains 6 parts (from all the four units) and answer should be brief but not in Yes / No.*
3. *Four more questions are to be attempted, selecting one question from each unit.*
4. *Questions 2-9 may contain two or more parts. All questions carry equal marks.*
4. *20% numerical problems are to be set.*
5. *Use of scientific (non-programmable) calculator is allowed.*

UNIT-I

Polarization : Polarization by reflection, refraction and scattering, Malus Law, Phenomenon of double refraction, Huygen's wave theory of double refraction (Normal and oblique incidence), Analysis of polarized Light. Nicol prism, Quarter wave plate and half wave plate, production and detection of (*i*) Plane polarized light (*ii*) Circularly polarized light and (*iii*) Elliptically polarized light. Optical activity, Fresnel's theory of optical rotation, Specific rotation, Polarimeters (Half shade and Biquartz).

UNIT-II

Fourier Analysis : Fourier theorem and Fourier series, evaluation of Fourier coefficient, importance and limitations of Fourier theorem, even and odd functions, Fourier series of functions $f(x)$ between (*i*) 0 to $2pi$ (*ii*) - pi to pi, (*iii*) 0 to pi, (*iv*) – L to L, complex form of Fourier series, Application of Fourier theorem for analysis of complex waves : solution of triangular and rectangular waves, half and full wave rectifier output, Parseval identity for Fourier Series, Fourier integrals.

UNIT-III

Fourier Transforms : Fourier transforms and its properties, Application of Fourier transform (*i*) for evaluation of integrals, (*ii*) for solution of ordinary differential equations (*iii*) to the following functions :

1. $f(x) = e^{-x^2/2}$ 2. $f(x) = \begin{cases} 1 \ , \lvert X \rvert < a \\ 0 \ , \lvert X \rvert > a \end{cases}$

Geometrical Optics I : Matrix methods in paraxial optics, effects of translation and refraction, derivation of thin lens and thick lens formulae, unit plane, nodal planes, system of thin lenses

UNIT-IV

Geometrical Optics II : Chromatic, spherical, coma, astigmatism and distortion aberrations and their remedies.

Fibre Optics : Optical fibre, Critical angle of propagation, Mode of Propagation, Acceptance angle, Fractional refractive index change, Numerical aperture, Types of optics fibre, Normalized frequency, Pulse dispersion, Attenuation, Applications, Fibre optic Communication, Advantages.

CONTENTS

PAPER : PH-401

[STATISTICAL PHYSICS]

PAPER : PH-402

[WAVE AND OPTICS II]