A-0589

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MSCPH–506

M.Sc. PHYSICS (MSCPH)

(Condensed Matter Physics)

2nd Semester Examination, Session December 2024

Time : 2:00 Hrs. Max. Marks : 70

Note* :–** This paper is of Seventy (70) marks divided into Two (02) Sections 'A' and 'B'. Attempt the questions contained in these Sections according to the detailed instructions given therein. ***Candidates should limit their answers to the questions on the given answer sheet. No additional (B) answer sheet will be issued.

Section–A

Long Answer Type Questions 2×19=38

***Note* :–** Section 'A' contains Five (05) Long-answer type questions of Nineteen (19) marks each. Learners are required to answer any *two* (02) questions only.

1. What are Bravais lattice ? Explain seven types of crystal systems in three dimensional space.

2. Show that in a one dimensional diatomic linear chain of atoms, both acoustic and optical branches of dispersion curve meet at zone boundary.

3. Find out the expression for the heat capacity of solids and explain the behavior of solids at low temperature and high temperature.

4. Define Thomas-Fermi screening and find out the expression for Thomas-Fermi screening length.

5. What is Type-1 and Type-2 superconductors ? Mention important differences between then.

Section–B

Short Answer Type Questions 4×8=32

***Note* :–** Section 'B' contains Eight (08) Short-answer type questions of Eight (08) marks each. Learners are required to answer any *four* (04) questions only.

1. What is the difference between single crystal and poly crystal ?

2. Describe Bragg's law for X-ray diffraction and give its significance. Explain this law in reciprocal lattice system.

3. Explain the origin of covalent bond.

4. Explain various types of point defects.

5. The energy gaps of Si, Ge and Ag are 1.1,0.7 and 0 eV respectively. Find the wavelength of electromagnetic radiation to which these solids are opaque.

(given $h = 6.63 \times 10^{-34}$ J-s, velocity of light, $c = 3.0 \times 10^{8}$m/s)

6. Calculate the intrinsic conductivity and resistivity of pure Si at room temperature, assuming intrinsic carrier (electron hole pair) density at this temperature to be $1.5 \times 10^{16}/\ m^3$. The electron and hole mobilities in Si are 0.135 and 0.048 m^2/V s respectively.

7. What do you mean by polarisation in the dielectrics ? Deduce the relation between dielectric constant and polarisability.

8. Explain Hall Effect in detail.

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