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MSCPH-506

CONDENSED MATTER PHYSICS

M.Sc. Physics (MSCPH)

2nd Semester Examination, 2023 (Dec.)

Time : 2 Hours] **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)

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.

(2×19=38)

1. What is a crystal structure? Draw the crystal structure of Diamond and explain its lattice vectors, primitive vector, coordinate number, packing fraction.

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 behaviour 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.

SECTION–B

(Short Answer Type Questions)

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. (4×8=32)

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

2. Explain the Bragg law in terms of reciprocal lattice vectors.

3. Explain the origin of covalent bond. What is the difference between primary and secondary bonds?

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, vel 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.
