C120

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PHY-503

Solid State Physics

M.Sc. PHYSICS (MSCPHY-16/17)

1st Year Examination, 2022 (June)

Time : 2 Hours] **Max. Marks : 80**

Note : This paper is of Eighty (80) marks divided into two (02) Sections A and B. Attempt the questions contained in these sections according to the detailed instructions given therein.

SECTION–A

(Long Answer Type Questions)

Note : Section 'A' contains Five (05) long answer type questions of Twenty (20) marks each. Learners are required to answer any Two (02) questions only.

(2×20=40)

1. Explain the paramagnetic phenomenon. Derive an expression for paramagnetic susceptibility using Langevin theory of paramagnetism.

2. What are the drawbacks of Einstein model of heat capacity of solids? Explain Debye model of heat capacity of solids.

3. Discuss the problem of an electron moving in a periodic potential. Explain the occurrence of energy gap in a semiconductor.

4. How are cooper pairs formed? Explain the BCS theory of superconductivity and discuss the energy gap based on this theory.

5. What do you mean by Schottky and Frenkel defect? Show that the number of Frenkel defects in equilibrium at a given temperature is proportional to $(NN_i)^{1/2}$, where N be the number of atoms and N_i be the interstitial atoms.

SECTION–B

(Short Answer Type Questions)

Note : Section 'B' contains Eight (08) short answer type questions of Ten (10) marks each. Learners are required to answer any Four (04) questions only. (4×10=40)

1. Explain concept of effective mass of electron and its physical interpretation.

2. Calculate the energy of an electron below the Fermi level at a temperature 200 K for F(E) = 0.9 and Fermi energy E_F = 3eV.

3. What is Superconductivity? Write down the difference between Type 1 and Type 2 superconductors.

4. What is Hall Effect? Explain how Hall coefficient is used to determine the mobility of charge carriers.

5. Explain Bragg's law for X-ray diffraction in crystals.

6. Derive Clausius-Mossotti equation.

7. What is the coordination number? What factors controls the coordination number.

8. Write a short note on classification of magnetic materials.
