C160

Roll No. ....

MSCPH-506

Condensed Matter Physics

M.Sc. Physics (MSCPH)

2nd Semester 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. State and prove the Bloch theorem.

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

4. Discuss the nearly free electron model and explain how it leads to the formation of forbidden gap and band structure.

5. Explain the spin wave and magnon. Find out the dispersion relation for ferromagnetic materials.

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 Josephson Effect for superconductors.

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

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

4. A paramagnetic material has 10^{28} atoms/m³. The magnetic moment of each atom is 1.8×10^{-23} A-m⁻². Calculate the paramagnetic susceptibility at 300 K.

5. For a simple square lattice, calculate K.E. of free electron at the corner and at the midpoint of the side face of the 1st Brillouin Zone. How are these two values related?

6. What do you mean by Bonding in solids? Explain different types of bonding in the solid.

7. The Hall coefficient of silicon sample is -6.65×10^{-5} m³/C at temperature range 100–400 K and electric conductivity 210 mho/m. Calculate the nature, charge carrier density and mobility of carrier.

8. What is Superconductivity? Explain difference between Type 1 and Type 2 superconductors.

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