Roll No. ☐☐☐☐☐☐☐☐☐☐☐   Total No. of Pages : 02

Total No. of Questions : 07

B.Sc.(CS) (2013 & Onwards)   (Sem.–5)
CONDENSED MATTER PHYSICS
Subject Code : BCS-503
Paper ID : [72576]

Time : 3 Hrs.   Max. Marks : 60

INSTRUCTION TO CANDIDATES :
1. **SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.**
2. **SECTION-B contains SIX questions carrying TEN marks each and a student has to attempt any FOUR questions.**

SECTION-A

1. **Answer briefly :**

   a) If the lattice parameter for a *fcc* crystal is 2.14 Å. Find the radius of the atom (particle).

   b) Define a primitive unit cell. Can a unit cell be primitive?

   c) What is Bragg's law?

   d) What is reciprocal lattice?

   e) What is atomic form factor?

   f) Explain the concept of phonon. What statistics does it obey?

   g) What are the assumptions of Einstein's theory of specific heat of solids?

   h) Define Fermi energy level.

   i) What do you mean by effective mass of an electron?

   j) What is Meissner effect?

SECTION-B

2. Explain the crystal structure of sodium chloride (NaCl). Draw a sketch of NaCl lattice and write down the coordinates of the atoms in the cell. What is the number of sodium ions in a unit cell of NaCl?

3. Describe the various experimental X-ray diffraction methods for study of crystal structure.

4. Define geometrical structure factor. How it is related to atomic scattering factor? Derive an expression for the scattering amplitude in terms of geometrical structure factor.

5. Derive an expression for the concentration of holes in the valence band of an intrinsic semiconductor.

6. What are the drawbacks of Einstein model of specific heat? Derive the expression for the lattice specific heat according to Debye model. Discuss the high and low temperature limits and define Debye T^3 law.

7. Describe BCS theory of superconductivity. Show that this theory provides adequate explanation of superconducting state.