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BT-2/M-23 42033

SEMICONDUCTOR PHYSICS

BS-115A

Time : Three Hours] [Maximum Marks : 75

Note : Attempt *Five* questions in all, selecting at least *one* question from each Unit. All questions carry equal marks.

Unit I

1. (a) What is Bravais lattice ? Explain different types of Brvais lattices in three dimensions. 7

   (b) Discuss the hexagonal closed packed (hcp) structure and determine the c/a ratio for hcp structure. 8

2. (a) What do you mean by point defects in solids ? Derive an expression for concentration of Frankel defects at thermal equilibrium. 8

   (b) Explain the different types of bonding in solids and give one example of each. 7

Unit II

3. (a) Describe the de-Broglie matter waves and establish the correspondence between particle concepts and wave concepts. 7

(b) Explain the group velocity and particle velocity. Prove that group velocity is less than the phase velocity in dispersive medium. 8

4. (a) State Heisenberg's uncertainty principle. Prove the non-existence of the electron inside the nucleus using uncertainty principle. 7

(b) Derive the time independent one-dimensional Schrodinger wave equation for s non-relativistic a free particle. Also give the significance of the wave function. 8

Unit III

5. (a) What are the drawbacks of classical free electron theory ? Discuss the quantum theory of free electron in a one-dimensional box. 8

(b) Discuss the Fermi-Dirac distribution function. Plot this function for various temperatures including 0 K. 7

6. (a) Explain the concept of effective mass of the electron on the basis of band theory of solids. 7

(b) What is Hall effect ? Derive an expression for Hall coefficient and mention some of the applications of this effect. 8

Unit IV

7. (a) What are Semiconductors ? Explain the intrinsic and extrinsic semiconductors. 8

   (b) Derive an expression for carrier concentration in *n*-type semiconductors. What would be the position of Fermi level in the same ? 7

8. (a) What are Bipolar Junction Transistors (BJT)? Explain the characteristics of the bipolar junction transistors. 8

   (b) Describe the principle, construction and working of a semiconductor laser. 7