

Roll No. ....

Total Pages : 03

BT-2/M-24

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.

**Unit I**

1. (a) Explain the terms : lattice translation vector, symmetry operations, basis, space lattice, unit cell, packing factor and crystal structure. 7
- (b) Determine the atomic packing factor for sc, bcc and fcc. 8
2. (a) What are Miller indices ? Obtain a relation between the interplanar spacing and cube edge. 7
- (b) What do you mean by point defects in solids ? Derive an expression for the concentration of Frankel defects. 8

**Unit II**

3. (a) What are limitations of old quantum theory ? Explain the wave particle dualism by giving examples. 7

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- (b) Prove that the wave group associated with a moving particle travels with the same velocity as that of the particle. 8
4. (a) What is Heisenberg's uncertainty principle ? Prove the existence of neutrons, protons and  $\alpha$ -particle in the nucleus using uncertainty principle. 7
- (b) Derive the time dependent Schrödinger wave equation and discuss the concept of stationary states, wave packet and the significance of wave function. 8

### Unit III

5. (a) Derive an expression for electrical conductivity and thermal conductivity on the basis of classical theory of free electron. 7
- (b) What is the density of states in metals ? Derive an expression for the density of states and hence obtain Fermi energy of a metal. 8
6. (a) Discuss the Kronig-Penney model for the motion of an electron in a periodic potential. 7
- (b) What is Hall effect ? Explain how the measurement of Hall coefficient helps one to determine the mobility of electrons in the metal. Mention some of the applications of Hall effect. 8

7. (a) Discuss the electrical conductivity in intrinsic semiconductors and show how it helps in determining the energy gap of an intrinsic material. 7
- (b) Derive an expression for carrier concentration in p-type semiconductors. What would be the position of Fermi level in the same? 8
8. (a) Explain the working of a  $p-n$  junction. Discuss the forward and reverse biasing along with its V-I characteristics. 7
- (b) What are different types of Transistors? Discuss the Field Effect Transistors in detail. 8