



UNIVERSITY OF THE PUNJAB

B.S. 4 Years Program / Sixth Semester – 2019

Paper: Solid State Physics-II

Course Code: PHY-308 Part – I (Compulsory)

Time: 15 Min. Marks: 10

Roll No. in Fig.

Roll No. in Words.

Signature of Supdt.:

ATTEMPT THIS PAPER ON THIS QUESTION SHEET ONLY.

Division of marks is given in front of each question.

This Paper will be collected back after expiry of time limit mentioned above.

Q.1. Encircle the correct choice.

(1x10=10)

- i. Addition of pentavalent impurity to a semiconductor creates many**
 - a. Free electrons
 - b. Holes
 - c. Valence electrons
 - d. Bound electrons
- ii. Hall voltage is directly proportional to**
 - a. current
 - b. electric field
 - c. magnetic flux density
 - d. all of above
- iii. Boltzman constant is actually**
 - a. gas constant per mole
 - b. gas constant per kg
 - c. gas constant per molecule
 - d. product of pressure and area
- iv. The energy required to break a covalent bond in a semiconductor**
 - a. is equal to 1 eV
 - b. is equal to the width of the forbidden gap
 - c. is greater in Ge than in Si
 - d. is the same in Ge and Si
- v. In an insulator, the forbidden energy gap is of the order of**
 - a. 1 MeV
 - b. 0.1 MeV
 - c. 1 eV
 - d. 5ev
- vi. P-type and N- type extrinsic semiconductors are formed by adding impurities of valency?**
 - a. 5 and 3 respectively
 - b. 5 and 4 respectively
 - c. 3 and 5 respectively
 - d. 3 and 4 respectively

P.T.O.

- vii. For metals conduction band and valence band are**
- a. Fully occupied
 - b. Empty
 - c. Partially occupied
 - d. Overlapping
- viii. Which is the correct ordering of the band gaps energy?**
- a. Diamond > silicon > copper
 - b. Diamond < silicon < copper
 - c. Diamond < silicon > copper
 - d. Diamond < silicon < copper
- ix. If the density of charge carriers is increased, the value of Hall voltage**
- a. Decreases
 - b. Increases
 - c. Remains constant
 - d. Changes the direction
- x. Specific heat capacity of a substance is equal to**
- a. mass of the substance \times heat capacity
 - b. heat capacity / mass of the substance
 - c. mass of the substance / heat capacity
 - d. None of the above



ATTEMPT THIS (SUBJECTIVE) ON THE SEPARATE ANSWER SHEET PROVIDED

Question No.2: Answer the following short questions.

(10x2=20)

- 1 Define Bloch function and Bloch theorem.
- 2 Explain briefly intrinsic mobility.
- 3 Differentiate between metals and insulators on the basis of orbital band theory.
- 4 What are significances of Hall-co-efficient?
- 5 Plot the distribution of probability 'p' in the lattice for $|\Psi +|^2$, $|\Psi -|^2$ and for pure travelling wave.
- 6 What is meant by density of energy states in metals?
- 7 Define and draw Fermi sphere.
- 8 What factors affect the resistivity of electrical materials?
- 9 State Weidman Franz law.
- 10 Explain the difference between direct and indirect band gap materials.

Q.3.

(10)

- a. Give quantitative explanation of energy gap formation under periodic potential.
- b. Plot Fermi dirac distribution function for various temperatures.

Q.4.

(10)

- a. Show that the wavelength associated with an electron having an energy equal to Fermi energy is given by

$$\lambda_F = 2 \left(\frac{\pi}{3n} \right)^{1/2}$$

- b. Derive an expression for intrinsic carrier concentration in a semiconductor.

Q.5.

(10)

- a. Consider Free electron gas in 3-dimensions, then by using periodic boundary conditions, derive expressions for Fermi energy and density of states for the system.
- b. Explain collision time and mean free path as applied to free electrons.