ASSIGNMENT – 1

(UNIT – 2)

Multiple Choice Questions

1. In n-type semiconductors, number of holes are_____ number of electrons.

(a) Equal

(b) Greater than

(c) Less than

(d) None of the above

2. Which of the following has the greatest mobility

(a) Donor Impurity atom

(b) Positive ion

(c) Electron

(d) Hole

3. Fermi level for extrinsic semiconductor not depends on

(a) its shape and size

(b) Impurity concentration

(c) Temperature

(d) All

4. Mobility of holes is _____mobility of electrons in intrinsic semiconductors.

(a) Equal

(b) Greater than

(c) Less than

(d) None of the above

5. Element can reach a stable atomic structure by

(a) losing electrons only

(b) gaining electrons only

(c) losing or gaining or sharing electrons

(d) collisions between atoms

6. Conduction electrons have more mobility than holes because they

(a) are lighter

(b) experience collision less frequently

(c) have negative charge

(d) need less energy to move them

7. An electron in the conduction band

(a) is bound to its parent atom

(b) has no charge

(c) is located near the top of the crystal

(d) has a higher energy than an electron in the valance band

8. Consider the following Statement:

If the temperature is increased the resistivity of a metal increases because of

(1) decrease in carrier concentration

(2) an increase in the extent of scattering of carrier

(3) increase in the density of impurity

Of these Statements

(a) 1, 2. 3 are correct

(b) 2 alone is correct

(c) 1 alone is correct

(d) 2 and 3 are correct

Short and Long answer based questions

1. What is generation and recombination of carriers?

2. What is the relationship between thermal generation rate and recombination rate in equilibrium?

3. In equilibrium, product of carrier concentrations in a semiconductor is constant (np = const.). Explain this based on thermal generation and recombination rate.

4. What can be done to manipulate the bandgap of a material?

5. What is drift? Is it possible for an intrinsic semiconductor to have higher conductivity than its extrinsic counterpart?

6. How are drift velocity and mobility related?

7. What is the expression for diffusion current due to electron and holes in a semiconductor?

8. Define Schottky Junction and its application.

9. Give the expression for the expression for diffusion current density.

10. Give the expression which gives law of mass action under thermal equilibrium.

11. Which are the most commonly used Semiconductor and Why?

12. Explain why at high temperature an extrinsic semiconductor behaves like intrinsic semiconductor.

13. What are mobility and conductivity? Obtain an expression for conductivity of a dropped semiconductor.

14. For an intrinsic semiconductor with a gap width of 1 eV. Calculate the position of Fermi level at T = 0K if $m_h^* = 6\ m_e^*$ where m_h^* and m_e^* are effective masses of hole and electron respectively.

15. Compute the carrier concentration and conductivity of intrinsic Ge at 300K. Given that $m_h^* = m_e^*$ = rest mass of an electron, $\mu_e = 0.38\ m^2V^{-1}s^{-1}$, $\mu_h = 0.18\ m^2V^{-1}s^{-1}$, $E_g = 0.68$ eV.

16. The intrinsic resistivity of Ge at 300K is 47 Ωcm. What is the intrinsic concentration when electron and hole mobilities in Ge at 200K are 3900 cm^2/volt sec and 1900 cm^2/volt sec respectively?

17. For a given semiconductor, the effective mass of electron is $m_e = 1.25 x m_0$ and the fermi level is 0.3 eV above the valance band. Determine the density of states in the valance band and concentrations of electron in semiconductor at T = 300K.

18. Derive the expression for carrier concentration, fermi energy level and conductivity of intrinsic semiconductor.

19. Derive the expression for carrier concentration, fermi energy level and conductivity of Extrinsic semiconductor.

20. Explain the law of mass action in SC.