Module 2 Unit 1

SEMICONDUCTORS – SAMPLE THEORY QUESTIONS

1. What is energy bandgap? Classify solids in terms of energy band gap.
2. What is E-k diagram? What is the difference between direct and indirect bandgap semiconductors? Give examples and applications of both.
3. Explain the concept of effective mass in semiconductors. Derive an expression for the same.
4. Explain the concept of hole as a positive charge carrier.
5. Give an account of Fermi-Dirac statistics. State Fermi-Dirac distribution function. What is Fermi level? State its importance. Define Fermi level for metals and semiconductors.
6. Show that Fermi level for intrinsic semiconductors is located midway between the conduction band and valence band.
7. Discus the effect of doping on Fermi level.
8. What is the effect of temperature on Fermi level position in doped semiconductors? Define intrinsic temperature.
9. Show that semiconductors behave as insulators at absolute zero temperature.
10. What is the effect of temperature on Fermi-Dirac distribution function? Also, plot the same.
11. Find an expression for intrinsic carrier concentration.
12. What do you mean by majority and minority charge carriers? State the expressions for both in case of p-type and n-type semiconductors.
13. State the expressions for resistivity for intrinsic, p-type and n-type semiconductors. Discuss the effect of temperature on conductivity of extrinsic semiconductors.
14. What is drift and diffusion of charge carriers? Define drift velocity and mobility. Define diffusion coefficient. State Einstein's relation. State the expressions for drift and diffusion current densities. Hence, state the expression for total current density in a semiconductor.
15. Show that the expression for drift current density for a semiconductor viz. $J = \sigma\mathcal{E}$ (where, σ is conductivity and $\mathcal{E}$ is electric field) is just another way of writing Ohm's law.
