IMPORTANT QUESTIONS

CH.1 ELECTRONIC MATERIALS

1. Give assumptions of classical free electron theory
2. Explain the dependence of Fermi level on temperature.
3. Give the difference between Direct and Indirect band gap.
4. Write a note on energy band diagram and formation of energy bands.
5. Explain fermi levels.
6. Explain classification of materials as conductors, insulators and semiconductors.
7. Explain Kronig Penney model in detail.
8. Explain direct and indirect band gap with E-k diagrams.
9. Give success and drawback of classical free electron theory.
10. Write short notes on E-K diagram.
11. Derive the mathematical expression for density of states.
12. What is meant by effective mass of an electron? Derive an expression for the effective mass of an electron.

CH.2 SEMICONDUCTORS

1. Give difference between N type and P type semiconductors.
2. Explain drift and diffusion current.
3. Explain diffusion mechanism in detail
4. Derive expression of electron concentration in conduction band.
5. Explain intrinsic and extrinsic semiconductors with necessary diagram.
6. What is PN junction diode? What is external bias? Describe its forward and reverse bias conditions with appropriate diagram.
7. Derive equations for n-type semiconductor to determine dependence of fermi level on temperature and doping concentration.
8. Write a note on metal semiconductor junctions.
9. Consider two-dimensional square lattice of side 3.0 Å. At what electron momentum values do the sides of first Brillouin zone appear? What is the energy of free electron with this momentum?
10. Consider n-type silicon semiconductor with a length of 100 μm, cross sectional area 10-7 cm^2 , minority charge carrier life time 10-6 s, μe is 0.13 m^2 / Vs and μh is 0.05 m^2 / Vs.

Find (a) Electron transit time (b) Photo conductor gain when voltage applied to the photoconductor is 12 V.

CH.3 LIGHT SEMICONDUCTOR INTERACTION

1. Explain Drude model and discuss how it is used for D.C. and A.C. conductivity measurement.
2. Define following terms with respect to Light-semiconductor devices.
   (a) Absorption of radiation.
   (b) Spontaneous emission
   (c) Stimulated emission
   (d) Meta stable state
3. Discuss fermi golden rule.
4. What is the cause and remedy for optical loss in photovoltaic cell?
5. Write a note on exciton.
6. Give details of applications of solar cell .
7. What is radiative and non-radiative transition. Explain in brief the optical joint density of states.
8. Explain photovoltaic effect. With required diagrams discuss construction and working of solar cell.
9. Write short notes on Density of states for photons.
10. Discuss how Drude model is used for Hall measurement and magnetoresistance.

CH.4 MEASUREMENTS

1. What are hot probe method.
2. Explain experimental procedure for DLTS.
3. Why two probe method for resistivity measurement failed and hence explain four probe method.
4. Discuss UV – VIS method for band gap measurement of semiconductors.
5. Define Hall effect and Hall coefficient. Derive equation to find Hall voltage. What does it signify?
6. Discuss the technique to obtain band gap by UV-Vis spectroscopy using absorption or transmission.
7. What are capacitance voltage measurements?
8. Discuss Van Der Pauw method.

9. Explain four probe method. Derive an equation to calculate resistivity of a thin sample.

10. Write short note on C-V measurement and how to determine semiconductor parameter.

CH.5 SUPERCONDUCTIVITY

1. Explain the phenomenon of superconductivity.
2. Write down the applications of superconductors.
3. Describe BCS theory of superconductivity.
4. What is Meissner effect? Prove that superconductors are perfect diamagnetic materials.
5. List various properties of superconductor. Explain in brief any three properties out of them.
6. Define: Penetration depth in the vicinity of Superconductivity.
7. The Critical temperature of superconductor is 9.15K. At zero Kelvin the critical field is 0.196 Tesla. Calculate the field at 6K.
8. Explain Josephson`s Junction and its applications.
9. The critical magnetic field of Niobium is 1×10^5 Tesla at 8 K and 2×10^5 Tesla at 0 K. Calculate the transition temperature of the element.
10. Calculate the critical current for a superconducting wire of lead having diameter of 1 mm at 4.5 K. Critical temperature for lead is 7.2 K and critical magnetic field at 0 K is 6.5×10^4 A/m.
11. Differentiate Type – I and Type – II superconductors.