Model Questions

Unit -3 (Electrical properties of materials)

1. Explain the terms (i) mean collision time (ii) mean free path (iii) Drift velocity.
2. What are the postulates of quantum free electron theory?
3. Define Fermi-Dirac distribution function. Explain how f(E) varies at T=0 K and T> 0K with energy. Sketch the variation.
4. Define density of states. Derive the expression for density of states in a metal. Show graphically how g(E) varies with E.
5. Define Fermi energy. Assume the expression for density of states and derive the expression for Fermi energy at 0 K.
6. Give the comparison between classical and quantum free electron theories.
7. What are superconductors? Define the terms: (i) Critical temperature (2) Critical magnetic field (3) Critical current.
8. Explain the Meissner effect in superconductors.
9. Mention the applications of superconductors.
10. What are polar and non-polar di-electrics?
11. What is di-electric polarization? Explain the different types of polarization mechanisms in di-electrics.
12. Explain internal field in di-electrics. Obtain an expression for the internal field in case of 1-D array of polar molecules and extend it for a cubic lattice.
13. Derive Clausius-Mosotti relation.