E 254

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2009.

SECOND SEMESTER

PH 23 — ENGINEERING PHYSICS — II

(Common to all B.E./B.Tech)

(REGULATIONS 2008)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. Give any two postulates of classical free electron theory.

2. Define Fermi level and Fermi energy.

3. A semiconductor crystal 12 mm long, 5 mm wide and 1mm thick has a magnetic flux density of 0.5 wb/m^2 applied from front to back perpendicular to largest faces. When a current of 20 mA flows lengthwise through the specimen, the voltage measured across its width is found to be 37μV. What is the Hall coefficient of this semiconductor?

4. What are intrinsic semiconductors? Give any two example.

5. Calculate the critical current which can flow through a long thin superconducting wire of aluminium of diameter 10^{-3}m. The critical magnetic field for aluminium is 7.9×10^3 A/m.

6. Define Hystersis loop.

7. What is meant by dielectric loss?

8. Calculate the dielectric constant of a material which when inserted in a parallel condenser of area 10mm × 10mm and distance of separation of 2 mm gives a capacitance of 10^{-9}F.

9. What are metallic glasses?

10. What is meant by nanophase materials?

PART B — ($5 \times 16 = 80$ marks)

11. (a) State and prove Wiedemann-Frantz law. Why does the Lorentz number determined experimentally does not agree with the value calculated from the classical formula. (16)

Or

(b) (i) Derive an expression for electrical conductivity using classical free electron theory. (6)

(ii) What are the drawbacks of classical free electron theory? (6)

(iii) The thermal conductivity of a metal is 123.92 W/m/k. Find the electrical conductivity and Lorentz number when the metal possess relaxation time 10^{-14}seconds and 300k (Density of electrons $= 6 \times 10^{28}$ /m^3). (4)

12. (a) Derive an expression for density of holes and electrons in valence band and conduction band in the case of p-type and n-type semiconductors. (16)

Or

(b) (i) What is Hall Effect? (3)

(ii) Obtain an expression for the hall coefficient for a p-type semiconductor. (7)

(iii) Describe an experimental setup for the measurement of Hall voltage. (6)

13. (a) (i) Explain dia, Para and Ferro magnetic materials on the basis of spin. (9)

(ii) What are ferrites? Give one example. (3)

(iii) Write short note on floppy disks. (4)

Or

(b) (i) Define Meissner effect. (3)

(ii) Explain BCS theory with a special note on Cooper pairs. (6)

(iii) Discuss the Type I and Type II superconductors. (7)

14. (a) (i) Discuss in detail about the various dielectric breakdown mechanisms. (8)

(ii) Explain the ionic polarization in a dielectric material. (5)

(iii) Calculate the electronic polarizability of argon atom. Given ε_r=1.0024 at NTP and number of atoms is 27×10^{25} atoms/m^3. (ε_o =8.85×10^{-12} F/m). (3)

Or

(b) (i) Derive an expression for internal field in dielectrics. (8)

(ii) What are Ferro electric materials? Give examples. (3)

(iii) Discuss the frequency dependence of various polarization mechanisms. (5)

15. (a) (i) Write an essay about the synthesis, characterization and properties of nano particles. (5+5+3)

(ii) What are carbon nano tubes? (3)

Or

(b) (i) Define metallic glasses. Explain how metallic glasses are prepared. (2+6)

(ii) Write note on shape memory alloys. (8)
