C 3366

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2007.

Second Semester

(Regulation 2004)

Chemical Engineering

PH 1156 — PHYSICS — II

(Common to Polymer Technology/Textile Technology/Bio-Technology/ Textile Technology (Textile Chemistry)/Textile Technology (Fashion Technology)/ Petroleum Engineering)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Sketch the variation of Fermi function with temperature for a metal.

2. Calculate the density of free electrons in copper at room temperature. Given that $\sigma = 58 \times 10^6\ \Omega^{-1} m^{-1}$ and $\mu = 3.5 \times 10^{-3}\ m^2/(V.s)$ $(e = 1.6 \times 10^{-19}\ C)$.

3. Draw the energy band structures of n-type and p-type semiconductors.

4. In intrinsic semiconductor CdTe, what fraction of the current is carried by electrons at 300 K? Given that at 300 K, $\mu_e = 0.070\ m^2 V^{-1} s^{-1}$ and $\mu_h = 0.007\ m^2 V^{-1} s^{-1}$.

5. Draw the B-H plots for paramagnetic and ferromagnetic materials.

6. Define dielectric strength.

7. Distinguish between crystalline and non-crystalline materials.

8. What are shape memory alloys?

9. Write short notes on A-scan and B-scan.

10. Mention any four radioactive isotope used in nuclear medicine.

PART B — (5 × 16 = 80 marks)

11. (a) Derive expressions for (i) electrical conductivity and (ii) thermal conductivity on the basis of classical free electron theory. Hence obtain Wiedemann-Franz law. (16)

Or

(b) (i) Explain Meissner effect, type I and type II superconductors. (8)

(ii) What are high T_c superconductors? Give four examples. (8)

12. (a) Derive an expression for carrier concentration in intrinsic semiconductors. Explain the variation of electrical conductivity with respect to temperature in the case of an intrinsic semiconductor. (10 + 6)

Or

(b) Show that for a p-type semiconductor, the Hall coefficient R_H is given by 1/pe. Discuss the applications of Hall effect. (16)

13. (a) Briefly outline the role of electron spin in magnetism. Explain how domain theory can be used to explain the magnetic behaviour of ferromagnetic materials. (16)

Or

(b) What is meant by local field in a dielectric and how is it calculated for a cubic structure? Deduce the Clausius-Mosotti relation. (16)

14. (a) What are the advantages of using composite materials? Explain the pultrusion and prepreg production processes of fiber reinforced plastics.

Or

(b) How are ceramics classified? Explain the steps involved in the fabrication of ceramic materials. (6 + 10)

15. (a) Explain the function of Geiger-Muller counter and scintillation detector with neat diagram.

Or

(b) Describe the principle and working of Gamma camera used in nuclear medicine imaging.

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