K 1080

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2004.

Third Semester

Electrical and Electronics Engineering

PH 231 — MATERIAL SCIENCE

Time : Three hours   Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define effective mass of an electron.

2. Calculate the Fermi function for an energy 2KT above Fermi energy.

3. Distinguish between direct and indirect band gap semiconductors.

4. How are N–type and P–type semiconductors produced?

5. What are magnetic domains?

6. Define dielectric loss.

7. What is photoconductivity?

8. Distinguish between fluorescence and phosphorescence.

9. What are shape memory alloys?

10. What are nanophase materials?

PART B — (5 × 16 = 80 marks)

11. (i)   What are metallic glasses? Explain their use as transformer core materials.

(3 + 5)

(ii)   What are Bio materials? Discuss the different types of biomaterials and their uses.

(2 + 6)

12. (a) (i)   What are density of energy state in metals? Derive an expression for density of energy states and hence obtain Fermi energy of a metal.

(2 + 10)

(ii)   Copper has electrical conductivity at 300 K as 604 X 10^7 mho m^{-1}. Calculate the thermal conductivity of copper.

(4)

Or

(b) (i)   What is superconductivity? Discuss briefly the applications of superconductors.

(2 + 8)

(ii)   Explain Type I and Type II superconductors.

(6)

13. (a) (i)   What is Fermi level in semiconductors?

(4)

(ii)   Discuss with neat sketch the variation of Fermi level and carrier concentration with temperature in the case of N type and P type semiconductors.

(6 + 6)

Or

(b) (i)   What is Hall effect? Derive an expression for Hall co-efficient.

(2 + 10)

(ii)   List any four applications of Hall effect.

(4)

14. (a) (i)   Distinguish between Dia, Para and Ferro magnetic materials.   (10)

(ii)   Describe the structure of ferrites.

(6)

Or

(b) (i)   Discuss in detail the various dielectric breakdown mechanisms. (10)

(ii)   Explain electronic polarization involved in a dielectric material.   (6)

2   **K 1080**

15. (a) (i) What is LED? Explain liquid crystal as display material. (2 + 10)

(ii) Calculate the wavelength of radiation emitted by an LED made up of Cds with bandgap energy 2.4 ev. (4)

Or

(b) (i) Explain briefly thermographic technique. What are its applications? (5 + 5)

(ii) Write a note on photoconductive materials. (6)

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