A 455

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2007

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 electrical conductivity for a metal with relaxation time 10^{-14} sec at 300°K (Density of electron is $6 \times 10^{28}/m^3$).

3. What is Fermi level in a semiconductor?

4. What is meant by carrier concentration in a semiconductor?

5. What are magnetic domains?

6. Define dielectric loss.

7. Calculate the wavelength of radiation emitted by LED with band gap of energy 1.8 ev.

8. What are excitons?

9. What is nonlinear optics?

10. What are nanophase materials?

PART B — (5 × 16 = 80 marks)

11. (i) What is Hall effect? Derive an expression for Hall coefficient.

(ii) Describe an experiment for the measurement of Hall Coefficient. Mention the important uses of Hall effect. (6 + 10)

12. (a) (i) Derive an expression for electrical conductivity on the basis of classical free electron theory of metals.

(ii) What are the drawbacks of classical free electron theory? (10 + 3)

Or

(b) (i) Explain high resistivity alloys.

(ii) What is meant by superconductor and mention any four properties?

(iii) Explain Type I and Type II superconductors. (4 + 6 + 6)

13. (a) (i) What is meant by Ferromagnetism?

(ii) Explain Hysterisis curve on the basis of Domain theory.

(iii) Write short notes on magnetic recording materials and discuss any one in detail. (2 + 8 + 6)

Or

(b) (i) What are the four types of polarization mechanisms in dielectrics?

(ii) Define dielectric breakdown.

(iii) Discuss in detail the various dielectric breakdown mechanisms. (2 + 2 +12)

14. (a) (i) Distinguish between fluorescence and phosphorescence.

(ii) What is meant by traps?

(iii) What are color centers? Describe the various types of color centers in detail. (4 + 2 + 10)

Or

(b) (i) What is meant by LCD?

(ii) Describe in detail the dynamic scattering display and twisted nematic display.

(iii) What is meant by thermography? What are its applications? (2 + 8 + 6)

15. (a) (i) What are metallic glasses? Explain their uses as transformer core materials.

(ii) What are shape memory alloys? Mention some of its applications.

(iii) Discuss the structure of polymers. (8 + 4 + 4)

Or

(b) (i) What are advanced ceramic materials? Discuss about their characteristics and their applications.

(ii) What are biomaterials?

(iii) Discuss the different types of biomaterials and their uses. (8 + 2 + 6)