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

Third Semester

Electrical and Electronics Engineering

PH 231 — MATERIALS SCIENCE

Time : Three hours   Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What are the failures of classical free electron theory?

2. What is fermi energy? What is its importance?

3. Why do we prefer extrinsic semiconductor over intrinsic semiconductor?

4. Define the operating temperature of a semiconductor.

5. What are ferrites? Mention any two applications of them.

6. What is dielectric break down?

7. How are the colour centres formed?

8. What are the differences between LED and LCD?

9. What are metallic glasses?

10. What are SMART materials?

PART B — (5 × 16 = 80 marks)

11. (a) Derive an expression for the electrical conductivity of a metal. How does the electrical conductivity vary with temperature and impurity concentration?   (12 + 4)

Or

(b) Derive an expression for the density of states and hence obtain the fermi energy in terms of density of electrons on the basis of quantum free electron theory.   (16)

12. (a) Derive expressions for carrier concentrations in an intrinsic semiconductor. (16)

Or

(b) Give the theory of Hall effect in the case of a semiconductor. Describe the experiment to find the concentration of charge carriers in n-type semiconductor using Hall effect. (12 + 4)

13. (a) Give an account of ferromagnetism according to Heisenberg's theory. What are the failures of Weiss theory of ferromagnetism? (10 + 6)

Or

(b) What is meant by local field in a dielectric? Derive an expression for it for a dielectric with cubic structure. Deduce Clausius-Mossotti relation. (10 + 6)

14. (a) Discuss in detail the optical absorption in metals, semiconductors and insulators. Mention any two optical materials and their applications? (12 + 4)

Or

(b) Explain in detail the principle and working of an LCD. What are the advantages and disadvantages of LCD over LED? (10 + 6)

15. (a) What are shape memory alloys? Explain in detail the preparation, characterisation and applications of shape memory alloys. (2 + 4 + 4 + 6)

Or

(b) Write short notes on :

(i) Conducting polymers

(ii) Intermetallic compounds

(iii) Biomaterials

(iv) Nanophase materials. (4 + 4 + 4 + 4)

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