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Question Paper Code: 21003

B.E. / B.Tech. DEGREE EXAMINATION, APRIL 2015.

Second Semester

Civil Engineering

01UPH203 - MATERIAL SCIENCE

(Common to Mechanical Engineering)

(Regulation 2013)

Duration: Three hours

Maximum: 100 Marks

Answer ALL Questions.

PART A - (10 x 2 = 20 Marks)

1. State any two postulates of classical free electron theory of metals.
2. Write any two drawbacks of the classical free electron theory of metals.
3. Define intrinsic semiconductor and give an example.
4. Write down the properties of compound semiconductors.
5. Magnetic field intensity of a paramagnetic material is 10^4 A/m. at room temperature, its susceptibility is 3.7×10^{-3} . Calculate the magnetization in the material.
6. Define Cooper pairs?
7. Define dielectric constant.
8. What is dielectric loss?
9. What is shape memory effect?
10. Mention any four properties of metglasses.

PART - B (5 x 16 = 80 Marks)

11. (a) (i) Derive electrical and thermal conductivity for a conductor. (12)
(ii) State the drawbacks of classical free electron theory. (4)

Or

- (b) Derive an expression for density of states in a metal and hence obtain the Fermi energy in terms of density of free electrons at $0K$. (16)

12. (a) (i) Derive an expression for the carrier concentration of electrons in the conduction band of an intrinsic semiconductor. (12)
(ii) Discuss the variation of Fermi level with temperature in intrinsic semiconductor. (4)

Or

- (b) Obtain an expression for the Hall coefficient for a p-type semiconductor. Describe an experimental setup for the measurement of Hall voltage and give its applications. (16)

13. (a) (i) Explain domain theory of ferromagnetism on the basis of hysteresis curve. (10)
(ii) Distinguish between soft and hard magnetic materials. (6)

Or

- (b) (i) Discuss the different types of superconductors. (8)
(ii) Describe the BCS theory of superconductivity. (8)

14. (a) (i) Discuss the different types of polarisation in dielectric materials. (8)
(ii) Derive an expression for the ionic polarizability. (8)

Or

- (b) Deduce an expression for the local field in a solid dielectric and hence obtain Clausius – Mosotti relation. (16)

15. (a) (i) What are metallic glasses? Explain the preparation of metallic glasses. (8)
(ii) With neat sketch, explain the fabrication of nanomaterials by ball milling method. (8)

Or

- (b) Discuss different types of techniques used in the synthesis of nano-phase materials and give their applications. (16)