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Question Paper Code: 21003

B.E. / B.Tech. DEGREE EXAMINATION, MAY 2014.

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. Find the Fermi function value, if the energy of a state 'E' is equal to Fermi energy ' E_F '.
3. Define intrinsic semiconductor and give an example.
4. Write down the properties of compound semiconductors.
5. What is Bohr magneton? Give its value.
6. What is Meissner effect in superconductors?
7. Define dielectric constant.
8. What is dielectric loss?
9. State some applications of shape memory alloys.
10. Mention the properties of nanomaterials.

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 energy states and hence obtain the expression for carrier concentration in metals.

(16)

12. (a) (i) Derive the expression for carrier concentration in n-type semiconductor. (10)
(ii) Discuss the variation of Fermi level of n-type semiconductor with temperature and impurity concentration. (6)

Or

- (b) (i) What is Hall effect? Derive the expression for Hall coefficient. Describe an experimental set up for the measurement for Hall co-efficient. (12)
(ii) Mention the applications of Hall effect. (4)
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) Explain Bardeen-Cooper-Schrieffer theory of superconductors. (8)
(ii) Discuss about high T_c superconductors. (8)
14. (a) (i) What is polarization? Derive an expression for the polarisability in electronic polarization. (10)
(ii) Explain the dependency of polarization on frequency and temperature. (6)

Or

- (b) Define internal field. Obtain an expression for internal field for a cubical dielectric and hence deduce the 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 chemical vapour deposition method. (8)

Or

- (b) (i) With neat diagram, explain the synthesis of nanoparticles by ball milling method. (10)
(ii) Write a short note on Fracture, Fatigue and Creep. (6)