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Question Paper Code: 42003

B.E. / B.Tech. DEGREE EXAMINATION, DEC 2021.

Second Semester

Civil Engineering

14UPH203 - MATERIALS SCIENCE

(Common to Mechanical Engineering)

(Regulation 2014)

Duration: Three hours

Maximum: 100 Marks

Answer ALL Questions.

PART A - (10 x 1 = 10 Marks)

- Drift velocity of electron is the
 - flow of electron per unit field
 - average electron velocity per unit field strength
 - reciprocal of conductivity
 - displacement current
- Wiedemann-Franz law states that the ratio between thermal conductivity and electrical conductivity for all metals is
 - directly proportional to pressure
 - inversely proportional to volume
 - inversely proportional to absolute temperature
 - directly proportional to absolute temperature
- What kind of elements is doped in p-type semiconductors?
 - trivalent
 - tetravalent
 - pentavalent
 - monovalent
- Semiconductors have _____ temperature coefficient
 - positive
 - negative
 - neutral
 - infinite

5. In the case of paramagnetic materials the spin magnetic moments of the adjacent atoms are aligned
 - (a) parallel to each other
 - (b) antiparallel to each other
 - (c) randomly
 - (d) antiparallel but of unequal magnitude
6. At critical temperature T_c , the value of critical magnetic fields H_c will
 - (a) zero
 - (b) infinity
 - (c) some non zero value
 - (d) one
7. In a dielectric, the polarization is
 - (a) linear function of applied field
 - (b) square function of applied field
 - (c) exponential function of applied field
 - (d) logarithmic function of applied field
8. The polarization that has low power loss is
 - (a) Electronic
 - (b) Ionic
 - (c) Orientation
 - (d) Space charge
9. Which of the following technique is used to form metallic glasses?
 - (a) Slow cooling
 - (b) Quenching
 - (c) Melt spinning
 - (d) Hardening
10. Materials that takes their own shape only upon heating are referred as_____
 - (a) Two way shape memory
 - (b) One way shape memory
 - (c) Three way shape memory
 - (d) none of these

PART - B (5 x 2 = 10 Marks)

11. Mention any four drawbacks of classical free electron theory of metals.
12. What is band gap in a semiconducting material?
13. Recall Meissner effect in superconductors.
14. Define dielectric constant.
15. Give any four applications of nanomaterial.

PART - C (5 x 16 = 80 Marks)

16. (a) (i) List out few postulates of classical free electron theory of metals. (4)
(ii) Arrive at a mathematical expression for electrical and thermal conductivity of a conducting material. (12)

Or

- (b) Define density of states and derive an expression for carrier concentration in metals. (16)

17. (a) What is intrinsic semiconductor? Derive an expression for carrier concentration in an intrinsic semiconductor. (16)

Or

- (b) (i) What is Hall effect? Derive an expression for Hall coefficient? Describe arrangement for the measurement of Hall coefficient. (12)
(ii) Write the applications of Hall effect. (4)

18. (a) Distinguish in detail Dia, Para and Ferromagnetic materials with examples. (16)

Or

- (b) (i) Classify the types of superconductors based on magnetization. (8)
(ii) Discuss in detail the phenomena of superconductivity based on BCS theory. (8)

19. (a) Explain the various types of Polarization mechanisms involved in a dielectric material. (16)

Or

- (b) What is internal field? Derive an expression for internal field and hence deduce the Clausius-Mosotti equation. (16)

20. (a) (i) What are metallic glasses? Write in detail their preparation, properties and applications. (8)
- (ii) What are carbon nano tubes? (8)

Or

- (b) Illustrate in detail the Sol-gel method to prepare nano material. (16)