Register Number: ……..

B.E DEGREE EXAMINATIONS: MAY/JUNE 2014

(Regulation 2013)

Second Semester

U13PHT202: MATERIALS SCIENCE

(Common to AE/AUTO/MECH/MCE)

Time: Three Hours **Maximum Marks: 100**

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. The electrical conductivity (σ) of a conductor at absolute temperature T is related to its thermal conductivity (K) as
   a) $(\sigma\ L\ T^2)= K$ b) $(K^2\ \sigma\ T)=L$
   c) $(\sigma / KT)=L$ d) $(K/\ \sigma\ T)=L$
2. The unit for electrical conductivity is ……..
3. In Hall effect the hall field is perpendicular with respect to the applied ……
   a) Current b) Magnetic field
   c) Current& magnetic field d) Critical magnetic field
4. The energy gap in Silicon and Germanium are respectively ……..
5. In ferromagnetic materials the susceptibility is
   a) Very small and negative b) Very small and positive
   c) Very large and negative d) Very large and positive
6. In a capacitor, dielectric material is used to ……the capacitance of the capacitor.
7. The two structures involved in shape memory alloy are
   a) Austenite, Marinite b) Peralite, Sterlite
   c) Martensite, Amber d) Martensite, Austenite
8. The production of ……. are by extremely rapid cooling method
9. In fatigue testing S-N graph is the graph with
   a) Strain versus Number of cycles tests b) Stress amplitude versus number of stress cycles
   c) Saturated stress versus Norman's strain d) Start of fracture stress versus Numerical strain
10. Toughness of a material under shock loading condition is ……testing.

PART B (10 x 2 = 20 Marks)

(Not more than 40 words)

11. Write the definition for Coefficient of thermal conductivity (K).
12. What is a cryotron?
13. The intrinsic carrier density is $1.8x10^{16}/m^3$. If the mobility of electron and hole are 0.1 and 0.08 $m^2\ V^{-1}\ S^{-1}$ respectively, determine the conductivity.
14. What is Fermi Dirac distribution function?
15. Draw hysteresis loop and show the retentivity and coercivity in it.
16. What is meant by polarization in dielectrics?
17. Write any two important properties of Carbon Nano Tubes suitable for engineering applications?
18. Write any four applications of Shape memory alloys.
19. In a compression test for a concrete cube of cross sectional area = 22952 mm^2 the maximum load applied is 710000 N, then find its Ultimate compressive strength.
20. Compare the differences between ductile and brittle fracture?

PART C (5 x 14 = 70 Marks)

(Not more than 400 words)

Q.No. 21 is Compulsory

21. (i) What is Hall effect? (2)
    (ii) Derive an expression for Hall coefficient in terms hall voltage for an n-type semiconductor (8)
    (iii) Describe an experimental setup for the measurement of the hall effect parameters. (4)

22. a) (i) Derive an expression for the electrical conductivity and thermal conductivity of a metal. (10)
    (ii) Deduce Wiedemann-Franz law. (4)

    (OR)

    b) (i) What is the difference between type-I and type-II superconductors and mention their general properties? (10)
    (ii) Critical temperature for lead is 7.18 K and $H_0 = 6.5x10^4$ A/m, determine the critical current for a wire of lead 1.2mm diameter at 4.5 K. (4)

23. a) (i) With necessary diagrams explain the manufacturing methods of metallic (10)

glasses & its mechanical, magnetic and electrical properties.

(ii) Why metallic glasses are preferred as transformer core material? (4)

(OR)

b) (i) Explain the types of carbon nano tubes. (4)

(ii) Explain the Pulsed laser deposition and chemical vapour deposition method of carbon nano tube preparation. (10)

24. a) (i) What is ferromagnetism? (3)

(ii) Explain the reason for the formation of domain structure in ferromagnetic material and how the hysteresis curve is explained on the basis of the domain theory. (11)

(OR)

b) (i) What is meant by polarization in dielectric material? (3)

(ii) Explain the different types of polarization mechanisms involved in a dielectric material. (11)

25. a) (i) Explain Griffith's theory of brittle materials and derive an expression for the applied stress at which fracture occurs due to an existing crack. (8)

(ii) Explain the tensile test with graph analysis. (6)

(OR)

b) (i) Explain with necessary diagrams creep failure with graph analysis and fatigue failure test with graph analysis. (10)

(ii) Explain about compression test. (4)

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