KUMARAGURU
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Register Number: ……..

B.E / B.TECH DEGREE EXAMINATIONS: DEC 2014

(Regulation 2009)

Second Semester

PHY104: MATERIALS SCIENCE

(Common to CSE/IT/EIE)

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

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. At very high temperature, the mean free path and collision time in a conductor are proportional to

   a) Independent to T b) $1/T^2$

   c) T^2 d) 1/T

2. In the superconducting state the thermo electric effect is

   a) increases b) degreases

   c) constant d) disappears

3. At 0K a semiconductor acts as

   a) a superconductor b) a good conductor

   c) an insulator d) same as semiconductor

4. The Fermi level in an n-type semiconductor at 0K lies

   a) below the donor level b) half way between the conduction band and donor level

   c) coincides with intrinsic Fermi level d) at valance band

5. 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

6. The magnetic recording tapes are most commonly made from

   a) silver nitrate b) silicon-iron

   c) austenite d) ferric oxide

7. Nitinol is a

a) conducting polymer b) shape memory alloy

c) Nano composite material d) thermoelectric material

8. The formation of colloidal suspension during the process of formation of nano materials is known as

a) sol b) gel

c) sol gel d) chemical reaction

9. ---------- will produce higher life time for free charge carriers.

a) recombination centers b) colour centers

c) excitons d) traps

10. ---------- device reflects light when light is incident on it.

a) LCD b) LED

c) solar cell d) photodiode

PART B (10 x 2 = 20 Marks)

11. List any two drawbacks of classical free electron theory.
12. A superconducting material has a critical temperature 3.7K at zero magnetic field and a critical field of 0.0306 tesla at 0K. Fid the critical field at 2K.
13. Distinguish between direct and indirect band gap semiconductors.
14. Sketch the variation of carrier concentration with temperature in n-type semiconductor.
15. Obtain the relation between magnetic susceptibility and relative permeability.
16. Outline any four important advantages of magnetic bubble memory.
17. Metallic glasses are strong and malleable. Why?
18. Write any four methods for the preparation of nano materials.
19. Compare the fluorescence with phosphorescence.
20. What is phase matching?

PART C (5 x 14 = 70 Marks)

21. a) (i) Deduce the Wiedemann Frantz law from the expression of electrical and thermal conductivity of metals. (10)

(ii) The resistance of copper at 20^0C is $1.69x10^{-4}$ ohm-m and density of free electrons (n) is $8.5x10^{28}$ m^3. Calculate the collision time. (4)

(OR)

b) (i) Distinguish between type I and type II superconductors. (7)

(ii) Explain the applications of superconductors in cryotron and SQUIDS. (7)

22. a) (i) Originate the general expression to find band gap of intrinsic semiconductors. (10)

(ii) Discuss the variation of Fermi energy level in n-type and p-type semiconductors. (4)

(OR)

b) (i) Explain how semiconducting material can be classified into p-type and n-type semiconductors using Hall co-efficient. (10)

(ii) List any four applications of hall effect. (4)

23. a) (i) Apply Domain theory to explain ferromagnetic materials. Discus the various energies involved in the domain growth mechanism. (10)

(ii) Outline any four applications of ferrites. (4)

(OR)

b) (i) Elaborate the electronic polarization mechanism and show that $\alpha_e = 4\pi\varepsilon_0 R^3$. (10)

(ii) Compile the various polarization mechanisms under frequency and temperature. (4)

24. a) (i) Explain with neat sketch how metallic glasses are prepared via rapid cooling process. (7)

(ii) Estimate the different phase transformation in SMA and list any four advantages of SMA. (7)

(OR)

b) (i) Determine how a nano material is synthesized from chemical vapour deposition technique. (7)

(ii) Discuss the fabrication process of carbon nanotubes through electric arc method. (7)

25. a) (i) Explain the mechanism involved in twisted nematic crystal display devices. (10)

(ii) Mostly colour centers takes place in ionic crystals. Justify. (4)

(OR)

b) (i) With simple experimental set-up, explain how frequency doubling is achieved using nonlinear material. (10)

(ii) Write short note on optical mixing. (4)

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