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Register Number: …………………….

B.E DEGREE EXAMINATIONS: DEC 2014

(Regulation 2009)

Second Semester

ELECTRONICS AND COMMUNICATION ENGINEERING

PHY105: Materials Science

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

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. The classical expression for the electrical conductivity of a metal in terms of mass of the electron, charge of the electron, concentration of electrons and collision time is given by
   a) $mn/e^2\tau$
   b) $me\tau/n$
   c) $ne^2\tau/m$
   d) $ne^2\tau^2/m$

2. In a superconductor, critical magnetic field
   a) increases if temperature decreases
   b) independent of temperature
   c) increases if temperature increases
   d) independent of magnetic field

3. The single crystals are obtained with smaller diameters through ----------- technique
   a) Bridgman's
   b) Czochralsi
   c) Crystal pulling
   d) Liquid phase epitaxy

4. The abbreviation for LSI is
   a) Low Scale Integration
   b) Large Scale investigation
   c) Linear Scale Integration
   d) Large Scale Integration

5. The materials exhibits spontaneous magnetization even absence of an external field
   a) paramagnetic
   b) diamagnetic square
   c) ferromagnetic
   d) ferrites

6. Polarization in dielectrics is defined as induced dipole moment per unit _____
   a) volume
   b) temperature
   c) mass
   d) volt

7. Which of the following is used for electron emission effect in vacuum lambs?
   a) Magnetic materials
   b) Fluorescent materials
   c) Carbon nanotubes
   d) SMA materials

8. Amorphous metals can be produced by
   a) melt spinning and mechanical alloying
   b) chemical reduction
   c) chemical precipitation
   d) Electric discharge method

9. ---------------- will produce higher life time for free charge carriers.
   a) recombination centers
   b) colour centers
   c) excitons
   d) traps

10. In optical mixing, the sources of -------------- frequencies are mixed together
    a) same
    b) different
    c) High and low
    d) Infra red

PART B (10 x 2 = 20 Marks)

11. State Widemann – Frantz law.

12. All superconductors are perfect diamagnetic but all diamagnetic materials are not superconductors. Justify.

13. Identify the factors that affect impurity diffusion.

14. What are the three types of monolithic capacitors?

15. Distinguish between polar and non-polar molecules

16. Write the classification of magnetic materials.

17. Shape memory alloys have pseudo-elasticity. Why?

18. Categorize different vapour phase deposition techniques for nanomaterial synthesis.

19. Compare F-colour center with V-colour center.

20. Based on nonlinear properties how the materials are classified?

PART C (5 x 14 = 70 Marks)

21. a) (i) Deduce the expression for density of energy states and show that the average (10) energy of an electron at 0K is $3/5E_{F0}$.

    (ii) Write any four important drawbacks of classical free electron theory. (4)

    (OR)

    b) (i) List out any seven applications of superconducting materials. (7)

(ii) Explain the important properties of superconductors. (7)

22. a) (i) Explain the Czochralsi method to produce large size crystals of semiconductor materials for device applications. (7)

(ii) List out various steps involved in the fabrication of monolithic integrated circuits. (7)

(OR)

b) (i) Explain with neat sketch how thin film is prepared from vacuum deposition technique. (10)

(ii) Compare thin film and thick film (4)

23. a) (i) Apply Weiss theory of ferromagnetism to calculate paramagnetic susceptibility of a magnetic material. (10)

(ii) Distinguish between hard and soft magnetic materials (any four points only). (4)

(OR)

b) (i) Explain the different types of break down mechanism occur in dielectric materials. (7)

(ii) Derive an expression for the ionic polarization in dielectric material. (7)

24. a) (i) Explain with neat sketch how shape memory alloys exhibit hysteresis effect. (7)

(ii) Identify the important applications of metallic glass. (7)

(OR)

b) (i) Illustrate how a nanomaterial is synthesized from ball milling process. (7)

(ii) Discuss the fabrication process of carbon nanotubes through laser ablation technique. (7)

25. a) (i) Elaborate the mechanism involved in dynamic scattering display devices. (7)

(ii) Outline the formation of Frankel and Mott-Wannier excitons in the metals and list their properties along with important applications. (7)

(OR)

b) (i) Explain the basic properties of nonlinear materials. (7)

(ii) List out the applications of nonlinear optical materials in the field of computers, optical communication and electronics. (7)

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