Register Number: ……..

B.E. DEGREE EXAMINATIONS APRIL/MAY 2010

Second Semester

PHY103: MATERIAL SCIENCE

(Common to Aeronautical Engineering, Mechanical Engineering & Mechatronics Engineering)

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

Answer ALL Questions:-

PART A (10 x 1 = 10 Marks)

1. The density of free electron states in a metal varies as

   A) $E^{1/2}$ B) $E^{-1/2}$ C) E D) 1/E

2. The Critical Magnetic field of a superconductor

   A) varies linearly with temperature B) is independent of temperature

   C) increases with increasing temperature D) decreases with increasing temperature

3. Which of the following statements are true?

   The probability of finding the electron at the Fermi Level in a metal

   A) depends on temperature B) is ½ at any temperature

   C) is 1 at any temperature D) is 0 at any temperature

4. Which of the following statements are true?

   A) A solid is an insulator if it has Eg = 1 eV

   B) A solid is a semiconductor if it has Eg ≥ 3 eV

   C) A solid is a metal if its valence band is empty

   D) A solid is a metal if its conduction band and valence band overlap

5. In high frequency applications, a ferrite is preferred to a ferromagnetic material because the ferrite has

   A) high permeability B)high resistivity

   C) high saturation magnetisationq D)square hysteresis loop

6. The unit of Polarisation is

   A) Coul.m B) Coul/m C)$Coul/m^2$ D) $Coul/m^3$

7. The structure of the metallic glass is

   A) Tetrahedral closed packing B) Face centered cubic

   C) Simle cubic D) Body centered cubic

8. Sol-gel is a ----------technique.

A) Wet chemical B) Physical vapour deposition

C) Spray pyrolysis D) Inert gas condensation

9. Scottky defect is a

A) Point defect B) Line defect C) Surface defect D) Volume defect

10. The unit of tensile strength is

A) Kg/cm^2 B) $Kgcm^3$ C) Kgcm D) Kg/cm

PART A (10 x 2 = 20 Marks)

11. Define Wiedemann Franz law.

12. What is Meissner effect?

13. What is effective mass of an electron?

14. State the properties of semiconductor.

15. Distinguish between hard and soft magnetic material.

16. What is meant by dielectric loss?

17. What are shape memory alloys?

18. Give any two applications of nanotechnology.

19. What is creep?

20. What do you understand by Fatigue of materials?

PART C (5 x 14 = 70 Marks)

21. (a) (i) Describe the classical free electron theory of metals and deduce the expression for electrical conductivity. (8)

(ii) Discuss the merits and demerits of free electron theory. (6)

(OR)

(b) (i) Distinguish between Type I and Type II superconductors. (8)

(ii) Explain in detail about Cryotron and Magnetic Levitation. (6)

22. (a) (i) Derive an expression for the carrier concentration of an electron in intrinsic Semiconductor. (10)

(ii) Discuss the variation of Fermi Level with temperature in intrinsic semiconductor.(4)

(OR)

(b) (i) What is Hall effect? Explain the determination of Hall Coefficient. (7)

(ii) Describe an experimental setup for the measurement of Hall voltage and give the applications of Hall effect. (7)

23. (a) (i) What is Ferromsgnetism?Explain the reason for the formation of Domain structure in a ferromagnetic material and how the hysteresis curve is explained on the basis of domain theory.

(OR)

(b) (i) Discuss in detail the different types of polarization mechanisms in dielectrics and sketch their dependence on the frequency of the applied electric field.

24. (a) (i) What are metallic glasses?How they are prepared? Mention some of its Properties and applications.

(OR)

(b) (i) Explain the fabrication of carbon nanotubes by chemical vapour deposition method. (8)

(ii) Discuss about its structure and applications. (6)

25. (a) (i) Explain in detail about various strengthening mechanisms for the improvement of mechanical properties.

(OR)

(b) (i) Distinguish between Brittle and Ductile fracture. (5)

(ii) Explain the various factors affecting the mechanical properties of materials. (9)

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