

B.E DEGREE EXAMINATIONS: JUNE 2010

Second Semester

PHY103: MATERIALS SCIENCE

(Common to B.E – Aeronautical Engineering, Mechanical Engineering and Mechatronics Engineering)

Time: Three Hours

Maximum Marks: 100

Answer ALL Questions:-

PART A (10 x 1 = 10 Marks)

1. The density free electron states in metal
A. varies as $E^{1/2}$ B. varies as $E^{-1/2}$ C. varies as E D. varies as $1/E$
2. If the T_c is 4.153 K for the isotope of Hg of atomic mass 202, then the T_c for the isotope of Hg of atomic mass 200 is
A. 1.174 B. 2.174 C. 3.174 D. 4.174
3. Which of the following statement is true?
A. mobility of holes is greater than that of electrons.
B. mobility of electron is equal to the mobility of holes.
C. mobility of electron is greater than that of holes.
D. mobility of electrons and holes are equal.
4. N-type silicon is obtained by doping Si with
A. Boron B. Aluminum C. Antimony D. Indium
5. The susceptibility of dia magnetic materials
A. varies directly with temperature (T) B. varies with (1/T)
C. varies with (1 / T²) D. independent of temperature
6. The unit of polarization is
A. Coulomb.meter B. Coulomb /meter C. Coulomb / m² D. Coulomb / m³
7. Melt spinning technique is used to prepare
A. shape memory alloys B. Nanoparticles
C. metallic glasses D. high sensitivity sensors
8. The size of the nanomaterial is the order of
A. 1 – 10 nm B. 1 – 100 nm C. 0.1- 1 nm D. 0.01 – 1 nm
9. Creep curve is a plot of
A. strain versus time B. strain versus Temperature
C. strain versus stress D. strain versus young modulus
10. Among the following materials, which one has the highest hardness?
A. Steel B. Copper C. Cast Iron D. Silicon carbide

PART B (10 x 2 = 20 Marks)

11. State the drawbacks of classical free electron theory of metals.
12. What is Cryotron?
13. State the properties of semiconductors.
14. What is Hall-effect?
15. State the applications of ferrites.
16. What are Ferro electric materials? Give examples.
17. What are Shape memory alloys?
18. State the principle involved in chemical vapour deposition (CVD).
19. What is Burgers vector?
20. What is meant by cold working of metals?

PART C (5 x 14 = 70 Marks)

21. (a) Based on the classical free electron theory, derive expressions for electrical conductivity and thermal conductivity of conducting materials and hence arrive at Wiedemann-Franz law.

(OR)

- (b) (i) State and explain the properties of superconductors. (10)
(ii) Distinguish between Type I and Type II superconductors. (4)

22. (a) (i) Derive an expression for the density of holes in the valence band of intrinsic semiconductor (10)
(ii) Explain a method to determine the band gap of the semiconductor. (4)

(OR)

- (b) (i) Derive an expression for the Hall coefficient. Describe an experiment for the measurement of the Hall coefficient. (10)
(ii) Mention the important uses of Hall effect. (4)

23. (a) (i) Explain the properties of Dia, Para, Ferro and Ferri magnetic materials. (10)
(ii) Differentiate between soft and hard magnetic materials. (4)

(OR)

- (b) (i) Explain the different types of polarization mechanisms involved in a dielectric materials. (10)
(ii) List any four applications of ferro electric materials. (4)

24. (a) (i) Explain the preparation, properties and applications of metallic glasses. (10)
(ii) What are the applications of shape memory alloys? (4)

(OR)

- (b) (i) Discuss any two techniques that are used to synthesis carbon nanotubes. (10)
(ii) Mention the applications of carbon nanotubes. (4)

- 25 (a) (i) Explain the different types of crystal imperfections. (10)
(ii) Draw a typical creep curve for a metal under constant load and its three stages. (4)

(OR)

- (b) (i) Describe the three stages in a brittle fracture of a metal. (10)
(ii) Comment on metal fatigue failure. (4)
