B.E DEGREE EXAMINATIONS: JUNE 2015

(Regulation 2014)

Second Semester

U14PHT202: MATERIALS SCIENCE

(Common to AERO/AUTO/MCT & ME)

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

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1.   Match List I with List II and correct the answers with following codes   [K_1]

List I	List II
A. Acceleration	i. $\Omega^{-1}m^{-1}$
B. Thermal conductivity	ii. $W \Omega k^{-2}$
C. Electrical conductivity	iii. ms^{-1}
D. Lorentz Number	iv. $Wm^{-1}k^{-1}$

	A	B	C	D
a)	1	3	4	2
b)	4	2	1	3
c)	2	4	1	3
d)	3	4	1	2

2. The highest energy state for an electron to occupy at 0 K in a metal level is   [K₁]

   a) Fermi level   b) Donor level

   c) Acceptor level   d) Metastable level

3. On heating one end of a rod, the temperature of whole rod will be uniform when the temperature is: [K₂]

   a) 1K   b) 0 K

   c) 100 K   d) α K

4. The susceptibility value for diamagnetic material is   [K₁]

   a) Small and negative   b) Large and negative

   c) Small and positive   d) Large and positive

5. Consider the following statements in properties of Super conducting materials   [K₁]

   1. The electrical resistivity drops to zero

   2. These materials attract the magnetic lines of force

   3. These are also called ferromagnetic material

   4. The magnetic flux lines are expelled from the material

   Which of these statements are correct?

   a) 1,3   b) 2,3

   c) 1,4   d) 2,4

6. NiTi is a   [K₁]

   a) Metallic glass   b) Ferrite material

   c) Shape memory alloy   d) Dielectric material

7. The following items consist of two statements, one labeled as the "Assertion (A)" and other as   [K₂]
   "Reason(R)". Examine these two statements and select the answers from the following codes.

   Assertion (A): The temperature coefficient of resistance is positive for metals and negative for p-type semiconductor.

   Reason (R): The effective charge carriers in metals are negatively charged whereas in p-type semiconductor, they are positively charged.

   a) A is true but R is false   b) A is false but R is true

c) A is true and R is true but R is a correct reason for A

d) A is true and R is true but R is not a correct reason for A

8. _____ is defined as the continuous deformation of a metal under steady load with the passage of time. [K$_1$]

a) Fatigue

b) Brittle fracture

c) Fracture

d) Creep

9. Sequence the following sentences [K$_1$]

During Zener breakdown

1. Electrons colliding with the other atoms

2. Breaking covalent bond and more electrons are released

3. Electrons are accelerated to very high velocity

4. Very high electric field is applied to dielectric material

a) 4-2-3-1

b) 4-1-2-3

c) 4-3-1-2

d) 4-3-2-1

10. A single sheet of graphite is called as [K$_1$]

a) Graphene

b) Nitinol

c) Carbon

d) Metallic glass

PART B (10 x 2 = 20 Marks)
(Answer not more than 40 words)

11. Calculate the relaxation time of conduction electrons in a metal of resistivity 1.54×10^{-8} ohm-m if the metal has 5.8×10^{28} conduction electrons /m^3. [K$_2$]

12. Prove that the superconductors are diamagnetic materials. [K$_2$]

13. Compare n-type and p-type semiconductor. [K$_1$]

14. Write the expression for electrical conductivity of an intrinsic semiconductor. [K$_1$]

15. Distinguish between soft and Hard Magnetic materials. [K$_1$]

16. Define ionic polarization. [K$_1$]

17. What are applications of Shape memory alloys? [K$_1$]

18. What are bottom-up and top-down approaches? [K$_1$]

19. What are the various diffusion hardening processes? [K$_1$]

20. Define Fatigue. [K$_1$]

Answer any FIVE Questions:-

PART C (5 x 14 = 70 Marks)

(Answer not more than 300 words)

Q.No. 21 is Compulsory

21. Explain Griffith theory of brittle materials and derive expression for the applied stress at which fracture occurs due to an existing crack. [K1]

22. i)Derive an expression for electrical conductivity and thermal conductivity of a metal (10) [K1]

    ii) Deduce Wiedemann- Franz law (4)

23. i) Define Hall Effect and derive an expression for Hall voltage and Hall coefficient in a semiconducting material. (10) [K1]

    ii) The intrinsic carrier density at room temperature in Ge is 2.4×10^{19} / m^3. If the electron and hole mobilities are 0.4 and 0.2 $m^3V^{-1}s^{-1}$ respectively. Determine its resistivity. (4) [K2]

24. i) Explain the Weiss theory of ferromagnetism and obtain an expression for ferromagnetic susceptibility. (7) [K_1]

    ii) Explain in detail domain theory of ferromagnetism. (7) [K_1]

25. Describe in details the preparation of metallic glasses and mention its properties and applications. [K1]

26. i) Explain the manufacturing of Carbon nano tubes by CVD and DC arc discharge methods. (10) [K_1]

    ii) Explain the types of Carbon nano tubes. (4)

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