Register Number:……..

KUMARAGURU
college of technology
character is life

B.E DEGREE EXAMINATIONS : JUNE 2017

(Regulation 2015)

Second Semester

U15PHT202: MATERIALS SCIENCE

(Common to AERO / AUTO / MECH / MCT)

COURSE OUTCOMES

CO1: Apply core concepts in Materials Science to solve engineering problems

CO2: Determine the position of the acceptor or donor levels an the band gap of an extrinsic semiconductor

CO3: Classify and differentiate the structure and physical properties of conducting materials

CO4: Apply the techniques to manufacturing of modern materials and nano materials for engineering applications

CO5: Recognize the basic concepts of strengthening of materials in technological applications

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

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. Match the items given in list-I with those in list-II CO1 [K_1]

List I	List II
A. Mobility	1. $\Omega^{-1}m^{-1}$
B. Lorentz number	2. $m^2V^{-1}s^{-1}$
C. Electrical Conductivity	3. $Wm^{-1}K^{-1}$
D. Thermal Conductivity	4. $W\Omega K^{-2}$

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

2. At critical field temperature T_c, the value of critical magnetic field H_c, is CO2 [K_1]

a) Some non zero value b) Zero

c) Minimum d) Infinity

3. The structure of Ferrites CO3 [K_1]

a) $M^{2+} Fe_2^{3+} O_4^{2-}$ b) $M^{2+} Fe_2^{3+} O_4^{4-}$

c) $M^{4+} Fe_2^{3+} O_4^{2-}$ d) $M_3^{2+} Fe_2^{3+} O_4^{2-}$

4. In metallic glasses, the ultra high cooling rate in rapid solidification process is CO4 [K_1]

a) 10^6 to 10^9 K s^{-1} b) 10^6 to 10^{11} K s^{-1} .

c) 10^6 to 10^8 K s^{-1} d) 10^6 to 10^{10} K s^{-1}

5. Consider the following properties of semiconductors CO2 [K_1]

1. Semiconductor have negative temperature coefficient of resistance.
2. The electrical conductivity of semiconductors increases with addition of impurities.
3. The electrical conductivity of a semiconductor decreases with increase in temperature.
4. They are bounded by covalent bonds.

Which are correct?

a) 1,4 b) 1,2,4

c) 1,2,3 d) 2,4

6. The continuous deformation of a metal under steady load with the passage of time is called _____. CO5 [K_1]

a) Fatigue b) Brittle fracture

c) Fracture d) Creep

7. The following items consists of two statements, one is labeled as the "Assertion (A)" and the other as "Reason (R)". Examine these two statements and select the answers from the following codes. CO3 [K_1]

Assertion (A): All dielectric materials are not insulators

Reason (R): All insulators are dielectric materials

a) Both A and R are Individually true and R is the correct explanation of A b) Both A and R are Individually true but R is not the correct explanation of A

c) A is true but R is false d) A is false but R is true

8. The single sheet of graphite is called CO4 [K_1]

a) Graphene b) Nitinol

c) carbon d) Metallic glass

9. Sequence the following sentences for SQUIDS. CO2 [K_1]

1. The interference current flow around the ring.
2. The magnetic field is applied perpendicular to the plane of the ring.
3. The induced current produces the interference pattern.
4. The current is induced at the two Josephson junctions

a) 1-2-3-4 b) 3-1-4-2

c) 2-4-3-1 d) 2-3-4-1

10. The property of a material by virtue of which it can be beaten or rolled into plates is called CO5 [K_1]

a) Malleability b) Ductility

c) Plasticity d) Reliability

PART B (10 x 2 = 20 Marks)

(Answer not more than 40 words)

11. Define Fermi energy. CO1 [K_1]
12. Prove that the superconductors are perfect diamagnets. CO1 [K_1]
13. Compare Type-I and Type-II Superconductors. CO2 [K_1]
14. What are Ferrites? CO2 [K_1]
15. Define dielectric loss. CO3 [K_1]
16. Mention the different structure of Carbon Nano tubes. CO3 [K_1]
17. Mention four properties of Nitinol. CO4 [K_1]
18. What are bottom-up and top-down approaches? CO4 [K_1]
19. Define Fatigue CO5 [K_1]
20. What do you meant by heat treatment ? CO5 [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. (i) Discuss the strengthening mechanisms for the improvement of mechanical properties. (10) CO5 [K_1]

(ii) Differentiate brittle and ductile fracture. (4) CO5 [K_1]

22. (i) Develop an expression for density of energy states and obtain an expression for Fermi energy of a metal at 0K. (10) CO1 [K_1]

(ii) The Thermal and Electrical conductivity of Cu at 20°C are $390 Wm^{-1}K^{-1}$ and $5.87 \times 10^7\ \Omega^{-1}m^{-1}$, respectively. Calculate the Lorentz number. (4) CO1 [K_1]

23. (i) Define Hall effect and derive an expression for Hall voltage and Hall coefficient in a semiconducting material. (10) CO2 [K_1]

(ii) The Hall coefficient and conductivity of Cu at 300 K have been measured to be $-0.55 \times 10^{-10}\ m^3A^{-1}s^{-1}$ and $5.9 \times 10^7\ \Omega^{-1}m^{-1}$, respectively. Calculate the drift mobility of electrons in copper. (4) CO2 [K_1]

24.	(i) Explain the Weiss theory of Feromagnetism and obtain the expression for ferromagnetic susceptibility.	(7)	CO3	[K_1]
	(ii) Explain the domain theory of ferromagnetism	(7)	CO3	[K_1]
25.	(i) Discuss various types of polarization mechanisms involved in dielectric materials.	(10)	CO3	[K_1]
	(ii) A paramagnetic material has a magnetic field intensity of 10^4 Am^{-1}.If the susceptibility of the material at room temperature is $3.7x10^{-3}$, calculate the magnetization and flux density of the material.	(4)	CO3	[K_1]
26.	(i) Discuss the characteristics and applications of Shape Memory Alloys.	(7)	CO4	[K_1]
	(ii) Write a note on the properties of Metallic Glasses.	(7)	CO4	[K_1]
27.	Discuss the Chemical Vapour Deposition and DC arc discharge methods of fabricating Carbon Nano Tubes.		CO4	[K_1]

****