A **Reg. No. :** | | | | | | | | | | |

Question Paper Code: 52003

B.E. / B.Tech. DEGREE EXAMINATION, MAY 2018

Second Semester

Mechanical Engineering

15UPH203 – MATERIAL SCIENCE

(Common to Chemical Engineering)

(Regulation 2015)

Duration: Three hours Maximum: 100 Marks

PART A - (10 x 1 = 10 Marks)

1. At T = 0K, the energy levels located above Fermi energy E_F are **CO1- R**

   (a) partially filled (b) empty (c) filled (d) none of these

2. Ionic polarization **CO1- R**

   (a) decreases with increase in temperature

   (b) is independent of temperature

   (c) increases with temperature

   (d) first increases and then decreases with temperature

3. If a semiconductor has energy band gap of 1.9eV, then its emitted energy will lie in **CO2 -R**

   (a) visible region (b) UV region

   (c) IR region (d) invisible region

4. The direction of Hall voltage is **CO2 -R**

(a) parallel to applied electric field

(b) perpendicular to applied magnetic field

(b) perpendicular to both applied electric and magnetic field

(d) perpendicular to applied electric field

5. Water is a _____ substance. **CO3 -R**

(a) paramagnetic (b) ferromagnetic

(c) diamagnetic (d) anti - ferromagnetic

6. SQUID works on the principle of **CO3- R**

(a) macroscopic quantum interference

(b) microscopic classical interference

(c) microscopic quantum interference

(d) macroscopic classical interference

7. Metallic glasses are prepared by rapid solidification of the liquid at the rates approaching a million degrees **CO4 -R**

(a) per minute (b) per second (c) per hour (d) per day

8. High conducting nature of CNT is due to **CO4 -R**

(a) more electrons (b) nanoporosity (c) microporosity (d) defects

9. Fatigue fracture occurs **CO5 -R**

(a) when materials are subjected to cyclic loading

(b) when materials are subjected to low temperature

(c) when materials are subjected to high temperature

(d) when materials are subjected to compressive stress

10. Which of the following is not a thermo dynamical function? **CO5 -R**

(a) enthalpy (b) work done (c) Gibb's energy (d) internal energy

PART – B (5 x 2= 10Marks)

11. State Wiedemann Franz law. **CO1 -R**

12. Distinguish between intrinsic and extrinsic semiconductors. **CO2 -R**

13. Show that superconductor is a perfect diamagnet. **CO3 -R**

14. Differentiate top down and bottom up method of nanoparticle synthesis. **CO4 -R**

15. What do you mean by entropy? **CO5 -R**

PART – C (5 x 16= 80Marks)

16. (a) What is meant by internal field in dielectrics? Obtain an expression for internal field experienced by an atom in a cubic structure using Lorentz method. Deduce Clausius- Mosotti relation using the expression obtained for internal field. **CO1 -App** (16)

Or

(b) (i) Outline the differences between electrical and thermal Conductivity. **CO1 -App** (4)

(ii) At T = 0K, all the levels above Fermi energy E_F are vacant – Justify this statement using Fermi distribution function **CO1 -App** (8)

(iii) Discuss also the condition for the above at a temperature T > 0K **CO1- App** (4)

17. (a) What is Hall effect? Obtain an expression for Hall coefficient in terms of current density and electronic charge. **CO2 -App** (16)

Or

(b) Classify extrinsic semiconductors. Obtain an expression for carrier concentration in an intrinsic semiconductor. **CO2 -Ana** (16)

18. (a) (i) Classify ferromagnetic material based on their spin. **CO3 -Ana** (8)

(ii) Distinguish between hard and soft magnetic materials **CO3 -Ana** (8)

Or

	(b)	(i) Distinguish type I and type II superconductors	**CO3 -Ana**	(12
		(ii) Why do we prefer type II superconductor for making permanent magnets?	**CO3 -Ana**	(4)
19.	(a)	What are metallic glasses? How are they prepared? Mention its properties and applications.	**CO4 -U**	(16)

Or

	(b)	Nanomaterials have greater surface area to volume ratio – Justify Describe any one method of synthesizing nanomaterials.	**CO4- Ana**	(16)
20.	(a)	(i) What is creep in metals? Draw a typical creep curve and explain the three stages of creep.	**CO5 -U**	(10)
		(ii) Explain the factors affecting creep.	**CO5 -U**	(6)

Or

	(b)	(i) Explain the working of Carnot's heat engine using Carnot's cycle. Obtain an expression for its efficiency when a perfect gas is a working substance.	**CO5- U**	(12)
		(ii) Calculate the efficiency of a Carnot's engine working between 400 K and 300 K.	**CO5 -U**	(4)