Reg. No. : | | | | | | | | | | |

Question Paper Code: 51203

B.E. / B.Tech. DEGREE EXAMINATION, JUNE 2016

Second Semester

Mechanical Engineering

15UPH203 – MATERIAL SCIENCE

(Common to Chemical Engineering)

(Regulation 2015)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. The fatigue strength of mild steel is

   (a) equal to its tensile strength (b) more than its tensile strength
   (c) equal to its yield strength (d) lower than its yield strength

2. A cation vacancy and an anion vacancy in a crystal of the type AB is called

   (a) Schottky effect (b) Frankel defect
   (c) pair of vacancies (d) none of these

3. The probability of occupation of an energy level E, when $E-E_f=kT$, is given by

   (a) 0.73 (b) 0.63 (c) 0.27 (d) 0.5

4. With increase in temperature, the orientation polarization in general

   (a) increases (b) decreases
   (c) is constant (d) none of these

5. During an electron transition across the energy gap in Si

(a) the momentum of the electron changes
(b) the direction of motion of the electron changes
(c) the kinetic energy of the electron remains constant
(d) all the above

6. For lasing action, the energy gap of a semiconductor should be

(a) direct gap (b) indirect gap
(c) negative gap (d) gap>5eV

7. The transition from the ferromagnetic to the paramagnetic state is named after

(a) Curie (b) Curie-Weiss (c) Neel (d) Debye

8. Cooper pair are formed due to the

(a) electron-hole interaction (b) electron-neutron attraction
(c) electron-lattice-electron interaction (d) all the above

9. Which ratio decides the efficiency of nano substances?

(a) weight/volume (b) surface area/volume
(c) volume/weight (d) pressure/volume

10. The compressive strength of a nanotube _____ its tensile strength.

(a) is less than (b) is greater than
(c) is equal to (d) may be greater than

PART - B (5 x 2 = 10 Marks)

11. What are the factors affecting creep?

12. Define Wiedeman-Franz law. Give the value of Lorentz number.

13. Draw a neat sketch to represent the variation of Fermi level with temperature for a p-type semiconductor at high and low doping levels.

14. Show that the superconductors are perfect diamagnetic materials.

15. What are nanostructured materials and nanoclusters?

PART - C (5 x 16 = 80 Marks)

16. (a) Explain Brinell hardness testing techniques in detail. (16)

Or

(b) State and explain the second law of thermodynamics. Obtain an expression for the efficieny of a Carnot's engine in terms of the temperatures of source and sink. (16)

17. (a) Derive an expression for density of energy states in metal. (16)

Or

(b) What is meant by internal field in a dielectric? How it is calculated for a cubic structure? Deduce the Claussius Mossotti equation. (16)

18. (a) Assuming F-D statistics, derive expressions for density of electrons and holes in an intrinsic semiconductor. (16)

Or

(b) What is Hall effect? Obtain an expression for the Hall coefficient for n-type semiconductor. Describe an experimental setup for the measurement of Hall voltage. (16)

19. (a) (i) Discuss the domain structure in ferromagnetic materials. (8)

(ii) Show how the Hysteresis curve is explained on the basis of domain theory. (8)

Or

(b) Write notes on: (i) SQUIDS (ii) MAGLEV and (iii) High Tc superconductor. (16)

20. (a) What are metallic glasses? Explain the twin roller method of preparing metallic strip. List any four properties and applications of metallic glasses? (16)

Or

(b) (i) Explain the construction and working of chemical vapour deposition of nano phase material preparation. (10)

(ii) Write a note on CNT. (6)
