Register Number: ……..

B.E / B.TECH DEGREE EXAMINATIONS: MAY/JUNE 2014

(Regulation 2013)

Second Semester

U13PHT203: MATERIALS SCIENCE

(Common to ECE, EIE, CSE & IT)

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

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. The unit of Lorentz number is
   a) $W\,\Omega^{-1}\,K^{-1}$ b) $W\,\Omega\,K^{-2}$
   c) $W\,m^{-1}\,K^{-1}$ d) $W\,m^{-2}\,K^{-2}$
2. At critical temperature T_c, the value of critical magnetic field H_c is ……..
3. N – type semiconductor is obtained by doping Si with
   a) Boron b) Aluminum
   c) Antimony d) Indium
4. At 0K semiconductor act as ……..
5. One Bohr magneton is equal to
   a) $9.27x10^{-24}Am^2$ b) $6.67x10^{-24}Am^2$
   c) $9.27x10^{24}Am^2$ d) $5.67x10^{24}\,Am^2$
6. The unit of polarization is ……..
7. Metallic glasses have the properties of
   a) Metals b) Glasses
   c) Insulator d) Both metals and glasses
8. The size of the nanomaterials is the order of ……..
9. The bound electron-hole pair in the forbidden energy gap is
   a) Exciton b) Trap
   c) Phonon d) Colour center
10. In ……., emission of light occurs within 10^{-8} sec

PART B (10 x 2 = 20 Marks)

(Not more than 40 words)

11. Mention the drawbacks of classical free electron theory.
12. Prove that superconductors are perfect diamagnetic material.

13. Write the expression for Fermi energy of n – type and p – type semiconductors at 0K.
14. The hall coefficient of certain silicon specimen was found to be – 7.1 x 10^{-5} m^3 C^{-1} from 100 to 400 K. Determine the nature of the semiconductor. If the conductivity was found to be 210 ohm^{-1} m^{-1}, determine the density of the charge carriers.
15. Magnetic field intensity of a paramagnetic material is 10^4A/m. At room temperature, its susceptibility is $3.7x10^{-3}$. Calculate the magnetization in the material.
16. What are ferro – electric materials? Give examples.
17. Give any four applications of metallic glasses.
18. Mention different structure of carbon nanotubes.
19. What are excitons? Give its type.
20. Ordinary light does not show non – linear effects when passed through crystals. Why?

PART C (5 x 14 = 70 Marks)

(Not more than 400 words)

Q.No. 21 is Compulsory

21. What is density of energy states? Derive an expression for density of states using that obtain an expression for Fermi energy of a metal at 0K.

22. a) (i) Derive an expression for density of electrons in the conduction band of an intrinsic semiconductor. (10)
    (ii) The intrinsic carrier density is 1.5 x $10^{16}/m^3$. If the electron and hole mobilities are 0.13 and 0.05 $m^2V^{-1}s^{-1}$, calculates its electrical conductivity. (4)

(OR)

    b) (i) What is hall effect? Derive an expression for Hall voltage and Hall coefficient in a semiconducting material. (10)
    (ii) Describe an experimental setup for the measurement of Hall coefficient. (4)

23. a) (i) Briefly explain domain theory of ferromagnetism and different types of energy involved in domain growth. (10)
    (ii) Distinguish between soft and hard magnetic materials. (4)

(OR)

    b) What is polarization and explain different types of polarization mechanism involved in dielectric materials.

24. a) What is shape memory effect? Discuss their characteristics, properties and applications.

(OR)

b) (i) Explain the synthesis of nanoparticles by electro – deposition. (7)

(ii) Explain the fabrication of carbon nano tubes by chemical vapour deposition. (7)

25. a) (i) What are colour centres? Briefly explain the various types of colour centres. (10)

(ii) Distinguish between fluorescence and phosphorescence. (4)

(OR)

b) (i) Explain different types of luminescence. (7)

(ii) Explain the working of twisted nematic liquid crystal display. (7)

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