S 132

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2005.

Second Semester

Electronics and Communication Engineering

PH 135 — MATERIALS SCIENCE

(Common to Biomedical Engineering and Metallurgical Engineering)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. A unit cell has the dimensions $a = b = 4$ Å; $C = 8$ Å; $\alpha = \beta = 90°$ and $\gamma = 120°$. What is the crystal structure. Give two examples.

2. The distance between two successive planes in NaCl is 2.820 Å. Find the wave length of X–ray which give rise to first order Bragg reflection at a glanzing angle of 8°35'.

3. Define density of states? Draw the density of states histogram for a metal and insulator.

4. Explain Type I and Type II superconductors.

5. What is an intrinsic semiconductor? Give examples.

6. How 'n' type and 'p' type semiconductors are formed.

7. On the basis of spin classify ferro, antiferro and ferri magnetic material.

8. What is an elemental dielectrics. Give one example.

9. What are excitons?

10. What is thermography?

upload your college symposium/conference
details,photo(s),video(s) in
www.technicalsymposium.com

PART B — ($5 \times 16 = 80$ marks)

11. (i) Differentiate between primitive and multiple cell.

(ii) How many atoms are there in simple cubic, body centered and face centered cubic unit cells?

(iii) Show that for an ideal hcp structure when the atomic sphere touch each other, the ratio of c/a is given by 1.633.

(iv) Compare the packing efficiency of spheres of equal size in a hexagonal close packing with that of face centered cubic packing. (2 + 3 + 6 + 5)

12. (a) (i) Derive an expression for the electrical conductivity of a free electron gas using the concept of collision time.

(ii) How does the electrical conductivity vary with temperature both at low and high temperature region.

(iii) A metal with bcc structure whose atomic radius is 1.85 Å has a mean free time of 3×10^{-14} sec. Calculate its electrical conductivity at 0°C. (8 + 4 + 4)

Or

(b) (i) Define Fermi energy. Write down the expression for Fermi Dirac distribution law. Derive an expression for Fermi energy of a system of free electron gas. (1 + 3 + 8)

(ii) Compute the Fermi level in copper at absolute zero. There are four atoms per unit cell and the radius of copper atom is 0.128 nm. (4)

13. (a) (i) Eventhough the atomic and mass densities of Cu and Al are the same, the differences in electrical conductivity is high. Why? (2)

(ii) Obtain an expression for the density of electrons and holes in an intrinsic semiconductor. Equate these equations and arrive at an expression for the fermi level. Discuss the significance. (10 + 2 + 2)

Or

(b) (i) What is Hall effect?

(ii) Obtain an expression for the Hall coefficient of a '*p*' type semiconductor.

(iii) Describe the experimental set up for the measurement of Hall voltage. (2 + 9 + 5)

14. (a) (i) What is hysteresis? (2)

(ii) Draw a B–H curve for a ferromagnetic material and identify retentivity and coercive field on the curve. (5)

(iii) What is the energy loss per cycle and how it is used to choose materials for applications. (3)

(iv) What are ferrites? How they are superior to ferromagnetic materials? (2 + 4)

Or

(b) (i) Explain orientational polarisation. (2)

(ii) Derive an expression for the dipole moment when a polar material is subjected to an external field. (8)

(iii) What is dielectric breakdown? Summarise the various factors that contribute to dielectric break down. (2 + 4)

15. (a) (i) Explain with a neat diagram the construction and working of a LED. What are the materials used and mention three applications.

(ii) A LED made of Gallium Arsenide phosphide produces a light of wavelength 6500 Å, what is the value of width of the band gap of the crystal? (8 + 2 + 3 + 3)

Or

(b) (i) What is luminescence?

(ii) Differentiate between photo–luminescence and fluorescence.

(iii) What is a color centre?

(iv) Explain the different types of color centres.

(v) Explain any two processes of producing color centres. (2 + 3 + 2 + 5 + 4)

upload your college symposium/conference details,photo(s),video(s) in www.technicalsymposium.com