B.Tech.

Fourth Semester Examination, 2014-15

Electrical & Electronics Engineering Materials

Time: 3 Hours **Total Marks: 100**

Note: Attempt all questions. Assume missing data if any.

1. Attempt any four parts of the following: **5x4=20**

(a) What is atomic radius? Calculate the atomic radius for the following cases:

(i) Simple cubic structure (ii) Body centre cubic structure

(iii) Face centred cubic structure

(b) Explain briefly the following mechanical properties of metals:

(i) Elasticity (ii) Plasticity (iii) Ductility (iv) Malleability

(c) Draw the (112) and (111) planes in a simple cubic cell.

(d) Explain with neat sketches the mechanism for 'dislocation' and 'twinning' as related to plastic deformation.

(e) X-rays with wavelength of $0.85A^0$ are used for calculating d_{200} in nickel. The reflection angle θ is 9.5^0. What is the size of unit cell?

(f) Give the comparison between ionic, covalent and metallic bonds.

2. Attempt any two parts of the following: **10x2=20**

(a) What is superconductivity? Name important superconductivity alloys and elements and give their application.

(b) Explain the following thermo-electric effect:

(i) Peltier effect (ii) Joulean effect

(iii) Thomson effect (iv) Conduction effect

(c) The following data is available for a conductor wire:

Resistivity of wire = 1.54×10^{-8} Ω-m at room temperature

Fermi energy = 5.5eV

No of conduction electrons per $m^3 = 5.8 \times 10^{28}$

Calculate – (i) Mobility and relaxation time of electrons:

(ii) Average drift velocity of the electron when the electric field applied to conductor is 1V/cm.

(iii) Velocity of an electron with Fermi energy
(iv) Mean free path of the electrons.

3. Attempt any two parts of the following: **10x2=20**

(a) What is Hall Effect? Derive the relation between Hall coefficient and carrier density. Assume the presence of only one type of charge carrier.

(b) What is semiconductor? Differentiate between p-type and n-type semiconductors. Explain with the help of energy diagram.

(c) Explain the working principle of a FET. Discuss also the advantages of FET over bipolar transistor.

4. Attempt any two parts of the following: **10x2=20**

(a) Explain the following:

(i) Ferromagnetism (ii) Paramagnetism (iii) Diamagnetism

(b) (i) Distinguish between soft magnetic materials and hand magnetic materials. Give examples of each type indicating their composition and applications.

(ii) Draw a typical B-H curve for a soft magnetic material and explain the significance of the nature of the curve

(c) (i) Show that for a magnetic material:

$B=\mu_o(M+H)$, B=magnetic flux density, H=Magnetic field intensity.

(ii) Calculate the energy lost per hour in a specimen of iron subjected to magnetisation at 50 c/s. The specimen weight 50 kg and the hysteresis loop is equivalent in area to 250 Jules per cubic meter. Density of iron is 7500 Kg/m^3.

5. Attempt any two parts of the following: **10x2=20**

(a) Explain the following:

(i) Luminescence (ii) Photoconductivity

(b) Explain the following optical properties – (any two)

(i) Reflection (ii) Absorption (iii) Color

(c) What are the different properties of materials? Explain their physical and Electrical properties.