

Time: 3 Hours

JUNE 2014

Max. Marks: 100

PLEASE WRITE YOUR ROLL NO. AT THE SPACE PROVIDED ON EACH PAGE IMMEDIATELY AFTER RECEIVING THE QUESTION PAPER.

NOTE: There are 9 Questions in all.

- Question 1 is compulsory and carries 20 marks. Answer to Q.1 must be written in the space provided for it in the answer book supplied and nowhere else.
- The answer sheet for the Q.1 will be collected by the invigilator after 45 minutes of the commencement of the examination.
- Out of the remaining EIGHT Questions answer any FIVE Questions. Each question carries 16 marks.
- Any required data not explicitly given, may be suitably assumed and stated.

Q.1 Choose the correct or the best alternative in the following: (2×10)

a. An electron shows wave like behaviour because it:

- (A) is diffracted by a crystal
- (B) is scattered by collision with a lattice of atoms
- (C) can penetrate solid objects
- (D) None of these

b. De-broglie's relationship between momentum and wavelength for an electron is

- | | |
|-----------------------------|-----------------------------|
| (A) $\lambda = \frac{h}{p}$ | (B) $p = \lambda h$ |
| (C) $p = \frac{\lambda}{h}$ | (D) $h = \frac{\lambda}{p}$ |

c. The Fermi level is the:

- (A) an average value of all available energy levels
- (B) the highest occupied energy level at 0 K
- (C) an energy level at the top of the valence band
- (D) the largest available energy level.

d. The total current in a semi-conductor is given by _____ of current due to the holes and electrons

- (A) sum
- (B) difference
- (C) product
- (D) none of these

e. The conductivity of pure semi-conductor is:

- (A) proportional to temperature
- (B) rises exponentially with temperature
- (C) decreases exponentially with increasing temperature
- (D) none of these

Code: AE58

Subject: MATERIALS & PROCESSES

- f. The donor atoms in an n-type semiconductor at normal temperature carry:
- (A) positive charge (B) negative charge
(C) neutral (D) depends on certain conditions
- g. In p-n junction in equilibrium with zero bias:
- (A) no holes or electrons cross the junction
(B) only electrons cross junction
(C) equal number of holes and electrons cross junction in opposite direction
(D) only holes cross the junction
- h. Eddy current losses can be minimized by
- (A) Decreasing the resistance of magnetic medium
(B) Increasing the resistance of magnetic medium
(C) Decreasing the permeability of magnetic medium
(D) none of these
- i. Conductor are those material which has
- (A) narrow conduction band (B) broad conduction band
(C) none of these (D) ?????
- j. For Ferromagnetic materials susceptibility is
- (A) Very small and positive (B) Very large and positive
(C) Very small and negative (D) Very large and negative

Answer any FIVE Questions out of EIGHT Questions.
Each question carries 16 marks.

- Q.2** a. Explain chemical bonding. In concept of chemical bonding explain bond energy, bond type and bond length? (8)
- b. What is Bragg's law and how it is used in X-ray diffraction process. (8)
- Q.3** a. What are the crystalline and non-crystalline states? Explain the structure of long chain polymer? (8)
- b. Explain the structure of silica and silicates. What is enthalpy? (8)
- Q.4** a. The resistivity of pure copper is $1.56\mu\Omega\text{-cm}$. An alloy of copper containing 1 atomic per cent nickel has a resistivity of $2.81\mu\Omega\text{-cm}$. An alloy of copper containing 3 atomic percent silver has a resistivity of $1.98\mu\Omega\text{-cm}$. What is the resistivity of an alloy containing 2 atomic percent nickel and 2 atomic percent silver? (8)

- b. Illustrate the equation of motion of an electron in an electric field. (8)
- Q.5** a. Explain the phenomena of polarization. What are the different types of polarization? (8)
- b. What are dielectric losses? Determine the significance of loss tangent. (8)
- Q.6** a. What do you understand by diamagnetic, paramagnetic and ferromagnetic materials? Explain the factors affecting permeability and hysteresis loop. (8)
- b. What do you mean by anti-ferromagnetism and ferri-magnetism? Explain. (8)
- Q.7** a. What do understand by conductors, semi-conductors and insulators? Classify different types of semi-conductors. (8)
- b. What is hall-effect? Derive the expression for hall-coefficient. (8)
- Q.8** a. What is a breakdown phenomenon in the barrier layer? (8)
- b. What are different types of junction diodes? (8)
- Q.9** a. What are the different methods of junction's fabrication? Explain any one in detail. (8)
- b. What is JFET? Explain the drain and transfer characteristics of JFET. (8)