

AMIETE – ET {NEW SCHEME}

Time: 3 Hours

DECEMBER 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. Which of the following elements is a covalently bonded crystal?
- (A) sodium chloride (B) germanium
(C) lead (D) aluminium
- b. The correct order of coordination number in BCC, FCC and HCP unit cells is
- (A) 12, 8, 6 (B) 6, 8, 12
(C) 8, 12, 12 (D) 12, 8, 24
- c. Burger's vector of an edge dislocation is
- (A) parallel to dislocation line
(B) perpendicular to dislocation line
(C) at any angle with dislocation line including 0° and 90°
(D) none of the above
- d. The stainless steels owe their resistance to the presence of
- (A) Carbon (B) Sulphur
(C) Manganese (D) Chromium
- e. Minerals and ceramics are
- (A) biological materials (B) inorganic materials
(C) plastics (D) organic materials

Code: AE106

Subject: MATERIALS AND PROCESSES

- f. At high temperatures, the mean free path and collision time of an electron in a metal are inversely proportional to
- (A) T^2 (B) T
(C) T^3 (D) independent of temperature
- g. The number of double bonds required in the monomer for cross-linking is
- (A) 2 (B) 3
(C) 4 (D) 1
- h. Plasticizers are added in plastics to
- (A) reduce hardness
(B) improve their strength
(C) reduce glass transition temperature (t_g)
(D) improve flexibility
- i. Which one of the following material does not have permanent magnetic dipoles?
- (A) ferromagnetic (B) paramagnetic
(C) Both (A)&(B) (D) diamagnetic
- j. PN junction is formed when P type semiconductor and N type semiconductor are joined
- (A) together
(B) physically
(C) to get homogeneous material chemically
(D) in such a manner that electrons and holes diffuse to give depletion layer

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

- Q.2** a. What do you understand by atomic bonding? Explain the various types of bonds along with their characteristics. (8)
- b. Explain crystal directions and planes on the basis of Miller indices. (8)
- Q.3** a. Define the term alloy. Describe three possible alloy microstructures and compare any two general characteristics with pure metals. (8)
- b. Identify the three types of microscopic imperfections found in crystalline structures. (8)

Code: AE106

Subject: MATERIALS AND PROCESSES

- Q.4** a. The diffusion coefficient for Cr^{+3} in Cr_2O_3 is $6 \times 10^{-15} \text{ cm}^2/\text{s}$ at 727°C and is $1 \times 10^{-9} \text{ cm}^2/\text{s}$ at 1400°C . Calculate the activation energy and the diffusion constant D_0 . (8)
- b. Discuss various factors affecting the resistivity of electrical materials. (8)
- Q.5** a. Explain the terms dielectric constant and dielectric loss. (8)
- b. Explain the various types of polarization phenomena in a dielectric material and the effect of applied electric field frequency on them. (8)
- Q.6** a. Distinguish between the characteristics of dia, para and ferro magnetism. Give an example of each type of material. Comment on the temperature variation of susceptibility of all types of materials. (10)
- b. Write the properties and application of permanent magnetic materials. (6)
- Q.7** a. Why at a very high temperature, the p type and n type semiconductor behaves like intrinsic semiconductor? (4)
- b. Explain the effect of doping on electrical conductivity of semiconductor. Compute the conductivity of Ge at 300K if the intrinsic carrier concentration for Ge is $7.2 \times 10^{19}/\text{m}^3$ (given that electron mobility (μ_e) = 0.38 and hole mobility (μ_p) = 0.18). (4)
- c. A magnetic field of 0.8 tesla is imposed on a 20 mm thick aluminum specimen in a direction perpendicular to a current of 30 A flowing through it. If the electrical conductivity and electron mobility for aluminum are $3.8 \times 10^7 (\Omega\text{-m})^{-1}$ and $0.0012 \text{ m}^2/\text{V-s}$, respectively, Calculate the Hall voltage. (8)
- Q.8** Discuss in detail **any two** among the following (8×2=16)
- (i) Zener diode and avalanche diode
 - (ii) Mica and Mica Products
 - (iii) Ceramics
- Q.9** a. Explain grown junction and alloyed junction process during the formation of a p-n junction. (8)
- b. Describe the construction and operation of JFET. Draw the equivalent circuit of a JFET. (8)