

AMIETE – ET/CS (Current & New Scheme)**December 2016**

Time: 3 Hours

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)

- Metallic bond is not characterized by

(A) opacity	(B) ductility
(C) high conductivity	(D) directionality
- If (3 2 6) are the Miller indices of a plane, the intercepts made by the plane on the three crystallographic axes are

(A) (a, b, c)	(B) (2a, 3b, c)
(C) (a, 2b, 3c)	(D) (2a, b, 3c)
- The atomic number of an atom is equal to

(A) atomic weight
(B) atomic mass
(C) number of protons
(D) mass number
- Magnesium crystallizes in HCP structure. If the lattice constant is 0.32 nm, the nearest neighbour distance in magnesium is

(A) 0.64 nm	(B) 0.32 nm
(C) 0.16 nm	(D) 0.8 nm
- Ceramic materials are

(A) good conductors of electricity
(B) basically crystalline oxides or metals
(C) inorganic compounds of metallic and non-metallic elements
(D) none of the above
- Mobility of the electron is

(A) reciprocal of electrical conductivity
(B) flow of electron per unit electric field
(C) average electron drift velocity per unit electric field
(D) none of the above
- Most widely used conducting materials are

(A) gold and silver	(B) copper and aluminium
(C) tungsten and platinum	(D) germanium and silk

- h. The temperature at which a metal becomes superconductor is called
 (A) Curie Temperature (B) Debye Temperature
 (C) Critical Temperature (D) Neel Temperature
- i. In a ferromagnetic material, susceptibility is
 (A) very large and negative (B) very large and positive
 (C) zero (D) negative
- j. The depletion region of a junction diode is formed
 (A) during the manufacturing process
 (B) when forward bias is applied to it
 (C) when the temperature of the junction is reduced
 (D) under reverse bias

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

- Q.2** a. Define the following terms: (8)
 (i) Crystal structure
 (ii) Body-centered cubic structure
 (iii) Face-centered cubic structure
 (iv) Hexagonal close-packed structure
- b. Explain how covalent bonds are formed? Write important characteristics of covalent compound. (8)
- Q.3** a. State how slip occurs in crystals? Identify the four types of bulk defects. (8)
- b. What are the essential conditions for polymerization process? What do you understand by cross – linking? (8)
- Q.4** a. The diffusion coefficient for O^{2-} in Cr_2O_3 is $4 \times 10^{-15} \text{ cm}^2/\text{s}$ at 1150°C and $6 \times 10^{-11} \text{ cm}^2/\text{s}$ at 1715°C . Calculate the activation energy and the diffusion constant D_0 . (8)
- b. Discuss various elements, alloys and heterogeneous mixtures which can be used as electrical contact material. (8)
- Q.5** a. What is the importance of dielectric materials? Give examples of any two important dielectric materials with their properties. (8)
- b. Explain Piezoelectricity. Write some of the applications of Piezoelectric materials. (8)
- Q.6** a. Give four examples of soft and hard magnetic materials each, along with their compositions. (4)
- b. What are the factors that affects permeability and hysteresis loss. (8)
- c. Explain ferrites and its uses in high frequency devices. (4)
- Q.7** a. What is meant by doping? Explain the two types of semiconductor materials that are formed after doping. (8)

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- b. Show that on doping with a pentavalent impurity of concentration of 1 ppm, the electrical conductivity of Ge increases significantly if Ge at room temperature ($=300\text{ K}$) has electron mobility (μ_e) and hole mobility (μ_p) equal to 0.38 and 0.18 respectively. Given that for Ge $n_i = 7.2 \times 10^{19}/\text{m}^3$ and $N_d = 4.42 \times 10^{28}$. (8)

Q.8 Discuss in detail any two among the following (8+8)

- (i) Breakdown phenomena in barrier layer of a p-n junction diode.
- (ii) Glass and glass products
- (iii) Plastics

Q.9 a. Explain grown junction and alloyed junction process during the formation of a p-n junction. (8)

- b. What are the advantages of the FET over a conventional bipolar junction transistor? Define pinch off voltage, trans-conductance, amplification factor and drain resistance of an FET. (8)