
AMIETE – ET (NEW SCHEME)

Time: 3 Hours

DECEMBER 2011

Max. Marks: 100

NOTE: There are 9 Questions in all.

- Please write your Roll No. at the space provided on each page immediately after receiving the Question Paper.
- 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. If the radius of anion is r_a and of cation is r_c , the bond length is

- | | |
|-------------------------------------|---------------------------|
| (A) $(r_a + r_c)$ | (B) $\sqrt{3}(r_a + r_c)$ |
| (C) $\frac{\sqrt{3}}{2}(r_a + r_c)$ | (D) $r_a - r_c$ |

b. The packing efficiency of NaCl crystal is

- | | |
|----------|----------|
| (A) 0.52 | (B) 0.66 |
| (C) 0.68 | (D) 0.74 |

c. Which of the following elements, has largest diffusion coefficient in steel

- | | |
|--------|-------|
| (A) Mn | (B) W |
| (C) Ni | (D) C |

d. The Fermi level of copper is 7ev. The maximum velocity of free electrons at 0°K is

- | | |
|--------------|--------------|
| (A) 1570Km/s | (B) 1110Km/s |
| (C) 860Km/s | (D) 0Km/s |

e. Pure silicon at 0°K is an

- | | |
|-----------------------------|---------------|
| (A) intrinsic semiconductor | (B) metal |
| (C) extrinsic semiconductor | (D) insulator |

Code: AE58**Subject: MATERIALS & PROCESSES**

- f. The transition from the ferromagnetic to the paramagnetic is named as
- (A) Curie (B) Curie-Weiss
(C) Neel (D) Debye
- g. Ionic polarization
- (A) decreases with temperature
(B) increases with temperature
(C) may increase or decrease with temperature
(D) is independent of temperature
- h. Which of the following diode is used as variable capacitor in tuned circuits
- (A) Zener diode (B) Varactor diode
(C) tunnel diode (D) p-n junction diode
- i. Non polarised electrolytic capacitors are used in
- (A) DC circuits (B) AC circuits
(C) Both (A) & (B) (D) None of the above
- j. JFET is
- (A) Unipolar device (B) Bipolar device
(C) Nonpolar device (D) P-N junction diode

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

- Q.2** a. What is unit cell? Derive the effective number of lattice points in the unit cell of the three cubic space lattices. (8)
- b. Compare Ionic, Covalent and metallic bonds based on their formation and properties with suitable examples. (8)
- Q.3** a. Calculate packing efficiency and density of diamond. (8)
- b. Explain different types of crystalline imperfections. (8)
- Q.4** a. Discuss the following applications of Fick's second law:
(i) Corrosion resistance of Duralumin
(ii) Carburization of steel. (4+4)

- b. The resistivity of pure copper is $1.56 \times 10^{-6} \Omega\text{-cm}$. An alloy of copper containing 1 atomic percent Nickel has a resistivity of $2.81 \times 10^{-6} \Omega\text{-cm}$. An alloy of copper containing 3 atomic percent silver has resistivity of $1.98 \times 10^{-6} \Omega\text{-cm}$. What is the resistivity of an alloy containing 2 atomic percent nickel and 2 atomic percent silver? (8)
- Q.5** a. What is permanent dipole moment? Show how the presence of permanent dipole contributes to the dielectric constant. Discuss the temperature dependence of dielectric constant. (8)
- b. Explain breakdown mechanism in dielectric materials. (8)
- Q.6** a. A transformer core is wound with a coil carrying an AC current at a frequency of 50 Hz. Assuming the magnetization to be uniform throughout the core volume of 0.01 m^3 , calculate the hysteresis loss. The hysteresis loop has area of 60,000 units, when the axes are drawn in units of 10^{-4} Tesla and 100 A/m^2 . (8)
- b. What is Ferromagnetism? Discuss Ferromagnetism below and above curie temperature. What are Ferromagnetic domains? (8)
- Q.7** a. Classify conductors, semiconductors and insulators based on energy band diagram. (8)
- b. 4 micrograms of antimony are thoroughly mixed in molten form with 100 gm germanium find
 (i) the density of antimony atoms.
 (ii) density of donated electrons.
 (iii) conductivity if $\mu_e = 3600 \text{ cm}^2/\text{v-s}$.
 Assume density of Ge = 5.46 gm/cm^3 and weight of Sb = 121.76. (8)
- Q.8** a. Explain construction and draw V-I characteristic of SCR. Discuss its working based on two transistor model. (8)
- b. Discuss characteristics and applications of the following:-
 (i) Thermistors
 (ii) Non symmetrical varistors. (8)
- Q.9** a. Discuss various methods used in fabrication of semiconductor junction. (8)
- b. Compare BJT and JFET based on construction, working and applications. (8)