

## AMIETE – ET

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. If the first reflection from a FCC crystal has a Bragg angle  $\theta$  of  $21.5^\circ$ , the second reflection will have an angle  $\theta$  of
- (A)  $18.5^\circ$  (B)  $25^\circ$   
(C)  $31.2^\circ$  (D)  $36.8^\circ$
- b. The tetrahedral bond angle of  $sp^3$  bonds is
- (A)  $90^\circ$  (B)  $99^\circ$   
(C)  $104^\circ$  (D)  $109.5^\circ$
- c. The packing efficiency of a NaCl crystal. (radius of  $Na^+ = 0.98\text{\AA}$ ,  $Cl^- = 1.81\text{\AA}$ ) is
- (A) 0.52 (B) 0.66  
(C) 0.68 (D) 0.74
- d. A cation vacancy and an anion vacancy in a crystal of a type AB is called.
- (A) Schottky defect (B) Frenkel defect  
(C) Pair of vacancies (D) All of these
- e. Among the following elements, the one of the largest diffusion coefficient in steel at  $1000^\circ\text{C}$  is
- (A) Mn (B) Ni  
(C) C (D) W

- f. During melting, the relative dielectric constant
- (A) Always Increases (B) Always decreases  
(C) May increase or decrease (D) None of these
- g. The total iron loss in a core at 25Hz & 50Hz is 250W & 800W respectively. The eddy current loss at 25 Hz is
- (A) 100W (B) 150W  
(C) 200W (D) 600W
- h. Energy gap in pure semiconductors at room temperature is
- (A) 0 ev (B) 1 ev  
(C) 6 ev (D) -2 ev
- i. Thermistors have
- (A) Only + ve temperature coefficient of resistance  
(B) Only - ve temperature coefficient of resistance  
(C) It may be + ve or -ve  
(D) None of above
- j. The following can be grown epitaxially on Si without creating significant distortion
- (A) Si of a different doping (B) SiO<sub>2</sub>  
(C) GaAs (D) None of these

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

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- Q.2** a. Discuss different types of Bravais Lattices. (8)
- b. Explain the following : (8)
- (i) Production of ions of Opposite Sign  
(ii) Coulomb Attraction
- Q.3** a. Calculate the c/a ratio for an ideally closed packed HCP crystal. (8)
- b. The surface of a copper crystal is of the [111] type. Calculate the surface energy of copper. (8)
- Q.4** a. Discuss carburization of steel based on the Fick's second law solution. (8)
- b. Explain the factors affecting the Resistivity of Electrical materials. (8)

- Q.5** a. Derive expression for dielectric constant of monoatomic gasses. (8)
- b. Write specific applications of the following :
- (i) Wood
  - (ii) Transformer Oil
  - (iii) PVC
  - (iv) Polythene (8)
- Q.6** a. Discuss the factors affecting permeability of Hysterisis Loss. (4)
- b. Define the following: (12)
- (i) Magnetostriction
  - (ii) Magnetic Resonance
  - (iii) Hysterisis Loop
- Q.7** a. What do you mean by energy band diagram? Classify different types of materials on the basis of energy band diagram. (8)
- b. What is Hall effect? Derive expression for Hall coefficient. (8)
- Q.8** a. Explain breakdown of depletion layer in semiconductors. (8)
- b. Write applications of the following:-
- (i) Carbon resistor
  - (ii) Paper capacitor
  - (iii) Air cored inductor
  - (iv) Thermal Relay (4×2)
- Q.9** a. Explain linear operation of JFET. (8)
- b. Discuss fabrication technology used in the making of semiconductor devices. (8)