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**AMIETE – ET (OLD SCHEME)**


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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. The interplanar spacing of the first reflecting plane in an FCC crystal is

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|------------------|------------------|
| (A) $a\sqrt{3}$  | (B) $a/\sqrt{3}$ |
| (C) $a/\sqrt{2}$ | (D) $a$          |

b. A cation vacancy and an anion vacancy in a crystal of a type AB is called

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|-----------------------|--------------------|
| (A) Schottky defect   | (B) Frenkel defect |
| (C) Pair of vacancies | (D) none of these  |

c. The degree of freedom when ice, water and water vapour co-exist in equilibrium is

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|-------|------------------|
| (A) 1 | (B) triple point |
| (C) 0 | (D) -1           |

d. Fick's second law for unidirectional flow under non steady state conditions is

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|--|---|
| (A) $\frac{\partial c}{\partial t} = -D \frac{\partial^2 c}{\partial x^2}$ | (B) $\frac{\partial c}{\partial t} = D \frac{\partial^2 c}{\partial x^2}$ |
| (C) $\frac{\partial c}{\partial t} = -D \frac{\partial c}{\partial x}$     | (D) $\frac{\partial c}{\partial t} = D \frac{\partial c}{\partial x}$     |

e. The probability of occupation of an energy level E, when  $E - E_F = KT$ , is given by

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|----------|----------|
| (A) 0.73 | (B) 0.63 |
| (C) 0.27 | (D) 0.5  |

Code: AE04

Subject: MATERIALS AND PROCESSES

- f. The energy gap in diamond is
- (A) 5.4 ev (B) 2-3 ev  
(C) 1.1 ev (D) 0.08 ev
- g. Among the common dielectric materials, the highest dielectric strength is possessed by
- (A) Mica (B) Transformer oil  
(C) PVC (D) Polyethylene
- h. The temperature of the antiferromagnetic-to-paramagnetic transition is called
- (A) Antiferromagnetic Curie temp (B) Curie-Weiss temp  
(C) Neel temp (D) Debye temp
- i. The grown single crystal generally contains
- (A) tilt boundaries  
(B) twin boundaries  
(C) grain boundaries  
(D) dislocation loops due to vacancy condensation
- j. The magnetic moment of a ferric ion in nickel-zinc ferrite is
- (A) 5 (B) 0  
(C) 2.2 (D) depends on Zn %

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

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- Q.2** a. Draw the curve between potential energy and distance of separation between atoms in bonds. Discuss effect of temperature on mean spacing between atoms. (8)
- b. Discuss triangular coordination of anions around a cation in ionic bonds. Find critical radius ratio for triangular coordinations. (8)
- Q.3** a. What is edge dislocation? Show that the Burgers vector is parallel to the screw dislocation line. (8)
- b. Explain Lever rule & Gibbs phase rule with example. (8)
- Q.4** a. Explain interstitial and vacancy diffusion based on atomic model of diffusion. (8)
- b. Differentiate between Hardening and Tempering, based on change in mechanical properties, process and applications. (8)

- Q.5** a. Differentiate between HOT & COLD working and discuss their effects on mechanical properties of metals. (8)
- b. Explain Czochralski process of single crystal growth. (8)
- Q.6** a. Discuss the properties of conducting materials used for electrical contacts and heating elements. (8)
- b. Calculate the energy difference between the  $n_x = n_y = n_z = 1$  level and the next higher energy level for free electrons in a solid cube of 10 mm dimension. (8)
- Q.7** a. Draw Fermi level diagram of P-N junction in forward and reverse bias. Write the applications of junction transistor. (8)
- b. Compare N-type & P-type semi conductors. Write any three elements that you would add to pure crystal of Si to make it
- (i) N-type and
- (ii) P-type extrinsic semiconductors. (8)
- Q.8** a. What is ionic polarizability? Explain effect of temperature and frequency over polarization. (8)
- b. Explain concept of Ferroelectricity and piezoelectricity. Write the properties and applications of piezoelectric materials. (8)
- Q.9** a. The saturation magnetization of BCC iron is 1750 KA/m. Calculate the net magnetic moment per iron atom in the crystal. (8)
- b. What are hard magnetic materials? Write properties and applications of alnico and ferrites. (8)