AMIETE - ET (OLD SCHEME)

JUNE 2009

Code: AE04 **Subject: MATERIALS AND PROCESSES**

Time: 3 Hours Max. Marks: 100

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.
- 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.

Choose the correct or the best alternative in the following: **Q.1**

 (2×10)

- a. Ionic bonding in solids depend primarily on
 - (A) Van der waal's forces.
- **(B)** electrical dipoles.
- (C) sharing of electrons.
- (**D**) transfer of electrons.
- b. Schottky effect describes
 - (A) effect of intensive electric field on the rate of electron emission from a cathode.
 - **(B)** current in temperature limited region.
 - (C) current in space charge region.
 - **(D)** Both **(B)** and **(C)**.
- c. Bragg's equation for X-ray diffraction from crystal planes is given by

$$(\mathbf{A}) \ \mathbf{d} = \frac{\mathbf{n}\lambda}{2} \sin \theta$$

(B)
$$n\lambda = 2d\sin\theta$$

$$\lambda = \frac{2dn}{\sin \theta}.$$

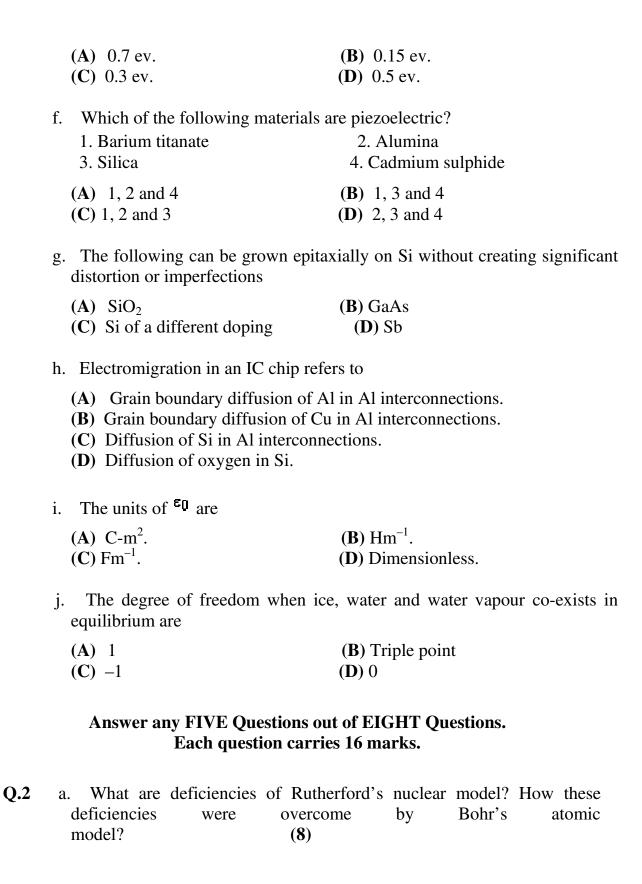
(B)
$$n\lambda = 2d \sin \theta$$
.
(D) $n = \frac{d}{2\lambda} \sin \theta$.

- d. d_{100} : d_{110} : d_{111} for simple cubic lattice stand in the ratio
 - (A) $\sqrt{2}:\sqrt{3}:\sqrt{6}$

(B)
$$\sqrt{6}:\sqrt{3}:\sqrt{2}$$
.
(D) $\sqrt{2}:\sqrt{6}:\sqrt{3}$.

(C) $\sqrt{3}:\sqrt{2}:\sqrt{6}$

- e. For germanium the forbidden energy gap is



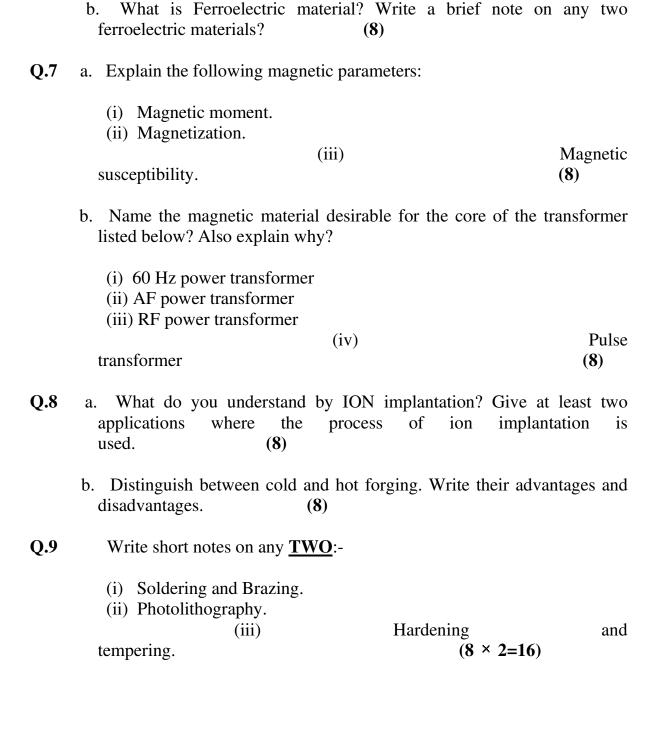
b.	Find atomic packing factor for FC	C. Also calculate number of	of atoms
1	per mm ² surface area in a plane for c	copper which has FCC struc	cture and
í	a lattice constant $a = 3.61 \times 10^{-7}$ cm	(8)	

- Q.3 a. Explain with simple sketches the arrangement of atom around an edge dislocation and a screw dislocation. Also illustrate Burgers vector on the sketches.
 (8)
 - b. State and explain the utility of Gibb's phase rule? (8)
- Q.4 a. State Fick's first and second law of diffusion. How diffusion coefficient is influenced by temperature?
 - b. A copper wire of area = 5×10^{-6} sq-m carries a steady current of 50A. Assuming one free electron per atom calculate
 - (i) density of free electrons
 - (ii) average drift velocity of electrons and
 - (iii) relaxation time of electrons

[$^{\circ}$ e for Cu = 5.85 × 10 7 mho/m and $^{\circ}$ Cu = 8.9 × 10 3 kg/m 3]

Permittivity of free space = $^{8.85 \times 10^{-12}}$ fd/m
. (8)

- Q.5 a. What is Hall effect? What are the applications of Hall effect? How the concentration of charge carriers (electrons or holes) in a semiconductor can be found from measurement of Hall coefficient? (8)
 - b. If the carrier concentration for silicon is $1.6 \times 10^{10} / \text{cm}^3$ at 300K, determine its conductivity and resistivity. Also calculate drift velocity of holes and electrons if the applied electric field is 50 V/cm. Given that $\mu_p = 500 \text{ cm}^2 / \text{V} \text{sec}$, $\mu_n = 1500 \text{ cm}^2 / \text{V} \text{sec}$ for silicon and the electronic charge, $e = 1.6 \times 10^{-19}$ coulomb. (8)
- **Q.6** a. Explain Dielectric strength of a dielectric material. On what factors dielectric strength of a dielectric



(8)

depends?