

AMIETE – ET (OLD SCHEME)

Time: 3 Hours

JUNE 2012

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. Thermal expansion of material arises from

- | | |
|------------------|---------------------------|
| (A) strong bonds | (B) thermal vibrations |
| (C) Weak bonds | (D) asymmetry of PE curve |

b. The Burgers vector of a dislocation in NaCl is

- | | |
|------------------------|------------------------|
| (A) 5.58 \AA | (B) 4.83 \AA |
| (C) 3.95 \AA | (D) 2.79 \AA |

c. Zone refining will be more efficient if the ratio of impurity in the solid to that in the liquid is

- | | |
|----------|----------|
| (A) 0.01 | (B) 0.1 |
| (C) 0.4 | (D) ~1.0 |

d. The fastest diffusing species in Fe is

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

e. The Fermi level for Cu is 7ev. The maximum velocity of free electrons at 0K is

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

Code: AE04

Subject: MATERIALS AND PROCESSES

- f. The resistivity of pure silicon at room temperature is $3000 \Omega\text{-m}$, the intrinsic carrier density is
- (A) $1.095 \times 10^{16}/\text{m}^3$ (B) $1.095/\text{m}^3$
 (C) $1.095 \times 10^{10}/\text{m}^3$ (D) $1.095 \times 10^6/\text{m}^3$
- g. With increase in temperature, the orientation polarization
- (A) increases (B) decreases
 (C) remains constant (D) None of these
- h. The curie temperature of Cobalt is
- (A) 2000 K (B) 1400 K
 (C) 1040 K (D) 650 K
- i. During purification of Si, the liquid that is produced by dissolving Si in HCL is
- (A) SiCl_4 (B) SiH_2Cl_2
 (C) SiH_3Cl (D) SiHCl_3
- j. Effective number of atoms in the DC unit cell are
- (A) 8 (B) 6
 (C) 5 (D) 4

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

- Q.2** a. Calculate the c/a ratio for an ideally closed packed HCP crystal. (8)
- b. What is Bragg's law? Discuss powder method to determine structure of crystals. (8)
- Q.3** a. Compare point, line, surface & volume imperfections in brief. (8)
- b. What is binary phase diagram? How it is drawn? Draw silver-platinum phase diagram. (8)
- Q.4** a. State Fick's First and Second Laws of diffusion. Write applications of second law. (8)
- b. Discuss requirement of heat treatment. Explain change in mechanical properties after annealing. (8)

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

- Q.5** a. Discuss thermal effect of welding on parent metal and its mechanical properties. (8)
- b. Explain photolithography and write its applications. (8)
- Q.6** a. What is basic assumption taken in free electron theory? Discuss Fermi-Dirac distribution of free electrons at different temperatures. (8)
- b. Calculate conductivity of copper at 300K. The collision time τ for electron scattering is 2×10^{-14} s at this temperature. (8)
- Q.7** a. Draw Fermi level diagram for pure semiconductor based on Fermi-Dirac probability distribution and discuss conductivity in pure crystal. (8)
- b. Show that the conductivity of a semiconductor is minimum when concentration of electrons $n_e = n_i \sqrt{\frac{\mu_h}{\mu_e}}$. Find the minimum value of conductivity. (8)
- Q.8** a. Discuss properties and applications of Glass and Mica as dielectric material. (8)
- b. What is polarization? Calculate relative dielectric constant of a material when it is inserted in a parallel plate capacitor of area 100mm^2 and distance of separation of 2 mm is 10^{-9} F. (8)
- Q.9** a. Write properties and applications of permalloy and ferrites. (8)
- b. What is hysteresis loop? Classify the magnetic materials based on their hysteresis loop. How we calculate hysteresis loss using hysteresis loop? (8)