Code: AE04   Subject: **MATERIALS AND PROCE**

AMIETE – ET (OLD SCHEME)

Time: 3 Hours   **JUNE 2012**   Max. Marks: 10

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) $5.58\,A^{\circ}$ **(B)** $4.83\,A^{\circ}$
   (C) $3.95\,A^{\circ}$ **(D)** $2.79\,A^{\circ}$

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)** $0\,Km/s$

f. The resistivity of pure silicon at room temperature is 3000 $\Omega - m$, t... intrinsic carrier density is

(A) $1.095 \times 10^{16} / m^3$ (B) $1.095 / m^3$

(C) $1.095 \times 10^{10} / m^3$ (D) $1.095 \times 10^6 / m^3$

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) $S_i Cl_4$ (B) $S_i H_2 Cl_2$
(C) $S_i H_3 Cl$ (D) $S_i HCl_3$

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)**

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 $n_e = n_i \sqrt{\mu_h / \mu_e}$. 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)**