ROLL NO. _____

Code: AE58/AE106 **Subject: MATERIALS & PROCESSES**

AMIETE – ET (Current & New Scheme)

Time: 3 Hours **JUNE 2015** **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. The miller indices of the line of intersection of a $[\bar{1}11]$ and a $[\bar{1}\bar{1}0]$ plane are

(A) $[\bar{1}10]$ **(B)** $[\bar{1}10]$

(C) $[\bar{1}\bar{1}0]$ **(D)** $[\bar{1}11]$

b. Hydrogen bonds are stronger than

(A) Van der waals bonds **(B)** Ionic bonds
(C) Metallic bonds **(D)** Covalent bonds

c. The bulkiest side group in the monomer is in

(A) Teflon **(B)** PVC
(C) PTFE **(D)** Polystyrene

d. Which type of dislocation has the t vector parallel to the b vector.

(A) Screw **(B)** Edge
(C) Mixed **(D)** None of these

e. The fastest diffusing species in Fe is

(A) H **(B)** Ni
(C) W **(D)** C

f. To increase the mechanical strength of an Aluminium ($A\ell$) conductor, we can use

(A) Solute Strengthening **(B)** Cold Working
(C) Doping **(D)** Steel Reinforcement

g. The energy gap in diamond is

(A) 5.4 ev **(B)** 2-3 ev
(C) 1.1 ev **(D)** 0.08 ev

h. The grown single crystal generally contains

(A) tilt boundaries
(B) dislocation loop due to vacancy condensation
(C) twin boundaries
(D) grain boundaries

i. A suitable material for audio & TV transformers is

(A) Ferrite **(B)** Fe - 4% Si
(C) Fe- 30 % Ni **(D)** Steel

j. In the polarization versus field strength plot for a ferroelectric crystal, Ps stands for

(A) Space charge polarization
(B) Saturation polarization
(C) Spontaneous polarization
(D) None of these

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

Q.2 a. Draw crystal system & unit cell for the following Bravais Lattices.
(i) Cubic (ii) Orthorhombic **(8)**

b. Discuss bond energy, bond type and bond length in chemical bonds. **(8)**

Q.3 a. Calculate the packing efficiency and the density of diamond. **(8)**

b. Discuss the following using suitable examples: **(8)**
(i) Point Imperfection
(ii) Screw Dislocation

Q.4 a. Discuss Fick's First & Second laws of diffusion. **(8)**

b. What is current density in metals? How it depends on mobility of electrons? Calculate mobility of electron in copper. **(8)**

Q.5 a. Discuss the following: **(4+4)**
(i) Ionic polarization
(ii) Dipolar polarization

b. Explain breakdown of the solid, liquid & gaseous dielectrics. **(8)**

Q.6 a. In a 440 V, 50 Hz transformer, the total iron loss is 2300 W. When the applied voltage is 220 V at 25 Hz, the total iron losses are 750W. Calculate the eddy current loss at the normal voltage & frequency. **(4)**

b. Explain the following: **(12)**
(i) Magnetostriction
(ii) Ferrites
(iii) Hysteresis Loop

Q.7 a. With the help of diagrams, explain the formation of energy bands in P-type and N-type semiconductors. **(8)**

b. Discuss the following: **(8)**
(i) Diffusion in semiconductors
(ii) Electrical conductivity of doped materials

Q.8 a. What is barrier capacitance? Derive the expression for the barrier capacitance. **(8)**

b. Write applications of the following: **(2×4)**
(i) Thermistors
(ii) Wire wound resistor
(iii) Ceramic dielectric capacitors
(iv) Inductors

Q.9 Discuss the following: **(8×2)**
(i) Linear operation of JFET
(ii) Fabrication of junction transistors