ROLL NO. _____

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

AMIETE – ET *{NEW SCHEME}*

Time: 3 Hours JUNE 2014 **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 atomic diameter of an FCC crystal is

(A) $a\sqrt{2}/2$ **(B)** $a\sqrt{2}/4$
(C) $a\sqrt{3}/4$ **(D)** $a/2$

b. Thermal expansion of materials arises from

(A) strong bonds **(B)** thermal vibrations
(C) weak bonds **(D)** asymmetry of potential energy curve

c. The diameter of the largest sphere that fits the void at the centre of a cube edge of a BCC crystal of lattice parameter a is

(A) 0.293 a **(B)** 0.414 a
(C) 0.134 a **(D)** 0.336 a

d. Among the common dielectric materials, the highest dielectric strength is possessed by

(A) Mica **(B)** Transformer oil
(C) PVC **(D)** Polyethylene

e. The unit of the diffusion coefficient D is

(A) m/s^2 **(B)** $\frac{1}{m^2 - s}$
(C) m^2/s **(D)** $m^2 s$

f. With the increase in temperature, the orientation polarization in general

(A) increases **(B)** decreases
(C) is constant **(D)** none of these

g. The curie temperature of cobalt is

(A) 2000 K **(B)** 1400 K
(C) 1040 K **(D)** 650 K

h. The following can be grown expitaxially on Si without creating significant distortions or imperfections

(A) Si of a different doping **(B)** SiO_2
(C) GaAs **(D)** None of these

i. During purification of Si, the liquid that is produced by dissolving Si in $HC\ell$ is

(A) $SiC\ell_4$ **(B)** $SiH_2C\ell_2$
(C) $SiHC\ell_3$ **(D)** SiH_4

j. For JFET, when $V_{GS} = V_P$ (pintch off voltage). The drain current I_d is

(A) $I_d = 0$ **(B)** $I_d = I_{dss}$
(C) $I_d = \frac{I_{dss}}{2}$ **(D)** $I_d = \frac{I_{dss}}{4}$

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

Q.2 a. Discuss Bragg's law of X-ray diffraction. **(8)**

b. Explain the following:
(i) Production of Ions of opposite sign.
(ii) The coulomb attraction **(2×4=8)**

Q.3 a. Discuss Ethylene based long chain polymers and write their uses. **(8)**

b. What is Burgers vector? Show that Burgers vector is perpendicular to the edge dislocation line. **(8)**

Q.4 a. Explain the Kirkendall effect. **(8)**

b. Discuss superconductivity and explain change in critical magnetic field H_C with variation in temperature. **(8)**

Q.5 a. Explain the following:
(i) Ionic polarisation (ii) Dipolar polarisation **(2×4=8)**

b. Discuss breakdown phenomenon in gaseous and liquid dielectrics. **(8)**

Q.6 a. Discuss paramagnetism and curie law for a paramagnetic materials. **(8)**

b. Discuss the following:
(i) Magnetostriction
(ii) Factors affecting permeability and hysteresis loss. **(2×4=8)**

Q.7 a. Discuss various types of lattice defects in a semiconductor. **(8)**

b. Explain the following:
(i) Thermal conductivity of semi conductors
(ii) Electrical conductivity of doped materials **(2×4=8)**

Q.8 a. Compare properties and applications of Thermistors and Varistors. **(8)**

b. Write properties and applications of the following:

(i) Variable resistors
(ii) Electrolytic capacitors **(2×4=8)**

Q.9 Discuss the following:

(i) Alloyed junction process
(ii) Linear operation of JFET **(2×8=16)**