Code: DE54   **Subject: ENGINEERING MATERIALS**

DipIETE – ET

Time: 3 Hours | **DECEMBER 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. High conductivity aluminium should have

   (A) Steel rod reinforcement   **(B)** Solute atoms such as Cu, Ag and Au
   (C) High dislocation density   **(D)** Dissolved impurities

   b. The Fermi level E_F depends on the length L of a linear solid as

   (A) $1/L^2$ **(B)** $1/L^3$
   (C) $1/L$ **(D)** is independent of L

   c. Ionic polarization

   (A) Increases with temperature
   (B) Decreases with temperature
   (C) May increase or decrease with temperature
   (D) Is independent of temperature

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

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

   e. 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

   f. The temperature of the antiferromagnetic to paramagnetic transition is called

   (A) Neel temp   **(B)** Debye temp
   (C) Curie-weiss temp   **(D)** Antiferromagnetic- curie temp

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g. The majority charge carriers in P type Ge are

   (A) Free electrons   **(B)** Ions
   (C) Holes   **(D)** Conduction electrons

h. The function of an oxide layer during IC Fabrication can be to

   (A) Mask against diffusion or ion implant
   (B) Insulate the surface electrically
   (C) Produce a chemically stable surface
   (D) All of these

i. Varactor diode offer

   (A) Variable resistance   **(B)** Variable capacitance
   (C) Variable inductance   **(D)** All of these

j. Loss tangent is related to

   (A) Resistors   **(B)** Inductors
   (C) Capacitors   **(D)** Transformers

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

Q.2 a. Discuss factors affecting the Resistivity of conducting materials.   **(8)**

   b. What is contact potential? Draw & explain energy distribution of electrons in two metals before & after contact.   **(8)**

Q.3 a. Discuss the effect of dielectric on the behaviour of a capacitor.   **(8)**

   b. Derive Clausius-Mossotti relation.   **(8)**

Q.4 a. What is loss tangent? Discuss its significance in dielectrics.   **(8)**

   b. Discuss the dependence of the dielectric constant of polar dielectric on frequency and temperature.   **(8)**

Q.5 a. Write the factors affecting permeability and hysteresis loss.   **(4)**

   b. Give the classification of magnetic materials.   **(8)**

   c. Write applications of the following: **(4)**
       (i) Ni-Fe Alloy
       (ii) Si steel

Q.6 a. Give the classification of conductors, semiconductors & insulators based on energy band diagram. **(8)**

b. Explain the following: **(8)**
(i) Thermal conductivity of semiconductors
(ii) Electrical conductivity of doped material

Q.7 a. Draw and explain the working of P-N Junction diode in forward & Reverse bias. **(8)**

b. The resistance of the p & n layers of a silicon abrupt p-n junction are 10^{-2} & 10 Ohm respectively. The capacitance of the junction at zero applied bias voltage is 200 pF. If the thickness of the p & n layers are 1 mm. Each and the junction has a rectangular cross-section 1 mm^2. **(8)**

(i) Determine concentration of impurity atoms on each side of the junction.

(ii) Width of depletion layer at zero applied voltage here $\mu_e = 1.45 \times 10^3$ cm^2/v-sec & $\mu_h = 0.5 \times 10^3$ cm^2/v-sec.

(iii) Find the contact potential.

Q.8 Discuss working principal & applications of the following: **(4×4)**
(i) Thermistors   (ii) Electrolytic capacitors
(iii) Cored coils   (iv) Relay

Q.9 Write short notes on the following: **(2×8)**
(i) JFET
(ii) Fabrication of transistors