Code: DE54/DE104   **Subject: ENGINEERING MATERIALS**

DiplETE – ET (Current & New Scheme)

Time: 3 Hours   **June 2019**   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. Pick the composite from the list
        (A) Wood   **(B)** Steel
        (C) Nylon   **(D)** Mica

    b. Strong and ductile materials are
        (A) Polymers   **(B)** Ceramics
        (C) Metals   **(D)** Semiconductors

    c. Nickel when added to copper improves
        (A) Machinability   **(B)** Hardness
        (C) Hardness and strength   **(D)** Strength and ductility

    d. The majority charge carriers in p type Ge are
        (A) free electrons   **(B)** ions
        (C) holes   **(D)** conduction electrons

    e. Diamagnetic materials
        (A) are non-magnetic
        (B) cannot be magnetized
        (C) can be magnetized in one direction only
        (D) are magnetized in direction opposite to that of applied field

    f. Which of the following type of inter-atomic bonding exists in a silicon atom?
        (A) Ionic bonding   **(B)** Metallic bonding
        (C) Covalent bonding   **(D)** None of these

    g. Dielectric constant of vacuum is
        (A) One   **(B)** Two
        (C) Zero   **(D)** None of these

    h. Solder is an alloy consisting of
        (A) tin, antimony, copper   **(B)** tin and lead
        (C) lead and copper   **(D)** nickel and lead

    i. Pure silicon at 0 K is an
        (A) intrinsic semiconductor   **(B)** extrinsic semiconductor
        (C) metal   **(D)** insulator

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j. A suitable material for audio and TV transformers is
    (**A**) Ferrite   (**B**) Fe - 4% Si
    (**C**) Fe - 30% Si   (**D**) very pure Fe

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

Q.2 a. Explain the motion of an electron in an Electric field.   **(6)**

     b. What is Fermi energy?   **(4)**

     c. How temperature effects the electrical conductivity of metals? Explain the phenomena of superconductivity.   **(6)**

Q.3 a. Derive Clausius-Mossotti relation for solid dielectrics due to internal field.   **(8)**

     b. What is polarization of dielectric material? Name and explain the various types of polarization mechanism in dielectric material.   **(8)**

Q.4 a. Write the properties of a good insulating material. Give some application of insulating material.   **(8)**

     b. What are the effects of frequency and temperature on the dielectric constant of polar dielectric?   **(8)**

Q.5 a. What is magnetic dipole? Explain the classification of magnetic material.   **(8)**

     b. Name some alloys and their composition which can be classified as magnetic materials.   **(8)**

Q.6 a. What is intrinsic and extrinsic type of semiconductor? How doping effect the properties of a semiconductor?   **(4+4)**

     b. Explain Hall Effect and derive the formula for Hall coefficient. What are the applications of Hall Effect?   **(8)**

Q.7 a. Differentiate between Zener and Avalanche breakdown.   **(8)**

     b. Explain the working of a silicon controlled rectifier (SCR) with the help of suitable circuit diagram.   **(8)**

Q.8 a. Discuss working principle & applications of the following: **(4×4)**
        (i) Alloy resistors   (ii) Electrolytic capacitors
        (iii) Cored coils   (iv) Thermal Type Relay

Q.9 a. What are the different techniques of fabrication of junction transistors? Explain each of them with the help of diagrams where ever necessary.   **(8)**

     b.   Explain the transfer characteristics of JFET. Also write its merit and demerits   **(8)**