

**DiplETE – ET (NEW SCHEME) – Code: DE54**

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**Subject: ENGINEERING MATERIALS****Time: 3 Hours****Max. Marks: 100****DECEMBER 2009****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.
  - 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.
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**Q.1 Choose the correct or the best alternative in the following: (2×10)**

a. A material which can store electrical energy is

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|---------------|--------------------------|
| (A) Capacitor | (B) Inductor             |
| (C) Resistor  | (D) Dielectric material. |

b. The main purpose of a capacitor is to

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|------------------------|-----------------------|
| (A) block current flow | (B) help current flow |
| (C) store energy       | (D) dissipate heat    |

c. Materials which provide path to the magnetic flux are classified as

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|--------------------------|------------------------------|
| (A) insulating materials | (B) semiconducting materials |
| (C) magnetic materials   | (D) dielectric materials     |

d. A pure semiconductor under ordinary conditions behave like

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|------------------------|------------------------------|
| (A) a conductor        | (B) an insulator             |
| (C) magnetic materials | (D) a ferroelectric material |

e. Which of the following materials have maximum magnetic permeability?

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|--------------------------|----------------------|
| (A) Pure iron            | (B) 4% silicon steel |
| (C) Grain oriented Si-Fe | (D) Ni-Fe            |

f. The temperature at which a ferromagnetic material becomes a paramagnetic is called

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|-------------------------|-------------------------|
| (A) Curie temperature   | (B) Maximum temperature |
| (C) Minimum temperature | (D) All the above       |

g. In photo emission of electrons the energies of electrons emitted depend on the

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|-----------------------|----------------|
| (A) intensity         | (B) wavelength |
| (C) velocity of light | (D) frequency  |

h. The Fermi level is

- (A) an average value of all available energy levels
  - (B) the highest occupied energy level at 0° K
  - (C) an energy level at the top of the valence band
  - (D) the largest available energy level
- i. In a p-n junction in equilibrium with zero bias
- (A) no holes or electrons cross the junction
  - (B) only electrons cross the junction
  - (C) equal number of electrons and holes cross the junction
  - (D) only holes cross the junction
- j. The Hall voltage across an impurity semiconductor crystal can be increased by
- (A) increasing the concentration of impurity atoms in the crystal
  - (B) increasing the thickness of the crystal
  - (C) increasing the width of the crystal
  - (D) increasing the current flowing through the crystal

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

- Q.2** a. Explain the effect of temperature on electrical conductivity of metals. (8)
- b. The resistivity of pure copper is 1.56 micro ohm cm. An alloy of copper containing one atomic percent of nickel has a resistivity of 2.81 micro ohm cm. An alloy of copper containing three atomic percent silver has a resistivity of 1.98 micro ohm cm. What is the resistivity of an alloy containing two atomic percent nickel and two atomic percent of silver? (8)
- Q.3** a. Explain, the phenomenon of polarisation. (8)
- b. Derive Clausius-Mossotti relation for dielectric constant  $\epsilon_r$  and Polarisability  $\alpha$ . (8)
- Q.4** a. Explain the dielectric properties of polymeric system. (8)
- b. Write a note on ferroelectricity and piezoelectricity. (8)
- Q.5** a. Explain the phenomenon of Magnetostriction. (8)
- b. Write a note on Silicon iron and Nickel iron alloy. (8)
- Q.6** a. Derive the relation between diffusion constant and mobility. (8)
- b. Explain device potting, susceptor materials, reactors envelopes, plastic and pump fluids. (8)
- Q.7** a. Explain zener breakdown and avalanche breakdown. (8)
- b. What are the different types of resistors? Explain metal oxide film resistors. (8)

- Q.8** a. Explain the two transistor analogue of an SCR. (8)
- b. What are relays? Explain thermal type of relay. (8)
- Q.9** a. Explain zone refining technique used for the purification of semiconductors. (8)
- b. Draw and explain the drain and transfer characteristics of JFET. (8)