Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS / B.TECH (EE) / SEM-3 / MS (EE) 301 / 2010-11

2010-11

ELECTRICAL ENGINEERING MATERIALS

Time Allotted : 3 Hours *Full Marks* : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

Note : Graph sheet is to be supplied by institution.

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following :

$10 \times 1 = 10$

i) Material that does not have permanent magnetic dipoles is

a) Ferromagnetic b) Diamagnetic

c) Paramagnetic d) Ferrimagnetic.

ii) The average drift velocity v_x of electrons in a metal is related to the electronic field E and the collision time τ as

a) $\sqrt{\frac{eE\tau}{m}}$ b) $\sqrt{\frac{m}{eE\tau}}$

c) $-\frac{eE\tau}{m}$ d) $\frac{m}{eE\tau}$.

iii) The dielectric strength of air under normal condition is

a) 33 kV/cm b) 32 kV/cm

c) 35 kV/cm d) 30 kV/cm.

iv) The temperature below which certain materials are antiferromagnetic & above which they are paramagnetic is called

a) Curie temperature

b) Neel temperature

c) Transition temperature

d) Weiss temperature.

v) Piezoelectric effect is the production of electricity by

a) chemical effect b) varying field

c) temperature d) pressure.

vi) The best suitable material for an electrical heating element is

a) manganese b) constantan

c) Eureka d) carbon.

vii) The fusing current I is given by

a) $I = ad^{3/2}$ b) $I = ad^2$

c) $I = a / d^{3/2}$ d) $I = d^{3/2} / a$.

where a is constant and d is diameter of wire.

viii) Carbon is used for commutator brushes because it

a) has negative temperature coefficient

b) is very strong

c) is brittle

d) is good at abrasion.

ix) Limiting temperature of 'Class C' insulating material is

a) 90°C b) 130°C

c) 180°C d) 225°C.

x) In paramagnetic materials, susceptibility is

a) very small & positive b) very small & negative

c) very large & positive d) very large & negative.

xi) Eddy current loss is proportional to the

a) frequency

b) square of the frequency

c) square root of the frequency

d) cube of the frequency.

xii) In high frequency application, ferrite is preferred to a ferromagnetic material because, the ferrite has

a) high permeability

b) high resistivity

c) high saturation magnetization

d) square hysteresis loop.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. 3 × 5 = 15

2. Explain the phenomenon of piezoelectricity exhibited by some crystals. What is electrostriction ?

3. a) Derive the curve-weiss low of ferromagnetism.

   b) What is curie temperature ?

4. Briefly describe the principle of operation of solar cells.

5. Discuss different factors affecting electrical resistivity of conducting materials.

6. Show that the absorption of energy in dielectric is proportional to the imaginary part of the complex dielectric constant.

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. 3 × 15 = 45

7. a) What is meant by relaxation time, collision time & mean free path as applied to conduction phenomenon ?

   b) Discuss Wiedmann-Franz law in connection with thermal conductivity of materials.

c) The following data has been obtained by measurements on silver :

Density = 10·5 g/c^3, Resistivity = 1·63 μ ohm cm, Atomic weight = 107·9.

Calculate the mobility of electrons in silver. 6 + 5 + 4

8. a) Explain the mechanism of polarization in dielectric materials.

b) Explain the frequency dependence of electronic polarizability of a dielectric in an alternating electric field. Show graphically the different components of polarizability on a function of frequency.

c) What is the atomic polarizability of neon gas if an electric field of 9×10^4 V/m is applied on the sample of neon gas at N.T.P. The dielectric constant of neon at N.T.P. is 1·000134. 3 + 7 + 5

9. a) Explain the following terms as applied to magnetic materials.

(i) Permeability, (ii) Diamagnetism,

(iii) Paramagnetism, (iv) Ferromagnetism.

b) What is magnetic shielding ?

c) Draw the B-H curve for a ferromagnetic material & identify the retentivity & coercive field on the curve. What is energy loss per cycle ? 8 + 2 + 5

10. a) What is meant by the dielectric strength of an insulating material ? How is it expressed ?

    b) What are the factors which affect the dielectric strength of an insulating material ?

    c) What are the characteristics of a good insulating materials ?

    d) Give the electrical properties & uses of the following :

    (i) Micanite, (ii) Wood, (iii) Bakelite,

    (iv) Glass, (v) Paper. 3 + 2 + 4 + 6

11. Write brief notes on any *three* of the following : 3 × 5

    a) Superconductivity

    b) Hard magnetic material

    c) Internal field in solids & liquids

    d) Fuel cells.

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