Total No. of printed pages = 3

ECE 181404

Roll No. of candidate

2022

B.Tech. 4th Semester End-Term Examination

ELECTRICAL ENGINEERING MATERIALS

(New Regulation and New Syllabus)

Full Marks – 70   Time – Three hours

The figures in the margin indicate full marks for the questions.

Answer Question no. 1 and any *four* from the rest

1. Answer the following questions : $(10 \times 1 = 10)$

    (a) With an increasing in the mean free path of electrons, materials conductivity
         _____ .

         (i) increase   (ii) decrease

         (iii) remains constant   (iv) first increase then decrease

    (b) The energy gap clan insulator is _____ .

         (i) $E_g < 3eV$ (ii) $E_g < 1eV$

         (iii) $E_g < 0eV$ (iv) $E_g > 3eV$

    (c) The unit of magnetic permeability is _____ .

    (d) Relative magnetic permeability is less.

         (i) True   (ii) False

    (e) If the relative permeability of a medium is 0.050. Its magnetic susceptibility
         will be _____ .

    (f) Ferromagnetic materials does not show hysteresis

         (i) True   (ii) False

    (g) A piezoelectric material is one which does not generate bound electric
         charge on its surface when it is mechanically deformed.

         (i) True   (ii) False

                                                                                                        [Turn over

(h) A material has no net magnetic moment. It can therefore only have domain magnetised in different directions

    (i) True   (ii) False

(i) A piece of magnetic material has net magnetic moment when no field is applied. It must therefore be ferromagnetic.

    (i) True   (ii) False

(j) A material with unequal anti parallel atomic magnetic moments is

    (i) An antiferroniagnet   (ii) A ferrimagnet

    (iii) A ferrite

2. (a) Mention the conditions for occurrence of electronic polarization and show that electronic polarizability $= [\epsilon_0 (\epsilon_r - 1)]/N$.   (7)

   (b) Find the current expression for drift and diffusion current of a semiconductor.   (4)

   (c) Discuss the Hall effect.   (4)

3. (a) How Alternating electric field affects the dielectric properties of an insulator?   (3)

   (b) Explain the frequency dependency of electronic polarizabiiity of a dielectric in an electric field by finding its expression. Draw the necessary graph.   (9)

   (c) What are the different dielectric losses?   (3)

4. (a) Write Lorentz-Lorentz equation?   (2)

   (b) The molecules of a polar gas have a permanent dipole moment of 1.2 Debye units. What should be the magnitude of the externally applied field so as to cause an orientational polarization of 0.5 % of saturation value at 27°C.   (8)

   (c) What is meant by the term loss angle' of a dielectric? Give its importance in dielectric materials.   (5)

5. (a) Find the average power dissipated per cubic metre in a non conducting dielectric medium with relative permittivity of 4 and loss tangent of 0.001 if $E = 1\,kVm^{-1}$ rms and the frequency is 10 MNz.   (5)

   (b) Explain the terms Diamagnetism, Paramagnetism, Ferromagnetism, Anti-Ferromagnetism and Ferri-Magnetism with reference to magnetic dipoles of the atoms. Discuss the origin of such dipoles.   (10)

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6. (a) Explain susceptibility versus temperature curves for each type of magnetic materials with proper diagram. (8)

(b) What are soft and hard magnetic materials? Indicate the properties of each type. (5)

(c) Define Superconductivity. (2)

7. (a) What do you mean by mobility of electron? How is mobility and conductivity related? (2)

(b) How does mean free path of an electron occur in an expression for the resistivity of a metal? (8)

(c) Explain with the help of energy diagram n-type and p-type semiconductor. (5)

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