3E1615

Roll No. _____ [Total No. of Pages : 3

3E1615

B. Tech. III Semester (Main) Examination-2014

Electronic Instrumentation & Control

3EI5A Electromagnetic Properties of Materials

(Common to EC & EIC)

Time : 3 Hours **Maximum Marks : 80**

Min. Passing Marks : 24

Instructions to Candidates:

*Attempt any **five** questions, selecting **one** question from **each** unit. All questions carry **equal** marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.*

Use of following supporting material is permitted during examination.

1. Scientific calculator.

Unit - I

1. a) Explain the significance of electronic polarization? Also derive the following expression for $\in_r$

$$\in_r = 1 + \frac{N\alpha_e}{\in_o}$$

Where N = number of molecules per unit volume

α_e electronic polarizability. **(8)**

b) The electronic polarizability of the Ar atom is 1.7×10^{-40} Fm^2. What is the static dielectric constant of solid Ar (below 84K) if its density is 1.8 gcm^{-3}? **(8)**

OR

1. a) Explain frequency dependence on dielectric constant and dielectric loss. Also draw the spectrum of dielectric constant v/s frequency. **(8)**

b) A typical 1MHz quartz crystal has the following properties:

f_s = 1MHz ; f_a = 1.0025 MHz, C_o = 5PF. R = 20Ω . Calculate the equivalent circuit parameter and quality factor of the crystal. Where f_s = mechanical resonant frequency f_a = anti resonant frequency. **(8)**

Unit - II

2. a) Name the categories into which magnetic materials can be classified. Mention their magnetic properties and examples. **(8)**

b) Explain the principle of the giant magnetostriction resistor (GMR). **(8)**

OR

2. a) Explain the soft and hard magnetic materials and their applications. **(8)**

b) Write short notes on

i) Magnetostriction.

ii) BH hysteresis loop. **(4+4)**

Unit - III

3. a) Explain and draw the energy band diagrams for semiconductors. **(8)**

b) An n-type si semiconductor containing 10^{16} phosphorus atoms cm^{-3} has been doped with 10^{17} boron atoms cm^{-3}. Calculate the electron and hole concentrations in this semiconductor. **(8)**

OR

3. a) Explain the electronic properties and applications of Germanium and silicon. **(8)**

b) A si sample has been doped with 10^{17} arsenic atoms cm^{-3}. Calculate the conductivity of the sample at 27°C and at 127°C? **(8)**

Unit - IV

4. What is Meissner effect? Explain and draw the characteristics of Type I and Type II superconductors and their applications. **(16)**

OR

4. a) Write short notes on

   i) Energy band gap structures of metals .

   ii) Matthiessen's rule. **(4+4)**

   b) Explain the electrical properties of conductive and resistive materials. **(8)**

Unit - V

5. Explain fabrication and characterization of Nanomaterials. **(16)**

OR

5. Write down the physical properties of Nanomaterials and also give the applications of Nanomaterials. **(16)**
