

3E1615

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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 ϵ_r

$$\epsilon_r = 1 + \frac{N\alpha_e}{\epsilon_0}$$

Where N = number of molecules per unit volume

α_e electronic polarizability.

(8)

- b) The electronic polarizability of the Ar atom is $1.7 \times 10^{-40} \text{ Fm}^2$. 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:

$f_s = 1\text{MHz}$; $f_a = 1.0025\text{ MHz}$, $C_o = 5\text{PF}$. $R = 20\Omega$. 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)