

3E1615

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3E1615

B. Tech. III Semester (Main) Examination-2014
Electronic Instrumentation & Control
3E15A 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:

$f_s = 1\text{MHz}$; $f_a = 1.0025\text{ MHz}$, $C_0 = 5\text{PF}$, $R = 20\Omega$. 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. rtuonline.com
- 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)