3E1495

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B. Tech. (Sem. III) (Main & Back) Examination, January - 2013
Electronics & Communication Engineering
3EC5 Electronic Materials and Processes

Time : 3 Hours] [Total Marks : 80
[Min. Passing Marks : 24

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.

(Mentioned in form No. 205)

1. Nil 2. Nil

UNIT - I

1 (a) Describe the various dielectric polarization mechanism. What is complex dielectric constant ? How does it vary with frequency of applied field ? 8

(b) Argon gas contains 2.7×10^{25} atoms/m^3 at 0°C and at one atmospheric pressure. Calculate the dielectric constant of argon gas at this temperature, if the diameter of the argon atom is 0.384 nm. 8

OR

1 (a) Explain how the dielectric constant of a ferroelectric crystal varies with temperature. Name two ferroelectric materials. What are the applications of ferroelectric materials ? 8

[Contd...

(b) The bakelite in found to have the real part of its complex relative dielectric constant as 4.36 with a loss tangent of 2.8×10^{-2} at a frequency of 1 MHz. Calculate the complex polarizability of the material assuming Lorentz field. Assume $N = 4\times10^{28}/m^3$. 8

UNIT-II

2 (a) How do you classify a material as dia or para or ferromagnetic ? Explain ferrimagnetism and antiferromagnetism. 8

(b) A magnetic material has a magnetization of 3300 ampere/meter and flux density of 0.0044 wb/m^2. Calculate the magnetic force and the relative permeability of the material. 8

OR

2 (a) Give an account of the origin of atomic magnetism. Which source is important in the case of ferromagnetism. Explain the Heizenberg's criteria for ferromagnetism. 8

(b) A paramagnetic salt contains 10^{28} ions/m^3. with magnetic moment of one Bohrmagnetion. Calculate the paramagnetic susceptibility and the magnetization produced in a uniform magnetic field of 10^6 ampere/metre when the temperature is 27°C. 8

UNIT-III

3 (a) Distinguish between intrinsic and extrinsic semiconductors. Obtain an expression for the carrier concentration for an intrinsic semiconductor. When does an extrinsic semiconductor become an intrinsic semiconductor. 8

(b) Mobilities of electrons and holes in a sample of intrinsic germanium at 300 k are 0.36 $m^2 V^{-1} S^{-1}$ and 0.17 $m^2 V^{-1} S^{-1}$ respectively. If the resistivity of the specimen is $2.12 \Omega m$, compute the for bidden energy gap.

8

OR

3 (a) Give the theory of direct recombination of carriers in semiconductors and hence obtain the expression for the decay of minority carrier injected into a semiconductor.

8

(b) In an n-type semiconductor, the Fermi level lies 0.3 eV below the conduction band at 300 k. If the temperature is increased to 330 k, find the new position of the fermi level.

8

UNIT-IV

4 (a) What is meant by superconductivity ? Describe the effect of :

(i) magnetic field

(ii) frequency and

(iii) isotopes on superconductors.

Mention a few industrial applications of superconducting materials.

8

(b) A super conducting tin has a critical temperature of 3.7 k is zero magnetic field and a critical field of 0.0306 tesla at 0k. Find the critical field at 2k.

8

OR

4 (a) Can you give an idea of the material parameters which you want to manipulate to raise the superconducting transition temperature ? Do you think that there is a theoretical limitation for raising the transition temperature indefinitely.

8

(b) The lead materials works as superconductor at a temperature of $T_c = 7.26$ k. If the constant characteristic field of the lead mate rial at 0k is $H_o = 8 \times 10^5$ ampere/metre. Calculate the magnetic field is the lead at 5 k. 8

UNIT - V

5 (a) Explain following processes :
(i) Eching
(ii) Board finishing
(iii) Photolithography
(iv) Drilling. 8

(b) Explain following characteristics for copper clad laminates :
(i) Dissipation factor
(ii) Flexural strength
(iii) Volume resistivity
(iv) Insulation resistance. 8

OR

5 (a) What do you mean by surface mount devices ? Compan them with these leaded counter parts. 6

(b) State advantages and disadvantages resulting from use of SMDs. 6

(c) How can you classify the SMDs. 4
