

B. Tech Second Year : 3rd Semester
Electronic Materials & Processes, Jan., 2012
(FOR 3EC5 BRANCH OF ENGINEERING)

Times : 3 Hours

Min. Passing Marks : 24

Total Marks : 80

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.)

◁ **Unit-I** ▷

1. (a) What is meant by polarization mechanism in dielectrics? Discuss the different polarization mechanism in dielectrics and explain their temperature dependence. [8]
- (b) Show that $P = E \epsilon_0 (\epsilon_r - 1)$, where P is the electric polarization. [8]

OR

1. (a) Describe the dipole theory of ferroelectricity. [8]
- (b) An elemental dielectric material has $\epsilon_r = 12$ and it contains 5×10^{28} atoms/m³. Calculate its electronic polarizability assuming Lorentz field. [8]

◁ **Unit-II** ▷

2. (a) Explain the physical basis of diamagnetism and paramagnetism of materials. Describe the Weiss molecular field theory of ferromagnetism and derive the Curie-Weiss law. [8]
- (b) A magnetic material has a magnetization of 3300 ampere/metre and flux density of 0.0044 Wb/m². Calculate the magnetizing force and the relative permeability of the material. [8]

OR

2. (a) Explain Heisenberg's criteria for ferromagnetism. Discuss ferromagnetism as a cooperative phenomenon. [8]
- (b) A paramagnetic salt contains 10^{28} ion/m³ with magnetic moment of one Bohr magneton. 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) Discuss various methods used for growth of semiconductor crystal. [8]
- (b) Explain degenerate and nondegenerate semi-

conductors.

[8]

OR

3. Describe the electronic properties of following semiconductor materials [8]
 - (i) Silicon
 - (ii) Germanium
 - (iii) Gallium Arsenide
 - (iv) Silicon Carbide.

[8]

◁ **Unit-IV** ▷

4. (a) Explain drift velocity and relaxation time of free electrons in metals. Discuss the various drawbacks of classical free electron theory of metals and explain the assumption made in quantum theory to overcome the drawbacks. [8]
- (b) What are the main sources of electrical resistance in a metal? Discuss the effect of impurity, temperature and alloying on the electrical conductivity of metal. [8]

OR

4. (a) Give an account of the phenomenon of superconductivity. Explain Type I and Type II superconductors. Write a note on the application of superconductivity. [8]
- (b) A superconducting tin has a critical temperature of 3.7 K in zero magnetic field and a critical field of 0.0306 Tesla at 0 K. Find the critical field at 2 K. [8]

◁ **Unit-V** ▷

5. Describe the fabrication methods of following passive components : [4×4 = 16]
 - (i) Fixed and variable type resistors
 - (ii) Inductors
 - (iii) Solenoid
 - (iv) Capacitors.

OR

5. (a) Explain the manufacturing process of single and double sided PCBs. [8]
- (b) What are the advantages and limitations of surface mount devices? [8]