53 (IE 303) ELEN

2019

ELECTRICAL ENGINEERING MATERIALS AND DEVICES

Paper : IE 303

Full Marks : 100

Time : Three hours

The figures in the margin indicate full marks for the questions.

*Answer **any five** questions.*

1. *(a)* What is a crystalline solid ? What are the different types of functional lattice structures ? 5

   (b) Find the number of atoms that can allocated in — 6

   (i) Simple cubic

   (ii) Body-centred cubic

   (iii) Face-centred cubic

   structures.

Contd.

(c) Draw the planes in a simple cubic lattice represented by following indices — 3×3=9

(i) (100)

(ii) (111)

(iii) (110)

2. (a) What is polarization? Derive the expression for dielectric constant of a monatomic gas. 10

(b) Discuss the effects of internal fields in solids and liquid-dielectrics. 10

3. (a) How do the dielectric constant and polarizability of a dielectric depend on frequency of an Alternating field? 14

(b) What is dielectric loss in alternating field? How does dielectric loss depend on frequency? 6

4. (a) Derive the expression for dielectric constant in the presence of relaxation effects in an alternating field. 12

(b) What is a magnetic material? How can magnetic materials be classified? 4

(c) Discuss the term — magnetostriction. 4

5. (a) What are hard and soft magnetic materials? 5

(b) Discuss the electron gas model of a metal. 5

(c) Explain the process of calculation of mean free path and mean free time in metals. 5

(d) What is superconductivity? Explain. 5

6. (a) What is diffusion in semiconductor? Derive the Einstein relation between diffusion constant and mobility. 8

(b) What is a fermi level? How the position of fermi level will vary in intrinsic, *n*-type and *p*-type semiconductors? 4

(c) State and explain Hall effect in a semiconductor. 8

7. Write short notes on : 10×2=20

(a) Czochralski method for crystal growth

(b) Photolithography.
