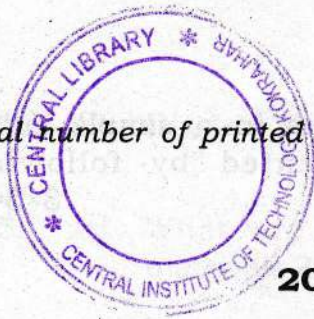


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53 (IE 303) ELEN

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 be allocated in — 6
 - (i) Simple cubic
 - (ii) Body-centred cubic
 - (iii) Face-centred cubicstructures.

Contd.

- (c) Draw the planes in a simple cubic lattice represented by following indices — $3 \times 3 = 9$
- (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

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- (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: $10 \times 2 = 20$
- (a) Czochralski method for crystal growth
- (b) Photolithography. _____

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