

2022

1st Semester Examination

ELECTRONICS

Paper : ELC 102

Full Marks : 40

Time : Two Hours

*The figures in the margin indicate full marks.
Candidates are required to give their answers
in their own words as far as practicable.*

Unit - 1

(Electronic Materials)

Answer any *two* questions each from Group-A and
Group-B; and *one* question from Group-C.

Group - A

Answer any *two* questions : $2 \times 2 = 4$

1. Classify the various types of interatomic bonds. 2
2. What is Fermi surface? 2
3. What are the different contributions to the total polarization of a dielectric material? 2
4. What is quantum well and quantum wire? 1+1

P.T.O.

Group - B

Answer any *two* questions : 4×2=8

5. What is meant by crystal imperfections? Classify them in order of their geometry. 1+3
6. Explain the terms — transition temperature and critical field for a superconductor. For lead, the critical field at 0 K is 6.39×10^4 A/m and critical temperature for zero magnetic field is 7.18 K. Find the critical field for lead at 4 K. 1+1+2
7. Explain the absorption of light by interband and intraband transitions. 2+2
8. Describe the structure of ferrites. Mention their uses. 2½+2½

Group - C

Answer any *one* question : 8×1=8

9. How are the point defects evolved? Obtain an expression for the equilibrium concentration of Schottky defects in ionic crystals. 2+6
10. Discuss the drawbacks of classical free electron theory. Derive the expression for Fermi energy E_F at temperature 0 K. 3+5

(3)

Unit - 2

(Semiconductor Device)

Answer any *two* questions each from Group-A and Group-B; and *one* question from Group-C.

Group - A

Answer any *two* questions : $2 \times 2 = 4$

1. Explain how can you determine carrier concentration of a semi-conductor from the C - V measurement of a $P^+ - N$ diode. 2
2. Why activation energy method is preferred over current-voltage measurement method to determine barrier height of a metal-semiconductor contact? 2
3. What do you mean by Fermi level pinning effect when interface state density is large? 2
4. Explain the terms input ionization and field ionization in connection with junction break down. 1+1

Group - B

Answer any *two* questions : $4 \times 2 = 8$

5. For a metal-semiconductor junction, prove that $9\phi_{Bn} + 9\phi_{Bp} = E_g$ where the symbols have their usual meanings.
6. Explain the working principle of a varactor diode. 4

P.T.O.

7. Define the terms accumulation, depletion, inversion and strong inversion in connection with a MOSFET.

1+1+1+1

8. Derive the expression of pinch off voltage and saturation drain current of a MOSFET.

2+2

Group - C

Answer any *one* question :

8×1=8

9. Derive the expressions of built-in-potential and depletion layer width of an abrupt PN junction. Distinguish between depletion capacitance and diffusion capacitance.

(3+3)+2

10. Derive the expression of diode current of a metal-semiconductor junction using thermionic emission theory.