

M.Sc. 1st Semester Examination, 2023

ELECTRONICS

PAPER – ELC-102 (U1 & U2)

Full Marks : 50.

Time : 2 hours

The figures in the right hand margin indicate marks

Candidates are required to give their answers in their own words as far as practicable

PAPER – ELC-102 (U1)

(Electronic Materials)

GROUP – A

Answer any **two** of the following questions :

1. What are the distinguishable characteristics of metallic bonding ?

2 × 2

2

(Turn Over)

2. What do you mean by conducting polymers ? 2
3. Explain intraband transitions. 2
4. What is the condition of quantum confinement ? 2

GROUP – B

Answer any **two** of the following questions : 2 × 4

5. What is meant by point defects in crystal lattice ? How are they formed ? 2 + 2
6. Derive Clausius-Mossoti relationship in static field. 4
7. Explain photoluminescence and electroluminescence 2 + 2
8. Derive the temperature dependence of magnetic susceptibility of a paramagnetic substance. 4

GROUP-C

Answer any **one** of the following question :

9. Obtain an expression for orientational polarization neglecting dipole-dipole interactions. Discuss what happens at high and low temperatures. 1 × 8
5 + 3
10. What are Cooper pairs ? Show that in d.c. Josephson effect the super current across the junction depends on the phase difference. 2 + 6

[Internal Assessment – 05 Marks]

PAPER – ELC-102(U2)

(*Electron Device*)

GROUP-A

Answer any **two** of the following questions :

1. What do you mean by depletion capacitance ?
How does it differ from diffusion capacitance ? 2 × 2
1 + 1
2. How population inversion can be achieved in a semiconductor LASER ? 2

3. Write down briefly the operating principle of a varactor diode. 2
4. How can you determine the carrier concentration of the n side of a P⁺-N junction using C-V measurements ? 2

GROUP - B

Answer any **two** of the following questions : 4 × 2

5. Derive the analytical expression of depletion layer width (W) of a P-N junction diode. 4
6. In case of a metal- semiconductor junction prove that $\phi_{Bn} + \phi_{Bp} = E_g$, where ϕ_{Bn} and ϕ_{Bp} are the barrier heights of a metal-N and metal-P junctions respectively. 4
7. Derive the expression of pinch-off voltage of a MESFET. What do you mean by the threshold voltage of the device ? 3 + 1

8. With a neat energy-band diagram discuss how a photo-diode works. How the performance of an ordinary photo-diode improves in a PIN photo diode ? 2 + 2

GROUP - C

Answer any one of the following question :

9. Prove that in case of a MESFET the drain conductance in the linear region is equal to the trans conductance in the saturation region. 8 × 1
10. Derive the expression of diode current of a metal-semiconductor diode using thermionic emission theory. 8

[Internal Assessment — 05 Marks]
