

(2 Hours)

Total Marks – 60

- N.B :** (1) Question No.1 is compulsory.
 (2) Attempt any three questions from Q.no 2 to Q.no 6.
 (3) Assume suitable data and symbol if required.
 (4) Figures to the right indicate full marks.

- Q1) Attempt any FIVE from the following.
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| a) Draw the following with reference to cubic unit cell (002), (101) and (111). | 3 |
| b) Calculate the conductivity of a Ge specimen if the donor impurity added to Ge is 1.2×10^{23} atoms/m ³ . Given mobility of electron is 3800 cm ² /V-sec. | 3 |
| c) What is principle of solar cell? Write its advantages and disadvantages? | 3 |
| d) Draw and explain Fermi level diagram of p-n junction diode. | 3 |
| e) An electron has a speed of 400 m/sec with uncertainty of 0.01%. Find the accuracy in its position. | 3 |
| f) Define superconductivity, critical temperature and critical magnetic field. | 3 |
| g) The Bragg angle corresponding to the first order reflection from (1 1 1) planes of a crystal is 30°. Wavelength of X-ray is 1.75 Å. Determine interplanar spacing and lattice constant of the crystal. | 3 |
- Q2)a) Derive the conditions for the maxima and minima due to interference of light in a wedge shaped film. 8
- b) Derive Bragg's equation for x ray diffraction in crystals. If X-rays of wavelength 1.549 Å is reflected from a crystal with interplanar spacing 4.255 Å, calculate the smallest glancing angle and the highest order of reflection that can be observed. 7
- Q3)a) Derive Schrodinger Time Independent Wave Equation. Find the lowest energy of a neutron within a nucleus of dimension 10⁻¹⁴ m. given mass of a neutron 1.67 X 10⁻²⁷ kg. 8
- b) Draw and explain the energy band diagram for a p-n junction in forward and reverse biased mode. 7
- Q4)a) Define drift current, diffusion current and mobility of charge carriers and state its S.I units. 5
- b) Describe in detail the concept of anti-reflecting film with a proper ray diagram. 5
- c) Explain phase velocity of a wave and group velocity of matter waves. 5
- Q5)a) Explain formation of Newton's rings with experimental arrangement? Also give characteristics of Newton's rings. 5
- b) Define Fermi level and explain it in detail for conductors. 5
- c) Explain de-Broglie hypothesis of matter waves and deduce the expression for wavelength. 5
- Q6)a) What are type- I and type-II superconductors? 5
- b) Find the thickness of the soap film which appear yellow (wavelength 5896 Å) in reflection when it is illuminated by white light at an angle of 45°. Given refractive index of the film is 1.33. 5
- c) The minimum energy possible for a particle trapped in a 1-d box is 3.2 X 10⁻¹⁸ J. What are the next three energies in eV the particle can have? 5
