

TIME: 2 Hours

MARK

- N.B
- 1) Question no 1 is Compulsory.
  - 2) Attempt any three questions from Q.2 to Q.6
  - 3) Assume suitable data wherever required.
  - 4) Figures on the Right indicates marks.

Q.1 Attempt any five questions from the following

- (a) Draw  $(0\ 0\ 2)$ ,  $(\bar{1}\ 0\ 0)$ ,  $(0\ 1\ 1)$
- (b) Explain any three properties of matter waves.
- (c) Differentiate between Direct and Indirect band gap semiconductor.
- (d) Explain any three conditions for Sustained Interference.
- (e) A source is emitting 150W of red light of wavelength of 600nm. How many photons per second are emerging from the source?
- (f) Explain the Meissner effect with application.
- (g) Explain Magneto Resistance with application.

Q.2 (a) Show that Non- Existence of electron in the Nucleus, Find the uncertainty in the position of electron . The speed of an electron is measured to be  $4.0 \times 10^3$  m/s to an accuracy of 0.002% .

(b) Define the Fermi energy level , Show that in intrinsic semiconductor Fermi level is at the centre of Forbidden energy gap. Draw the position of Fermi level in intrinsic, P-type and N-type semiconductor.

Q.3 (a) Explain with diagram Bragg's X Ray Spectrometer . Calculate the interplaner spacing between the family of planes  $(1\ 1\ 1)$  in crystal of lattice constant  $3A^0$ .

(b) Prove that the Diameter of the  $n^{\text{th}}$  dark ring in Newton's ring setup is directly proportional to the square root of the ring number . In Newton's Rings reflected light of wavelength  $5 \times 10^{-5}$  cm. The diameter of the  $10^{\text{th}}$  dark ring is 0.5 cm. Calculate radius of curvature R.

- (a) Derive one dimensional time independent Schrodinger Equation. [5]
- (b) Differentiate between Type I superconductor and Type II superconductor. [5]
- (c) Find Resistance of an intrinsic Ge rod of dimensions ( 1cm long , 1mm wide and 1mm thick) at 300K . For Ge  $n_i = 2.5 \times 10^{19}/m^3$  ,  $\mu_n = 0.39m^2/v-s$  ,  $\mu_p = 0.19m^2/v-s$  [5]
- (a) Derive the condition for maxima and minima due to interference of light reflected from thin film of uniform thickness. [5]
- (b) Explain Hall Effect . Derive the equation for Hall Voltage. [5]
- (c) Calculate the lowest three energy states of an electron confined in potential well of width  $10A^0$ . [5]
- (a) Explain multiferroics and its different types. [5]
- (b) A soap film  $4 \times 10^{-5}$  cm thick is viewed at angle of  $35^0$  to normal. Calculate Wavelength of light in the visible spectrum which will be absent from the Reflected light (  $\mu = 1.33$  ) [5]
- (c) The Coefficient ( $R_h$ ) of semiconductor is  $3.22 \times 10^{-4} m^3c^{-1}$  . Its resistivity is  $9 \times 10^{-3} \Omega m$  . Calculate the mobility and concentration of carriers. [5]

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