TIME: 2 Hours MARKS: 60

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 [15]

(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 4.0×10^3 m/s to an accuracy of 0.002% . [8]

(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. [7]

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 $3A^0$. [8]

(b) Prove that the Diameter of the n^{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 5×10^{-5} cm. The diameter of the 10^{th} dark ring is 0.5 cm. Calculate radius of curvature R. [7]

Q.4 (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 $n_i = 2.5 \times 10^{19}/m^3$, $\mu_n = 0.39 m^2/v\text{-}s$, $\mu_p = 0.19 m^2/v\text{-}s$ [5]

Q.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]

Q.6 (a) Explain multiferroics and its different types. [5]

(b) A soap film $4x10^{-5}$ 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 (Rh) of semiconductor is $3.22 \times 10^{-4} m^3 c^{-1}$. Its resistivity is 9×10^{-3} Ω m . Calculate the mobility and concentration of carriers. [5]

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