

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