Time: 2 Hours   **Max. Marks: 60**

N.B.: (1) Question. **1** is **compulsory.**
       (2) **Assume** suitable **data** wherever required.
       (3) **Figures** to the **right** indicate **marks.**

Q1.   **Attempt Any Five of the following (03 marks each)**
    a.   Define the terms: Fermi energy and Band gap energy.
    b.   State piezo- electric effect.
    c.   Define the terms: Bel and Decibel.
    d.   Define: Critical Temperature and Critical magnetic field for superconducting state of material.
    e.   A neutron of 1.67×10^{-27} kg is moving with a kinetic energy of 20 keV. What is de Broglie wavelength associated with neutron motion.
    f.   What are Miller indices?
    g.   In a semiconductor with Hall coefficient 145 cc/C having width 2cm and thickness 0.2 cm with a magnetic field induction of 2T along the smaller dimension, a current of 150 mA is flowing, calculate the current density and Hall voltage.

Q.2   **Answer THREE questions out of FIVE (05 marks each)**
    a.   State Heisenberg's uncertaintity principle. An electron is confined in a box of length 10^{-8} m. Calculate minimum uncertaintity in its velocity.
    b.   Show that in pure semiconductor, fermi energy level lies midway between valence band and cinduction band.
    c.   What is ligancy? Find the critical radius ratio for ligancy 4.
    d.   Distinguish between Type-I and Type-II superconductor.
    e.   Find the natural frequency of vibrations of quartz plate of thickness 2 mm. Given that Young's modulus of quartz $= 8 \times 10^{10}$ N/m^2. And density $= 2650$ kg/m^3. Also calculate the change in the thickness required if the same plate is to be used to produce ultrasonic waves of frequency 3MHz.

Q.3   **Answer THREE questions out of FIVE (05 marks each)**
    a.   With reference to the unit cell, draw the following: (110), [002],[231], (200), (101)
    b.   What are properties of matter waves?
    c.   Write a short note on Bragg's diffractometer.
    d.   Draw Diamond and NaCl structure.
    e.   Explain how the reverberation time is affected by (i) size (ii) nature of its wall surfaces

Q.4   **Answer THREE questions out of FIVE (05 marks each)**
    a.   Explain the formation of barrier potential at P-N junction.
    b.   Derive Schrodinger's time dependent equation.
    c.   Write a short note on Non destruction Testing.
    d.   Write short note on liquid crystal and its phases.
    e.   State Magnetostriction effect. Explain the construction and working of Magnetostriction oscillator.

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