**Q.P. Code : 18533**

[Time : 2 Hours]                                                      [ Total Marks : 60

Please check whether you have got the right question paper.

**N.B:**   1.  Questions **No.1** is **compulsory**.
         2.  Attempt **any three** from **Q.No.2** to **Q.No.6**.
         3.  Assume any **data** wherever **required**.
         4.  **Figures** to the right **indicate marks**.

1.   Solve **any five** of the following :                                                          15

   (a)   Draw the unit cell of HCP structure and work out the no. of atoms per unit cell.

   (b)   The mobility of holes is $0.025 m^2/V$-sec. What would be the resistivity of n-type Si if the Hall coefficient of the sample is $2.25 \times 10^{-5} m^3/C$.

   (c)   What is the principle of solar cell? Write its advantages and disadvantages.

   (d)   An electron is confined in a box of dimension 1A°. Calculate minimum uncertainty in its velocity.

   (e)   Explain the factors on which reverberation time depends.

   (f)   Explain cavitation effect.

   (g)   What is Maglev? How it can have very high speed?

2.   (a)   Draw the following : $(1\bar{1}3), (200) [00\bar{1}]$.                                     8
          An electron is accelerated through 1200 volts and is reflected from a crystal. The second order reflection occurs when glancing angle is 60°. Calculate the inter planar spacing of the crystal.

   (b)   Explain the concept of Fermi level. Prove that the Fermi level exactly at the centre   7
          of the Forbidden energy gap in intrinsic semiconductor.

3.   (a)   Find the following parameters for DC (Diamond Cubic) structure :                         8
          i)    No. of atoms per unit cell
          ii)   Co-ordination No.
          iii)  Nearest atomic distance
          iv)   Atomic radius
          v)    APF

   (b)   Define drift current, diffusion current and P – N junction. The electrical               7
          conductivity of a pure silicon at room temperature is $4 \times 10^{-4}$ mho/m. If the
          mobility of electron is $0.14 \ m^2/V \cdot S$ and that of hole is $0.04 m^2/V \cdot S$. Calculate the
          intrinsic carrier density.

**TURN OVER**

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4. (a) Distinguish between Type I & Type II superconductors. 5

(b) A classroom has dimensions $10 \times 8 \times 6$ m$^3$. The reverberation time is 3 sec. 5
Calculate the total absorption of surface and average absorption.

(c) Explain the principle, construction and working of a Magnetostriction Oscillator. 5

5. (a) Write Fermi Dirac distribution function. With the help of diagram, explain the 5
variation of Fermi level with temperature in n-type semiconductor.

(b) Derive Schrodinger's time dependent wave equation for matter waves. 5

(c) Find the depth of sea water from a ship on the sea surface it the time interval of 5
two seconds is required to receive the signal back. Given that : temperature of sea
water is 20°C, salinity of sea water is 10gm/lit.

6. (a) Define the term critical temperature. Show that in the superconducting state the 5
material is perfectly diamagnetic.

(b) In a solid the energy level is lying 0.012eV below Fermi level. What is the 5
probability of this level not being occupied by an electron?

(c) What is the wavelength of a beam of neutron having : 5

    i) an energy of 0.025eV?

    ii) an electron and photon each have wavelength of 2A°. What are their
    momentum and energy? $m_n = 1.676 \times 10^{-27}$kg, $h = 6.625 \times 10^{-34}$ J-sec.