(2 Hours)   [Total Marks: 60]

N.B.: (1) Question. 1 is compulsory.

   (2) Attempt any three questions from the remaining questions N0.2 to 6.

   (3) Assume suitable data wherever required.

   (4) Figures to the right indicate marks.

1. Attempt any **five** questions from the following-   15

(a) Calculate atomic packing fraction of HCP unit cell.

(b)Express de-Broglie hypothesis and calculate the De-Broglie wavelength.

(c)Draw the energy band diagram for p-n junction diode in forward and reverse bias condition.

(d) Define: persistent current, critical temperature, critical magnetic field.

(e) What is reverberation time? Explain its formula.

(f) With the help of diagram state direct and inverse piezoelectric effect.

(g) The resistivity of intrinsic material at room temperature is 2×10^{-4} Ohm-cm. If the mobility
   of electron is 0. 6 m^2/V-sec and mobility of hole is 0.2 m^2/V-sec. Calculate its intrinsic
   carrier density.

2 (a) Arrive at the statement that electron cannot survive inside the nucleus.   8

   An electron has a speed of 300m/s with uncertainty of 0.01%. Find the accuracy in its

   position.

  (b) A sample of semiconductor is placed in uniform magnetic induction B with sample   7

   current I and thickness w then obtain the expression for (a) Hall voltage and (b) Hall

   coefficient

3 (a) with neat diagram of unit cell explain the structure of diamond crystal.   8

  (b) Explain variation of Fermi level with temperature in extrinsic semiconductor.   7

   What is the probability of an electron being thermally excited to the conduction band?

   In Si at 30^0C. The band gap energy is 1.12eV (k=1.38X 10^{-23} J/K)

33616   **Page 1 of 2**

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

(b) A class room has dimension of (20x15x10) m^3; the reverberation time is 3 sec. 5

Calculate the total absorption of its surfaces and average coefficient of absorption

(c) Explain the construction and working of piezoelectric oscillator? 5

5 (a) Show that for an intrinsic semiconductor, the Fermi level lies half way between 5

Conduction and valence band...

(b) Find the depth of sea water from a ship on the sea surface if the time interval of 5

2 seconds is required to receive the signal back.

Given that temperature of sea water $=25^oC$, Salinity of sea water $= 20gm/lit$

(c) The lowest energy of an electron trapped in a one dimensional box is 5

$3.2X10^{-18}$ J. Calculate the width of the box. Also calculate the next two energies

in eV the particle can have?

6 (a) Define ligancy and critical radius ratio. Calculate critical radius ratio for ligancy 8. 5

(b) Derive one dimensional time dependent Schrodinger equation 5

(c) Explain photovoltaic effect and write a note on solar cell. 5

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