

[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 $0.025\text{m}^2/\text{V}\cdot\text{sec}$. What would be the resistivity of n-type Si if the Hall coefficient of the sample is $2.25 \times 10^{-5}\text{m}^3/\text{C}$.
 - (c) What is the principle of solar cell? Write its advantages and disadvantages.
 - (d) An electron is confined in a box of dimension 1\AA . 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) $[0\ 0\ \bar{1}]$. 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 of the Forbidden energy gap in intrinsic semiconductor. 7
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 conductivity of a pure silicon at room temperature is $4 \times 10^{-4}\text{mho/m}$. If the mobility of electron is $0.14\text{m}^2/\text{V}\cdot\text{S}$ and that of hole is $0.04\text{m}^2/\text{V}\cdot\text{S}$. Calculate the intrinsic carrier density. 7

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4. (a) Distinguish between Type I & Type II superconductors. 5
- (b) A classroom has dimensions $10 \times 8 \times 6 \text{ m}^3$. 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 if 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 2\AA . What are their
momentum and energy? $m_n = 1.676 \times 10^{-27}\text{kg}$, $h = 6.625 \times 10^{-34}\text{ J-sec}$.
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