

(Revised Course)

(2 Hours)

[Total Marks : 60

- N.B. :** (1) Question No.1 is **compulsary**.
 (2) **Attempt** any **three** questions from Question No. 2 to 6.
 (2) Use **suited** data wherever **required**.
 (3) **Figures** to the right indicate **full** marks.

1. Solve any **five** from the following :- **15**
- (a) Define the term space lattice, unit cell and lattice parameter.
 - (b) Find the interplaner spacing between the family of planes (111) in a crystal of lattice constant $3A^\circ$.
 - (c) Represent the following in the cubic unit cell :-
 $(1\bar{1}2)$, (002) , $[121]$
 - (d) Define drift current, diffusion current and mobility of charge carriers.
 - (e) Explain the use of P-N junction as a solar cell.
 - (f) State with neat diagram direct and inverse Piezoelectric effect.
 - (g) What is magnetic circuit ? Explain Ohm's Law in case of magnetic circuit.
2. (a) Explain the Hall effect in metal ? Derive the formulae to determine the density and mobility of the electrons. **8**
- (b) Define ligancy and critical radius ratio in case of ionic solid. Write the conditions for stability of ionic crystal in 3-D ? Determine critical radius ratio for ligancy 6. **7**
3. (a) Explain with neat diagram construction of Bragg's X-ray spectrometer ? Write the procedure to determine crystal structure. Calculate the maximum order of diffraction if X-rays of wavelength $0.819 A^\circ$ is incident on a crystal of lattice spacing 0.282 nm . **8**
- (b) Calculate the number of turns required to produce a magnetic flux of $4 \times 10^5 \text{ wb}$, if an iron rod of length 50 cm and cross sectional area 4 cm^2 carrying an electric current 1 A is in the form of ring. (*Permeability of iron is $65 \times 10^{-4} \text{ H/m}$*). **7**
4. (a) What is mesomorphic state of matter ? Explain with neat diagram cholesteric phase. **5**
- (b) What is dielectric polarization and dielectric susceptibility ? Find the relation between them ? **5**

[TURN OVER

- (c) The resistivity of intrinsic InSb at room temperature is $2 \times 10^{-4} \Omega \text{ cm}$. If the mobility of electron is $6 \text{ m}^2/\text{V-sec}$ and mobility of hole is $0.2 \text{ m}^2/\text{V-sec}$. Calculate its intrinsic carrier density. **5**
5. (a) Identify the crystal structure if its density is $9.6 \times 10^2 \text{ kg/m}^3$, lattice constant is 4.3 \AA and atomic weight is 23. **5**
- (b) Explain the formation of depletion region in P-N junction. **5**
- (c) Define reverberation time? State Sabine's formula and explain the terms involved in it? **5**
6. (a) What are soft and Hard magnetic material? State their properties and applications. **5**
- (b) What is Fermi level in semiconductor? Show that in intrinsic semiconductor Fermi level always at the middle between the forbidden energy gap? **5**
- (c) An Ultrasonic sound wave is used to detect the position of defect in a steel bar of thickness 50 cm. If the echo times are 40 and 90 $\mu\text{-sec}$. Locate the position of defect. **5**
-