(This Question Paper contains 2 printed pages)

Roll No.:

Sr. No. of Question Paper: 2464

E

Unique Paper Code: C104 (Subject Code)

Name of the Course: B.Sc.(H) Physics

Name/Title of the Paper: Physics of Material (Paper-XX)

Year: 3 Year

Duration: 3 hours

Max marks: 38

Instructions for candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt five questions in all. Question No. 1 is compulsory. Attempt one question from each of the units.

1. Attempt any five of the following: 2 X 5 = 10
   a) Calculate the spacing between nearest planes containing exclusively Na^+ and Cl^- ions in a sodium chloride lattice of lattice constant 5.63 A^0.
   b) Draw the diagram of two types of Bravais Lattices included in the Monoclinic System and mention its unit cell characteristics.
   c) Discuss the concept of phonons in the elastic waves.
   d) Discuss B-H hysteresis and its significance.
   e) Explain Sellmeier relation for 'normal' and 'anomalous' dispersion in a dielectric. Discuss the
   f) ~~Give an account of~~ ferroelectric properties of materials.
   g) On the basis of Band theory of solids, distinguish between conductors, semiconductors and insulators.
   h) Explain critical magnetic field of a superconductor and its temperature dependence.

UNIT – I

2. (a) Obtain the reciprocal lattice vectors for a body centered cubic (bcc) lattice and a face centered cubic (fcc) lattice. 3,2
   (b)Obtain the geometrical structure factor for a bcc lattice. 2

3. (a) Derive Bragg's Law $2d \sin\Theta = n\lambda$ for diffraction of X-rays by a crystal. The symbols used in the expression have their usual meanings. 4

(b) For BCC iron, compute the interplanar spacing and the diffraction angle for the (220) set of planes. The lattice parameter for Fe is 0.2866 nm. Also assume that monochromatic radiation having a wavelength of 0.1790 nm is used and the order of reflection is 1. 3

UNIT – II

4. Derive the dispersion relation for an infinite linear mono-atomic chain. Discuss its long and short wavelengths limit. 5,2
5. (a) Derive the expression for diamagnetic susceptibility on the basis of classical Langevin theory. 5
   (b) Distinguish between dia-, para- and ferro-magnetic materials on the basis of magnetic susceptibility. 2

UNIT – III

6. (a) Describe the various sources of polarizability. 2
   (b) Obtain Lorentz relation for the local electric field at a point inside a dielectric. 5

7. Derive the expression for electronic polarizability in varying field and discuss the variation of dielectric constant with frequency. 5,2

UNIT – IV

8. (a) Derive the law of mass action governing the relative concentrations of electrons and holes in a semiconductor. 5
   (b) Explain qualitatively the Hall effect in a semiconductor. 2

9. (a) ~~Give an account of~~ Discuss the heat capacity and thermal conductivity of superconductors. 2
   (b) Derive London's eqation and an expression for magnetic field penetration depth in a superconductor. 2,3