AU–302

M.Sc. Semester–II (CBCS Scheme) Examination

PHYSICS

Paper–2-PHY-3

(Solid State Physics)

Time : Three Hours] [Maximum Marks : 80

Note :— All questions are compulsory and carry equal marks.

1. (a) Define crystalline and polycrystalline solids. 4

   (b) What is Wigner-Seitz cell ? Explain its construction. 5

   (c) Show that five-fold symmetry cannot exist in crystals. 7

OR

   (p) Explain in detail glide and roto-inversion symmetries. 6

   (q) Explain possible symmetry operations in two dimensions and enlist the Bravais lattices in 2D. 7

   (r) What is space group ? 3

2. (a) Derive Laue's equations and show that they lead to Bragg's condition of X-ray diffraction. 7

   (b) Discuss drawback of rotating crystal method. 2

   (c) Derive relation for geometric structure factor. Comment on the intensity and conditions for getting X-ray diffraction peaks in BCC crystal structure. 7

OR

   (p) Define geometrical structure factor. 2

   (q) Deduce an expression for atomic scattering factor. 7

   (r) Discuss the powder X-ray diffraction technique to study crystal structure of solids. 7

3. (a) Explain analytical method to determine lattice parameters. 9

(b) Describe in detail use of inelastic neutron scattering to study phonon dispersion relation. 7

OR

(p) What is the reciprocal lattice ? Show that the fcc lattice is the reciprocal lattice of the bcc lattice. 8

(q) Express Bragg's equation in terms of reciprocal lattice vector. 8

4. (a) Derive frequency and wave function associated with localised lattice vibrations. 6

(b) Derive a relation for binding energy of ionic crystal in terms of Madelung constant α. 6

(c) Discuss the thermal conductivity of solids. 4

OR

(p) Derive dispersion relation for diatomic chain lattice. 6

(q) Show that, in optical branch, atoms of different masses move in opposite direction and amplitude is inversely proportional to their masses. 6

(r) Explain the nature of interatomic forces and enlist types of crystals. 4

5. (a) What is Dulong and Petit law ? 3

(b) Give Debye's Theory of Heat Capacity. 13

OR

(p) Discuss the variation of specific heat with temperature. 4

(q) Give Einstein's theory of heat capacity. 12