

241421

Roll No. 203112300064

Exam Code : M-23

Subject Code—59356

B. Sc. EXAMINATION

(Main/Reappear) (Batch 2018 Onwards)

(Sixth Semester)

PHYSICS

Course—III

CPL-601

Solid State Physics

Time : 3 Hours

Maximum Marks : 80

Note : Attempt *Five* questions in all, selecting *one* question from each Unit. Q. No. 1 is compulsory. All questions carry equal marks.

1. (a) What is Phonon ? 2
- (b) What is symmetry operation ? 2
- (c) Explain the significance of effective mass of electron. 2

- (d) What is isotopic effect ? 2
- (e) What is Bragg's law ? 2
- (f) What is Bloch function ? 3
- (g) What is critical magnetic field ? 3

Unit I

2. (a) Discuss the following terms in detail : 12
 - (i) Wigner Seitz primitive cell
 - (ii) Liquid crystals
 - (iii) Rotation and reflection symmetry.
- (b) Determine the Miller indices of a plane which is parallel to x-axis and cuts intercepts of 2 and $1/2$ respectively along y and z-axes. 4
3. (a) What is crystal structure ? Discuss the Sodium Chloride crystal structure. 8
- (b) What are Bravais lattices ? Discuss Bravais lattice in three dimensions. 8

Unit II

4. (a) Derive the phonon dispersion relation for diatomic lattice and discuss acoustical and optical phonon modes. 8
- (b) What is K-space ? Discuss reciprocal lattice to bcc lattice. 8
5. (a) What is specific heat of solid ? Discuss Debye theory for specific heat of solids. 9
- (b) Estimate the Debye temperature of gold if its atomic weight is 197, the density is $1.9 \times 10^4 \text{ kg/m}^3$ and the velocity of sound in it is 2100 m/s. 7

Unit III

6. (a) Discuss the Kronig-Penny model for the motion of electrons in a periodic potential. 8
- (b) Discuss the classical theory of paramagnetic materials. 8

7. (a) What is Hall effect ? Explain. 8
(b) Discuss temperature dependence of the susceptibility of dia, para and ferromagnetic materials. 8

Unit IV

8. (a) Discuss BCS theory of superconductivity. 12
(b) The penetration depth of mercury at 3.5 K is about 750 angstrom. Estimate the penetration depth at 0 K. Also calculate the superconducting electron density. 4
9. (a) Discuss the following : 10
(i) Meissner effect
(ii) High T_c superconductor.
(b) Enumerate the properties of type-I and type-II superconductors. 6