Roll No. .....
1000 -/-/40/20

DS-544

January 2017

M. Sc. IIIrd Semester Examination

PHYSICS

First Paper : Condensed Matter Physics – I

Time 3 Hours] [Max. Marks : Regular 85 / Private 100

Note : This question paper is meant for all Regular and Private students. Answer all five questions. All questions carry equal marks. The blind candidates will be given 60 minutes extra time.

1. Discuss hexagonal closed packed (hcp) structure. Calculate the packing fraction and show that the c/a ratio for hcp structure has the values 1.633.

   OR

   Discuss the various symmetry elements associated with a crystal and hence discuss two-dimensional bravais lattices.

2. (a) Explain the concept of Reciprocal Lattice. Write steps of its geometrical construction.
   (b) Prove that reciprocal lattice of *fcc* is *bcc* and vice-versa.

   OR

   Discuss Ewald Construction and derive Bragg diffraction condition in terms of reciprocal lattice vector.

3. (a) Define Elastic Compliance and Stiffness Constants.
   (b) Derive an expression for the velocity of transverse waves in [100] direction of a cubic crystal.

   OR

   Define the elastic constants for a crystal. Using concept of elastic energy density, prove that the elastic stiffness constants are symmetrical i.e. $C_{ij} = C_{ji}$.

4. Obtain dispersion relation of a linear diatomic lattice and show that spectrum consists of two branches. Discuss the main features of these branches.

   OR

   What do you mean by inelastic scattering of X-rays ? Describe the scattering of neutrons of Phonons.

5. Obtain the equation of state for solids and hence define "Gruneisen Constant".

   OR

   Write short notes on any two of the following :
   (a) Fermi Surface.
   (b) Anomalous Skin Effect.
   (c) Cyclotron Resonance.
   (d) Effective Mass of Charge Carriers.