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

DS-544

February 2016

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 question carry equal marks. The blind candidates will be given 60 minutes extra time.

1. Explain the concepts of lattice, basis and crystal structure. Describe the crystal structure of NaCl. Explain clearly how this structure differs from that of CsCl.

   OR

   Discuss the various symmetry elements associated with a crystal. Show that an actual crystal can not possess a five fold rotational symmetry.

2. What is reciprocal lattice ? Discuss some of its important properties. Show that the volume of a unit cell of the reciprocal lattice is inversely proportional to the volume of a unit cell of the direct lattice.

   OR

   (a) Find the reciprocal lattice to a *fcc* and *bcc*.
   (b) Show that a simple cubic lattice is self-reciprocal but with different cell dimensions.

3. Consider the effect of symmetry on the elastic stiffness constants of crystal and show that the cubic crystal have only three independent elastic constants. How are these constants determined experimentally ?

   OR

   How are stress and strain in a crystal analysised ? What is the meaning of dialation in crystal?

4. Describe in details about lattice dynamics of a linear diatomic lattice. Differentiate between optical and acoustical branches. Why are these branches named so.

   OR

   Describe following :
   (a) Concept of phonons and phonons momentum.
   (b) Inelastic scattering of photons and phonons.

5. (a) What is thermal expansion ? Explain why it is necessary to include anharmonic interactions to understand this phenomenon.
   (b) Find an expression for the thermal expansion of a solid and explain its temperature dependence.

   OR

   Describe the phenomenon of cyclotron resonance and its applications.