Roll No. ....

500   –/–/15/20

D-701

January-February 2012

M. Sc. (Final) (III Semester) EXAMINATION

PHYSICS

First Paper

Condensed Matter Physics-I

Time : Three Hours

Maximum Marks : 35

Note : Attempt all questions. All questions carry equal marks. The blind candidates will be given 60 minutes extra time.

1. (a) Discuss the various symmetry elements associated with a crystal. Why is five fold symmetry not possible in a crystal ?

    (b) Describe Hexagonal-close pack structure. Show that ratio c/a for hexagonal closest-packing of spheres has the value $\left(\dfrac{8}{3}\right)^{1/2} = 1\cdot633$?

    $3\frac{1}{2}$

Or

    (a) Describe the crystal structure of NaCl. How does this structure differ from cesium chloride ?

    (b) Discuss the structure of Diamond.

2. Describe Reciprocal lattice and prove that the :

    (a) Reciprocal lattice vector σ_{hkl} is normal to the crystal plane (*hkl*).

    (b) Reciprocal of fcc is bcc and vice-versa.

(2-01) H-D-701

(c) Volume of a unit cell of the reciprocal lattice is inversely proportional to the volume of a unit cell of the direct lattice. 7

Or

(a) Discuss Ewald construction and derive Bragg's diffraction condition in terms of the reciprocal lattice.

(b) How are Brillouin Zones constructed ? Mention their importance in Crystal analysis.

3. Define the elastic constants for a crystal. Prove that the elastic stiffness constants are symmetrical $C_{ij} = C_{ji}$. 7

Or

Describe elastic waves in cubic crystals in [1 0 0] direction.

4. Obtain dispersion relation of a linear diatomic lattice and show that spectrum consists of two branches. Calculate the ratio of Amplitudes (A/B) in both the mode. 7

Or

Write notes on the following :

(a) Quantization of lattice vibrations

(b) Inelastic scattering of Neutrons.

5. Write notes on the following :

(a) Origin of Thermal Expansion

(b) Gruneisen Relation. 7

Or

(a) Explain DE-HAAS-VAN effect.

(b) Discuss Anomalous skin effect.

(2-01) H-701