CONDENSED MATTER PHYSICS – I

Semester-V

Time Allowed : 3 Hours]　　　　　　　　　　　　　　　　　　　[Maximum Marks : 40

Note : The candidates are required to attempt *two* questions each from Section A and B carrying 8 marks each and the entire Section C consisting of 8 short answer type questions carrying 1 marks each.

Section - A

1. Discuss Bravais lattice in three dimensions.　　　　　　　　　　　　8

2. (i) What do you mean by symmetry operation ? Prove that a crystal lattice cannot have five fold symmetry.　　　　　　　　　　　　5

(ii) Prove that in a cubic lattice the direction [hkl] is perpendicular to the plane (hkl). 3

3. (a) Explain the crystal structure of sodium chloride. 4
   (b) Copper has an fcc structure and the atomic radius is 1.278 Å. Calculate its density given that the atomic weight of copper is 63.54. 4

4. What are Miller indices ? Using them explain the set of crystal planes. 8

Section - B

5. What is k-space ? Find Bragg's diffraction condition in terms of reciprocal lattice. 8
6. Show that reciprocal lattice to a fcc is a bcc lattice. 8
7. What are different methods of x-ray diffraction ? Discuss Laue's method. 8
8. Derive Laue's equations. 8

Section - C

9. (a) Can a unit cells be primitive ?
   (b) Find packing fraction of bcc lattice.
   (c) What is space group ?
   (d) In diamond crystal structure, what is the number of nearest neighbours ?
   (e) What do you mean by reciprocal lattice ?
   (f) Define atomic scattering factor.
   (g) What is Brillouin zone ?
   (h) What are Laue's patterns ?

$8\times1=8$