

Exam. Code : 103205

Subject Code : 1362

B.A./B.Sc. 5<sup>th</sup> Semester

## PHYSICS

## Paper—A : (Condensed Matter Physics)

Time Allowed—3 Hours] [Maximum Marks—35

**Note** :— There are **five** sections, Section-A consist of Seven short answer type questions and is compulsory. Sections B, C, D and E consist of **two** questions each. The candidates are required to attempt **one** question from each section.

## SECTION—A

1. Write the properties of reciprocal lattice. 2
2. Show that  $c/a$  ratio for hexagonal close packing structure is 1.633. 3
3. Why do Dulong and Petit model fail at low temperature ? 2
4. What is the value of band gap in good conductor ? 2
5. Find the Einstein temperature if Einstein frequency  $f_E = 4.0 \times 10^{12}$  Hz. 2
6. What is an extrinsic semiconductor ? Give two examples. 2
7. What is the use of Laue's diffraction pattern ? 2

**SECTION—B**

1. What is packing fraction ? Calculate the value of atomic packing fraction for :
- (i) SC  
 (ii) BCC  
 (iii) FCC. 5

**OR**

2. Explain the concept of miller indices. Derive an expression for distance between lattice planes in cubic crystals. 5

**SECTION—C**

1. Derive Laue's equations for X-rays and obtain Bragg's diffraction conditions from them. 5

**OR**

2. Define reciprocal lattice. Prove that the FCC lattice is the reciprocal lattice of the BCC lattice and also find the reciprocal lattice of SC lattice. 5

**SECTION—D**

1. Define phonons. Discuss in detail the inelastic scattering of photons by phonons. 5

**OR**

2. What are the drawbacks of Einstein theory of heat capacity ? Explain the theory in detail and also discuss why this theory fails at low temperature. 5

**SECTION—E**

1. Define Fermi energy. What is the physical meaning of Fermi energy ? 5

**OR**

2. Metallic silver has 1 free electron/atom. Find the Fermi energy if density of silver is  $10.5 \text{ g/cm}^3$  and atomic weight is 1.08 g atomic. 5