Exam. Code : 103205
Subject Code : 1340

B.A./B.Sc. 5th Semester
PHYSICS
Paper—A
(Condensed Matter Physics)

Time Allowed—3 Hours] [Maximum Marks—35

Note :— Attempt **FIVE** questions in all, selecting at least **ONE** question from each section. The fifth question may be attempted from any section. All questions carry equal marks.

SECTION—A

1. (a) Draw the structure of diamond and determine its packing fraction. 5

   (b) What are the various Bravais lattices possible in a cubic crystal system ? 2

2. (a) Show that five-fold symmetry is not possible in crystals. 4

   (b) What are Miller indices ? Draw a crystal plane having Miller indices [101]. 3

SECTION—B

3. Derive the Bragg's law in reciprocal lattice and obtain the first Brillouin zone for a simple cubic crystal. 7

4. (a) What is atomic scattering fraction ? Derive an expression and explain its physical significance. 5

   (b) Name the various methods used to study X-ray diffraction from crystals. 2

SECTION—C

5. Discuss the Einstein's theory of specific heat of solids. What are its limitations ? 7

6. (a) What are phonons ? Discuss the inelastic scattering of photons by long wavelength phonons. 6

   (b) Why does the Dulong and Petit law fail at low temperature ? 1

SECTION—D

7. Explain the formation of energy bands in solids using Kronig-Penney model. 7

8. (a) Discuss the variation of electrical conductivity with temperature in case of semiconductors. 4

   (b) Draw energy band diagram for intrinsic and extrinsic semiconductors showing the Fermi level. 3